OCEANIC-ATMOSPHERIC AND HYDROLOGIC VARIABILITY IN LONG LEAD-TIME FORECASTING

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DEDICATION

I dedicate this work to my mother Marie Said Abdallah and my aunt Moina Fatima Said Abdallah who left this world all too soon. It is their love, support, and dedication to me that laid the foundation for this achievement.

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It has been a long journey to reach this point. Along the way, I was blessed with the help of so many incredible people. From family members, classmates, teachers, friends, everyone greatly contributed to this achievement and it is fitting that I acknowledge them and express my gratitude to them.

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ABSTRACT

Water managers throughout the world are challenged with managing scarce resources and therefore rely heavily on forecasts to allocate and meet various water demands. The need for improved streamflow and snowpack forecast models is of the utmost importance. In this research, the use of oceanic and atmospheric variables as predictors was investigated to improve the long lead-time (three to nine months) forecast of streamflow and snowpack. Singular Value Decomposition (SVD) analysis was used to identify a region of Pacific and Atlantic Ocean SSTs and a region of 500 mbar geopotential height (Z500mb) that were teleconnected with streamflow and snowpack. The resulting Pacific and Atlantic Ocean SSTs and Z500mb regions were used to create indices that were then used as predictors in a non-parametric forecasting model. The majority of forecasts resulted in positive statistical skill, which indicated an improvement of the forecast over the climatology or no-skill forecast. The results indicated that derived indices from SSTs were better suited for long lead-time (six to nine month) forecasts of streamflow and snowpack while the indices derived from Z500mb improved short lead-time (3 month) forecasts. In all, the results of the forecast model indicated that incorporating oceanic-atmospheric climatic variability in forecast models can lead to improved forecasts for both streamflow and snowpack.

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CHAPTER I
INTRODUCTION

Management of water resources is one of the many critical challenges in the world today. A 1999 assessment of water resources by the United Nations found that about one third of the world population live in area with moderate to high water stress and that by 2025, this number could rise to two third of the world population. Scientists and engineers search for different methods to forecast future water availability. Forecasting has tremendous advantages in planning and managing the available resources. Researchers use established relationships between oceanic-atmospheric phenomena and their hydrologic responses to make potential previsions. This is the basis for hydrologic forecasting using oceanic-atmospheric variability. Oceanic-atmospheric phenomena such as the El-Niño Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), the Atlantic Multdidecadal Oscillation (AMO), and the North Atlantic Oscillation (NAO), have been found in a considerable number of studies to influence hydrologic variability in many regions of the world. However, certain regions exist where these climate phenomena have little or no impact. These regions include the Upper Colorado River Basin (UCRB) in western United States and also the Adour-Garonne region southwest of France.

In this research, the possible teleconnections between oceanic-atmospheric phenomena and the Upper Colorado River basin snowpack as well as the French Adour-Garonne regional streamflow will be investigated. The aim is to use the resulting climate-hydrology teleconnections in a non-parametric model to establish a long lead-time forecast.

1.1 Oceanic-Atmospheric Variables

The earth is surrounded by large masses of air which form the atmosphere. The atmosphere is composed of different layers with varying thickness from the surface of the earth. The first layer, the Troposphere, extends to an altitude of 12 kilometers where the atmosphere is the densest. Above the Troposphere is the Stratosphere which reaches an altitude of 50km. The Troposphere and the Stratosphere are separated by the Tropopause. Above the Troposphere lay the Mesosphere and Thermosphere.

The earth is mostly covered with large bodies of waters with the oceans taking up 70% of its surface. With an average depth of 4 kilometers, the oceans' density varies depending on the salinity and temperature of the waters at different location. Complex interactions and dynamics between the atmospheric winds, pressure, temperatures, the oceans, solar radiations, vegetation cover and other processes create the climate systems experienced all over the world. Through observations, scientific experimentation, and physical laws, different ocean currents as well as atmospheric circulations and different climate phenomena are discovered *(C. Donald Ahrens, Essentials of Meteorology, third edition).*

Understanding the weather and climate has fascinated people and scientists from the ancient Greeks until today. Even though modern tools have considerably enhanced the knowledge of weather and climate systems, a great deal remains to be understood. Researchers have used regional and global Sea Surface Temperatures (SST) as well as atmospheric pressure to obtain information about coupled oceanic and atmospheric phenomena and hydrologic responses. The temperature at the surface of certain regions of the oceans as well as atmospheric pressure has been used to create climate indices for use in studies related to climate and hydrology.

The best known climate indices are the El-Niño Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), the Atlantic Multidecadal Oscillation (AMO) and the North Atlantic Oscillation (NAO).

1.1.1 ENSO

ENSO climate variability is probably the most studied, understood and talked about in the world. It is characterized by the El Niño and La Niña. It is observed along the equatorial region of the Pacific Ocean between Darwin, Australia, and Tahiti, a south Pacific island. It is driven by a change in the distribution of atmospheric pressure between the two locations. Low pressure over Darwin combined with high pressure over Tahiti cause warm water to move away from the South American coast towards Indonesia and Australia. At the same time, a low pressure zone is concentrated around Indonesia causing heaving rains. In contrast, the shallow cold waters along the coast of South America cool the air and prevent any moisture from drifting over land. This creates very dry conditions along the coast of South America. The process then reverses itself with pressure rising over Darwin and dropping over Tahiti. The winds change direction and bring the warm waters and moisture to the coast of South America, resulting in heaving rains replacing the dry conditions and at the same plunging Indonesia in very dry conditions. This is an El Niño. When the pattern reverses itself, carrying the warm waters towards Indonesia, the event is called a La Niña. This oscillation in the tropical

South Pacific Ocean is known as the El Niño Southern Oscillation (ENSO) *(Trenberth, 1997)*.

ENSO events were first observed along the coast of Peru. Farmers and fishermen thought that the best conditions, brought on to give them plenty of food and fish around the Christmas time, were a gift from God and they called the event El Niño (the child). ENSO events are known to happen every 2 to 7 years in two phases, a warm phase and a cold one. The warm phase is El Niño and the cold phase is known as La Niña. *(NOAA at http://www.pmel.noaa.gov/tao/elnino/nino-home.html)*

1.1.2 Pacific Decadal Oscillation (PDO)

The Pacific Decadal Oscillation (PDO) is a pattern of climate variability observed in the North Pacific Ocean above 20° latitude. It is known to exhibit some ENSO-like climate variability patterns in the Pacific Ocean; however the patterns differ in their temporal characteristics and behavior. Unlike ENSO events that occur every 2 to 7 years, the PDO has a period of 20 to 30 years. It has two phases, a warm and a cold phase. The PDO pattern was discovered by Stephen Hare while studying the pattern for Salmon production in the North Pacific *(Mantua et al., 1997; Hare et al., 1999).* While studying the catch history of Pacific Salmon, a relationship between a multi-decadal North Pacific Ocean climate variability and the salmon production was established. Previously different studies have used different names to describe the PDO. The Pacific Decadal Variability (PDV), Interdecadal Pacific Oscillation (IPO) and the North Pacific Oscillation (NPO) were all used to identify the same thing *(Mantua and Hare, 2002).*

The warm phase of the PDO is characterized by below average cooler sea surface temperature of the central North Pacific Ocean and above average warmer sea surface temperatures along the west coast of North America. The opposite is true for the cold phase of the PDO.

1.1.3 Atlantic Multidecadal Oscillation (AMO)

The Atlantic Multidecadal Oscillation (AMO) is a mode of climate variability observed in the North Atlantic sea surface temperatures. Like the other climate oscillations described here, the AMO has a warm and a cold phase. The spatial coverage of the AMO spans from the equator to Greenland and the temporal aspect of each phase of the AMO last from 20 to 40 years. The oscillation was first identified by Schleinsger and Ramankutty in 1994 while doing spectrum analysis of global climate data. Records from 1856 to 1999 showed a multidecadal cycle of sea surface variability with a cooling and a warming period lasting between 65 and 80 years *(Schleinsger and Ramankutty, 1995).* Subsequent studies using paleoclimatic and sea ice concentration data found a similar pattern in the North Atlantic and linked the cycle with changes in the North Atlantic thermohaline circulation. The AMO cycles are known to alternately mask and amplify the anthropogenic impact of global warming *(Knight et al., 2006).*

1.1.4 North Atlantic Oscillation (NAO)

The North Atlantic Oscillation (NAO) is a climatic phenomenon observed in the North Atlantic Ocean. Unlike the ENSO, PDO, and AMO whose variabilities are found in the cooling and warming of sea surface temperature, the NAO arises from fluctuation of sea level atmospheric pressure differences between the Icelandic low and the Azores high. This pressure difference affects the westerly winds across the North Atlantic onto Europe. The variability of the NAO is characterized by a positive and a negative NAO index. A positive NAO is associated with a high pressure difference resulting from a stronger Azores high pressure and a weaker Icelandic low while a low pressure difference resulting from a weak subtropical high and Icelandic low characterizes a negative NAO. The NAO is mostly connected with winter time changes in sea level pressure across the two stations *(Hurrell, 1995)*.

1.2 Effects of oceanic-atmospheric phenomena

Oceanic-atmospheric phenomena fluctuations cause major weather and climatic variations all over the world. From cooler or warmer than normal winters, higher or lower than normal streamflow or precipitations, extreme local and regional weather have been attributed to one phenomena or another or at time a combination of different phases of these events *(Knight et al., 2006; Zhang and Delworth, 2006; Hurrell, 1995; Durkee et al., 2008; Vicente-Serrano et al., 2008; Enfield et al., 2001; Gershunov, 1998; Giannini et al., 2000; Kahya and Dracup, 1993; Uvo et al., 1998)*. Effects of these events as related by the literature are described below.

1.2.1 ENSO

The El Niño Southern Oscillation is probably one of the most researched and understood oceanic-atmospheric phenomena. Because of the knowledge acquired, researchers can follow the formation of an event as its precursors develop in the western Pacific Ocean and move easterly towards the west coast of South America. Weather and climatic changes associated with and La Niña events are numerous and recorded all over the world. In the United States, during an El Niño event, the Northwest and the Midwest experience warmer and drier than average conditions with reduced snowpack. In the other hand, cooler and wetter conditions prevail over the winter in the Southeast. El Niño effects are also felt in East Africa which experience wetter conditions in parts of the year. Australia also experience drier than normal conditions. El Niño events have been strongly correlated with drought, famine, floods, diseases and forest fires. La Niña events, on the other hand, produce the opposite effect in the United States.

1.2.2 PDO

Studies suggest that the climate changes associated with the PDO are very much similar to milder effects of those associated the El Niño and La Niña events. Warm phases of the PDO bring drier than normal conditions in eastern Australia and the Pacific Northwest, and at the same time, the southwest US experiences wetter than normal conditions. In addition, warmer temperatures are experienced in northwestern North America, northern South America, and northwestern Australia. The southeast US in the other hand gets cooler.

1.2.3 AMO

The AMO has been linked to climate variability for much of North America and Europe. Research suggests that the warm phase of the AMO corresponds to a decrease in rainfall in much of North America. Subsequently, droughts frequency in the Midwest and the

Southwest US are found to be more frequent and prolonged. Florida experiences wetter than normal conditions during the warm phase of the AMO, unlike most of the other regions in North America. The cool phase of the AMO is found to produce the opposite effects in those regions. The AMO has also been associated with the frequency and strength of Atlantic hurricanes. Analyses suggest the number of severe hurricanes during warm phases of the AMO is greater than during the cool phases. Many forest fires resulting from the prolonged drought conditions are also linked to the AMO phases.

1.2.4 NAO

Changes in weather patterns resulting from NAO positive and negative phases are observed especially in Europe. The strength and direction of the North Atlantic Ocean winds resulting from the difference in sea level pressure which characterize the NAO regulate winter time climate in Europe. Strong westerly winds, from a positive NAO, are associated with milder than normal winters, cooler summers and more frequent rainfall events in central Europe and the Atlantic coast. On the other hand, when the NAO phase is negative, the westerly winds are weak or blocked because of a low pressure difference between the arctic low and the tropical high, these regions experience extremely hot summers, very dry conditions as well as very cold winters *(Hurrell, 1995; Gallego et al., 2005; Jacobeit et al., 2009)*. In the United States, the positive phase of the NAO is linked to significantly more rain in the East and a significant increase in snow in the Northeast *(Durkee et al., 2008).* The positive phase of NAO is also linked to wet conditions in the Tennessee River valley. The negative phase of the NAO is found to bring significant cold air spells to the East coast *(Yin, 1994).*

While ENSO, PDO, AMO and NAO can be effectively used in long lead-time forecasts of hydrologic responses, many regions in the world exist where these phenomena are not teleconnected and thus do not produce good forecast skill. Therefore the motivation of this research is to evaluate these challenging regions, including the Upper Colorado River Basin (UCRB) in the USA and the Adour-Garonne region of France.

1.4 Objectives

Even though the climate indices cited above were found to drive the hydrology of many parts of the world, there are still some areas where they have no significant influence. This research project will focus on those areas where the traditional climate indices do not have a significant influence, to identify oceanic-atmospheric region of influence that drive their hydrology and investigate the potential use of these new regions in long lead-time hydrologic forecasting. The research work is devised in the following three objectives:

- Identification of Pacific Ocean sea surface temperature influences of Upper Colorado River Basin (UCRB) snowpack.
- Identification of Atlantic Ocean Sea Surface Temperatures influences on the Adour Garonne (France) Regional Streamflow Variability
- Evaluation of long lead-time streamflow and snowpack Forecasting of the Upper Colorado River and Great Basin using Pacific Ocean SSTs and Z500mb

The first two objectives, which will be covered in Chapters III and Chapter IV, will test the use of global sea surface temperatures to identify new regions of SST that influence hydrological response in watershed or basins that do not respond to classic climate indices (ENSO, PDO, AMO, and NAO). The third objective, which will be covered in Chapter V, will then use a new region of SST, as found in the first two objectives, influence as well as Z500mb geopotential height pressure, in a forecast model to test any improvement in forecast skill

1.4.1 Research Hypothesis #1:

There exists a Pacific oceanic-atmospheric driver of the UCRB snowpack.

The UCRB is a critical hydrologic area. It is estimated that about 90% of the Colorado River water originates from the upper basin and that about 25 million people rely on it for water supply. Water availability in the western United States is critical. This is compounded by a growing demographic and climate change. In the western U.S., snow is the primary source of water for municipal, agricultural and hydropower. This is primarily attributed to precipitation occurring in the form of snowfall. It is estimated that in the western U.S., snowfall accounts for approximately 50 to 70% of total precipitation *(Clark et al., 2001).* While research has found evidence of a teleconnection between the ENSO, PDO, and the majority of western U.S. snowpack, the UCRB showed no evidence of such a teleconnection. *McCabe and Dettinger (2002)* studied snowpack for 323 April 1st western U.S. stations and the relation with ENSO and PDO. The results showed that the UCRB was not significantly influenced by either of those climate indices. While previous research used predefined climate indices, this research will use sea surface temperatures of the Pacific Ocean to investigate the relationship with March 1st, April 1st, and May 1st UCRB snowpack. This has the advantage of eliminating the limitations associated with using a predefined climate index. It will also use the singular value decomposition (SVD) method described in *Bretherton et al (2002)*. The results will identify a region of Pacific Ocean SST variability that influences the UCRB snowpack.

1.4.2 Research Hypothesis #2:

There exists an Atlantic Ocean oceanic-atmospheric driver of the Adour-Garonne stream flow.

The French Adour-Garonne is a very important hydrographic basin. It is the fifth largest French basin by area covering 116,000 km^2. The main river is the Garonne River, the third largest French river based on flow. Approximately 6.5 million people, a tenth of the total French metropolitan population, rely on its water for domestic, agricultural, hydropower, and industrial use. This basin is dominated by the Pyrenees and Massif Central mountains. The basin's hydrologic system is fed by the Garonne and Adour which take their source from the Pyrenees and the Tarn, Lot, Dordogne, and Charente rivers, all flowing from the Massif Central. In most of Europe, researchers have found that the NAO and the AMO are the major drivers of hydrologic variability. However, neither of these Atlantic Ocean climate phenomena were significantly teleconnected in this region. *Durand et al. (2009)* and *Massei et al (2005)* could not establish a relationship between the NAO and ENSO with snow cover in the French Alps and Pyrenees and rainfall in the adjacent northwestern France. Similarly to research hypothesis #1, this research will use Atlantic Ocean sea surface temperature and SVD to investigate the Atlantic Ocean SST drivers for the Adour-Garonne streamflow. The results will identify a region of Atlantic Ocean SST variability that influences the Adour-Garonne streamflow

1.4.3 Research Hypothesis #3:

Using Pacific Ocean SST and Z500mb geopotential pressure drivers of snowpack and streamflow, a skillful non-parametric model can be developed to improve the long lead-time forecast for the April-July (AMJJ) streamflow April 1st snowpack on the UCRB and Great Basin.

Researchers *(Knight et al., 2006; Zhang and Delworth, 2006; Hurrell, 1995; Durkee et al., 2008; Vicente-Serrano et al., 2008; Enfield et al., 2001; Gershunov, 1998; Giannini et al., 2000; Kahya and Dracup, 1993; Uvo et al., 1998)* have shown that there is evidence that interannual and interdecadal oceanic-atmospheric phenomena drive hydrologic variability in many regions of the world. Numerous studies have related ENSO and the PDO to western U.S. streamflow and snowpack variability *(Hunter et al., 2006; Tootle et al., 2005; Rogers and Coleman, 2003; McCabe and Dettinger, 2002; Enfield et al., 2001; Cayan et al., 1999; Gershunov, 1998; Kahya and Dracup, 1993; Cayan and Webb; 1992; Cayan and Peterson, 1989).* Climate indices have been used as predictors in streamflow forecast studies. Streamflow forecasting is very important especially in regions where water resource availability is scarce. This is the case in the western U.S, where a growing population accentuates an already critical situation. Water managers who bear the challenge to allocate water rely heavily on the prevision provided by forecast models. The National Resources and Conservation Service (NRCS) in coordination with the National Weather Service (NWS) provides forecasts each first day of the months from January to June, using parametric models. *Lall et al. (1996)* suggest that using linear methods may not be appropriate for forecasting.

This study will use the Pacific Ocean SST region identified in research hypothesis #1 and Z500mb, and a non-parametric model to create long lead-time forecast of Spring-Summer (April – July) streamflow and April 1st snowpack for the UCRB and Great Basin.

CHAPTER II
LITERATURE REVIEW

2.1 Research Hypothesis #1

<u>"There exists a Pacific oceanic-atmospheric driver of the UCRB snowpack".</u>

Numerous investigations have evaluated oceanic-atmospheric variability and continental U.S. hydrologic (e.g., streamflow, precipitation, and snowpack) response *(Hunter et al., 2006; Tootle et al., 2005; Rogers and Coleman, 2003; McCabe and Dettinger, 2002; Enfield et al., 2001; Cayan et al., 1999; Gershunov, 1998; Kahya and Dracup, 1993; Cayan and Webb; 1992; Cayan and Peterson, 1989)* with the possible goal of using climate as a predictor or forecaster *(Soukup et al., 2009; Grantz et al., 2004; Tootle and Piechota, 2004).* These studies show strong sub-continental impacts linked to particular phases (e.g. cold or warm) of Pacific Ocean climate variability [e.g., El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO)]. The current research will concentrate on Pacific Ocean sea surface temperature variability precisely because the mechanistic links to western North American snowpack are better understood than those with Atlantic and / or Indian Ocean variability.

Bretherton et al. (1992) compared four methods for isolating the important coupled modes of variability between 2 matrices of two fields. The methods compared were principal component analysis with fields combined (CPCA), canonical correlation analysis (CCA), principal component analysis of one field followed by correlation of its component amplitude with the second field (SFPCA) and singular value decomposition of the covariance matrix between the two fields (SVD). The results indicated that SVD was simple to apply and preferable for general use since it does not require user-chosen variables. *Wallace et al. (1992)* also used SVD to study the interannual relationship between the Pacific Ocean SST anomalies and 500mb atmospheric pressure in winter time and found that SVD isolates the most important modes of variability.

SVD has been used to evaluate SST and hydrologic variability in a number of studies *(eg. Tootle et al., 2008; Tootle and Piechota, 2006; Shabbar and Skinner, 2004; Rodriguez-Fonseca and de Castro, 2002; Rajagaopalan et al., 2000; Wang and Ting, 2000; Giannini et al., 2000; Enfield and Alfaro, 2000; Uvo et al., 1998).* In *Tootle et al. (2008),* the authors applied SVD to Pacific and Atlantic Ocean SST and Colombia streamflow variability. In that study, the authors evaluated the variability of 10 streamflow stations for a period of 41 years. They found that by using SST and SVD, they were able to find regions of the Pacific and Atlantic Ocean SST with stronger relationships with the streamflow compared to when they used ENSO.

A previous study applied multivariate and correlation statistical techniques to western U.S. snowpack data, attempting to identify Pacific Ocean climatic variability in snowpack (Snow Water Equivalent or SWE). *McCabe and Dettinger (2002)* applied Principal Components Analysis (PCA) to April 1st SWE for 323 western U.S. stations. April 1st snowpack was used because it is estimated that snowpack on that day provides a very good estimate of the eventual annual runoff *(McCabe and Dettinger, 2002).*The two primary modes (components) accounted for 61% of the total snowpack variability in the western United States. Interestingly, the first mode of snowpack variability closely represented the PDO while the second mode represented both PDO and ENSO. However, when utilizing correlation analysis, neither an ENSO or PDO signal was identified in UCRB (Utah and Colorado) snowpack *(McCabe and Dettinger, 2002).*

2.2 Research Hypothesis #2:

"There exists an Atlantic Ocean oceanic-atmospheric driver of the Adour-Garonne stream flow".

A number of studies have evaluated oceanic-atmospheric variability and continental European hydrologic (e.g., streamflow, precipitation, and snowpack) response *(Brandimarte et al., 2011 ; Lavers et al., 2010; Bartolini et al., 2009; Jacobeit et al. 2009 ; Lopez-Bustins et al., 2008; Massei et al. 2007; Gallego et al., 2005; Rodwell et al., 1999).* Bartolini et al., (2009) studied the interannual variability of winter precipitation in the Alpes. The Alpines winter precipitation has a major influence on the hydrology of the surrounding basins, and understanding its variability is very important. The authors used gridded precipitation data with a resolution of 20 Kilometers, the NAO index, and the Arctic Oscillation (AO). The results indicated that the Alps winter precipitation was not significantly influence by the NAO. They also indicated that the NAO has a significant influence on the continental European climate and that it has a positive (negative) correlation with winter precipitation with the North (South) of Europe, and the Alpes are found at the latitude where the sign of the correlation changes. This is interestingly similar to the relationship observed with ENSO and Western U.S. snowpack where the correlation is positive(negative) with the Southwest (Northwest) and that no significant correlation was found with the Upper Colorado River Basin, which is located at the latitude where the sign of the correlation changes as well.

Rodriguez-Fonseca and de Castro, (2002) used SVD to study the relationship between monthly winter precipitation anomalies in Europe and North Africa with North Atlantic Ocean SST and sea level pressure (SLP). In the analysis, the authors use the winter season going from November to February (NDJF) for precipitation and the NDJF, October-January (ONDJ), September-December (SOND), August-November (ASON), July-October (JASO), and June-September (JJAS) periods for the SST and SLP. The authors argued that the lagged connection between the different periods could make it possible to use the SST and SLP for long lead-times forecasting of the precipitation. The results indicated that the subtropical and subpolar North Atlantic SST had a positive teleconnections with the precipitation anomalies in the Iberian Peninsula, North Africa, and the Mediterranean areas while the relationship is with the anomalies in the British Isles, Scandinavian Peninsula, and Denmark was negative. The opposite is true for the Northwestern Atlantic SST. The same patterns remained the same when the authors used longer time periods for the SST and SLP.

Because of the importance of this area, numerous hydrologic research studies have been conducted in the Adour-Garonne or adjacent basins *(Cabellero et al. (2005), Dupeyrat et al. (CEMAGRAF, EDF), Hau M. (2008), Tisseuil C. (2009), Voirin-Morel, (2003)).* *Durand et al. (2009)* used the French model SAFRAN, which is a model that simulates atmospheric conditions related to snowpack, to study the evolution of snowpack given the elevation and slope in the French Alps and Pyrenees. They could not establish a relationship between the NAO and ENSO with snow cover in the French Alps and Pyrenees. *Massei et al (2005)* used continuous wavelet transforms of seven precipitation time series and compared them with NAO wavelet transforms. They could not establish a link between NAO and rainfall as precipitation records did not contain easily retrievable NAO-like components in northwestern France. *Lespinas et al. (2009)* identified an NAO influence on precipitation; however, it was not strong enough to cause long-term trends in their study of rivers in southern France.

However, this research represents the first study in which a teleconnection of Atlantic Ocean SSTs and Adour-Garonne streamflow was identified.

2.3 Research Hypothesis #3:

"Using SST and Z500mb drivers of snowpack/streamflow and a non-parametric model will improve long lead-time forecast for the UCRB snowpack and streamflow".

A number of studies have used established oceanic-atmospheric phenomena relationship with hydrologic variability for forecasting. *Filho and Lall (2003)* used Nino 3, ENSO, and Equatorial Atlantic Ocean sea surface temperature to forecast yearly streamflow for the Ceara River in northern Brazil. Previous studies had established the link between streamflow in this area and they used this link as a basis for forecasting. They found that the Nino 3 and Atlantic SST indices yielded a useful forecast for reservoir operation. *Piechota et al (1998)* used the Southern Oscillation Index (SOI) and equatorial SST to forecast seasonal streamflow in Australia after studies established a strong relationship between Australian streamflow and ENSO. They found that incorporating ENSO index in the forecasting relatively improved the reliability of the forecast.

Established relationships between climate indices and hydrologic variability provide interesting and useful information for forecasting water availability. However, for these forecasts to have significant impact on the decision of water managers, they need to be as reliable as possible. The reliability of linear models for forecasting is disputed by a number of studies which argue that because of the great variability of these climate indices and the more than likely non-linear aspect of these relationships due to the complex dynamics of nature, linear parametric models may not be adequate and that instead a non-parametric approach may yield better results *(Piechota et al.1998; Lall et al. 1996)*. *Lall et al., 1996; Piechota et al., 1998; Lall and Sharma, 1996; Rajagopalan and Lall, 1999; Filho and Lall, 2003; Piechota and Dracup, 1999; Tootle and Piechota, 2004; Soukup et al., 2009* used non-parametric models for long lead-time streamflow forecasts that resulted in significant improvements.

Kalra and Ahmad (2009) used oceanic-atmospheric oscillations and a data driven model to investigate a 3 year lead-time streamflow forecasting of three streamflow gages of the UCRB. PDO, NAO, AMO and ENSO indices and data from the Cisco, Green River, and Lees Ferry gages were used. The model used was calibrated using data from 1906 to 1991 and tested for the period of 1992 to 2000. The resulted indicated that ENSO and NAO have stronger predictive values than the PDO or the AMO. A combination of both ENSO and NAO gave the best results. *Thomas B. (2007)* also used climate variability of the SOI, AMO and PDO with regression equations to develop a forecast for streamflow in the Lower Colorado River Basin (LCRB). The author found that the AMO, PDO and SOI were significantly correlated to the streamflow in the central part of the study area with the SOI and AMO being the most dominant forcing. The resulted also indicated that the northwestern and southwestern part of the study had lower correlations with the PDO and SOI than the central part.

Other studies used SST instead of the traditional climate indices. *Aziz et al (2010)* evaluated western U.S. snowpack and Pacific Ocean SSTs using the Singular Value Decomposition (SVD) statistical method and identified a region in the Pacific Ocean that was teleconnected with snowpack. *Lamb et al (2011),* again using SVD, identified a similar Pacific Ocean region when evaluating streamflow. A similar pattern was identified in previous research efforts *(e.g., Rajagopalan et al., 2000; Wang and Ting, 2000; Grantz et al., 2005; Tootle and Piechota, 2006; Soukup et al., 2009).*

In addition to SSTs, *Grantz et al (2005)* and *Soukup et al (2009)* identified 500 mbar geopotential height (Z500mb) values as a useful long lead-time predictor of streamflow. Geopotential height is the height to the pressure zone of interest, as measured above the mean sea surface elevation.

Most, if not all, of the studies cited here focused on streamflow forecasting. Water resources managers require an estimate of the quantity of water that they will have available and an evaluation of surface water in the form of streamflow will provide them an estimate of available water supply. However, during the winter, snowpack accumulates high up in the mountains and acts as a reservoir. A high percentage of this water is released to the streams during the spring season (warmer temperatures). As mentioned before, snowpack accounts for 50 to 70% of precipitation in this region and forecasting snowpack may prove to be very useful.

CHAPTER III
IDENTIFICATION OF PACIFIC OCEAN SEA SURFACE TEMPERATURE INFLUENCES OF UPPER COLORADO RIVER BASIN SNOWPACK

A version of this chapter was originally published by Oubeidillah A. Aziz, Glenn A. Tootle, Stephen T. Gray and Thomas C. Piechota:

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The Results and Conclusion sections were updated in this chapter to include the March 1st and May 1st results.

Abstract

Given the importance of Upper Colorado River Basin (UCRB) snowpack as the primary driver of streamflow (water supply) for the southwestern U.S., the identification of Pacific Ocean climatic drivers [e.g., Sea Surface Temperature (SST) variability] may prove valuable in long lead-time forecasting of snowpack in this critical region. Previous research efforts have identified ENSO and PDO as the main driver for Western U.S. snowpack but these drivers have limited influence on regional (Utah and Colorado) UCRB snowpack.

The current research applies for the first time the Singular Value Decomposition (SVD) statistical method to Pacific Ocean SSTs and continental U.S. snowpack to identify the primary Pacific Ocean climatic driver of UCRB snowpack. The use of SSTs eliminates any limitation as to specific climate signals. The second mode of SVD identified a UCRB snowpack region (Colorado and Utah), and, a corresponding Pacific Ocean SST region. A "non-ENSO / non-PDO" Pacific Ocean SST region between 34°N to 24°S and 150°E to 160°W was identified as being the primary driver of UCRB snowpack. To confirm the UCRB snowpack results, data from 13 unimpaired (or

naturalized) streamflow gages in Colorado and Utah were used to evaluate and support the snowpack findings. Finally, a new and beneficial data set (western U.S. March 1st, April 1st and May 1st SWE) was developed that may be used in future research efforts.

3.1. Introduction

Numerous investigations have evaluated oceanic-atmospheric variability and continental U.S. hydrologic (e.g., streamflow, precipitation and snowpack) response [*Hunter et al., 2006; Tootle et al.*, 2005; *Rogers and Coleman*, 2003; *McCabe and Dettinger*, 2002; *Enfield et al.*, 2001; *Cayan et al.*, 1999; *Gershunov*, 1998; *Kahya and Dracup*, 1993; *Cayan and Webb*; 1992; *Cayan and Peterson*, 1989] with the possible goal of using climatic variables as a predictor [*Soukup et al.*, 2009; *Grantz et al.*, 2005; *Tootle and Piechota,* 2004]. These studies show strong sub-continental impacts linked to particular phases (e.g. cold or warm) of Pacific Ocean climate variability [e.g., El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO)]. Therefore, the current research will concentrate on Pacific Ocean variability precisely because the mechanistic links to western North American snowpack are better understood than those with Atlantic and / or Indian Ocean variability. Additionally, in the western U.S., the primary source of water for municipal, agricultural and hydropower use is snowpack. This is primarily attributed to precipitation occurring in the form of snowfall and, in the western U.S., snowfall accounts for approximately 50 to 70% of total annual precipitation [*Clark et al.*, 2001].

A previous study applied multivariate and correlation statistical techniques to western U.S. snowpack data, attempting to identify Pacific Ocean climatic variability in snowpack (Snow Water Equivalent or SWE). *McCabe and Dettinger* [2002] applied Principal Components Analysis (PCA) to April 1st SWE for 323 western U.S. stations. The two primary modes (components) accounted for 61% of the total snowpack variability in the western United States. Interestingly, the first mode of snowpack variability closely represented the PDO while the second mode represented both PDO and ENSO. However, when utilizing correlation analysis, neither an ENSO or PDO signal was identified in UCRB (Utah and Colorado) snowpack [*McCabe and Dettinger*, 2002]. Given that ENSO and PDO are not the primary Pacific Ocean climatic drivers of UCRB (Utah and Colorado) snowpack, the motivation of the current research is to identify what Pacific Ocean climatic variability is associated with UCRB (Utah and Colorado) snowpack variability. To investigate this, Pacific Ocean SSTs were selected and Singular Value Decomposition (SVD) was applied.

SVD is a powerful technique that *Bretherton et al.* [1992] concluded was simple to use and preferable for general use while *Wallace et al.* [1992] found SVD isolates the most important modes of variability. SVD has been utilized to evaluate SST and hydrologic variability [*Tootle et al.*, 2008; *Tootle and Piechota*, 2006; *Shabbar and Skinner*, 2004; *Rodriguez-Fonseca and de Castro*, 2002; *Rajagaopalan et al.*, 2000; *Wang and Ting*, 2000; *Giannini et al.*, 2000; *Enfield and Alfaro*, 2000; *Uvo et al.*, 1998]. While several of these studies investigated SST and hydrologic variability (e.g., Palmer Drought Severity Index (PDSI), precipitation, streamflow) in the U.S. and Canada, this research is a comprehensive (e.g., three predictor periods and three predictand periods) and first-time investigation of Pacific Ocean SSTs and western U.S. snowpack. While PCA is very useful in data reduction when working with one spatial-temporal field, the SVD approach used in this analysis has the advantage of evaluating the cross-covariance matrix of two spatial-temporal fields to identify regions of similar behavior. Additionally, the use of SVD with SSTs and SWE does not limit the investigator to pre-defined (e.g., ENSO, PDO) regions of climate variability and the resulting SWE response to phases (e.g., warm or cold) of these climate signals. Therefore, the contributions of the current research are (1) the development of a new dataset of western U.S. snowpack (SWE) for March 1st, April 1st and May 1st; (2) a comprehensive (i.e., three predictor periods and three predictands) first time analysis of Pacific Ocean SST and western U.S. snowpack variability; (3) the identification of the Pacific Ocean SST regions that influence western U.S. snowpack; and (4) the verification of these Pacific Ocean SST regions of influence in an alternate hydrologic variable (e.g., UCRB streamflow).

3.2. Data and Methodology

Historic March 1st, April 1st and May 1st SWE data were obtained from the Natural Resources Conservation Service (NRCS) website (http://www.wcc.nrcs.usda.gov/snotel/) for snow measurement stations in the western United States. A tradeoff between the period of record length (temporal dimension) and the number of snowpack stations (spatial dimension) resulted in 291 (March 1st), 323 (April 1st) and 216 (May 1st) snowpack stations being identified with a period of record 1961 to 2006 (46 years) (Figure 1).

(a) (b) (c)

Figure III.1: Location map of SWE stations for (a) March 1st, (b) April 1st, and (c) May 1st

Each of the snowpack stations used in the current research had complete records and the April 1st SWE dataset has been used in previous research efforts [*Hunter et al.*, 2006]. Both the temporal (46 years) and spatial (number of stations) dimensions were consistent with previously published studies utilizing SVD with SSTs and hydrologic variables [*Tootle et al.*, 2008; *Tootle and Piechota*, 2006; *Uvo et al.*,1998].

Pacific Ocean SST data were obtained from the National Climatic Data Center website (http://www.cdc.noaa.gov/cdc/data.noaa.erSST.html). This dataset consists of monthly average values at a resolution of 2° by 2° and ranges from latitude 20o south to 60o north and 120o east to 80o west. This resulted in 2,792 active Pacific Ocean SST cells. Average Pacific Ocean SSTs were calculated for three different six month windows (January-June or JFMAMJ, April-September or AMJJAS, and July-December or JASOND) preceding each snow season. This resulted in lead-times varying from two to 10 months. For both the Pacific Ocean SSTs and SWE data sets, anomalies, defined as the deviation of the seasonal mean from the long time average, were calculated and then standardized. These standardized anomalies of the data sets were used in this study. Thus, the de-trending was based on the least squares fit of a straight line to the data sets and subtracting the resulting function from the data. De-trending the SST and snowpack data removes any trends in the data sets that may bias the analysis and mask the underlying variability.

Two of the applicable predefined datasets representing oceanic – atmospheric climatic phenomena are the Niño 3.4 index (ENSO) and the PDO index. The average monthly values for the climatic indices (Niño 3.4 and PDO) were averaged for each of the six month (e.g., JFMAMJ, AMJJAS, JASOND) predictor periods. The Niño 3.4 *(Trenberth, 1997)* SST region is located along the equatorial Pacific Ocean (5°S – 5°N, 170° – 120°W). Monthly index Nino 3.4 data were obtained from the NOAA ESRL Physical Sciences Division [http://www.cdc.noaa.gov/Pressure/Timeseries/Nino34/]. The Niño 3.4 index was used since it is an overall representation of ENSO. The PDO is a oceanic / atmospheric phenomenon associated with persistent, bimodal climate patterns in the northern Pacific Ocean (poleward of 20° north) that oscillate with a characteristic period on the order of 50 years (a particular phase of the PDO will typically persist for about 25 years) *(Mantua, et al., 1997; Mantua and Hare, 2002).* PDO Index *(Mantua et al., 1997, Hare and Mantua, 2000)* values were obtained from the Joint Institute for the Study of the Atmosphere and Ocean, University of Washington [http://tao.atmos.washington. edu/pdo/].

SVD is a powerful statistical tool for identifying coupled relationships between two, spatial-temporal fields. While *Bretherton et al.* [1992] provide a detailed discussion of the theory of SVD, a brief description of SVD as applied in this study, is provided. Initially, a matrix of standardized SST anomalies and a matrix of standardized SWE anomalies were developed. Please note that an individual SST anomaly matrix is developed for each predictor period (one matrix each for JFMAMJ, AMJJAS and JASOND Pacific Ocean SSTs) and an individual SWE anomaly matrix is developed for each predictand (one matrix each for March 1st, April 1st and May 1st SWE). This results in the development of three predictor (SST) matrices and three predictand (SWE) matrices. The time dimension of each matrix (i.e., 46 years) must be equal while the spatial component (i.e., the number of SST cells and the number of SWE stations) can vary in dimension. The cross-covariance matrix was then computed for the two spatio-temporal matrices and SVD was applied to the cross-covariance matrix and "teleconnection" information regarding the relationship between the two was obtained. A total of nine cross-covariance matrices resulted, representing all combinations of the three predictors (SSTs) and three predictands (SWE).

The resulting SVD of each cross-covariance matrix created two matrices of singular vectors and one matrix of singular values. The singular values were ordered such that the first singular value (1st mode) was greater than the second singular value and so on. *Bretherton et al. (1992)* defines the squared covariance fraction (SCF) as a useful measurement for comparing the relative importance of modes in the decomposition. Each singular value was squared and divided by the sum of all the squared singular values to produce a fraction (or percentage) of squared covariance for each mode. In applying

SVD, the SCF is somewhat analogous to the percent of explained variance (by components) when applying PCA.

Finally, the two matrices of singular vectors were examined, generally referred to as the left (i.e., SST) matrix and the right (i.e., SWE) matrix. The first column of the left matrix (1st mode) was projected onto the standardized SST anomalies matrix and the first column of the right matrix (1st mode) was projected onto the standardized SWE anomalies matrix. This resulted in the 1st temporal expansion series (TES) of the left and right fields, respectively. The left heterogeneous correlation field (for the 1st mode) was determined by correlating the SST values of the left matrix with 1st temporal expansion series of the right field and the right heterogeneous correlation field (for the 1st mode) was determined by correlating the SWE values of the right matrix with the 1st temporal expansion series of the left field. The left temporal expansion series have a physical meaning since they represent SST variability that may not already be included in existing SST indices and could represent a new index of SST variability. This procedure is then repeated for the 2nd and 3rd modes.

While a 90% level of significance was used in previous research efforts [*Tootle et al.*, 2008], a threshold value of 95% significance was established for the current research and maps displaying significant correlation values for SWE regions and Pacific Ocean SSTs regions are provided.

While SVD is a powerful tool for the statistical analysis of two spatio-temporal fields, there exist several limitations to its use that should be investigated *(Newman and Sardeshmukh, 1995)*. However, if the leading (1st, 2nd, 3rd) modes explain a significant amount of the variance of the two fields, then SVD can be applied to determine the strength of the coupled variability present [*Newman and Sardeshmukh, 1995).*

3.3. Results

The use of three Pacific Ocean SST predictor periods (JFMAMJ, AMJJAS and JASOND) and three SWE predictands (March 1st, April 1st and May 1st) resulted in square covariance fractions ranging from 42 % to 78 % for the 1st mode; 8 % to 31% for the second mode; and 4 % to 14% for the 3rd mode (Figure 2).

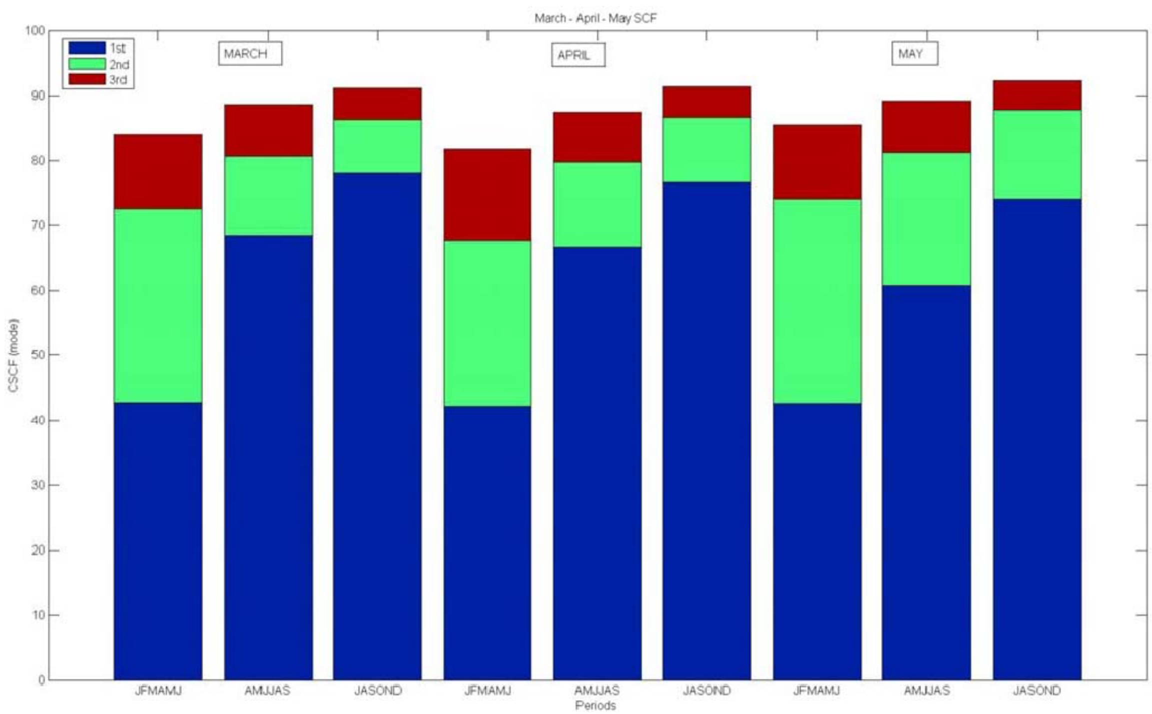


Figure III.2: Cumulative Squared Covariance Fractions (CSCF) for March 1st, April 1st and May 1st SWE (1961 to 2006) and Pacific Ocean SST (1960 to 2005) predictor periods (JFMAMJ, AMJJAS and JASOND). Blue, green and red represents 1st mode, 2nd mode, and 3rd mode, respectively

In the resulting nine individual analyzes, the leading (1st, 2nd and 3rd) modes explained, together, a minimum of 82% to a maximum of 92% of the variance. Thus, SVD can be used in the analysis [per *Newman and Sardeshmukh*, 1995]. For each of the figures, blue represents negative correlation values while red represents positive correlation values above the 95% significance level. Non-significant snowpack stations are represented by black dots. Only April 1st snowpack (and Pacific Ocean SSTs) results are presented below in the current research as similar spatial patterns (and significance levels) were observed in March 1st and May 1st snowpack (and Pacific Ocean SSTs). Finally, an additional analysis was performed such that the Pacific Ocean SST data were weighted by the square root of cosine of latitude to account for spatial variations of the grid cells. Similar to *Wallace et al.* [1992], the results did not show any noticeable differences.

3.3.1 SVD 1st Mode: Pacific Ocean SSTs (JFMAMJ, AMJJAS, JASOND) and Western U.S. March 1st, April 1st and May 1st SWE

First, a distinct Pacific Ocean equatorial SST pattern (e.g., ENSO) was observed and this pattern appears to intensify as the lead-time between the SST period and the SWE date reduces (Figure 3). A similar pattern was observed for March (Figure 4) and May (Figure 5) snowpack. This ENSO-like pattern was verified through the use of correlation analysis. The SVD SST 1st TES for all three predictor seasons (JFMAMJ, AMJJAS and JASOND) and April 1st snowpack were correlated with the seasonal average Niño 3.4 index for the corresponding (matching) SST season. The magnitude of the correlation values ranged from 0.81 to 0.93, which is evident in the plot of the 1st TES and the Niño 3.4 (and PDO) indices (Figure 3).

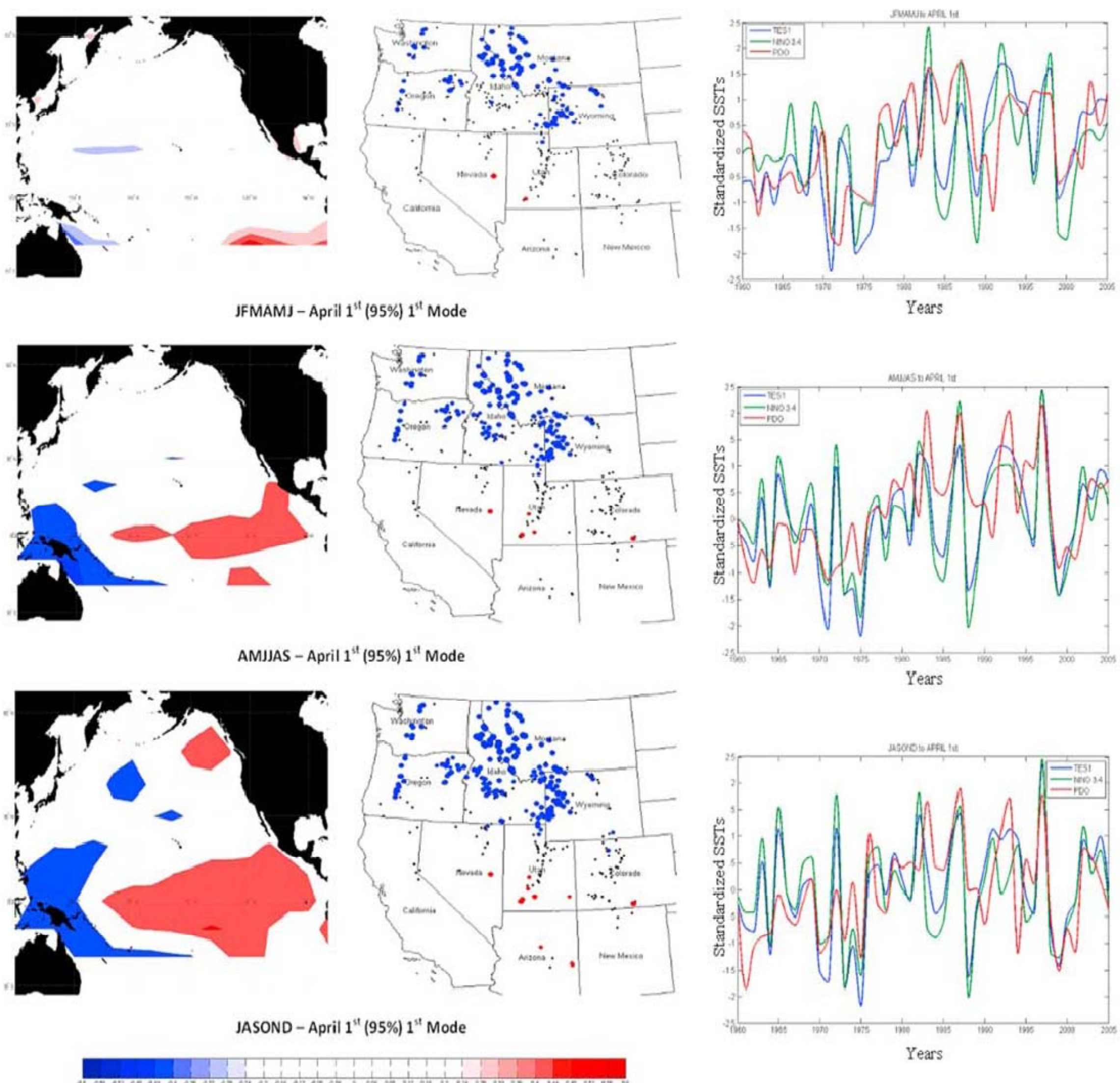


Figure III.3: Heterogeneous correlation figures (1st mode) when applying SVD to the previous year (1960 to 2005) Pacific Ocean SSTs for (a) JFMAMJ (b) AMJJAS and (c) JASOND and current year (1961 to 2006) April 1st SWE. Negative (positive) correlations (95% significance) are represented by blue (red). Non-significant snowpack stations are represented by black circles. Time series plot of seasonal 1st Temporal Expansion Series (TES1), Niño 3.4 index, and PDO index.

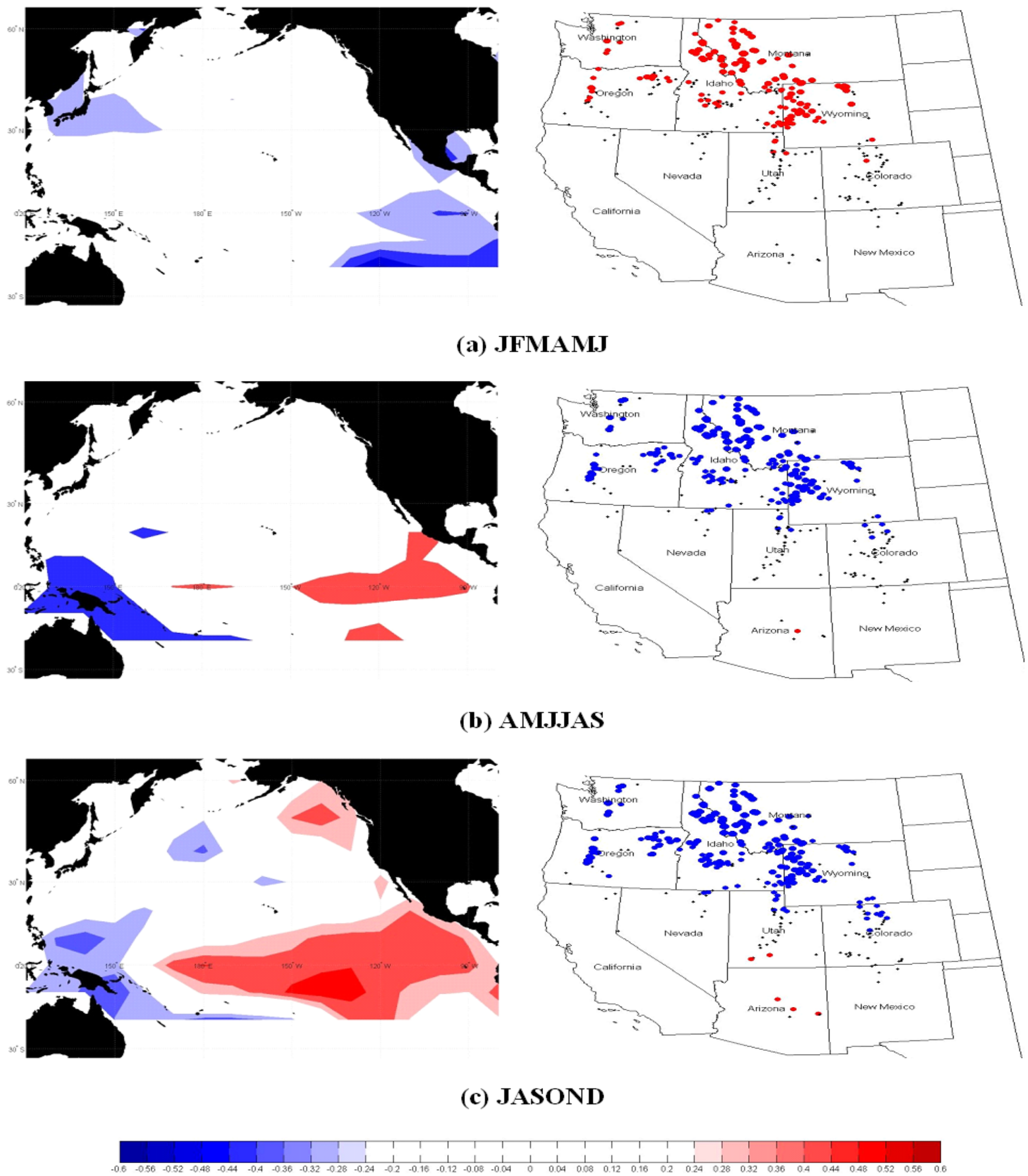


Figure III.4: Heterogeneous correlation figures (1st mode) when applying SVD to the previous year (1960 to 2005) Pacific Ocean SSTs for (a) JFMAMJ (b) AMJJAS and (c) JASOND and current year (1961 to 2006) March 1st SWE. Negative (positive) correlations (95% significance) are represented by blue (red). Non-significant snowpack stations are represented by black circles.

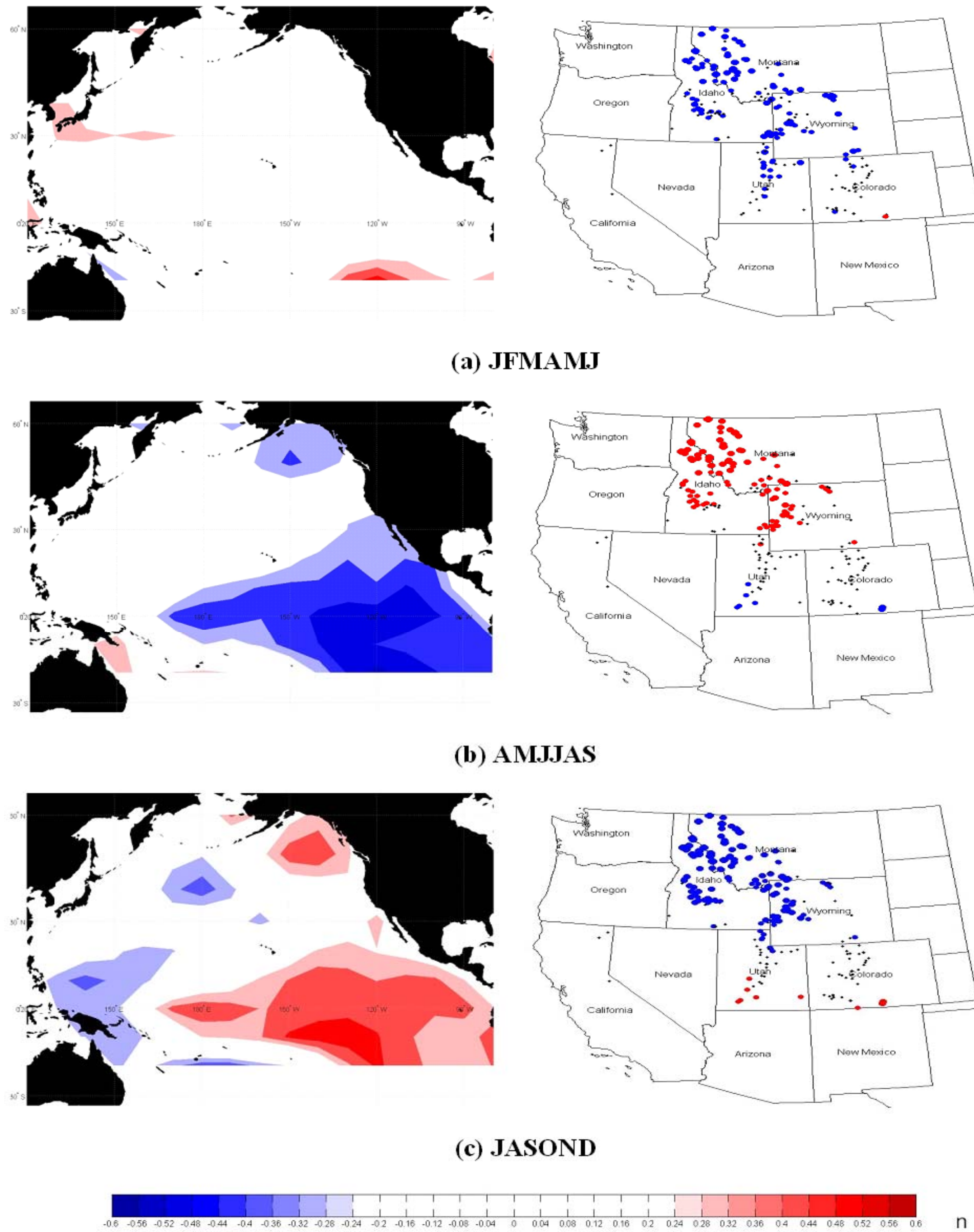


Figure III.5: Heterogeneous correlation figures (1st mode) when applying SVD to the previous year (1960 to 2005) Pacific Ocean SSTs for (a) JFMAMJ (b) AMJJAS and (c) JA-SOND and current year (1961 to 2006) May 1st SWE. Negative (positive) correlations (95% significance) are represented by blue (red). Non-significant snowpack stations are represented by black circles.

Thus, the ENSO signal was present and identified (verified) in the observed Pacific Ocean SST spatial patterns. A similar correlation analysis was performed with the seasonal average of PDO for the corresponding (matching) predictor season. The magnitude of the correlation values ranged from 0.54 to 0.65. It should be noted that a distinct northern Pacific (south of Alaska) SST pattern (e.g., PDO) was observed in the figures and, similar to ENSO, appears to intensify as the lead-time shortens. Based on the correlation analysis, the ENSO signal appears to have a stronger relationship (higher correlation values) than the PDO signal in western U.S. snowpack, for the stations identified as being significant in the 1st mode.

Also, more important is the relationship the SST pattern exhibits with western U.S. snowpack. As previously discussed, while negative and positive regions are displayed for both Pacific Ocean SSTs and SWE stations, it is important to understand that the signs (+/-) of the correlation values represent how the Pacific Ocean SST regions interact with the western U.S. SWE stations. Pacific Ocean SST regions and SWE stations that exhibit the same color (sign) have a positive relationship and behave similarly. As such increased (decreased) Pacific Oceans SSTs result in increased (decreased) SWE. However, if the signs are opposite for the Pacific Ocean SST regions and SWE stations, they will behave in an opposite manner [i.e., increased (decreased) Pacific Oceans SSTs result in decreased (increased) SWE].

Interestingly, a distinct ENSO-like SWE response was identified in western U.S. snowpack such that a warming (cooling) of equatorial SSTs results in a decrease (increase) in Pacific Northwest snowpack. While SWE stations are limited in the southwestern U.S., a similar ENSO-like pattern was observed such that a warming (cooling) of equatorial SSTs results in an increase (decrease) in Southwest snowpack.

However, most notable is that a consistent pattern of non-significant UCRB (Utah and Colorado) snowpack stations were identified. Therefore, it appears that ENSO (and PDO) are not the primary Pacific Ocean climatic drivers of snowpack in this region. In an attempt to identify the Pacific Ocean climatic drivers of snowpack in this region, the results of the SVD 2nd mode were examined.

3.3.2 SVD 2nd Mode: Pacific Ocean SSTs (JFMAMJ, AMJJAS, JASOND) and Western U.S. March 1st, April 1st and May 1st SWE

First, a distinct SST pattern was observed in the western Pacific Ocean (east of Japan) and no “ENSO-like” or “PDO-like” SST patterns were identified. Next, the “missing” SWE region [i.e., UCRB (Utah and Colorado)] of SWE stations (from the SVD 1st mode) was identified as significant in the SVD 2nd mode (Figure 6). The same was observed for the March and May SST data (Figure 7 and Figure 8). It appears that an increase (decrease) in SST in this Pacific Ocean region east of Japan results in a decrease (increase) in UCRB SWE. While ENSO (and to some degree, PDO) are recognized as the primary climatic drivers of western U.S. snowpack, the UCRB region (UT and CO) appears to be driven by this SST region. This is also evident in the plot of the 2nd TES and the Niño 3.4 (and PDO) indices, in which lower correlations (when compared to the 1st TES) are observed (Figure 6). Please note, the “switching” of the signs is inherent to SVD and the importance of the results is the positive/negative relationships between SSTs regions and SWE stations, as displayed by the figures.

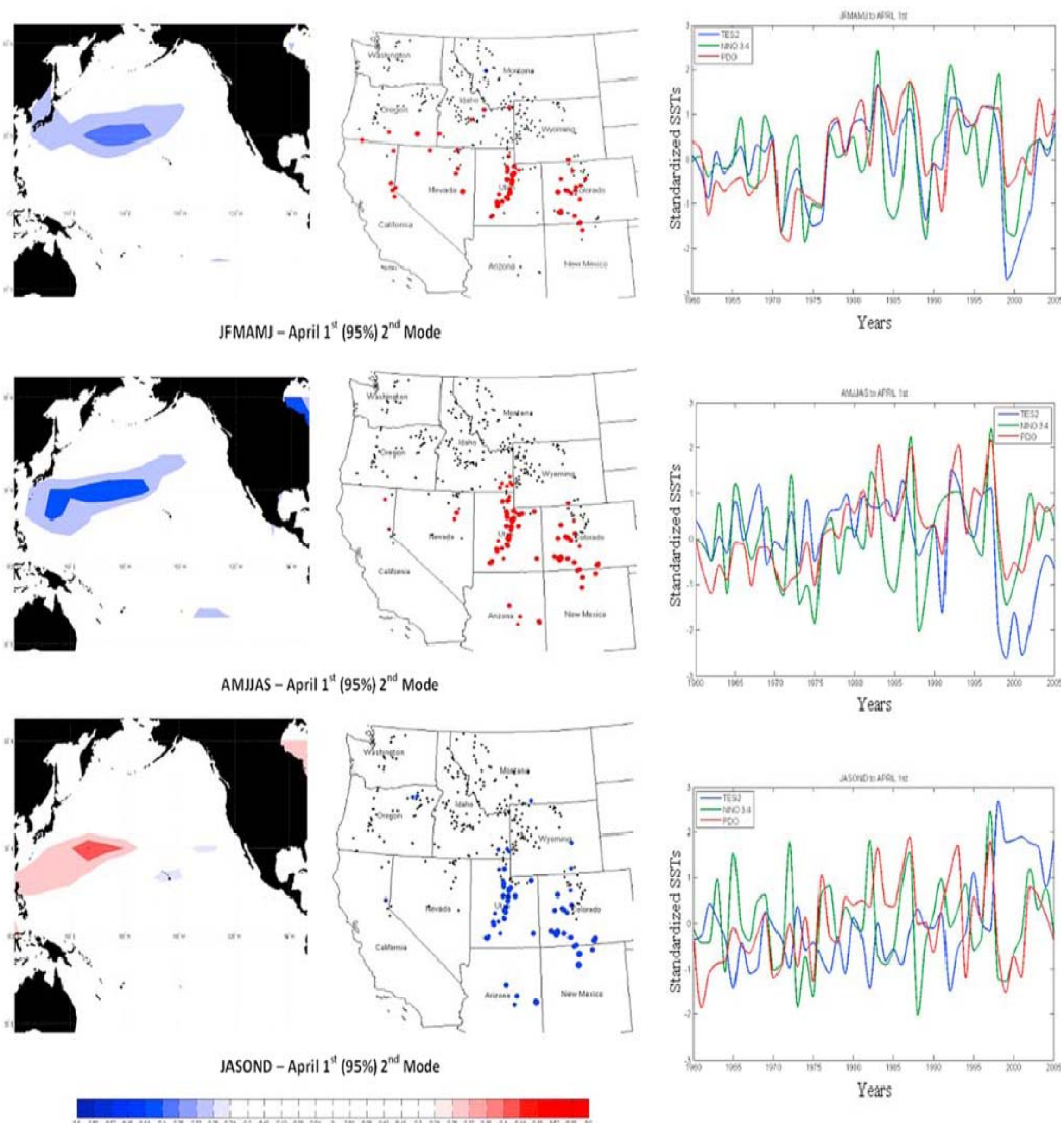


Figure III.6: Heterogeneous correlation figures (2nd mode) when applying SVD to the previous year (1960 to 2005) Pacific Ocean SSTs for (a) JFMAMJ (b) AMJJAS and (c) JASOND and current year (1961 to 2006) April 1st SWE. Negative (positive) correlations (95% significance) are represented by blue (red). Non-significant snowpack stations are represented by black circles. Time series plot of seasonal 2nd Temporal Expansion Series (TES2), Niño 3.4 index and PDO index.

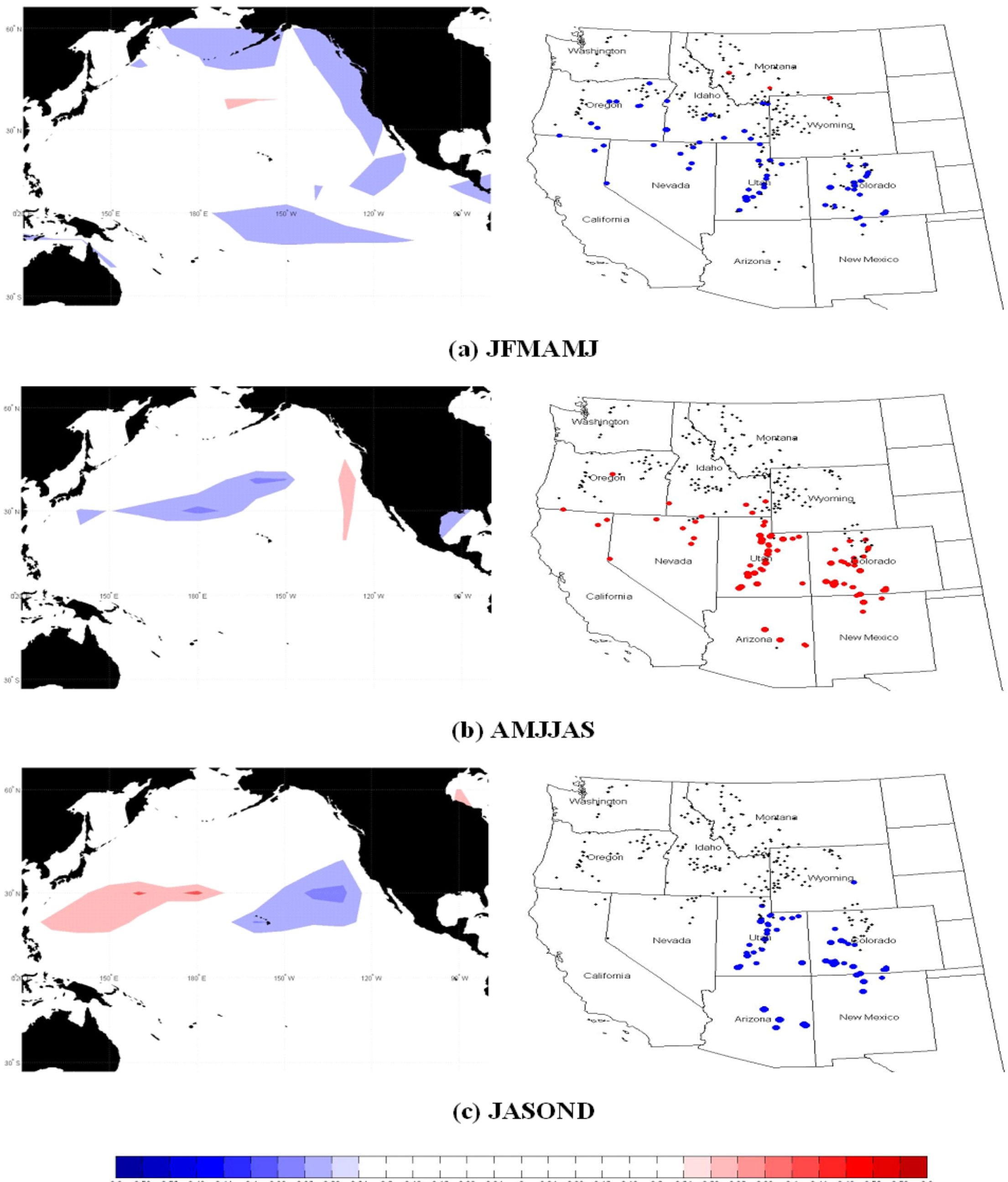
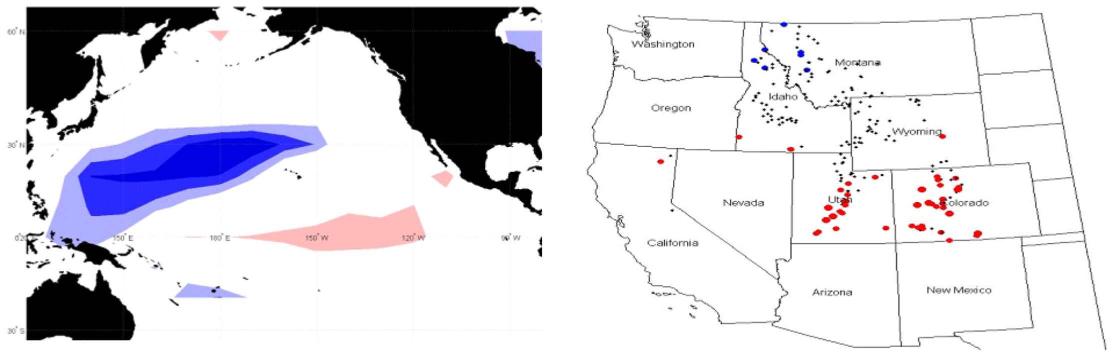
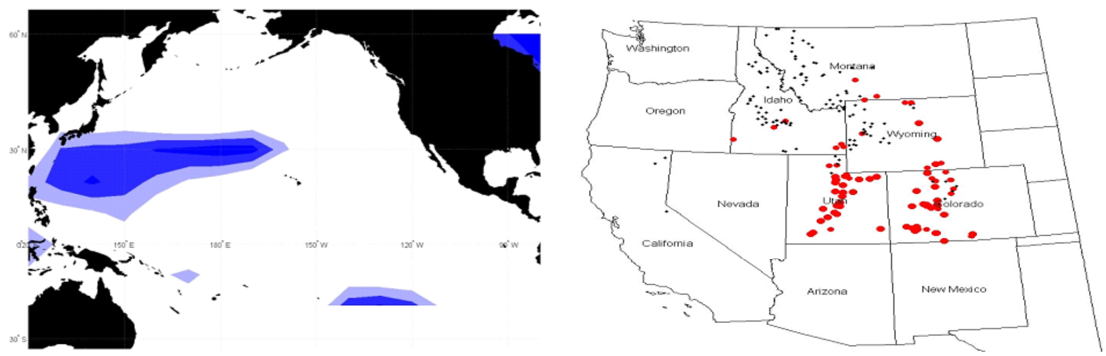


Figure III.7: Heterogeneous correlation figures (2nd mode) when applying SVD to the previous year (1960 to 2005) Pacific Ocean SSTs for (a) JFMAMJ (b) AMJJAS and (c) JASOND and current year (1961 to 2006) March 1st SWE. Negative (positive) correlations (95% significance) are represented by blue (red). Non-significant snowpack stations are represented by black circles.



(a) JFMAMJ



(b) AMJJAS

(c) JASOND

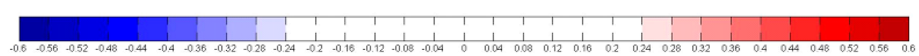


Figure III.8: Heterogeneous correlation figures (2nd mode) when applying SVD to the previous year (1960 to 2005) Pacific Ocean SSTs for (a) JFMAMJ (b) AMJJAS and (c) JASOND and current year (1961 to 2006) May 1st SWE. Negative (positive) correlations (95% significance) are represented by blue (red). Non-significant snowpack stations are represented by black circles.

To further investigate the Pacific Ocean SST region identified in the 2nd mode, the SVD analysis was performed on a sub-set of April 1st snowpack stations. Fifty-four (54) April 1st snowpack stations were selected in Colorado and Utah and SVD was performed using the same three predictor periods for Pacific Ocean SSTs. Interestingly, the results of this analysis (1st mode) displayed similar spatial SST and snowpack regions as the previous results (Figure 6).

Next, an additional analysis of 13 reconstructed streamflow (water year) gages in the UCRB (Utah and Colorado) with a period of record of 1861 to 1990 and Pacific Ocean SSTs with period of record of 1860 to 1989 was conducted. The results supported the findings from the snowpack analysis in Figure 4 (2nd mode) and the previous 54 station snowpack analysis in that a similar Pacific Ocean SST region was identified and all 13 streamflow gages were determined to be significant. Finally, previous research efforts [*Uvo et al.*, 1998; *Wang and Ting*, 2000; *Shabbar and Skinner*, 2004; *Tootle and Piechota*, 2006; *Tootle et al.*, 2008) had large spatial differences between SSTs (i.e., number of cells) and hydrologic variables (i.e., number of gages). To assure the current results were not due to the Pacific Ocean SST field overwhelming the snowpack field, an additional analysis was performed such that the Pacific Ocean SST region [34^{o} N to 24^{o} S and 150^{o} E to 160^{o} W] identified in the 2nd mode (Figure 6) was isolated such that only that region was used in SVD with western U.S. snowpack. The intent is to reduce the SST spatial component (i.e., number of cells) such that it is similar in size to the snowpack spatial component (i.e., number of snowpack stations). The results supported the current research efforts in that UCRB (Utah and Colorado snowpack region) was identified in the 1st mode. This represents an important discovery as confirmed in the following validation analysis.

3.3.3 Validation Analysis

To confirm the results for the current research, which evaluated three, 6-month predictor periods, an additional analysis was performed using four, 3-month predictor periods for the Pacific Ocean SSTs [December-January-February (DJF), March-April-May (MAM), June-July-August (JJA) and September-October-November (SON)]. The results of the 1st mode and the 2nd mode revealed similar spatial patterns for both Pacific Ocean SSTs and snowpack as displayed in the current research.

The Pacific Ocean SST region identified by the SVD 2nd mode extends from approximately 34° N to 24° S and 150° E to 160° W (Figure 6). A yearly (1960 to 2005), seasonal (JFMAMJ, AMJJAS, JASOND) SST index for this region, analogous to the Niño 3.4 index representing ENSO strength, were created by seasonally averaging all the cells within that region per year. Following the procedure outlined in *McCabe and Dettinger* [2002], the three seasonal (JFMAMJ, AMJJAS, JASOND) SST averages for the 34° N to 24° S and 150° E to 160° W spatial region were correlated with April 1st SWE. This results in three maps that display correlations exceeding the 95% confidence level (Figure 9). The results are very similar to Figure 4 in that the UCRB SWE stations are identified as being significant while northwestern and southwestern U.S. SWE stations are not significant. Additionally, the SWE stations identified as being significant are negatively correlated with the SST region, thus verifying the results from the SVD analysis that an increase (decrease) in SST temperatures in this region results in a decrease (increase) in UCRB SWE. The resulting correlation analysis displays significant SWE stations that were not identified as significant in *McCabe and Dettinger* [2002], who used (only) ENSO and PDO indices (Figure 5).

As performed in *Watson et al.* [2009], spectral analysis [*Torrence and Compo*, 1998] reveals that the 1st TES displays a higher-frequency signal (approximately 4 to 6 years) while the 2nd TES does not display a similar higher-frequency signal (Figure 10). The higher-frequency signal in the 1st TES is most likely associated with ENSO. A visual comparison of the spectral analysis of the 1st TES and the Niño 3.4 index for the same season (AMJJAS) and period of record displayed similar patterns.

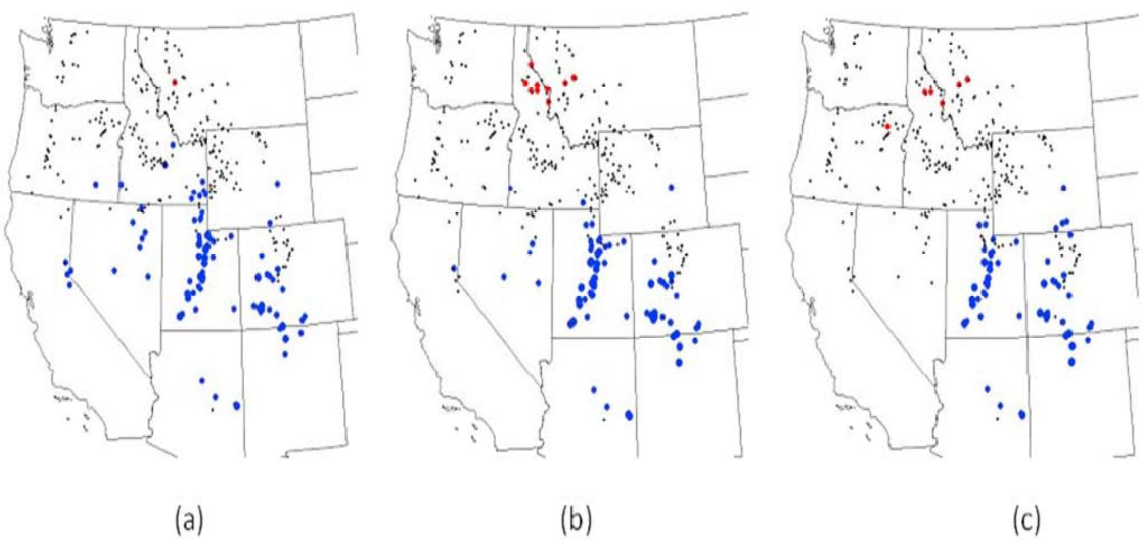


Figure III.9: Correlation figures for yearly (1960 to 2005), seasonal (a) JFMAMJ (b) AMJJAS and (c) JASOND, Pacific Ocean SST region [34^o N to 24^o S and 150^o E to 160^o W] and yearly (1961 to 2006) April 1st SWE. Negative (positive) correlations (95% confidence level) are represented by blue (red) circles while non-significant correlations are represented by black circles.

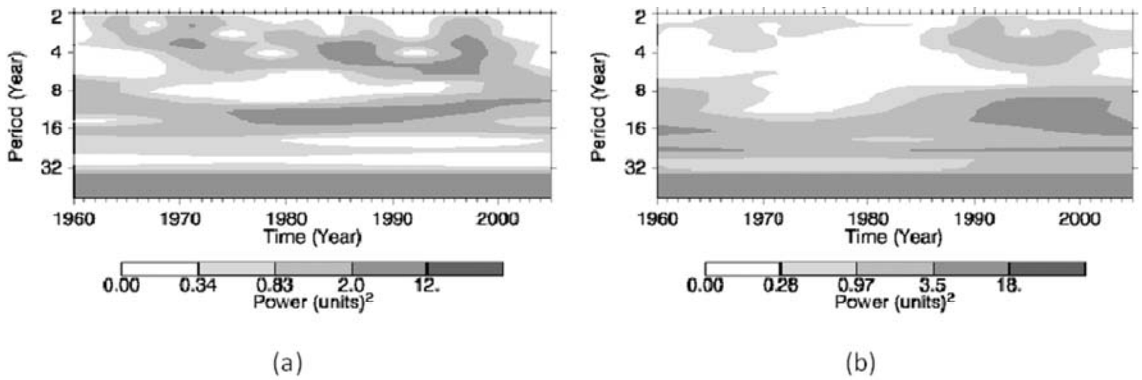


Figure III.10: Wavelet Power Spectra for the SVD (a) 1st (b) 2nd Temporal Expansion Series for previous year AMJJAS Pacific Ocean SSTs (1960 to 2005) and current year April 1st SWE (1961 to 2006).

3.3.4. Discussion and Conclusions

A thorough (three predictor periods, three predictands, two modes) investigation of Pacific Ocean SSTs and western U.S. snowpack resulted in the development of a comprehensive SWE dataset and the "possible first-time" identification of the primary Pacific Ocean driver of UCRB snowpack. However, has this Pacific Ocean SST pattern been previously observed and perhaps overlooked due to the focus on ENSO and PDO? *Rajagopalan et al. (2000)* utilized SVD to evaluate global SSTs and continental U.S. PDSI for several periods including 1963 to 1995 (similar period of record to the current research). While there may be considerable "noise" in the *Rajagopalan et al. (2000)* analysis (global SSTs instead of Pacific Ocean SSTs and continental U.S. PDSI instead of western U.S. SWE), *Rajagopalan et al. (2000)* identified a similar spatial Pacific Ocean SST pattern (east of Japan). Also, this SST pattern was equal in strength (correlation significance) to the ENSO-like pattern that was concurrently identified. Thus, it appears that a significant non-ENSO climatic driver, similar to the current research, was identified by *Rajagopalan et al. (2000). Wang and Ting (2000)* utilized SVD to evaluate Pacific Ocean SSTs and continental U.S. precipitation from 1951 to 1994. A similar Pacific Ocean SST pattern (east of Japan) was simultaneously identified with an ENSO-like pattern. Similar to *Rajagopalan et al. (2000),* this SST pattern was equal in strength to the ENSO like pattern. *Grantz et al. (2005)* identified a similar Pacific Ocean SST pattern and no ENSO-like SST pattern when developing predictors for long lead-time forecasts of the Truckee-Carson River system, located in eastern California and western Nevada, near Lake Tahoe. The physical explanation for this Pacific Ocean SST region that was provided by *Grantz et al. (2005)* was based on a composite analysis of average SST, wind and 500mb pressure patterns, focusing on high and low (extreme) streamflow years. *Grantz et al. (2005)* concluded that the SST patterns in high and low streamflow years were a direct response to pressure and winds, resulting in evaporative cooling that results in cooler than normal SSTs in this region. *Tootle and Piechota (2006)* utilized SVD to evaluate Pacific Ocean SSTs and continental U.S. streamflow for 1951 to 2002. Again, given the increase in dataset "noise" (continental U.S. streamflow instead of western continental U.S. snowpack), a similar Pacific Ocean SST pattern (east of Japan) was simultaneously identified with a ENSO-like pattern and, the SST pattern displayed higher strength (correlation significance) than the ENSO-like pattern. Finally, *Soukup et al. (2009)* extended the work of *Grantz et al. (2005),* utilizing SVD (in lieu of correlation techniques) to identify long lead-time predictors (SSTs) of North Platte River streamflow and identified a similar Pacific Ocean SST pattern. While *Grantz et al. (2005)* and

Soukup et al. (2009) appeared to capture (isolate) this Pacific Ocean SST pattern without a concurrent ENSO-like pattern, the current research represents the first time this pattern has been associated with UCRB (Utah and Colorado) hydrology (both snowpack and streamflow). The ability to isolate this pattern in *Grantz et al. (2005)* and *Soukup et al. (2009)* and the current research efforts can most likely be attributed to the loss of "noise" (i.e., smaller spatial regions – Truckee-Carson River System and North Platter River Basin) in the predictand dataset. Additionally, these predictand regions tend to be aligned along the 40^{o} North parallel and may reflect the "switching or turning axis" of the acknowledged hydrologic response to ENSO.

In particular, the use of SVD on SST fields covering the majority of the Tropical and North Pacific Ocean rather than a predefined SST sub-region (e.g., Nino 3.4) eliminates important limitation associated with the use of composite climatic indices. An analysis of spatial patterns in the mapped correlation fields (Figure 3) provided an independent confirmation of ENSO and PDO-like patterns. However, while *McCabe and Dettinger (2002)* identified the PDO as the slightly more dominant signal, the current research found ENSO to be slightly more dominant based on correlation analysis. This is most likely due to SVD requiring the use of a defined (seasonal six-month SST) predictor period. Although the current research evaluates a 46 year period of record, six-month predictor periods would most likely capture an interannual (high frequency) climate signal (e.g., ENSO) versus and interdecadal (low frequency) climate signal (e.g., PDO). While the current research was limited to evaluating Pacific Ocean SSTs, other climatic variables (e.g., 500mb anomalies) may provide additional insight into the physical mechanisms and drivers of UCRB snowpack.

McCabe and Dettinger (2002), through the use of correlation analysis, showed ENSO and PDO were not identified in UCRB (Utah and Colorado) snowpack. However, due to the limitation of using climate indices (only), no explanation could be provided as to what Pacific Ocean SST regions drive UCRB snowpack. The current research accomplished this when evaluating the SVD 2nd mode (Figures 6 and 9). This was further verified in streamflow data from Utah and Colorado. A similar pattern was verified in other research efforts [e.g., *Rajagopalan et al.*, 2000; *Wang and Ting*, 2000; *Grantz et al.*, 2005; *Tootle and Piechota*, 2006 and *Soukup et al.*, 2009] but, the importance of this Pacific Ocean SST region as a possible driver of UCRB hydrology (both SWE and streamflow) was not advocated in these research efforts.

CHAPTER IV
ATLANTIC OCEAN SEA SURFACE TEMPERATURES AND ADOUR GARONNE (FRANCE) REGIONAL STREAMFLOW VARIABILITY

A version of this chapter has been accepted for publication in the *Hydrological Sciences Journal:*

Abdoul Aziz Oubeidillah, Glenn Tootle and SallyRose Anderson. Atlantic Ocean Sea Surface Temperatures and Adour Garonne (France) Regional Streamflow Variability. *Hydrological Sciences Journal* (In Press).

Abstract

The identification of Atlantic Ocean climatic drivers may prove valuable in long lead-time forecasting of streamflow in the Adour-Garonne basin in southwestern France. Previous studies have identified the Atlantic Multidecadal Oscillation (AMO) and the North Atlantic Oscillation (NAO) as drivers of European hydrology. The current research applied the Singular Value Decomposition (SVD) statistical method to Atlantic Ocean SSTs to identify the primary Atlantic Ocean climatic drivers of the Adour-Garonne basin streamflow. Annual and seasonal streamflow volumes were selected as the hydrologic response while average Atlantic Ocean SSTs were calculated for three different six month averages (January to June or JFMAMJ, April to September or AMJJAS, and July to December or JASOND) for the year preceding streamflow. The results identified a region along the equator as the probable driver of the basin streamflow. Additional analysis evaluated the influence of the AMO and NAO on Adour-Garonne basin streamflow.

4.1. Introduction

The Adour-Garonne basin is the fifth largest French watershed with an area of 116,000 km^2 (Figure 1). The main river in the basin is the Garonne River, the third largest in France based on annual flow rate. Approximately 6.5 million people, a tenth of the total French metropolitan population, rely on this water for domestic, agricultural, and industrial use with the demand increasing annually. This basin headwaters is dominated by the Pyrenees and Massif Central mountains which feed the Garonne and Adour rivers, from the Pyrenees mountain ranges. The Tarn, Lot, Dordogne and Charente rivers all flow from the Massif Central mountain range. Identifying and understanding of any underlying Atlantic Ocean climatic drivers will benefit the water availability prediction and management for this region.

A number of studies have evaluated oceanic-atmospheric variability and continental U.S. hydrologic (e.g., streamflow, precipitation, and snowpack) response *(Hunter et al., 2006; Tootle et al., 2005; Rogers and Coleman, 2003; McCabe and Dettinger, 2002; Enfield et al., 2001; Cayan et al., 1999; Gershunov, 1998; Kahya and Dracup, 1993; Cayan and Webb; 1992; Cayan and Peterson, 1989)* as well as European hydrology *(Brandimarte et al., 2011 ; Lavers et al., 2010; Bartolini et al., 2009; Jacobeit et al. 2009 ; Lopez-Bustins et al., 2008; Massei et al. 2007; Gallego et al., 2005; Rodwell et al., 1999).* These papers represent a small number of the many research studies conducted in the area.

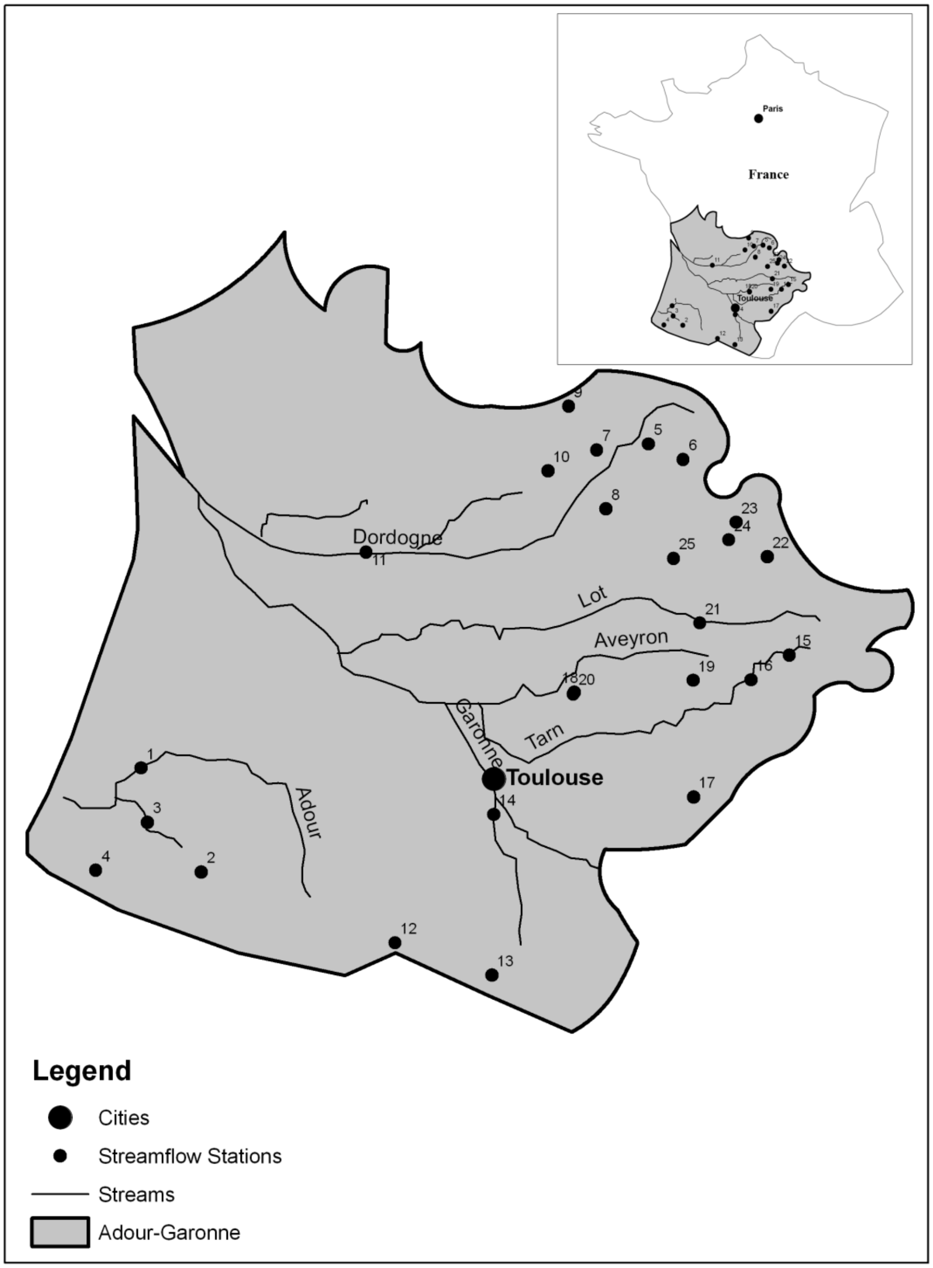


Figure IV.1: Map of the Adour-Garonne Basin with locations of streamflow stations. The numbers correspond to those in Table 1.

The results led to the use of climatic variables as a predictor in long lead-time streamflow forecast models *(Soukup et al., 2009; Tootle et al., 2007; Pagano and Garen,2006;*

Grantz et al., 2005; Tootle and Piechota, 2004; Uvo et al, 2002). Previous studies evaluating the relationship between the AMO and NAO climate indices and hydrologic response neighboring regions to the Adour-Garonne basin were inconclusive.

Durand et al. (2009) used the French model SAFRAN, which simulates atmospheric conditions related to snowpack, to study the evolution of snowpack given the elevation and slope in the French Alps and Pyrenees. They could not establish a relationship between the NAO and ENSO with snow cover in the French Alps and Pyrenees. *Massei et al (2007)* used continuous wavelet transforms of seven precipitation time series and compared them with NAO wavelet transforms. They could not establish a link between NAO and rainfall as precipitation records did not contain easily retrievable NAO-like components in northwestern France. *Lespinas et al. (2010)* identified an NAO influence on precipitation; however, it was not strong enough to influence long-term trends in their study of rivers in southern France.

All the study areas in the work cited above were adjacent to the Adour-Garonne basin. Because of its hydrologic importance, numerous studies have been conducted to investigate climate change impacts on this region's hydrology *(Tisseuil C.,2009; Hau M., 2008; Caballero et al., 2007; Voirin-Morel, 2003).*

Bretherton et al. (1992) concluded that Singular Value Decomposition (SVD) was simple to use and preferable for general use while *Wallace et al. (1992)* found that SVD was a powerful technique that isolates the most important modes of variability. Various studies have used SVD to evaluate SST and hydrologic variability *(Aziz et al., 2010; Tootle et al., 2008; Tootle and Piechota, 2006; Shabbar and Skinner, 2004; Martin et al., 2004;*

Rodriguez-Fonseca and de Castro, 2002; Rajagaopalan et al., 2000; Wang and Ting, 2000; Giannini et al., 2000; Enfield and Alfaro, 2000; Uvo et al., 1998). These studies investigated SST and hydrologic [e.g., snowpack, drought, precipitation, streamflow] response in the U.S., Canada and Europe. While the use of Principal Components Analysis (PCA) is very common in this type of analysis, SVD has the advantage of being able to evaluate the cross-covariance matrix of two spatial-temporal fields to identify similarities between them. PCA, on the other hand, evaluates only one spatial-temporal field. Additionally, the use of SVD with SSTs and streamflow eliminates the limitations associated with using pre-defined SST regions (e.g., AMO) of climate variability and the resulting streamflow response to phases (e.g., warm or cold) of these climate signals. Therefore, the hypothesis of the current research is that an Atlantic Ocean SST region (or regions) exist which is a climatic driver of Adour-Garonne basin streamflow. The most well established and understood Atlantic Ocean climate phenomena, AMO and NAO, were not identified as being teleconnected with regions adjacent to the Adour-Garonne basin in previous research efforts. Thus, the identification of an Atlantic Ocean SST climatic driver of Adour-Garonne basin streamflow would represent an important discovery. The motivation of the current research is that the Atlantic Ocean SST region (or regions) identified may be used as a long lead-time predictor of Adour-Garonne basin streamflow. Similar to the Nino 3.4 index representing the El Nino-Southern Oscillation (ENSO), an index can be developed for the Atlantic Ocean SST region (or regions) identified and this index may be used as a predictor in a statistically based long lead-time streamflow forecast model.

The current research will provide a comprehensive [i.e., three Atlantic Ocean SST (predictor) periods and two Adour-Garonne basin streamflow (predictand) periods], first time analysis of Atlantic Ocean SSTs and the Adour-Garonne basin streamflow variability and the identification of Atlantic Ocean SST regions that influence streamflow. This study will apply SVD to Atlantic Ocean Sea Surface Temperatures (SSTs) and Adour-Garonne basin streamflow in an attempt to identify climatic drivers and, perhaps, a useful long lead-time predictor of streamflow. Although not previously identified as a climatic driver of hydrologic response in neighboring regions to the Adour-Garonne basin, an evaluation of Adour-Garonne basin streamflow and climate indices (AMO and NAO) will also be performed and compared to previous research efforts. While previous publications evaluated the impact of climate change on water resources of the Adour-Garonne basin *(Caballero et al., 2007; Caballero et al., 2003; Lehenaff, 2002)*, this study will focus solely on the possible teleconnection between the Atlantic Ocean SSTs and the regional streamflow.

4.2. Data

Atlantic Ocean sea surface temperature (SST) data were obtained from the National Climatic Data Center website. The National Oceanic and Atmospheric Administration (NOAA) extended reconstructed SST version 3b from *Smith, Reynolds et al. (2008)* were downloaded from http://www.esrl.noaa.gov/psd/data/gridded/data.noaa.ersst.html. These data consist of a 2° by 2° grid of average monthly SSTs from January 1854 to February 2010. For this study, the SST region spanning from 20° South to 70° North and 80° West to 2° West was used. After land masses were removed, this resulted in 1,361 SST cells being identified. Average Atlantic Ocean SSTs were calculated for three different six month periods (January to June or JFMAMJ, April to September or AMJJAS, and July to December or JASOND). The period of record for the SSTs is 1960 to 2005 (46 years).

Streamflow data were obtained from the hydrology website of the Ministry of Ecology and Sustainable Development (Ministère de l'Ecologie et du Developpment Durable) at http://www.hydro.eaufrance.fr. Streamflow time series in this database are produced by regional services called DIREN. For this study, unimpaired streamflow stations (stations identified with no anthropogenic influences) were selected. While there were many streamflow stations with records extending further back in time, many had large gaps of missing data or were discontinued in recent times. Only streamflow stations with complete records were evaluated. The selected period of record for streamflow (1960-2006) balanced the number of stations that had complete records with an acceptable length of record. This resulted in 25 streamflow stations being used in the current research (Table 1).

An evaluation of the distribution of monthly streamflow identified that the period of November through March resulted in the highest streamflow (Figure 2). This was confirmed by other studies such as *Caballero et al. (2007),* which identified the July to October period as the low flow period. Thus, streamflow for the November to March period along with the calendar year period were evaluated in the study. Average monthly streamflow rates (cubic meters per second – m^3/s) were converted to either calendar year streamflow volume or seasonal (November to March) streamflow volume. Two data sets of 25 streamflow stations were created. The first one consisted of annual streamflow volume (Million Cubic Meters or MCM) from January to December of the same year. The second consists of streamflow volume (MCM) for November of the previous year to March of the current year. This resulted in a wide range of lead-times varying from 0 to 6 months.

Table IV.1: List and description of streamflow stations. The numbering corresponds to the station numbers shown on the figure maps

Station Order	Station #	Station Name	Lat*	Lon*	Department
1	Q3120010	L'Adour à Saint-Vincent-de-Paul	1862643	326445	Landes (40)
2	Q7002910	Le Gave d'Oloron à Oloron-Sainte-Marie [Oloron-SN	1804085	360293	Pyrénées-Atlantiques (64)
3	Q7412910	Le Gave d'Oloron à Escos	1832099	329975	Pyrénées-Atlantiques (64)
4	Q9164610	La Nive des Aldudes à Saint-Étienne-de-Baïgorry	1804972	300932	Pyrénées-Atlantiques (64)
5	P0190010	La Dordogne à Bort-les-Orgues	2045815	612807	Corrèze (19)
6	P0364010	La Santoire à Condat [Roche-Pointue]	2037176	632571	Cantal (15)
7	P1154010	La Luzège à Lamazière-Basse [Pont de Bouyges]	2042504	583744	Corrèze (19)
8	P1502510	La Maronne à Pleaux [Enchanet]	2009197	588829	Cantal (15)
9	P3021010	La Vézère à Bugeat	2067161	567826	Corrèze (19)
10	P3502510	La Corrèze à Tulle [Pont des soldats]	2030679	556281	Corrèze (19)
11	P5140010	La Dordogne à Bergerac	1984849	453459	Dordogne (24)
12	O0015310	Le Maudan à Fos	1764001	469828	Haute-Garonne (31)
13	O1115010	L'Artigue à Auzat [Cibelle]	1745647	524405	Ariège (09)
14	O1900010	La Garonne à Portet-sur-Garonne	1836493	525406	Haute-Garonne (31)
15	O3121010	Le Tarn à Montbrun [Pont de Montbrun]	1926545	692591	Lozère (48)
16	O3141010	Le Tarn à Mostuéjouls [La Muse]	1912540	670860	Aveyron (12)
17	O4102510	L'Agout à Fraisse-sur-Agout	1846445	638444	Hérault (34)
18	O5292510	L'Aveyron à Laguépie [1]	1905684	570939	Tarn-et-Garonne (82)
19	O5344010	Le Vioulou à Salles-Curan [Trébons-Bas]	1912229	638138	Aveyron (12)
20	O5572910	Le Viaur à Laguépie	1904680	570581	Tarn-et-Garonne (82)
21	O7131510	Le Lot à Lassouts [Castelnau]	1944600	642030	Aveyron (12)
22	O7272510	La Truyère au Malzieu-Ville [Le Soulier]	1982106	680007	Lozère (48)
23	O7354010	La Lander à Saint-Georges	2001559	662432	Cantal (15)
24	O7502510	La Truyère à Neuvéglise [Grandval]	1991614	658173	Cantal (15)
25	O7635010	La Bromme à Brommat [EDF]	1981284	627222	Aveyron (12)

* Lambert II coordinate system (France)

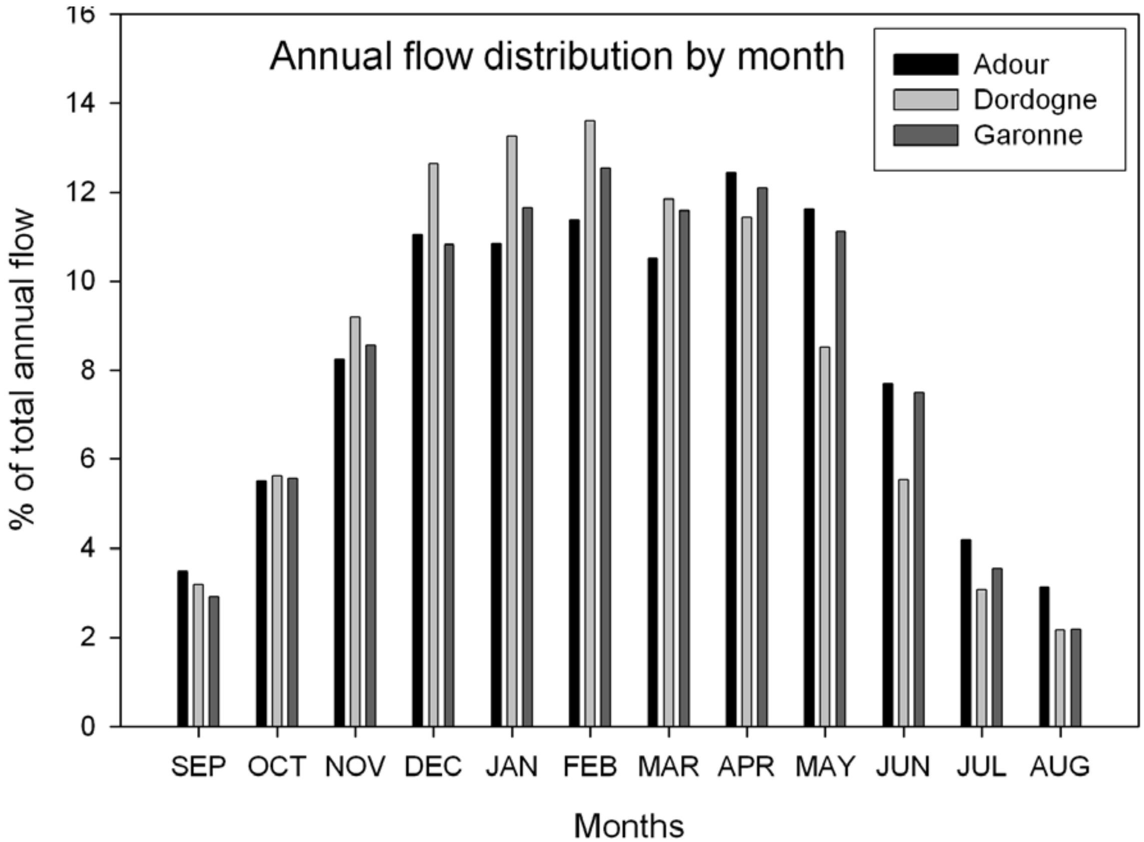


Figure IV.2: Monthly distribution of streamflow for the Adour, Dordogne and Garonne Rivers in the Adour-Garonne basin as a percent of total annual flow.

The anomalies of the data sets were calculated. For the Atlantic Ocean SSTs, the deviation of the seasonal means from the long time average were calculated for each cell and for the streamflow, the anomalies were calculated for each station. Each of the data sets was then standardized. These standardized anomalies of the data sets were used in this study. These datasets were then detrended by removing the best straight-line fit from the data vectors. Consequently, the correlation results will be independent of any trend that may be present in the datasets.

The Atlantic Ocean oceanic–atmospheric climatic phenomena data used in this study were the Atlantic Multidecadal Oscillation (AMO) and the North Atlantic Oscillation (NAO). The AMO, is an oscillation observed in the northern part of the Atlantic Ocean with long duration periods that last between 20 and 40 years. It is composed of a cold phase and a warm phase. It is acknowledged to affect air temperature and precipitation over North America and Europe and its footprint can also be identified in Atlantic hurricane frequency data *(Enfield et al, 2001).* The AMO data used in the analysis are the unsmoothed time series from the Kaplan SST version 2 calculated at NOAA/ESRL/PSD1 and they were obtained from http://www.cdc.noaa.gov/Pressure/Timeseries/Data/amo.long.data.

The NAO is a winter climate variability defined as the normalized difference in sea level atmospheric pressure between stations in Iceland and in the Azores. An extended version of the NAO index can be derived by using a station at the southwest part of the Iberian Peninsula *(Hurrell, 1995).* The NAO is also known to affect Atlantic hurricane strength and direction. The data used in this analysis were obtained from http://www.esrl.noaa.gov/psd/gcos_wgsp/Timeseries/Data/nao.long.data.
The average monthly values for the climatic indices (AMO and NAO) were averaged for each of the six month (e.g., JFMAMJ, AMJJAS, JASOND) predictor periods for the same period of record (1960 to 2005) as the Atlantic Ocean SSTs.

4.3. Methods

4.3.1 Correlation of Streamflow Data with AMO and NAO Seasonal Indices

To evaluate the relationship between the streamflow stations and the Atlantic Ocean climate indices AMO and NAO, simple correlation analyses were performed. The seasonal (JFMAMJ, AMJJAS, JASOND) average values of the climate indices were evaluated with all streamflow stations using Pearson correlation. Thus, the relationship is limited to a pre-determined region of the Atlantic Ocean. To eliminate this limitation, SVD was used to evaluate the relationship between the Atlantic Ocean SST region covering 20° South to 70° North and 80° West to 2° West and streamflow.

4.3.2 Singular Value Decomposition (SVD)

While *Bretherton et al.(1992)* provides a detailed discussion of Singular Value Decomposition (SVD) methods, in the current research, SVD was used in the form:

$$[U,S,V] = svd(X).$$

This results in a diagonal matrix, S, of the same dimension as X. The diagonal elements of S were non-negative and were arranged in decreasing order. It also produces the unitary matrices, U and V. U and V were orthogonal singular vectors and were called Left and Right, respectively. The matrices U, S and V were such as:

$$X = U*S*V^{-1}.$$

The matrix X, (m x n) with $m \geq n$, was the cross-covariance matrix created from the two spatial-temporal matrices used for the analysis. The matrices must have the same temporal size while the spatial elements may vary. The matrices can be square or diagonal and it is important to note that the two spatial-temporal fields must consist of detrended standardized anomalies.

In this study, sst(x,t) was the left side matrix composed of x SST anomaly data points over a period T and Q(y,t) was the right side matrix composed of y streamflow stations Q anomalies over the same length period T, with x and y representing the space and T the time. The cross-covariance matrix, X, was obtained by multiplying the left side matrix by the transpose of the right side matrix and dividing the product by the number of years.

$$X = \frac{sst * Q^{-1}}{T}$$

The modes were determined by the Square Covariance Fractions (SCF) matrix, which was analogous to the eigenvalues in Principal Components Analysis (PCA). The SCF matrix was obtained by dividing each squared element, k of S_k by the sum of all squared elements, arranged in descending order.

$$SCF = \frac{S_k^2}{\sum S_k^2}$$

Each value indicates a mode and the amount of variance explained in the corresponding mode, with the first mode accounting for the largest percentage of the variation and the second mode accounting for the second most variation and so on. All the modes were uncorrelated. The second mode was orthogonal to the first mode which was orthogonal to the third mode and so on. The Temporal Expansions Series (TES), also known as time series, were analogous to the principal components scores in PCA, and were obtained by projecting the data matrix (left side, right side) into each eigenvector of the corresponding unitary matrix (Left, Right). Consider the Left singular vectors L_k and the left side matrix sst(x,t). The left temporal expansion series (LTES) (A_k) results from:

$$A_k = L_k * \text{sst(x,t)}$$

The procedure was the same for the right temporal expansion series (B_k).

The temporal expansion series were then used to create heterogeneous correlation maps by correlating each time series to the opposing side data set. The following is an example for a left heterogeneous correlation:

$$r_k = \text{r[sst(x,t), B}_\text{k}\text{]}$$

SVD has been shown to detect correlations in data, even when the dataset has significant "noise." The terms Left and Right were arbitrarily used for easier comprehension. Interchanging them at the beginning or using different appellations would be of no consequence on the results.

4.4. Results

4.4.1 Correlations with Atlantic Ocean Climate Indices

4.4.1.1 AMO

Correlation of the AMO index and streamflow, for the various seasons and lead-times, did not result in a consensus statistical relationship as few streamflow stations were identified as significant at 90% level ($p < 0.1$). When using calendar year streamflow as the predictand, nine (of 25) streamflow stations were significant for the first predictor period (JFMAMJ), seven for the second predictor period (AMJJAS), and nine for the third predictor period (JASOND). Five stations -Q7002910 (2), O1900010 (14), O7272510 (22), O7354010 (23) and O7502510 (24), per Table 1, were found to be significant for all three periods. For the November to March streamflow period, fewer streamflow stations were identified as significant. One station was significant for the first (JFMAMJ) and one station was significant for the second (AMJJAS) predictor periods. The JASOND was not correlated due to overlap with the predictand period (November to March). The streamflow stations that displayed statistical significance with the AMO exhibited a negative correlation. Thus, a positive (negative) phase of the AMO results in a decrease (increase) in streamflow in the region.

4.4.1.2 NAO

Correlation of the NAO index was similar to that of the AMO index. Eight annual streamflow stations were significant for the first (JFMAMJ) period, five for the second (AMJJAS) period, and zero for the third (JASOND) period. When using the November-March streamflow, only five stations were significant for the first (JFMAMJ) and none were significant for the second (AMJJAS) predictor periods. The JASOND period was not correlated due to overlap with the predictand period (November to March).

The streamflow stations that showed a significant correlation with the NAO exhibited a negative relationship, thus, a positive (negative) phase of the NAO results in a decrease (increase) in streamflow in the region. Interestingly, *Hurrell (1995)* identified a similar finding on the correlation between euro-Mediterranean region precipitation and the NAO. *Struglia et al. (2004)* found similar negative correlations between the NAO and streamflow stations discharging into the Mediterranean Sea, which include stations adjacent to the Adour-Garonne region. Given the lack of an AMO or NAO climate signal in the Adour-Garonne basin streamflow, it is highly unlikely these established climate signals, when used in a long lead-time statistical streamflow forecast model, will produce acceptable (skillful) results.

4.4.2 SVD Analysis

The cumulative SCF for the first three modes was above 90% in all cases. Generally, if the leading three modes explain a significant (greater than 80%) amount of the variance between the two fields, then SVD can be applied to determine the strength of the coupled variability present *(Newman and Sardeshmukh, 1995).* Therefore, SVD can be applied in the current research efforts.

The results of this study show that the majority of the variability in the data is explained in the 1st mode. The 1st mode Square Covariance Fractions (SCF) ranged from 75% to 85%. Given the vast majority of the variability was explained in the first mode, only figures for the first mode were provided.

4.4.2.1 Annual Streamflow

For the annual streamflow, the cumulative square covariance fractions, for the first three modes, for the three SST predictor periods (JFMAMJ, AMJJAS and JASOND) were 94%, 95%, and 96%, respectively (Figure 3).

For the first period (JFMAMJ) Atlantic Ocean SSTs, 22 out of the 25 stations were significant at 90% for the first mode (1st mode SCF = 85%). The streamflow correlation values were positive (red in Figure 3). 524 of the 1,361 SST cells were significant at 90% in the first mode. The significant SST cells are in a region along the equator between Brazil and Senegal, and the eastern Atlantic near northwestern Africa. A small region just east of North America, almost centered at 30° North and 15° West, was also identified. All of the SST correlation values were negative (blue in Figure 3).

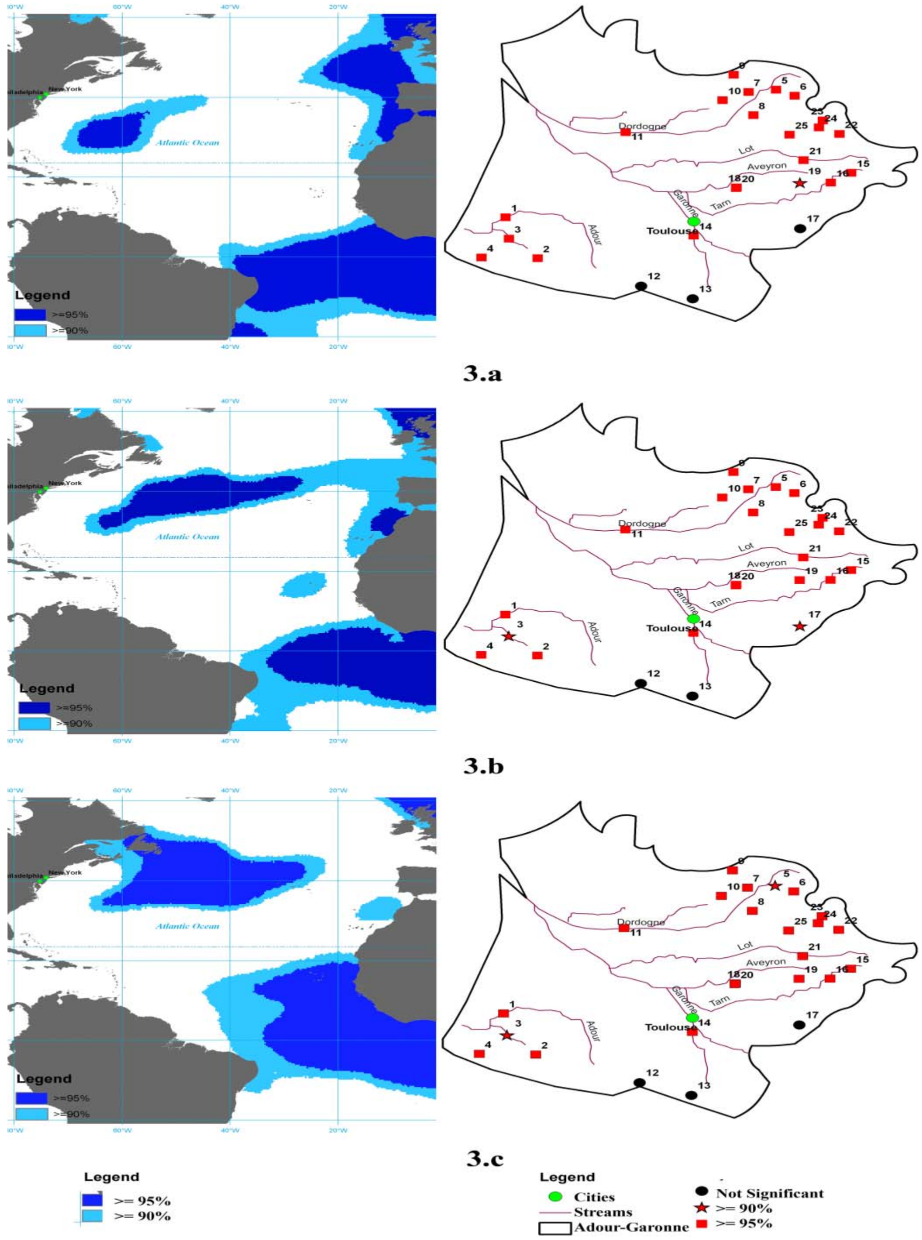


Figure IV.3: Heterogeneous correlation figures (1st mode) when applying SVD to the previous year Atlantic Ocean SSTs on the left side for (3.a) JFMAMJ (3.b) AMJJAS and (3.c) JASOND and current year (Jan-Dec) streamflow on the right side. Negative (positive) correlations are represented by blue (red).

In SVD, the opposite signs identified in the streamflow stations and SST regions reveal they behave in an opposite manner. When the significant Atlantic Ocean SSTs regions identified increase (decrease) in temperature, the significant Adour-Garonne basin streamflow stations identified will decrease (increase) in runoff volume.

For the second period (AMJJAS) Atlantic Ocean SSTs, 23 of the 25 streamflow stations were identified as 90% significant and displayed a positive relationship (red in Figure 3) in the first mode (1st mode SCF = 88%). Non-significant streamflow stations observed in this period were similar to those identified in the first period. An SST region, similar to the one identified in the first period, was identified. However, the small region east of North America shifted slightly north. In all, about 600 SST cells exhibited negative correlation (blue in Figure 3).

Results from the third six-month period (JASOND) Atlantic Ocean SSTs were almost identical to the second period results in that 23 of the 25 streamflow stations were 90% significant and displayed a positive relationship (red in Figure 3) in the first mode (1st mode SCF = 89%). The identified Atlantic Ocean SST region exhibited a similar pattern as the first two SST predictor periods with a region extending down the west coast of Europe and Africa and along the equator between Brazil and Africa. In addition, the SST pattern spanned across the Atlantic Ocean, linking the previously identified region east of North America with the region along the west coast of Europe just above the 30th parallel, covering the Azores islands. In all, about 600 SST cells had negative correlation values (blue in Figure 3).

4.4.2.2 November-March Streamflow

For this period, the cumulative square covariance fractions for the three periods (JFMAMJ, AMJJAS and JASOND) were 92%, 93%, and 93%, respectively (Figure 4).

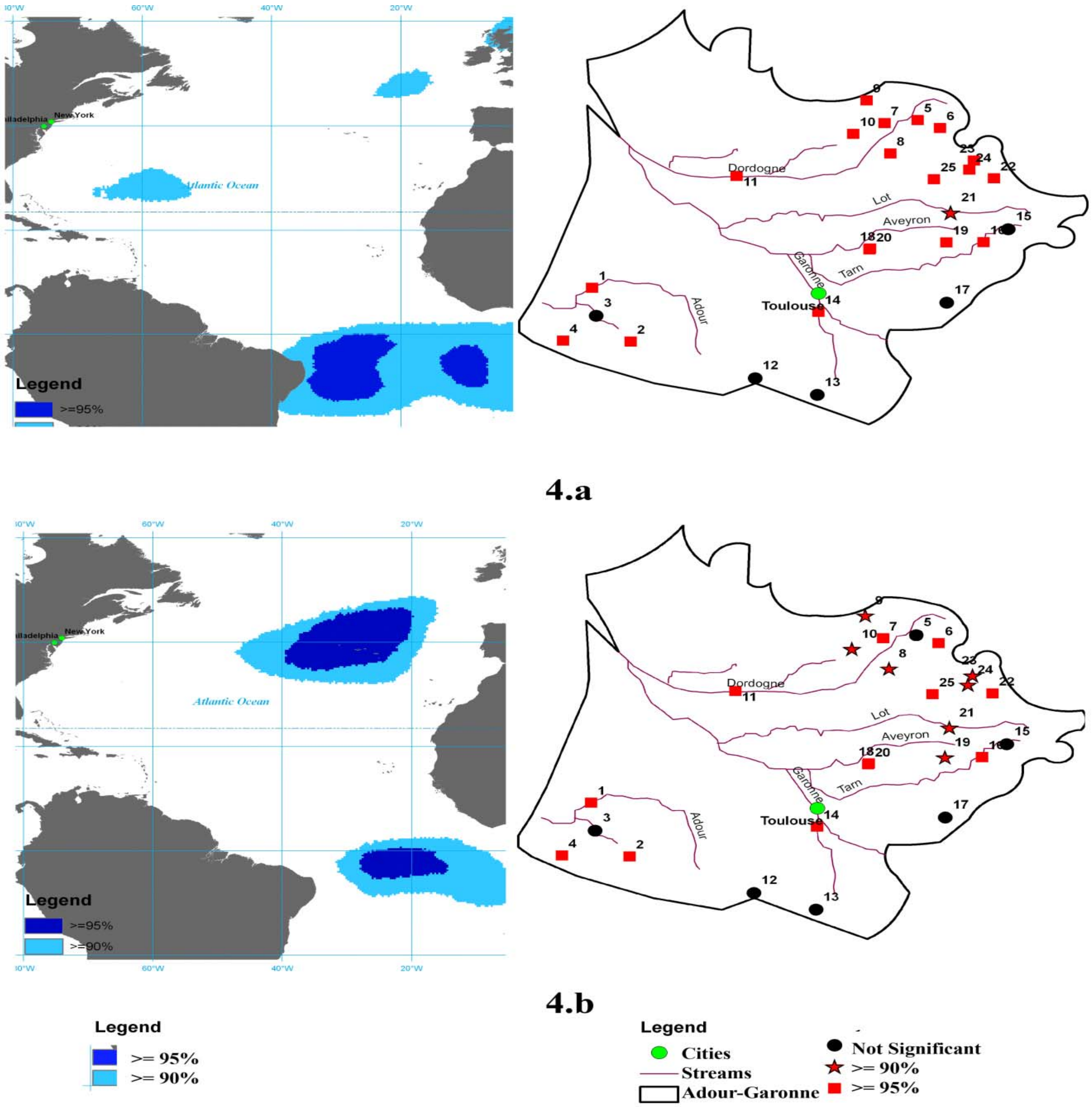


Figure IV.4: Heterogeneous correlation figures (1st mode) when applying SVD to the previous year Atlantic Ocean SSTs on the left side for (4.a) JFMAMJ (4.b) AMJJAS and seasonal (Nov-March) streamflow on the right side. Negative (positive) correlations are represented by blue (red).

For the first period (JFMAMJ) Atlantic Ocean SSTs, 20 of the 25 stations were significant at 90% for the first mode (1^{st} mode SCF = 77%). The streamflow correlation values were positive (red in Figure 4). Approximately 300 of the 1,361 SST cells were significant at 90% in the first mode and had negative correlation values (blue in Figure 4). The significant SST cells are in a region along the equator between Brazil and Senegal, a small region of the east coast of North America and a region north-west of Europe.

For the second period (AMJJAS) Atlantic Ocean SSTs, 20 of the 25 streamflow stations were identified as 90% significant in the first mode (1^{st} mode SCF = 74%). The streamflow correlation values were positive (red in Figure 4). Similar non-significant streamflow stations observed in the first period were also not significant in the second period. An SST region similar to the one observed in the first period was also identified. In addition, another SST region covering the Azores islands, just above the 30^{th} parallel, was also observed. In all, about 300 SST cells had negative correlation values (blue in Figure 4).

The third SST period (JASOND) was not evaluated because it overlapped with the predictand period.

4.5. Discussion and Conclusions

The results identified no clear relationship between established Atlantic Ocean climate indices (AMO, NAO) and streamflow in the Adour-Garonne basin, which confirmed previous research in adjacent regions. As a result of the eight subsequent evaluations of

Atlantic Ocean SSTs and Adour-Garonne basin streamflow detailed above, it appears that the streamflow in the Adour-Garonne basin is influenced by Atlantic Ocean SSTs along the equatorial region between Brazil and the west coast of Africa, and a region off the west coast of Europe.

As discussed above, it is important to note the nature of the relationship between the Atlantic Ocean SST regions and the Adour-Garonne basin streamflow stations by observing the signs of the correlation values for each dataset. By analyzing the resulting data and figures, it was apparent that the identified Atlantic Ocean SST regions and the Adour-Garonne basin streamflow stations have an opposite relationship. This was explained because the SST regions show negative correlation values and the streamflow stations show positive correlations.

For the long lead-time analysis, the majority of higher SST correlation values were consistently concentrated along the equator. Increasing the lag time between the SST periods and the streamflow period from 0 to 6 months identified a similar Atlantic Ocean SST equatorial region. Interestingly, the signal was stronger (higher correlations) for the longer lag time than the shorter lag time. This is probably an indication that SST could potentially be better for use in long lead-time forecasting.

Additionally, an SST time series index was created for the Atlantic Ocean region expanding from 10°South to 4°North and 30°West to 2°West, by taking the annual average of all the cell SST's within that region. This time series was then correlated to each streamflow station. All but five stations resulted in significant correlation (r) values ranging from -0.26 to -0.49. It is interesting to note that the correlation test shows a negative relationship similarly to the SVD analysis results.

Future research may focus on the use of a non-parametric or regression based long lead-time streamflow forecast model *(Soukup et al., 2009; Tootle et al., 2007; Tootle and Piechota, 2004; Hastenrath et al., 1984)* for Adour-Garonne basin streamflow. Additionally, future research efforts may focus on determining a physical explanation of the results (Atlantic SST regions identified) found in this study by examining Z500mb geopotential height pressure as well as global circulation phenomena. *Z. X. Li (2000)* stated that the physical mechanisms affecting the interannual and interdecadal climate variability in the tropical Atlantic Ocean are not yet understood. The paper also identified two modes of variability, and the one centered in the equatorial region with ENSO like dynamics involving the thermocline depth of the Ocean and the atmosphere's trade winds, could be responsible. Similar results were found in Chang et al. [1997] where it was also pointed out that the equatorial region of the Atlantic SST has been found in many studies to influence the variability of northeast Brazil and Sahel rainfall *(Follan et al., 1986; Hastenrath, 1984; Moura & Shukla, 1981).*

CHAPTER V
STREAMFLOW AND SNOWPACK FORECASTING OF THE UPPER COLORADO RIVER BASIN AND GREAT BASIN USING A NON-PARAMETRIC FORECAST MODEL

A version of this chapter is currently in review with *the Journal of Hydrology*.

Abdoul A. Oubeidillah, Glenn A. Tootle, Cody Moser, Thomas Piechota, Kenneth Lamb. Upper Colorado River and Great Basin Streamflow and Snowpack Forecasting using Pacific Oceanic-Atmospheric Variability

Abstract

Water managers, especially in western U.S., are left with the difficult task of managing scarce resources and rely heavily on forecasts to allocate and meet various competing water demands. The need of better and improved forecast models is of utmost importance. In this research, the use of oceanic and climatic variables as predictors to improve the forecast of streamflow as well as snowpack was investigated. SVD analysis was used to find region of Pacific Ocean SST and global Z500mb geopotential height pressure that are significantly correlated with streamflow and snowpack in the study area. The resulting significant SST and Z500mb cells were used to create indices that were used as predictors to a non parametric forecasting model. Most of the analysis showed positive skills, which indicate an improvement of the forecast from the climatology or no-skill forecast. They also indicated that the SST indices were better suited for long lead-time (seven to nine month) forecasts while the Z500mb indices were better in the short-lead time (3 month) forecasts. In all, the results of the forecast model indicated that incorporating oceanic-atmospheric phenomena in the forecast model can lead to improved forecasts for both streamflow and snowpack.

5.1. Introduction

The State of Utah provides a critical source for streamflow and water supply with the accumulation and spring-summer melt of snowpack in several mountain ranges. One such range, the Wasatch Range, stretches approximately 260 km from the Idaho-Utah border south into central Utah. Snowpack driven streamflow from the west slope provides the primary water supply for nearly 2 million residents including Salt Lake City. Approximately 85% of Utah's population lives within 30 km of the Wasatch Range with the majority being near the west slope which contributes to the Great Basin. Equally important, the east slope of the range contributes directly to the Upper Colorado River Basin which provides water to over 25 million residents. The Uinta Mountains are located in the northeast part of the state and are noted for their unique east-west direction. Similar to the Wasatch Range, the snowpack driven streamflow from the Uinta Mountains contributes both to the Upper Colorado River Basin (south and east slopes) and the Great Basin (north and west slopes). Several smaller mountainous regions (Henry Mountains, Tushar Mountains, Pahvant Range) also provide snowpack driven streamflow.

Over the past several decades, hydrologists and climatologists have developed relationships between large scale oceanic-atmospheric variability and climate (hydroclimatology). Atmospheric – oceanic climatic and sea surface temperature (SST) variability can provide important predictive information about hydrologic variability in regions around the world. Significant research has focused on identifying Pacific atmospheric – oceanic climatic phenomena such as the El Niño-Southern Oscillation (ENSO) *(Philander, 1990)* and the Pacific Decadal Oscillation (PDO) *(Mantua, et al., 1997).* Further research has identified what influence these phenomena have on U.S. hydrology, including streamflow *(Tootle et al., 2005)* and snowpack *(McCabe and Dettinger, 2002).* The identified atmospheric – oceanic climate variability relationships may be used as long lead-time (e.g., three to nine months) predictors (forecasters) of various hydrologic responses, including streamflow and snowpack.

However, previous research efforts have failed to identify ENSO or PDO signals in hydrologic (streamflow and snowpack) response in the majority of Utah. *Tootle et al (2005)* evaluated ENSO and PDO signals in 639 unimpaired streamflow gages in the continental U.S. which included several gages located in Utah. When applying the non-parametric rank-sum test, a statistically significant ENSO (or PDO) signal was not detected in water-year streamflow for most of these gages *(Tootle et al., 2005). McCabe and Dettinger (2002)* evaluated 323 snowpack (April 1st Snow Water Equivalent – SWE) stations in the western continental U.S. and southwestern Canada. Similar to the streamflow results, *McCabe and Dettinger (2002)* did not identify an ENSO or PDO signal in most snowpack for stations in Utah. Given this research, the use of ENSO or PDO as a long lead-time predictor of streamflow (or snowpack) in Utah will likely result in poor forecast skill.

Thus, the identification of a Pacific oceanic-atmospheric driver of Utah streamflow (or snowpack) may provide a useful predictor in long lead-time forecast models. *Aziz et al*

(2010) evaluated western U.S. snowpack and Pacific Ocean SSTs using the Singular Value Decomposition (SVD) statistical method and identified a region in the Pacific Ocean that was teleconnected with snowpack. *Lamb et al (2011),* again using SVD, identified a similar Pacific Ocean region when evaluating streamflow. A similar pattern was identified in previous research efforts *(e.g., Rajagopalan et al., 2000; Wang and Ting, 2000; Grantz et al., 2005; Tootle and Piechota, 2006; Soukup et al., 2009)* but, the importance of this Pacific Ocean SST region as a possible driver of hydrology in Utah was not pursued in these research efforts.

In addition to SSTs, *Grantz et al (2005)* and *Soukup et al (2009)* identified 500 mbar geopotential height (Z500mb) values as a useful long lead-time predictor of streamflow. Geopotential height is the height to the pressure zone of interest, as measured above the mean sea surface elevation. *Blackmon (1977)* explored the behavior of the 500 mbar wind statistics upon northern hemisphere wintertime circulation. The results of these studies suggested that Z500mb index values can be attributed to substantial impacts on climate. *Xoplaki et al. (2000)* determined that the link between precipitation over Greece and changes in large scale atmospheric circulation were strong in relation to 500 mbar geopotential heights. *Serreze et al. (1998)* evaluated the relationship between snowfall and low frequency atmospheric variability and found that the troughs and ridges associated with the 500 mbar zone do play a role in the characteristics of snowfall over the eastern United States.

Streamflow (snowpack) forecasting is the process of predicting the volume of water (snow water equivalent) at a specific location for a specific time period. An alternative to typical parametric regression techniques is a non-parametric approach. Non-parametric routines avoid the usual assumption that the data comes from a normal distribution (or any specific distribution). Essentially, a non-parametric model is derived from the data and does not pre-define the form (i.e. linear or non-linear) of the function. Non-parametric methods have been successfully applied to streamflow forecasting. *Piechota and Dracup (1999)* applied non-parametric (kernel density estimator) methods to forecasting streamflow for long lead-times and showed significant improvement when comparing the results to the climatology (no skill) forecast *(Piechota and Dracup, 1999)*. The non-parametric kernel density estimator was also successfully applied to El Niño-Southern Oscillation (ENSO) affected streams in eastern Australia and Florida *(Piechota et al., 1998, Tootle and Piechota, 2004).* The exceedance probability forecast developed provides an example of applying non-parametric techniques to forecasting. An exceedance probability forecast explains the likelihood that a certain streamflow volume will be equaled or exceeded during a certain period of time. Exceedance probability forecasts are used for the design and operation of water resource systems that require a high degree of system reliability *(Piechota et al., 2001)*. The idea of developing exceedance probability forecasts of snowpack (April 1st SWE) is novel, given the importance of snowpack in water supply, and worthy of investigation.

The motivation of the current research was the Wasatch and Uinta Ranges (and adjacent regions) represent an extremely challenging area in identifying traditional Pacific Ocean climate teleconnections (El Niño-Southern Oscillation and Pacific Decadal Oscillation) in hydrologic (streamflow and snowpack) response. Given this challenge and the likely inability to use ENSO and PDO as a skillful forecaster of streamflow and snowpack, SVD was utilized to verify the Pacific Ocean SST region identified in previous research efforts and this SST region was used as a predictor in a long lead-time non-parametric forecast model. SVD was also applied to identify 500 mbar geopotential height (Z500mb) values which were also utilized as predictors. Using the SST and Z500mb values, the forecast skill was determined for various lead-times (three to nine months) to evaluate if a skillful forecast of streamflow (or snowpack) could be obtained for a vital water supply region of the western United States.

5.2. Data

5.2.1 Streamflow

Data from seven unimpaired streamflow stations (Figure 1, Table 1) were obtained from the U.S. Geological Survey (USGS) National Water Information System. USGS provides historical monthly mean streamflow in cubic feet per second (cfs). The average monthly streamflow rate in cfs for April, May, June and July (AMJJ) were summed and converted into streamflow volumes using appropriate conversions. The period of streamflow volume used in the analysis was 1961 to 2002 (42 years).

5.2.2 Snowpack

April 1st Snow Water Equivalent (SWE) data for six stations (Figure 1, Table 1) were obtained from the Natural Resources Conservation Service (NRCS) website (http://www.wcc.nrcs.usda.gov/snotel/). Each of the snowpack stations selected had complete records and was used in previous research efforts *(Aziz et al., 2010; Hunter et al., 2006).* Similar to streamflow, the period of record was 1961 to 2002 (42 years).

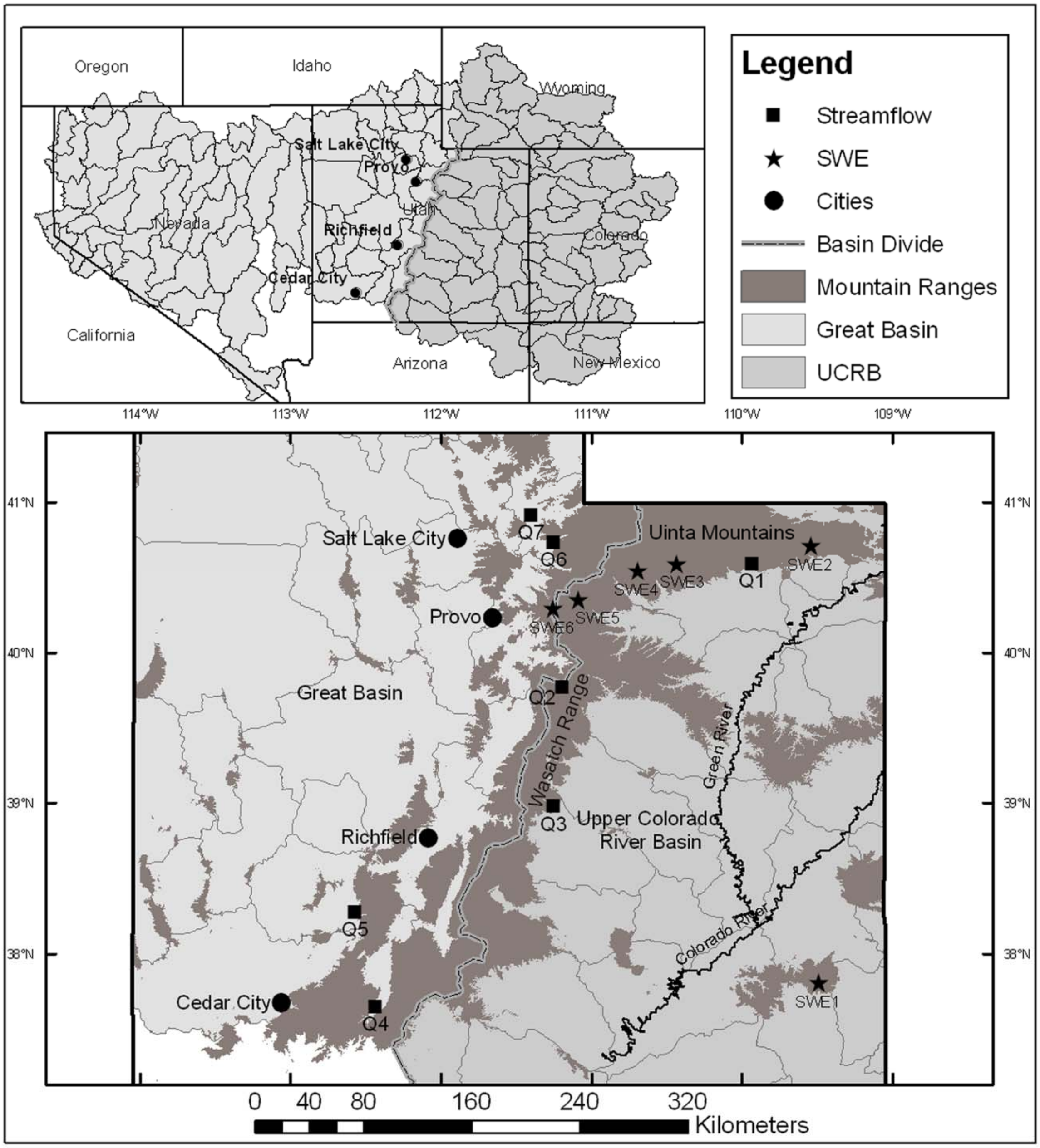


Figure V.1: Map of the study area showing the location of the streamflow gage stations and snowpack measuring stations. The numbers correspond to Table 1.

Station	ID	Name	Lat.	Lon.
Q1	**09299500**	Whiterocks River Near Whiterocks, UT	40.59	-109.93
Q2	**09310500**	Fish Creek Above Reservoir, Near Scofield, UT	39.77	-111.19
Q3	**09330500**	Muddy Creek Near Emery, UT	38.98	-111.25
Q4	**10174500**	Sevier River At Hatch, UT	37.65	-112.43
Q5	**10234500**	Beaver River Near Beaver, UT	38.28	-112.57
Q6	**10128500**	Weber River Near Oakley, UT	40.74	-111.25
Q7	**10131000**	Chalk Creek At Coalville, UT	40.92	-111.40
SWE1	**09m02s**	Camp Jackson Pillow, UT	37.81	-109.488
SWE2	**09j01s**	King's Cabin Pillow, UT	40.716	-109.544
SWE3	**10j10s**	Lakefork #1 Pillow, UT	40.597	-110.433
SWE4	**10j18s**	Rock Creek Pillow, UT	40.549	-110.693
SWE5	**11j32s**	Currant Creek Pillow, UT	40.357	-111.090
SWE6	**11j23s**	Daniels-Strawberry Pillow, UT	40.295	-111.256

Table V.1: Streamflow and Snowpack stations

5.2.3 Pacific Ocean Climate Indices

Two pre-defined datasets representing Pacific oceanic – atmospheric climatic phenomena are the Niño 3.4 index and the Pacific Decadal Oscillation (PDO) index. Similar to Soukup et al (2009), the average monthly values for the climatic indices (Niño 3.4 and PDO) were averaged for the various 6-month predictor periods January-February-March-April-May-June (JFMAMJ), April-May-June-July-August-September (AMJJAS), and July-August-September-October-November- December (JASOND). The period of record was 1960 to 2001, the previous year to AMJJ streamflow or April 1st snowpack.

The Niño 3.4 (Trenberth, 1997) SST region is located along the equatorial Pacific Ocean (5°S – 5°N, 170° – 120°W) and monthly index data were obtained from the NOAA ESRL Physical Sciences Division, (http://www.cdc.noaa.gov/Pressure/Timeseries/Nino34/). The Niño 3.4 index was used since it is an overall representation of the El Nino-Southern Oscillation (ENSO). The PDO is a oceanic / atmospheric phenomena associated with persistent, bimodal climate patterns in the northern Pacific Ocean (poleward of 20° North) that oscillate with a characteristic period on the order of 50 years (a particular phase of the PDO will typically persist for about 25 years) (Mantua, et al., 1997; Mantua and Hare, 2002). PDO Index (Mantua et al., 1997, Hare and Mantua, 2000) values were obtained from the Joint Institute for the Study of the Atmosphere and Ocean, University of Washington (http://tao.atmos.washington. edu/pdo/).

5.2.4 Pacific Ocean Sea Surface Temperatures

Sea Surface Temperature (SST) data for the Pacific Ocean was obtained from the Kaplan SST V2 SST anomalies provided by the NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, and obtained from their Web site at http://www.esrl.noaa.gov/psd/ *(Kaplan et al., 1998).* This dataset consists of monthly average values at a resolution of 5° by 5° and ranges from latitude 30° south to 70° north and 120° east to 80° west. This resulted in 538 active Pacific Ocean SST cells. Average Pacific Ocean SSTs were calculated for three six-month windows (JFMAMJ, AMJJAS, and JASOND). Similar to the Nino 3.4 and PDO, this resulted in lead-times varying from three to nine months.

5.2.5 500mbar Geopotential Height

Monthly values of 500 mbar geopotential height (Z500mb) data from the National Centers for Environmental Protection (NCEP) Reanalysis Derived data were provided by the NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, and were obtained from their web site at http://www.esrl.noaa.gov/psd/ *(Kalnay et al., 1996).* This dataset consisted of monthly average values at a resolution of 2.5° by 2.5° and ranges from latitude 30° south to 70° north and 120° east to 80° west. This results in 2,665 active 500mbar cells. Average 500 mbar geopotential height (Z500mb) data were calculated for three six-month windows (JFMAMJ, AMJJAS, and JASOND).

5.2.6 Data Preparation

Pacific Ocean SSTs, 500 mbar geopotential height (Z500mb) values, AMJJ streamflow and April 1st SWE anomalies, defined as the deviation of the seasonal mean from the long time average, were standardized. These standardized anomalies were used in the current research. Detrending was based on the least squares fit of a straight line to the datasets and subtracting the resulting function from the data. Detrending the Pacific Ocean SSTs, 500 mbar geopotential height (Z500mb) values, AMJJ streamflow and April 1st snowpack data removed any trend in the data sets that may bias the analysis and mask the underlying variability *(Aziz et al., 2010; Soukup et al., 2009; Tootle et al, 2008; Tootle and Piechota, 2006).*

5.3. Methods

Pacific Ocean climate variability (ENSO, PDO, SSTs and 500 mbar geopotential height (Z500mb)) teleconnections with unimpaired streamflow were examined for various lead-times *(Soukup et al., 2009; Tootle et al., 2008; Tootle and Piechota, 2006; Grantz et al. 2005)*. For the current research, in addition to streamflow, Pacific Ocean teleconnections with snowpack (April 1st SWE) were also examined. Singular Value Decomposition (SVD) was utilized to examine the relationships between Pacific Ocean SSTs and streamflow (snowpack). An index was developed for the Pacific Ocean SST regions identified by SVD for the various predictor periods and predictands (streamflow and snowpack). SVD was repeated with 500 mbar geopotential height (Z500mb) values being used in lieu of Pacific Ocean SSTs and an index was developed for the various predictor periods and predictands (streamflow and snowpack). Similar to *Tootle and Piechota (2004)*, initially, the ENSO index and PDO index were used as predictors in a non-parametric model *(Piechota et al., 2001)* to determine forecast skill for streamflow (and snowpack) for the various lead-times (three to nine months). Next, the Pacific Ocean SST index was used in the non-parametric model to determine forecast skill. Finally, the 500 mbar geopotential height (Z500mb) index was used to determine forecast skill. A comparison was made between ENSO / PDO, Pacific Ocean SSTs and 500 mbar geopotential height (Z500mb) values to determine which climatic driver provided the best skill in long lead-time forecasts of streamflow and snowpack for the various predictor periods.

5.3.1 Singular Value Decomposition (SVD)

This method consists of applying the Singular Value Decomposition statistical analysis on the cross-covariance matrix of two spatial-temporal fields in order to extract similarities between them. Time series representing each spatial-temporal fields are created as a result of the analysis. A detailed explanation of this method is given in chapter 4.3.2.

5.3.2 Pacific Ocean SST and 500 mbar geopotential height (Z500mb) Index

The SVD analysis resulted in regions of significant Pacific Ocean SST and 500 mbar cells. These cells were then averaged to create Pacific Ocean SST and 500 mbar indices for the various predictor periods and predictands. These time series were used (and the results compared) in the non-parametric forecast model to evaluate their skills as predictors to streamflow and snowpack forecasts.

5.3.3 Forecast Methodology

The streamflow (snowpack) forecast developed is a continuous exceedance probability curve that can be used for any assumed risk level and was developed by *Piechota et al., (2001)*. The "no skill / climatology" forecast curve is generated by dividing the rank of each historical value by the total number of years in the record.

Two advantages are found using the model developed by *Piechota et al. (2001):* it considers the continuous relationship between the predictand and the predictor, and it does not assume a particular model structure. However, it suffers from its semi-empiricism; fitting the model to the data points assumes that the historical data represents the entire population. A detailed description of the methodology and model can be found in *Piechota et al., (2001)* and *Piechota et al., (1998).* A brief description of the model (for one predictor) is provided below *(Soukup et al., 2009):*

1. The climate predictor values (Pi) for each year and the corresponding streamflow (snowpack) predictand values (Qi) for each year are compiled, where (Pi) represents the ENSO index, PDO index, Pacific Ocean SST index and 500 mbar geopotential height (Z500mb) index.

2. The streamflow (snowpack) values (Qi) are ranked in ascending order and the corresponding climate predictor (Pi) for the corresponding year of the streamflow (snowpack) are noted.

3. The first data point for analysis occurs immediately after the five lowest streamflow (snowpack) values (Qi) and the last point for analysis occurs immediately prior to the five highest streamflow (snowpack) values (Qi). This is required since a minimum of five values are needed to generate a probability density function.

4. The first data point for analysis is the sixth ranked streamflow (snowpack) value (lowest to highest) based on #3 above. Using the kernel density estimator (Silverman, 1986; Piechota et al., 1998), a probability density function is developed for all climate predictor values below the first data point and a probability function is developed for all climate predictor values above the first data point. Whereas f(x) is the probability density function expressed as,

$$f(x) = \frac{1}{hn}\sum_{i=1}^{n}\left(\frac{x - x_i}{h}\right)$$
$$h_i = 0.9A_i n_i^{-\left(\frac{1}{5}\right)}$$
$$A_i = \min\left(\sigma_i, \frac{\text{interquartile range}}{1.34}\right)$$

where,

- X_1 to X_i is a set of n observations
- f( ) is the kernel function
- h is the bandwith
- optimal h = h_i
- σ_i is the stdev of predictor data in each subset i
- n_i is the # of observations in each subset.

and the Bayes probability theorem is expressed as,

$$\text{Prob}\left(\frac{Q_i}{x}\right) = \frac{P_i f_i(x)}{\sum_{i=1} k P_i f_i(x)}$$

where,

- X = predictor value
- Q_i = streamflow
- P_i = prior probability streamflow
- f_i (x) = probability density function of prior X value

5. A unique probability value is determined for each predictor value, given the sixth ranked streamflow (snowpack) value. These values are single points on the exceedance probability curve (Probability versus Streamflow or Snowpack). The procedure is then repeated for the seventh ranked streamflow (snowpack) value and so on.

6. An exceedance probability is then determined for each predictor value. The forecast curve will represent the probability of exceeding a value of streamflow (snowpack), based on the value of the predictor.

7. The final exceedance probability forecast is found by combining the three individual forecasts into one combination forecast that has better overall skill. The combination forecast is found by applying weights a, b, and, c to the three models so that the weights add up to one. The optimal forecast is found by applying more weight to individual forecasts that better predicts streamflow and less weight to poor individual forecasts. These optimal weights are determined by an optimization procedure that evaluates the Linear Error in Probability Space (LEPS) score for all possible combinations, using weighting increments of 0.02 in which the weights vary between 0 and 1 for each model. The final combination forecast is the model with the highest LEPS score.

The skill of the forecast, as produced by the model, was measured using the Linear Error in Probability Space (LEPS) score. The LEPS score is a measure of skill that was originally developed to assess the position of the forecast and the position of the observed values in the cumulative probability distribution (non-exceedance probability); the LEPS score can be used for continuous and categorical variables *(Ward and Folland, 1991; Potts et al., 1996)*. A modified LEPS score is required due to the absence of a convenient measure of skill for an exceedance probability forecast. A better measure of skill is one in which more weight is given to a forecast that effectively predicts low or high values and less weight to a forecast that successfully predicts average values. The application of the LEPS score is desirable here because it is less sensitive to changes near the center of the cumulative probability distribution and more sensitive to forecasts of high or low values.

Essentially, it rewards a successful forecast of extreme values *(Piechota et al., 2001)*. The developmental steps and the equations used to generate a LEPS score for an exceedance probability forecast can be reviewed in Piechota et al. (2001) and a brief description is hereby provided. In terms of probability, the LEPS score measures the distance between the forecast and observed values. First, a “no skill” or “climatology” curve was developed for the observed yearly streamflow (snowpack) values. The “climatology” curve was created by ranking observed yearly streamflow (snowpack) values in decreasing order (i.e., exceedance probability) of magnitude and dividing the rank of each observed value by the total number of years in the record. The LEPS score is defined as

$$S'' = 3 * (1 - |Pf - Po| + Pf2 - Pf + Po2 - Po) - 1$$

where Pf and Po are the forecasted and observed cumulative probabilities, respectively. The LEPS score was calculated for each year and “good” or “bad” forecast years were identified. The average skill (SK) is defined as

$$SK = \frac{\sum 100S''}{\sum S''_m}$$

where the summation S” is for all years of record. If S” is positive, S”m is the sum of the best possible forecast (i.e. Pf = Po) for all years of record. If S” is negative, S”m is the sum of the worst possible forecast (i.e. Pf = 1 or 0) for all years of record. A LEPS SK score of greater than +10% is generally considered good skill.

The skill associated with each individual forecast is calculated for calibration and cross-validation analyses. The LEPS score for the calibration analysis does not provide an independent skill score because it is based on the same data in which the model was calibrated. To report the skill scores explained in the results section, each individual yearly calibrated and cross validated LEPS skill score (CV Skill) was averaged over the entire 42 year period of record to develop an overall average forecast skill. The more rigorous CV Skill for the various predictor periods and predictands was determined and reported in the following Results section.

5.4. Results

5.4.1 Singular Value Decomposition (SVD)

5.4.1.1 Pacific Ocean SSTs and Streamflow / Snowpack

The SVD analysis of the relationship between Pacific Ocean SSTs and streamflow identified a similar region of significant ($p < 0.05$) cells for each of the three predictor periods (Figure 2). The Pacific Ocean SST region identified was similar to that reported in *Aziz et al (2010)* and *Lamb et al (2011)*. Significant SST cells in the Pacific Ocean region identified were selected. The significant SST cells, for the various predictor periods (JFMAMJ, AMJJAS, JASOND), were averaged for each year (1960 to 2001). Thus, an index was developed and this index was used as a predictor in the non-parametric forecast model. The SVD analysis was repeated for Pacific Ocean SSTs and snowpack and a similar region to that of streamflow was identified (Figure 3). The Pacific Ocean SST region was again similar for all three predictor periods and an index was developed for use as a predictor in the non-parametric forecast model. It should be noted that the Pacific Ocean SST region displays an opposite relationship to streamflow /

snowpack in that increased (decreased) SSTs result in decreased (increased) streamflow / snowpack.

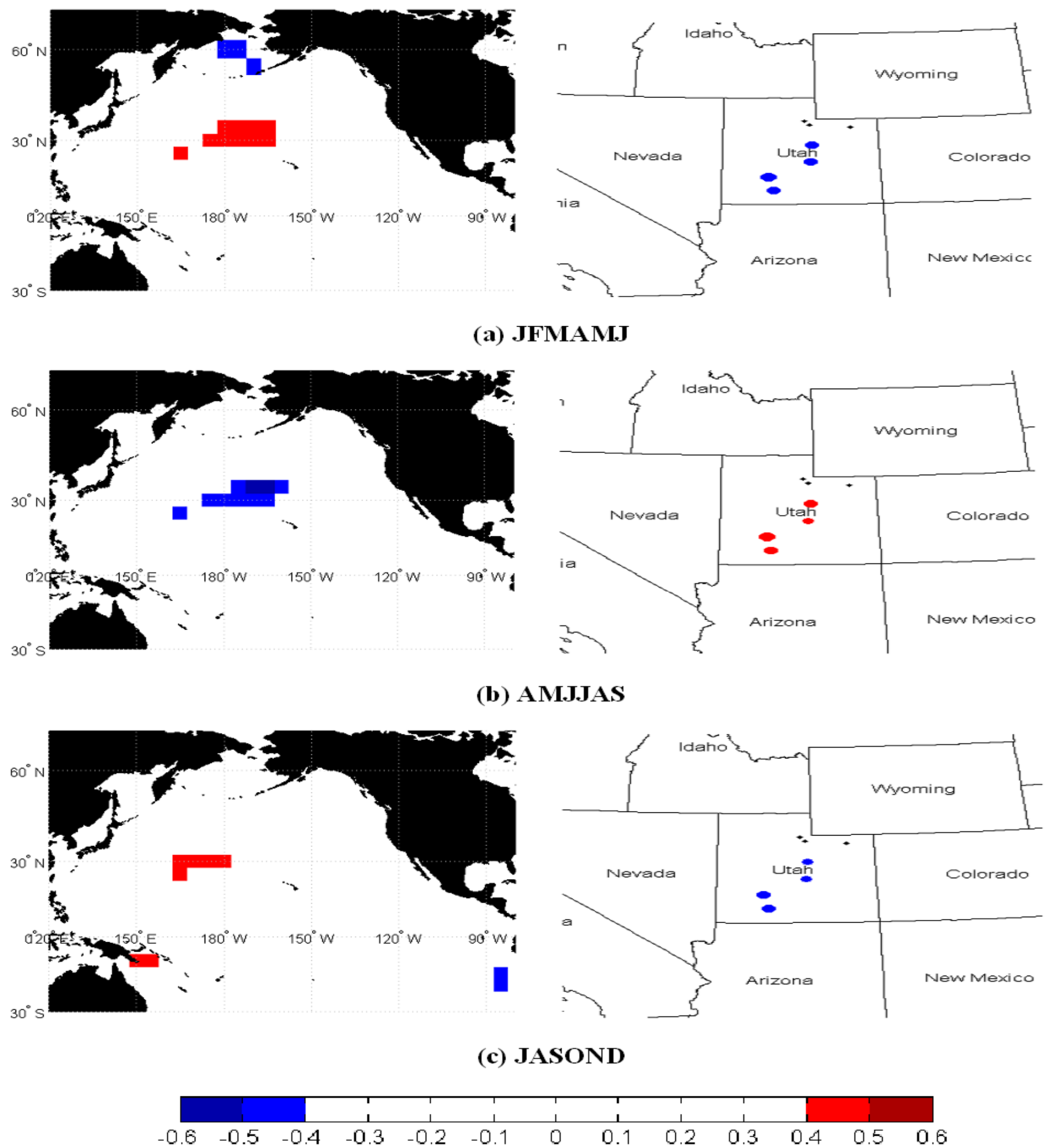


Figure V.2: Heterogeneous correlation maps ($p < 0.05$) figure when applying SVD to the previous year (a) JFMAMJ, (b) AMJJAS and (c) JASOND Pacific Ocean SSTs with AMJJ streamflow

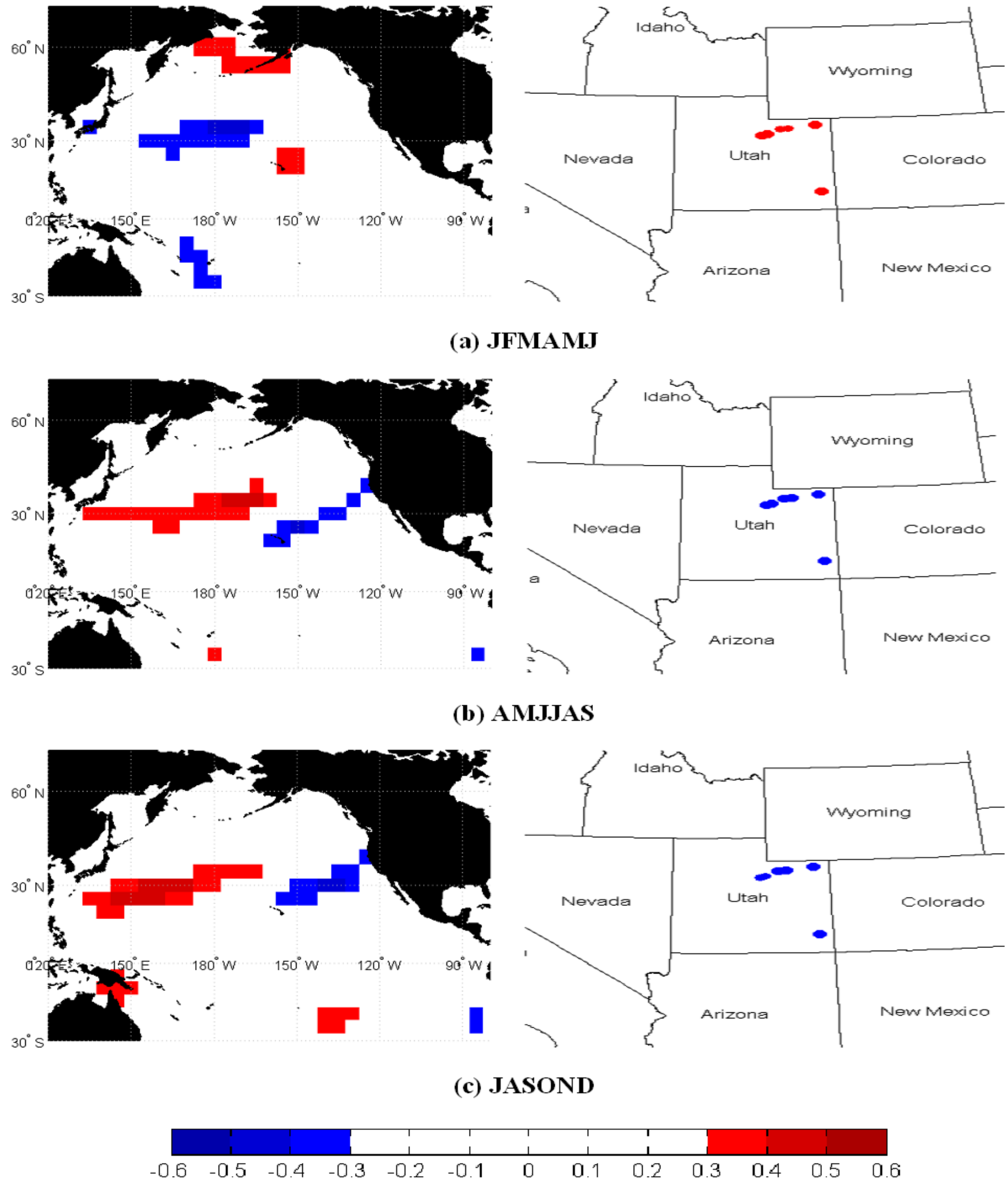


Figure V.3: Heterogeneous correlation maps ($p < 0.05$) figure when applying SVD to the previous year (a) JFMAMJ, (b) AMJJAS and (c) JASOND Pacific Ocean SSTs with April 1st snowpack

5.4.1.2 500 mbar Geopotential Height (Z500mb) and Streamflow / Snowpack

The SVD analysis of the relationship between 500 mbar Geopotential Height (Z500mb) and streamflow / snowpack identified a similar region of significant ($p < 0.05$) cells for each of the three predictor periods (Figures 4 and 5). Two regions were identified, one near the Northeast corner of the grid over Russia and the second over the Northwest U.S. and Southwest Canada. The latter Northwest U.S. region was similar to that identified in *Soukup et al (2009).* The two patterns both display an opposite relationship to streamflow / snowpack in that high (low) 500 mbar Geopotential Height (Z500mb) results in decreased (increased) streamflow / snowpack. An index was developed and used as predictors in the non-parametric forecast model.

5.4.2 Forecast Model

5.4.2.1 Climate Indices (ENSO and PDO)

As displayed in Table 2, the use of ENSO and PDO as predictors consistently resulted in negative cross-validated skill for the three predictor periods, for both streamflow and snowpack. These results were expected based on previous research *(McCabe and Dettinger, 2002; Tootle et al., 2005)* that failed to identify a teleconnection between ENSO, PDO and hydrologic response (streamflow and snowpack) in this region. These results were also observed by *Grantz et al (2005)* and *Soukup et al (2009)* in the Truckee / Carson Basins and North Platte River Basin, respectively. Thus, if limited to only Pacific Ocean climate phenomena, a skillful forecast could not be achieved in this region. Therefore, there is a need to investigate Pacific Ocean SSTs and 500 mbar geopotential height (Z500mb) as predictors, as identified in the SVD analysis.

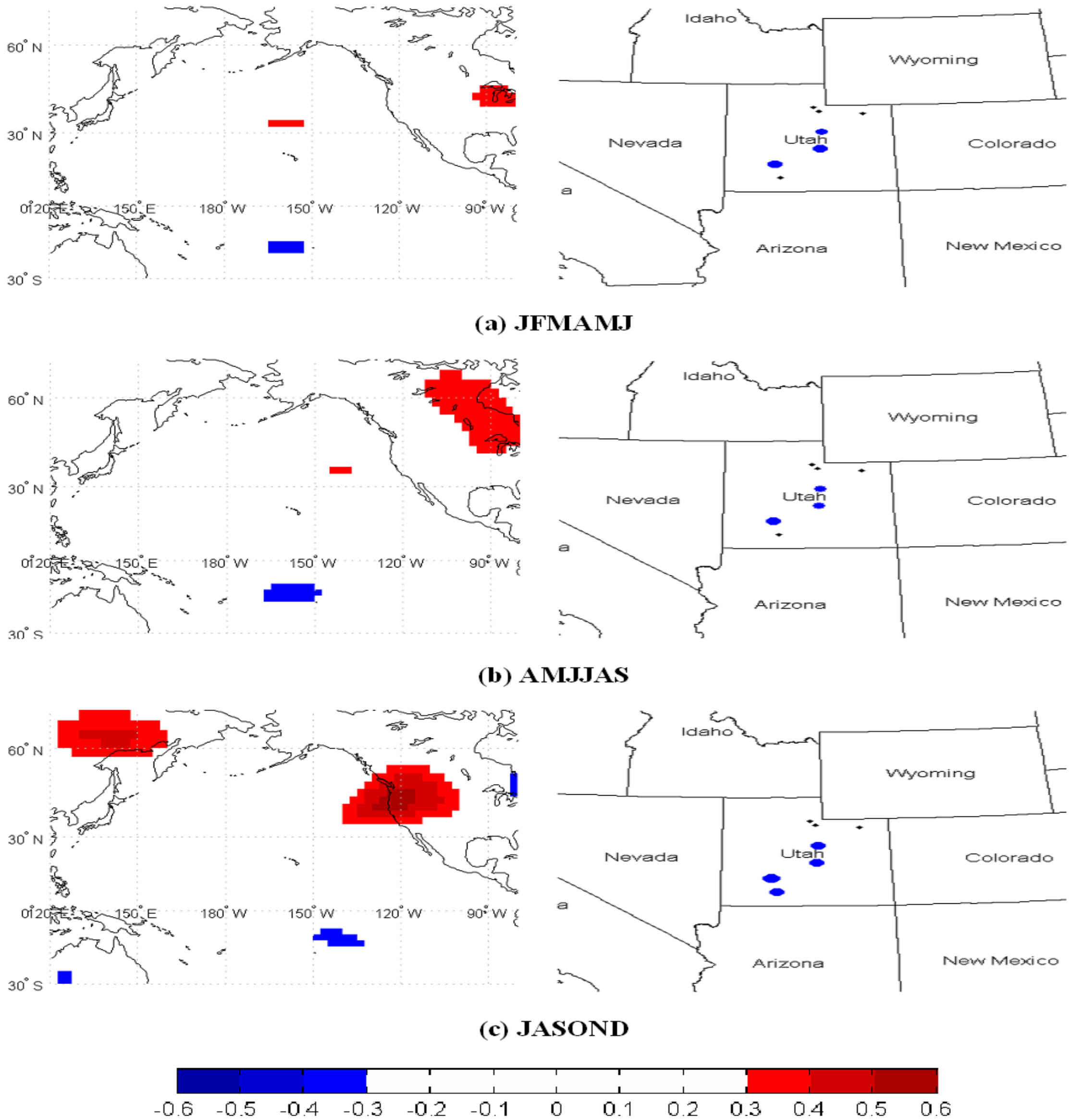


Figure V.4: Heterogeneous correlation maps (p < 0.05) figure when applying SVD to the previous year (a) JFMAMJ, (b) AMJJAS, and (c) JASOND Z500mb with AMJJ streamflow

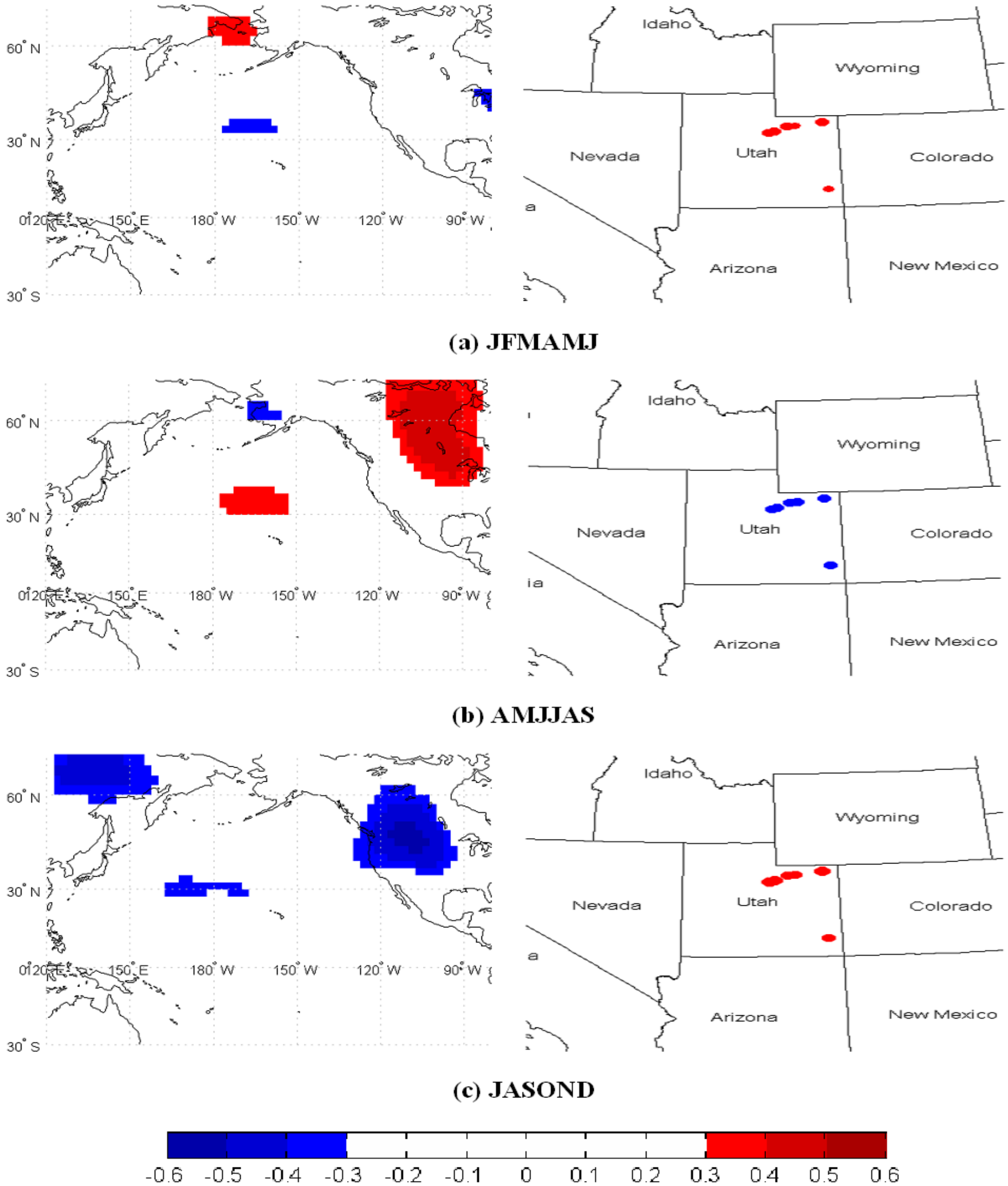


Figure V.5: Heterogeneous correlation maps ($p < 0.05$) figure when applying SVD to the previous year (a) JFMAMJ, (b) AMJJAS, and (c) JASOND Z500mb with April 1st snowpack

Period	JFMAMJ CV Skill			AMJJAS CV Skill			JASOND CV Skill		
Station	ENSO/PDO	SST	Z500mb	ENSO/PDO	SST	Z500mb	ENSO/PDO	SST	Z500mb
Q1	-11.0	-2.2	-1.4	-11.0	-0.2	2.4	-6.7	-8.2	-2.8
Q2	1.4	8.9	7.0	-2.5	9.8	6.3	-2.4	5.8	12.4
Q3	-9.6	4.5	5.8	-3.6	1.5	3.9	2.8	-5.8	10.6
Q4	-4.7	6.2	-0.4	-5.5	12.2	4.7	-3.1	8.8	7.8
Q5	-9.2	11.1	-1.2	-2.2	9.7	-0.4	-3.9	9.1	8.4
Q6	-6.5	3.9	12.2	-9.6	-2.7	1.9	-6.1	0.8	8.9
Q7	-6.8	2.5	8.2	0.7	-4.3	-3.5	-8.5	-2.1	8.5
SWE1	-3.5	3.5	-6.9	-2.8	14.9	5.7	-3.0	8.1	6.6
SWE2	-1.8	8.8	0.0	-4.9	4.6	3.8	-8.6	2.6	16.7
SWE3	-2.5	-5.5	-10.6	0.0	8.1	-12.0	-2.2	-3.2	6.0
SWE4	-2.3	2.9	-7.2	0.0	7.4	-0.4	0.1	-4.1	5.4
SWE5	-5.5	7.3	-1.8	-9.3	6.6	-2.3	-10.1	1.7	13.7
SWE6	-6.7	7.2	-0.7	-5.4	3.8	8.8	-4.9	-2.0	15.5
	Legend		0 - 5			> 10			
			5 - 10			< 0			

Table V.2: Cross-valided skills from the results of the forecast model for different predictor periods of SST and Z500mb with AMJJ streamflow and April 1st snowpack.

5.4.2.2 Pacific Ocean SSTs and Streamflow / Snowpack

Using the Pacific Ocean SST indices determined with SVD as predictors in the non-parametric forecasting model yielded mostly positive values for streamflow and snowpack stations (Table 2). For the seven streamflow stations, the JFMAMJ forecast model CV LEPS score (skill) was positive for six stations with one station (Q5) exceeding +10. The AMJJAS and JASOND resulted in four stations displaying positive CV LEPS scores with one station (Q4) exceeding +10 for the AMJJAS predictor period. In reviewing Table 2, it appears Pacific Ocean SSTs consistently produce moderate to good skill for all three predictor periods. For the three predictor periods and seven streamflow stations (e.g., 21 forecast models), ENSO / PDO exceeded Pacific Ocean SST indices in CV LEPS scores only twice. Thus, identifying a specific Pacific Ocean SST region (teleconnection) with streamflow increased forecast skill.

For the six snowpack stations, the JFMAMJ forecast model CV LEPS score (skill) was positive for five stations. For the AMJJAS predictor period, all six stations were positive with one station (SWE1) exceeding +10. For the JASOND predictor period, only three stations were positive and it appears that the use of Pacific Ocean SSTs as a predictor for snowpack was stronger for longer lead-times (JFMAMJ and AMJJAS).

5.4.2.3 500 mbar Geopotential Height (Z500mb) and Streamflow / Snowpack

Using the Z500mb indices determined with SVD as predictors in the non-parametric forecasting model yielded mostly positive values for streamflow and snowpack stations (Table 2). For the seven streamflow stations, the JFMAMJ and AMJJAS forecast model CV LEPS score (skill) was positive for four stations with one station (Q6) exceeding +10 in the first period. The JASOND resulted in six stations displaying positive CV LEPS scores with two stations (Q2, Q3) exceeding +10. In reviewing Table 2, it appears Z500mb consistently produce moderate to good skill for all three predictor periods. For the three predictor periods and seven streamflow stations (e.g., 21 forecast models), ENSO / PDO exceeded Z500mb indices in CV LEPS scores only once. Thus, identifying a specific Z500mb region (teleconnection) with streamflow increased forecast skill.

For the six snowpack stations, no positive forecast model CV LEPS score (skill) was observed for the JFMAMJ predictor period. For the AMJJAS predictor period, only three stations showed positive skills. For the JASOND predictor period, all six stations were positive with three stations forecast skill exceeding +10. It appears that the use of Z500mb as a predictor for snowpack was stronger for short lead-times (JASOND).
To verify the results obtained using the indices created by averaging the significant cells by year, new indices using the same significant cells were created by using Principal Component Analysis (PCA) on the group of cells and then the principal component scores were used as indices representing the significant cells. The results obtained from the forecast model using the PC scores as indices were similar to those obtained using the cell averages. In addition, new indices were created by first weighting the significant cell values (SST or Z500mb) by the cosine of the latitude of the cell and then taking the average of all the cells. In this case, the forecast model results were also similar.

5.5. Discussion and Conclusions

The results of the SVD analysis identified similar Pacific Ocean region as in *Aziz et al. (2010), Soukup et al. (2009) and Grantz et al. (2005).* As in *Aziz et al. (2010),* ENSO and PDO indices were not found to influence snowpack and streamflow in this region.

A physical explanation was provided in *Grantz et al., (2005)* who concluded that the SST patterns in high and low streamflow years were a direct response to pressure and winds, resulting in evaporative cooling that results in cooler than normal SSTs in this region *(Aziz et al. 2010).*

Wang et al (2010) went further by analyzing the moisture flux streamfunction data, which is a vertically integrated and gridded dataset measuring the amount of moisture being transported at each grid cell. They connected the Pacific Ocean to precipitation in the Intermountain west, and *Lamb et al (2011)* identified that the same circulation pattern is teleconnected to streamflow in the Colorado River Basin.

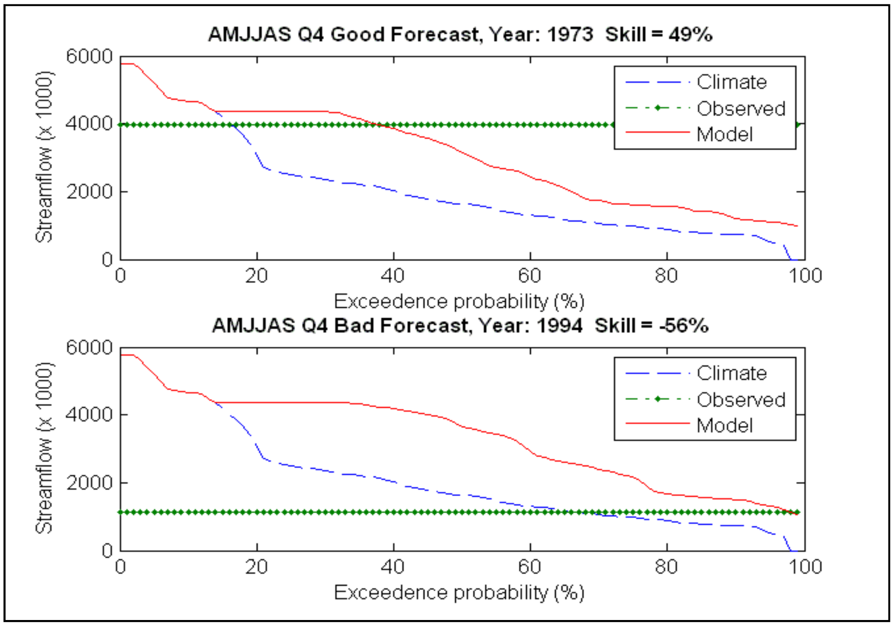
In *Aziz et al. (2010),* it is argued that the region of Pacific Ocean SST identified as the driver of snowpack and streamflow could be used as predictor in a long lead-time forecast or streamflow and snowpack. The results of the non-parametric forecast model provided in the result section support that assessment. The current research showed that the majority of forecasts resulted in positive LEPS score (skill) and that the model skills, when the identified Pacific Ocean region SST indices were used as predictors, were the highest in the first two periods (JFMAMJ, AMJJAS). That resulted in a six to nine month lead time forecasts for April 1st snowpack and AMJJ streamflow. It is important to note that a positive skill indicates an improvement of the forecast as compared to the climatology or “zero skill” forecast, which is none other than a distribution of the observed data.

The results of the SVD analysis of geopotential height at 500 mb (Z500mb) with streamflow and snowpack yielded results similar to those found in *Soukup et al., (2009)* and *Grantz et al., (2005).* LEPS score (skill) of the model, when the identified Z500mb region indices were used as predictors, were highest in the more recent period (JASOND or three month lead-time). These results were consistent with the ones observed in *Soukup et al., (2009)* and explained by the observation that winter precipitations *(Wang et al, 2010; Lamb et al, 2011)* are strongly influenced by Z500mb and the response to the Z500mb effects are not delayed but that instead they are more immediate. To explain how this short lag time between Z500mb and precipitation can be related to streamflow, it was argued that the good forecast skill displayed by the Z500mb and streamflow in this period were an indirect result of the Z500mb induced winter precipitations, which were mainly in the form of snow, melting for a period of time before feeding streams and rivers the following Spring-Summer *(Soukup et al., 2010*) and thus causing a delayed effect of Z500mb on streamflow.

One of the advantages of using the non-parametric forecast model is the development of exceedance probability forecasts (Figure 6). The exceedance probability curves give a clear indication to the water managers or user of the volume of streamflow to expect in a given probability that is better than the climatology forecast. For example, a forecast of Q4 using only the climatology forecast for the SST index of the AMJJAS predictor period gives a 40% chance of equaling or exceeding two million cubic feet of water. However the model forecast expects about four million cubic feet instead (Fig. 6a).

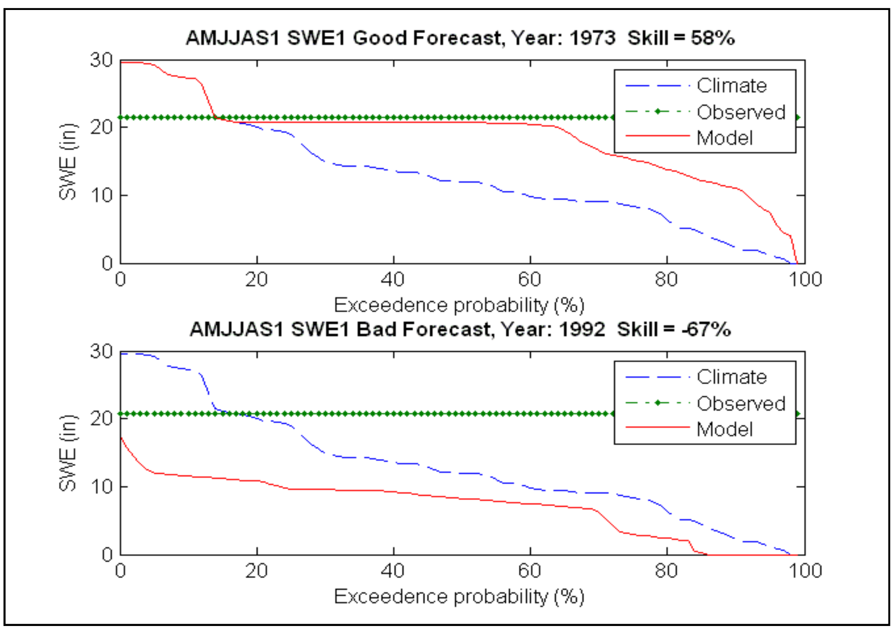
It may seem conservative to under predict but this could have devastating consequences. The same thing can be observed when using JASOND Z500mb for a forecast of Q2. In this case the climatology over predicted the expected volume of water at 40% exceedence probability. However the model forecast was a lot less than the climatology forecast. The simplicity and clarity of these exceedence probability curves are able to give a clear picture of what to expect while at the same time showing the climatology distribution for comparison and for making informed decisions.

Since the SVD analysis results did not identify an ENSO or PDO region of influence, the use of these indices as predictors in the forecast model did not provide better skill than the no-skill climatology forecast. Almost all of the forecast model skills were negative when using ENSO and PDO as predictors.



AMJJAS Q4 Good Forecast, Year: 1973 Skill = 49%
Streamflow (x 1000)
Exceedence probability (%)
Climate
Observed
Model
AMJJAS Q4 Bad Forecast, Year: 1994 Skill = -56%
Streamflow (x 1000)
Exceedence probability (%)
Climate
Observed
Model

Fig. 6a



AMJJAS1 SWE1 Good Forecast, Year: 1973 Skill = 58%
SWE (in)
Exceedence probability (%)
Climate
Observed
Model
AMJJAS1 SWE1 Bad Forecast, Year: 1992 Skill = -67%
SWE (in)
Exceedence probability (%)
Climate
Observed
Model

Fig. 6b

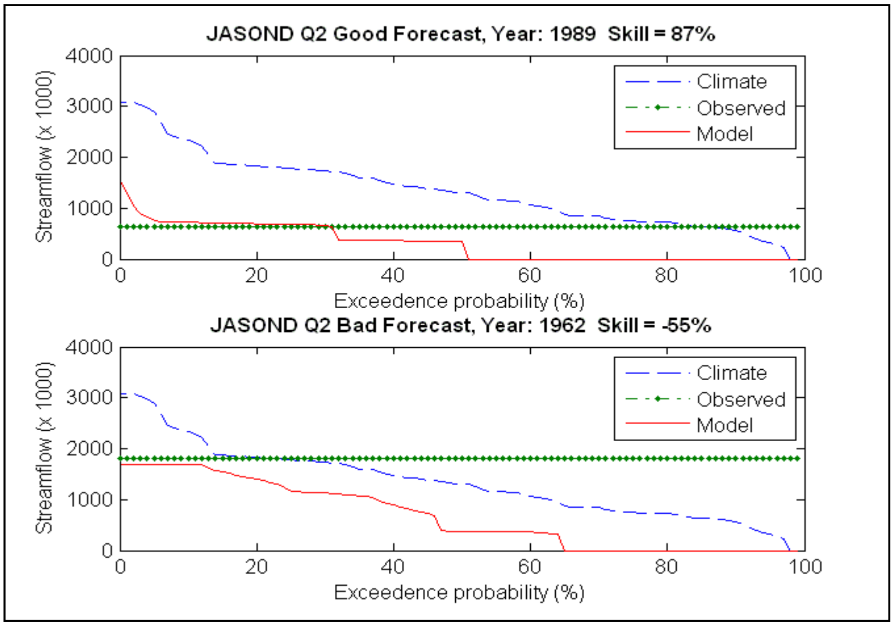


Fig. 6c

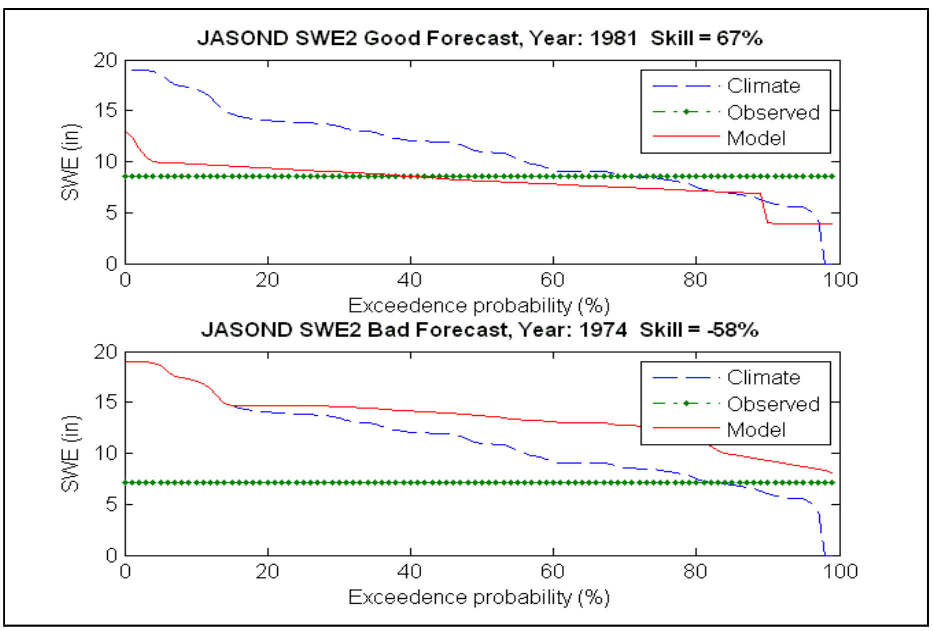


Fig. 6d

Figure V.6: Exceedence probability plots for AMJJAS Pacific Ocean SSTs with (a) Q4 and (b) SWE1 and JASOND Z500mb with (c) Q2 and (d) SWE2. Streamflow is in cubic feet and snowpack is in inches.

CHAPTER VI
CONCLUSIONS

Numerous researchers have previously applied predefined SSTs and pressure indices to study the relationship between oceanic-atmospheric phenomena and hydrologic responses as well as their potential use in hydrologic forecasting. Among the most used indices are ENSO, PDO, AMO, and the NAO. However, it was shown that many regions throughout the world are not affected by these phenomena. Therefore, as presented in this research, the use of SST and Z500mb as predictors for snowpack and streamflow forecasting was investigated under the hypothesis that they can remove the limitations set forth by relying on these predefined regions. The analysis was performed using the Singular Value Decomposition (SVD) statistical method, which was found to be simple to use, since it does not require user-defined parameters, and yet powerful when it comes to establishing relationships between two spatial-temporal fields.

The results showed that, by using SSTs, new SST regions of influences for hydrologic regions were identified. These regions of influence have been consistent for the different time periods and lead-times used in the analysis. Two hydrologic basins were evaluated; the Upper Colorado River Basin (UCRB) and the Adour-Garonne basin in Southwest France. Previous research failed to identify a climatic driver of these two regions yet they are vital for water supply and hydropower. For the UCRB, a Pacific Ocean SST region (34°N to 24°N and 150°E to 160°W) was identified and for the Adour-Garonne basin, a region along the Equator between Brazil and the West coast of Africa was identified. There is still much to learn about the physical explanation of these teleconnections, however the identified Pacific Ocean SST region has been observed in other studies and may have been overlooked since most of the focus was on ENSO.

As mentioned earlier, the purpose of the research was to investigate the potential use of the newly discovered SST regions as predictor in a model to improve streamflow and snowpack forecasting. The results from Chapter 5 indicated that there is an improvement in the forecast skill when the SST index identified is used in a non-parametric forecast model. The use of "traditional" indices did not yield good forecast skill, having limited predictive capabilities for these regions. It also appears the use of SST indices resulted in better skill for longer lead-times and that Z500mb indices were better in shorter lead-times. It is also important to mention that these teleconnections or relationships are not expected to be linear and as such, other factors may be involved in these complex interactions.

Research studies investigating these relationships have generally looked at periods extending back around 50 years. The question now is whether these relationships will be valid in the next fifty years, in light of climate change. How will climate change impact oceanic-atmospheric phenomena like ENSO? In the example of El Niño, some researchers argue that it may be getting warmer and stronger in intensity and, it may also be shifting location. What would be the impact of any change on the currently established teleconnections?

Future research efforts may include the impacts of climate change on oceanic-atmospheric phenomena and their hydrological responses. By including climate change impacts on future studies, there may improvement on the reliability of forecasts. As we go into periods where scarcity in water resources is expected to further stress a situation that is already delicate in many parts of the world, better water supply forecast could prove very critical.

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APPENDIX

APPENDIX A

DATA SETS

APPENDIX A.1

Western U.S. March 1st snowpack

State	Arizona	Arizona	Arizona	Arizona	Arizona	California	California	Colorado	Colorado	Colorado	Colorado
Station Id	09s01s	09s02s	10r04s	10s01s	11r03s	20h06s	20h13s	06j01s	06j15s	07k02s	06j03s
Latitude	33.979	33.921	34.312	33.812	34.941	41.582	41.236	40.534	40.848	39.875	40.395
Longitude	109.503	109.459	110.754	110.918	111.518	-120.303	-120.792	-106.781	-106.969	-107.599	-106.604
1961	5.5	6.4	1.6	0	0.5	14.3	8.4	12.2	10.5	10.6	12.8
1962	17.6	21.4	8.2	15.3	12.8	13.7	11.3	29.7	24.6	24.9	27.9
1963	5.4	6.5	0	2.5	0.9	0.8	0	13.6	9.2	6.8	18.2
1964	2.7	3.4	3.2	3.3	0.9	9.8	10.4	16	16.7	9.2	14.9
1965	13.3	15.9	4.2	4.8	4.3	17.8	7.1	22.1	25.1	20.4	26.7
1966	14.9	19.3	7.7	10.4	7.3	10.5	9.9	17	13.7	13.5	14.7
1967	0.4	1.3	1.2	0	0	11.9	12.8	19.2	21.4	15	23.1
1968	14.5	17.1	13.8	20.4	10.5	10.7	8.7	21.8	20.3	15.7	21.8
1969	10.5	14.1	6	9.1	10.1	21.8	22.7	21.4	18.8	16.9	22.5
1970	0.8	0.6	0	0	0	13.2	10.6	20.9	18	15.9	24.8
1971	1.4	0.6	1.9	2.4	1.9	13.1	14.1	20.9	20.6	19	26.7
1972	2.3	3.9	0	0	0	25.5	19.1	18.2	17.8	13.1	24.4
1973	13.4	15.4	12.5	17.5	13.3	11.8	11.3	18	14.1	15.7	17
1974	7.6	9.2	4.7	8.1	6.3	15.4	15.5	24.6	19.5	14.7	24.8
1975	8.8	10.4	5.2	5.9	6.4	20.6	15.9	21	17.1	19.9	25.6
1976	9.2	11.8	4	7.7	8.8	11.7	4.4	14	16.3	14.1	18.8
1977	3.3	5.7	3.2	1.5	3.2	2.5	2	8	7.9	3.4	11.5
1978	7.5	15.2	9.9	5.7	10.3	12.3	9.7	28.3	23.6	21	32.7
1979	17.2	24.4	12.5	13.1	14.4	12.6	9.4	25.2	20.6	17.7	22.6
1980	15.6	21.3	13.3	7.5	17	23.1	12.4	22.9	21.1	16	22.9
1981	0.1	0	1.6	0	0.3	10	4.4	7.1	6.4	4.7	8.2
1982	9	10.5	6.7	5.4	12.5	14.2	9.3	22.1	16.6	18.1	27.6
1983	13.7	16.8	5.4	9.8	13.3	16.5	19.3	19.6	12.8	14.8	18.6
1984	6.4	6.6	0	0	0	19.3	17.5	25.1	17.6	17.6	40.1
1985	16.1	19.6	5.4	12.4	11.5	17.1	14.9	19.8	15.2	14.9	20.5
1986	4.6	3.8	0	0	0	19.5	15.5	22.3	20.1	21.1	22.1
1987	13.3	12.2	6.8	5.6	5.3	11.1	8	9.8	9.3	10.3	11.9
1988	7.3	9.2	0.3	0.9	3.4	10.3	7.8	22.8	16.5	14	21.8
1989	6.2	8.6	0	6	4	19.8	16.6	19	14.9	15.7	21.4
1990	3.9	4.3	1.5	5.2	4.3	10.6	8.2	15.6	14.6	6.7	20.5
1991	9.2	13.8	2.5	0.9	2.6	6.1	2.4	13.4	12	11.5	16.1
1992	9	11.6	5.7	4.3	9.2	6.4	5.4	13.6	11.5	13.6	17
1993	17.2	23.6	11.2	6.7	16.7	23.7	21.1	19.1	18	17.6	21.5
1994	6.7	9.1	6.6	7.8	4.7	11.6	10.4	14.6	13.7	11.3	19.8
1995	10.1	11.2	5	1.2	7.5	22.2	17.7	15.9	14.4	12.6	19.7
1996	1.4	0.3	1.7	1.6	1.9	19.4	13.8	26	18.6	19.5	32.8
1997	10.5	13.4	11.1	6.4	9.2	18.6	9.8	25.8	26.2	24.4	27.5
1998	9.1	10.6	11.4	14.2	12.2	25.9	20	16.8	13.7	16.1	19
1999	0.3	0.8	0.2	0	0	23.8	17.6	16.1	16.2	12.3	18.4
2000	0.5	1.1	0	0.4	0.3	14.2	12.8	21	16.2	11.9	25.3
2001	9.2	8.8	5.5	6.5	3.7	10.4	9.5	16.4	14.4	10.1	18.2
2002	3.5	3.9	0	0	0	16.7	8.8	15.3	11	9.6	14.8
2003	8	7	4	6.1	3.1	8.3	6.9	17.8	14	11	18.8
2004	5.8	6.5	3.3	5.1	6.9	20.9	17	18.1	15.7	12.5	18
2005	11.3	14.6	6.6	1.4	11.3	13.6	8.3	16.3	18.3	10.7	15.6
2006	0	0	0	0	0	12.6	10.4	21.9	17.8	13.4	27.3

State	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado
Station Id	06j06s	05j04s	06k01s	06k06s	06k04s	07k01s	06l02s	06m03s	07m05s	06j05s	05j10s
Latitude	40.078	40.399	39.361	39.297	39.075	39.078	38.820	37.486	37.651	40.347	40.414
Longitude	-106.670	-105.848	-106.060	-106.607	-106.612	-107.144	-106.590	-106.835	-107.806	-106.094	-105.820
1961	5.4	4.2	7.9	2.1	7	7.3	4.6	10.7	4.9	5.6	15.5
1962	17.5	9.2	14.7	7.4	24.8	27.9	13.8	33.2	16	14	30.9
1963	7	4.9	9.4	3.2	10.4	9.8	8.3	19.5	7.4	7	19
1964	7.6	5.1	7.4	2.9	9.1	11	4.5	12.3	3.4	6.3	15
1965	13.8	10.3	18.5	7.4	16.5	21	14	36	13.8	12.7	28.5
1966	7.1	6.9	6.4	4.1	11.5	16.7	8.1	30.9	13.9	7.6	11.8
1967	11.8	9.5	10.7	8.2	15.4	13.9	11.4	25	11.2	11.3	21.5
1968	13.2	8.4	11.7	6.6	14.2	18	7.6	25.2	16.5	7.5	22.6
1969	12.9	9.2	10.4	8.5	14.5	23.5	11.9	33.7	20.8	11.4	19.5
1970	12.9	9.7	15.2	7	15.7	14.2	12.6	11.8	2.7	11.4	26.5
1971	15.6	9.2	10.6	7.2	16.2	15.6	7.8	19.7	7.4	12.5	26.3
1972	11.6	6.5	12.4	5.9	12.9	18.2	9.2	22.5	8.6	9.4	22.8
1973	10.6	6.7	9.5	6.6	11.4	16.8	7.6	31.4	15.5	9.3	17.8
1974	9.7	7.6	10.9	9.2	10.8	19.1	9	23.4	11.5	10.2	22.6
1975	13.4	8.7	14.1	7.7	14.8	17.1	8.8	28.3	14.1	9	20.6
1976	11	6.8	11.3	6.9	14.1	15.9	9.9	28.9	17	9.4	20.5
1977	3.8	3.4	5.5	2.6	7.8	1.3	2.1	6	1.3	3.1	7.1
1978	15.9	11.9	13.9	8.6	16	15.2	9.5	23.4	13.1	9.6	30.7
1979	11.8	10.4	11.9	9.6	16.8	22.9	13.4	47	26.2	11.5	25.6
1980	11.4	11.7	17.7	9.2	17.3	22.7	13.3	39.4	23	9.2	27.6
1981	2.8	4	5.5	1.4	6.2	3.4	4.5	10.5	0.8	4.3	9.4
1982	13.2	9.1	16.8	8.5	15.5	15.3	9.8	22.8	11.8	8.2	24.1
1983	7.9	6.4	7.1	4.9	10.8	12.1	6.1	29.6	11.9	6.7	17.5
1984	11.3	10.3	14.2	9.4	17.3	21.6	11.7	30.4	14.2	10.4	24.3
1985	10.3	7.7	9.9	7.7	12.1	17.3	8.7	31.9	14.6	7.5	19.1
1986	12.3	12	15	8.7	16.1	19.3	14.1	28.5	15	17.8	30.7
1987	7.2	5.6	14.2	5.9	11.8	11.8	8.6	25.7	16	6.6	15.3
1988	10.8	10	11.6	5.7	10.6	12.6	5.9	20.6	6.9	9.4	23.3
1989	12.1	7.9	10.4	6.6	12.9	16.8	9.6	37.1	17.5	10.6	27
1990	7.5	5.1	8.3	4.3	9.9	7.6	5.3	9.7	2.7	7.1	15.7
1991	8.4	6.6	7.5	5.4	9.7	11.2	6.4	20.7	9.5	9.6	11.7
1992	7.4	7.7	9.7	3.8	10.5	10.6	6	26.1	10.4	7.4	16.2
1993	11.3	9.6	10.7	8.5	15.1	22.7	13	41.4	25.3	14.4	23.3
1994	7.4	9.7	10.8	6.7	13.7	13.5	6.5	20.6	12.9	11.6	20.1
1995	9.2	7.3	11.8	8.5	15	16.9	12.3	30.4	9.4	8.8	17.3
1996	13.5	12	17.1	11.4	17.1	13.8	12.3	14.5	11.6	12.1	27.1
1997	11.9	10.9	18.6	12.3	17.4	21.5	15.1	45	21.1	16.3	26
1998	8.8	9.2	11	5.7	11.8	14.6	7.3	16.5	8.9	5.5	17.3
1999	8.7	7.4	12.2	6.7	11.7	11.8	8.3	25.6	8.4	10	21.9
2000	8.7	10.4	10.8	7.7	10.9	12.2	7.1	11	6.3	11	19.7
2001	8.5	7.1	10.6	6	11	10.7	6.3	27.2	13.9	9.6	17.4
2002	7.2	7.1	7.3	5.1	9.9	7	4.6	8.6	5	6.5	13.8
2003	8.9	9.6	9.7	6.3	12.7	11	7.7	20.2	7.3	11	19.1
2004	7.4	6.5	8.5	6.3	11.9	14.7	8.4	31.2	15.3	8.5	13.3
2005	8.3	7.1	10.7	4.6	12.8	20.8	9.6	49.8	20.3	11.4	16.1
2006	10.8	8.3	15.8	7.8	13.8	12.4	8.7	8.1	4.9	10.8	21.1

State	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado
Station Id	05j42s	05j08s	05k06s	06k08s	06j12s	06l03s	06k10s	05j12s	07m12s	06j09s	05k14s
Latitude	40.035	40.033	39.916	39.380	40.875	38.489	39.292	40.225	37.749	40.368	39.804
Longitude	-105.544	-105.576	-105.761	-106.197	-106.046	-106.340	-106.549	-105.920	-107.689	-106.740	-105.778
1961	8.1	10.3	5.9	8.1	8.8	11	4.5	3.8	8.2	13.2	10.1
1962	15	18.5	11.4	17.4	21.3	17.6	15.8	9	23.8	28.9	17.9
1963	11.1	13.9	8.2	10.8	10.9	12	8.3	5.8	12.4	11.6	11.1
1964	8.3	10.6	7.2	7.5	7.9	12	7.3	4.5	7.4	15.4	10.9
1965	14.2	17.5	10.6	16.3	16.9	15.6	13.4	10.5	22.7	24.2	15.2
1966	6.6	8.6	7.5	9.1	10	10.1	7.2	6.3	19.9	16.2	10.1
1967	8.5	10.8	10.2	13.7	14.5	10.9	11.9	8.3	18.7	19.5	14.7
1968	13.2	16.3	10.7	13	14.2	11.4	11.9	6	21.6	25.7	15.5
1969	7.2	9.3	10.2	12.6	12.6	12.6	11.9	8.3	22.8	24.4	11.1
1970	14.2	17.6	13.7	16.3	16.6	14	15.4	9.3	12.5	27.4	17.4
1971	11	13.8	13.8	14.5	21	12.4	14.6	8.1	16.2	29.2	18.3
1972	11.5	14.4	11.1	12.5	14.7	10.4	12	8.5	15.6	22	13.1
1973	8.6	10.9	10	10.5	13.3	14.1	11.5	5.3	20.3	18.9	12.2
1974	11.3	14.1	12.7	13.1	18	14.6	14.5	8.7	16.6	26.1	16.1
1975	11.1	13.9	10.1	13.2	12.5	16	12.3	7.5	19.4	24.5	15.4
1976	8.5	10.8	9.8	14.1	15.6	10.4	11.2	7.7	18.9	15.8	12.2
1977	3.9	5.4	4.8	7	6.7	6.1	5.1	3	5	7.5	8.7
1978	14.3	17.6	11.6	17.9	16.4	15.7	13.4	9.1	19.8	31.2	19
1979	11.6	14.5	11.2	13.4	17.1	14.6	13.4	10.1	29.5	23.4	12.9
1980	13.7	15.8	13.2	15.3	18.2	14.1	14.3	8.7	24.5	23.6	17.3
1981	3	3.1	5.4	6.4	8.1	5.8	5.2	2.9	3.6	9.1	7.5
1982	11.4	14.7	13.4	15.1	14.2	15.8	14.1	5.8	16.7	29.2	15.9
1983	6.8	8.7	11.4	10.6	10.8	10.3	9.5	4.9	13.4	23.1	13.8
1984	12.5	15.3	15.8	17.5	15.8	19.1	16.2	9.5	19.9	29.6	20.3
1985	8.6	10	10.8	11.3	12.3	12.8	12.1	7.5	19.6	20.7	14.6
1986	12.4	16.3	11.4	15.5	23.8	14.9	13.2	10.5	19.8	23.5	17.6
1987	9.6	11.3	8.1	11.4	9.5	13.9	8.3	4	17.8	13.5	13.3
1988	9.9	12.8	15.5	13.7	14	13.7	10.2	6.3	14	18.8	16.1
1989	9.3	12.6	11	10.9	10.9	11.8	9.8	6.7	21.8	19.1	15.4
1990	9	13.8	9.6	9.9	13	7.2	6.7	5.4	6.9	18.6	8.9
1991	6.1	7.8	7.2	9.5	10.4	7.7	7.7	5.5	14.1	16.1	11.3
1992	7	8.5	7.7	10.6	9.8	9.2	8.8	4.8	9.7	17.9	14.6
1993	8.8	13.9	12.5	15.4	14.7	16.2	13.9	10.2	27.1	20.9	16.3
1994	11.3	15	9.7	12.2	12.5	10.7	10.3	6.6	14.6	18.8	13.9
1995	7	9.3	10.8	13.2	9.1	11.5	12.2	6.3	23	19	11.8
1996	18.2	25	17.7	18.9	17.3	19.2	15.9	9.8	15.8	31.9	20.3
1997	14.1	17.8	14.1	16.9	19.6	19.5	14.6	11	25.2	32.5	17.2
1998	9.5	11.3	10.6	11.4	11.7	12.4	9.8	6	11.6	20.4	13.6
1999	7.2	10.6	9.8	13.5	14.5	10.7	9.3	6.6	18.6	19.8	10.6
2000	9.7	11.9	11.7	11.5	12.3	10.5	11.9	8.5	10.7	23.3	12.2
2001	5.7	8.6	12.3	11.1	9.8	11.1	8.4	6.3	14.7	15.7	13.3
2002	5.2	7.2	8.8	11.2	6.6	6.8	8.3	4.6	8.4	14.5	9.1
2003	8.3	10.3	9.9	12.2	10.1	11.6	10	8.7	12	20.8	12.1
2004	7.2	9	9.5	10.3	12.7	12	8.3	6.1	17.1	19.2	13.2
2005	8.8	9.7	11	10.2	12.1	15.3	9.8	7	24.1	15.4	12.3
2006	9.6	15	13.6	18.8	12.4	12.2	15.5	9.8	10.2	28.2	17.4

State	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado
Station Id	05k09s	06k40s	07k06s	07k09s	06l11s	05m07s	05m14s	05m03s	06m22s	06m17s	07m16s
Latitude	39.646	39.088	39.046	39.129	38.894	37.331	37.214	37.209	37.019	37.479	37.722
Longitude	-105.870	-106.542	-107.874	-107.288	-106.953	-105.067	-105.122	-105.200	-106.452	-106.802	-107.260
1961	7.1	2.7	11.1	9.1	6	5.1	6.4	8.1	12	11.8	2.7
1962	18.4	15.2	30.2	27.4	18.3	9.6	11.5	10.8	28.5	35.3	8.2
1963	11.9	3.9	14.1	11.3	8	3.5	4.6	8	21.4	18.4	2.1
1964	7.8	3.4	11.6	10.8	6.7	9.2	6.8	7.3	10.1	11.6	0.9
1965	18.6	10.1	19.8	20.7	18.7	6	10	12.2	30.1	37.8	8.2
1966	8.5	4.4	22.6	20.1	11.9	4	5.6	11.2	27.5	32.2	5.4
1967	13.8	8.4	22.6	12.9	14	3.4	7.2	7.8	23.7	25.6	2.9
1968	14.9	6.9	20.6	19.1	13.4	7.4	8.5	9.6	16.7	24.6	7.4
1969	13	5.2	30.8	18.7	15.6	3.4	6.3	9.7	29.3	30.4	8.1
1970	22.3	9.3	16	12.4	13.5	5.2	6.1	7.4	7.7	18.7	1
1971	18.4	6.1	21	14.2	11.8	5.5	6.8	7.6	16.8	21.6	4.1
1972	14.9	9.2	18.7	16.6	10.9	3.9	6.1	10.8	14.6	28.3	7.6
1973	9.2	4.4	22.3	19.1	10.8	7.2	8.5	11.1	22.5	34.6	7.4
1974	14.7	6.9	17.9	17.8	13.4	10.2	8	8.2	19.8	22.3	3.1
1975	14.5	9.9	18.9	17.5	13.2	6.2	8.2	9.8	21.4	29.9	7.1
1976	12.2	6.8	22	15	12.2	5.3	7.2	8.3	22.5	27.1	4.9
1977	8.4	1	7.2	3.6	5.2	4	5.8	5.6	6.4	5	0.3
1978	20.2	11.3	26.5	16	15.9	3.9	5.8	12	19.4	19.5	4.2
1979	14	11.7	24.1	22.9	20	5	10.2	16.2	37.6	48.6	12.6
1980	17.1	11	24	21.5	20.4	7.2	9.9	12.3	40.2	38.5	8.6
1981	6.1	3	10	7.4	4.8	0.6	1.9	3.7	8.9	13.3	0.3
1982	14.7	9.3	26	12.9	13.1	7.5	8.9	10.3	24.3	30	2.8
1983	11.3	4.2	27.9	16.8	10.6	8.3	9	9.2	24.3	28.6	3.8
1984	18.8	12.9	23.6	19.8	18.5	11.4	11.4	13.1	29.1	29.9	4.5
1985	12.2	8	23.6	17.8	13.2	5.3	9.3	14	27.8	35	5.3
1986	19.6	8.9	29.1	15.8	19.8	1.3	5.6	6.8	21.3	29.4	5.3
1987	9.6	6.7	25.5	11	11.8	9.3	12.3	9.9	20.3	31.3	11.8
1988	13.7	7	19.6	11.6	9.5	7.8	5.5	9.5	20.1	22.1	2.7
1989	9.4	8	22.2	13	11.4	14.5	11.4	14.4	30.4	34.1	8.3
1990	9.8	6.1	14.3	7.8	5.7	4.9	5.3	5.8	6.5	10.9	3
1991	7.6	5.1	16	10.3	6.9	6.2	7.1	10.7	23.3	24.2	2.9
1992	9.1	6.2	16.4	10.4	8.7	8.4	8.8	13	20.3	21.3	7.4
1993	15.5	9.6	40.2	24.1	20	12.2	14.6	16.1	34.2	38.6	7.7
1994	13.5	8.7	18.8	13	9.9	6.4	9.9	10.2	21	21.9	5.4
1995	13.3	9.1	25.1	17.2	14.6	4.3	9.2	15.5	27.1	28.6	5.7
1996	23.7	12.8	20.1	12.4	17.5	3.3	8	7.8	18.5	16.2	2.1
1997	19.4	12.3	33.1	22.8	17.8	6.7	13.8	12.3	32	35	10.1
1998	13.8	6.7	22	15.3	10.4	8.6	8.7	10.8	17.7	20.1	4.6
1999	13.8	6.5	19.6	10.4	9.5	2.5	5.2	7.1	14.2	24.9	5.6
2000	13.1	6.8	15.8	11.5	9.7	4.3	5	8.2	10.1	9.7	2.1
2001	11.4	6.5	14.2	12.2	8.4	3.7	7.6	10.5	21.8	27.2	8.1
2002	8	4.8	11.9	8.1	7.5	5.1	4.6	7.1	10	7.3	2.2
2003	12.2	7	18.4	12.9	10.5	4.3	9.3	11.2	20.3	17.4	2.3
2004	10.1	5.1	23.8	13.9	10.9	7	7.4	9.3	22.5	29.2	5.9
2005	9.6	6.9	40	21.6	15.3	10.8	13	14.8	31.2	42.9	7.8
2006	18.7	11.1	14.8	13.6	13	0	1.5	4.1	10	10.1	3.7

State	Colorado	Colorado	Colorado	Colorado	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	07m14s	07m33s	07m29s	08m07s	16a04s	15b21s	15b02s	15b14s	16c01s	16c20s	15c04s
Latitude	37.847	37.892	37.799	37.892	48.057	47.532	47.458	47.072	46.950	46.840	46.566
Longitude	-107.727	-107.713	-107.924	-108.195	-116.231	-115.776	-115.706	-115.958	-116.340	-116.122	-115.742
1961	6.4	12.4	7.6	8.8	35.4	13.8	29.2	52.5	8.3	33.9	21.4
1962	16.2	28.2	16.7	20	32.7	14.1	30.2	58.9	16.9	39	24.9
1963	7.9	14.3	10.6	12.5	19	8.9	18.7	37.1	3.8	15.3	9
1964	6	11.6	6.8	7.8	36.4	13	30.5	55.9	17	42.8	27.8
1965	16.7	24.7	15.8	13.7	37.1	13.8	32.8	63.3	16.1	47.1	32.2
1966	11.2	18.1	13.9	12.6	31.2	12.5	26.6	48.6	12.8	34.8	16.5
1967	11.9	16.5	13.1	12.8	48.1	16.1	34.6	68.3	11.6	46.5	32
1968	16.3	24.6	15.3	14.8	29.7	12	25.6	50.9	5.6	27.5	14.6
1969	16.7	24.7	17.7	19.8	41	18.3	39.5	77.3	16.5	42.9	32.4
1970	11.1	19.2	11	11.2	31.9	14.4	30.7	52.3	9.6	36.8	22.7
1971	12.8	22	11.9	14.6	39.8	20	39.3	65.8	12.9	40.5	28.7
1972	11.3	20.7	12	13	43.7	20.4	48.8	86.4	22.7	67.2	49.1
1973	15.2	24.4	14.7	15.1	23.8	6	17.6	39.9	5.5	23.9	15.6
1974	10.4	17	13.6	16.5	55.2	19.2	42.7	84.5	19.1	75.9	44.8
1975	16	24	15.6	15.8	36	17.9	29.9	57.2	18.1	41.7	31.6
1976	15	20.7	12.7	17.2	33.8	15.8	30.7	61.1	15	43.3	29.5
1977	3.9	4.3	3.6	4.1	12.4	6.2	9.9	21.8	4.1	15.3	9.5
1978	14.5	24.1	15.5	16	39.1	13.6	32.5	53.3	9.1	35	25.4
1979	21.5	26.9	18.8	21.3	31.3	16.7	27.4	46.9	14.8	32.6	28.4
1980	15.8	23.3	17.7	20.3	23.7	8.6	20.3	38.9	6	22.3	13.9
1981	4.7	9.2	7.2	8.2	22.8	6.5	16.4	34.1	3.2	18.2	6.1
1982	12.9	24	14	17	34.2	13.6	30.1	61.9	13.5	39.7	28.3
1983	11.5	17.8	13.2	14.8	37.7	11.5	28.9	51.9	8.4	28.7	21.1
1984	14	25.5	17.8	15.8	22.8	6.4	18.9	41.6	11	30	18.6
1985	13.4	22.8	13.4	16.5	34.1	15.4	31.8	59.1	14.5	38.5	31.9
1986	12.4	18.6	13	16.3	21	9	24.1	41.6	10.2	27.9	20.5
1987	12.8	23.1	12	17.1	23.8	8.4	20.6	41.8	6.3	22.6	17.1
1988	10	16.1	8.7	10.8	20.6	8.9	17.6	31.3	7.5	21.3	15.3
1989	15.3	21.9	12.1	18.7	30	10.9	23.5	44.2	16.1	33.9	29.9
1990	5	7.3	4.6	4.2	36.7	12.2	31.1	51.1	11.8	35	22.7
1991	8.1	12.3	9.7	12.2	30.2	7.1	24.1	64.6	5.4	32.4	18.9
1992	9.8	16.6	12.1	14.4	30.9	8.6	25.7	48.4	4.2	30.5	15.4
1993	19.7	26.1	21	23.1	22.9	8.8	27.6	38.4	10.1	27.9	21.5
1994	9.7	16	9.6	14.4	22.1	9.1	18.4	31.9	8.7	23.3	18.7
1995	16.1	21	13.5	16.9	28.2	4	22.4	42.8	8.3	29.5	17.5
1996	12.7	19.1	12.3	12.4	28.1	8	22.6	48.3	7.4	26.5	17.9
1997	19.3	27.2	19.5	27.5	44.4	19.3	40.9	79.8	17.1	54.9	35.4
1998	8.6	14.1	9.8	14.1	24	8.5	22.3	36.3	7.1	25.5	21.6
1999	11.1	17.1	8.8	12.7	45.8	18.5	40.1	67.5	14	52.4	35.7
2000	8.8	13.9	10.5	11.2	33.2	13.1	28.7	48.6	13.2	40	30.7
2001	12.1	16.8	11.6	12.5	15.5	8.8	16.8	22.5	9.2	18.2	17.3
2002	7	12.1	6.2	8.4	34	14.1	34.9	58	15.5	42.8	30.4
2003	10.4	14.7	11.2	12.2	21.6	2.9	14.1	27.2	4	23.9	15.4
2004	13.4	20.4	13.2	15.1	34.2	12.4	26	44	10.8	33.9	31.2
2005	17	23.1	16.1	16.8	16	1.7	9.3	23.9	2.8	13.5	6.6
2006	8.9	15	8.1	8.5	32.1	9.8	25.8	46.8	8.9	28.9	23.3

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	15c06s	15c16s	15c09s	14c05s	14c04s	15d01s	16d08s	16d09s	16e11s	16e05s	16e10s	15e11s
Latitude	46.481	46.764	46.563	46.634	46.466	45.189	45.072	45.043	44.952	44.771	44.606	44.303
Longitude	-115.634	-115.295	-115.288	-114.581	-114.633	-115.973	-116.454	-116.133	-116.143	-116.249	-116.980	-115.234
1961	41.4	42.1	38.7	31.2	21.3	26	23.9	18.7	15.1	18.9	18.7	18.8
1962	47.3	47.8	44	37.8	24.5	29.9	23.3	28.1	18.9	23.2	18.3	22.8
1963	26.1	26	23.6	20.6	19.2	20.6	11	13.6	7.4	8.2	9.5	15.2
1964	48	43.3	39.8	32	22.7	23.3	18.8	20.8	14.1	19.1	16.4	18.4
1965	56.1	55.3	51	36.9	29.9	45	35.8	37.5	23.7	30.9	27	34.6
1966	32.7	34.3	31.4	22.5	21.6	22.2	21.4	24.1	12.6	19.7	14.4	19.1
1967	51	59.4	55	33.9	26.4	30.7	21.7	29.7	18.1	21.9	20.1	23.1
1968	31.4	42.2	38.8	26.5	24.3	23.3	20.6	23.7	14.7	18.3	17.2	16.3
1969	49	48.8	45	32.3	27.8	39.6	27.1	35.4	22.1	34	28.4	33.3
1970	40.8	39	35.7	27.6	20	30.6	26.8	28.9	19.1	27.8	25	30.9
1971	54.5	57.4	53	34.8	28.7	37.9	29.3	36.6	24.1	31.7	30	29.9
1972	72.3	76	70.5	51	37	37.8	33.4	33	21.2	27.8	27.6	34.2
1973	35.4	34.2	31.3	18.7	17.1	24.9	18.6	23.2	12.7	14.3	18.9	20.9
1974	70.6	61	56.4	39.9	27.3	50.3	35.8	44.8	22.7	33.5	30.3	32.4
1975	48.8	49.1	45.2	31.9	24.5	33.7	26.4	30.1	18.7	24.1	23.6	24.6
1976	52.7	50.9	47	36	31.4	31.8	23.5	27.9	18.8	24	16.5	25
1977	17.8	20.9	18.8	10.1	7.9	4.9	5.2	4.4	5.7	2.9	2.6	5.5
1978	43	43.3	39.8	33.4	28	34.7	24.6	30.9	19.9	27.3	25.5	29.3
1979	39.9	42.6	39.1	33.7	25.1	25.5	22.2	23	16.5	16.7	18.3	18.7
1980	31.4	35.1	32.1	23.8	20	30.3	15.7	27.8	14.1	19.2	18.5	25.1
1981	20.3	22.6	20.4	14.4	15.1	21	16.3	19.2	12.4	10.8	16.2	17.1
1982	49.4	50.7	46.8	34.9	29.4	41	25.7	34.4	18.3	25.3	26.7	29.7
1983	39.3	39.4	36.2	21.1	19.8	38.3	28.4	32.9	23.8	27.6	32.5	27.9
1984	32.4	33.5	30.6	19.2	16.8	27.2	20.6	23.9	16.3	15.8	23.6	21.3
1985	45.3	43.5	39.3	26.4	22.8	29.9	19.1	26.7	12.8	18.8	21.1	22.3
1986	32.6	34.8	28.2	23.5	22.8	31.6	21.8	28.1	15.1	26.2	21.6	30
1987	27.8	28.3	26.2	18.1	15.2	15.6	13.5	13.8	9.6	11.7	13.1	13
1988	27	29.6	27.9	20.1	18.6	21	13.9	14.4	10.2	13.5	13.5	15.6
1989	41.7	36.8	36	22.6	20.8	23.8	18.5	21	18.8	16.8	24.8	19.5
1990	41.3	44.8	37.1	26.4	21.7	21.2	17.9	19.4	9.2	13.4	12.6	16.5
1991	39.8	42.4	41.1	23.4	22.7	16.2	10.5	12.6	6.5	6.3	8.8	11.1
1992	34.4	36.2	31.8	21.4	17.8	22	14.6	19.9	13.5	14.7	13.5	17.1
1993	32.8	29.7	29.6	18.8	16.7	26.1	19.8	22.8	18.3	21.7	26.1	23
1994	27.1	26.4	28.4	17.1	14.8	18.4	16.4	17.9	12.3	15.7	15.5	15.7
1995	34.4	34.8	32	19.5	21	30.3	22.5	21.5	19.8	20.8	24.8	22.6
1996	36.4	41.6	41.6	32.1	28.6	34.4	20.5	29.2	14.7	20.1	15.8	28.7
1997	61	67.5	62.6	40.6	32.6	41	28.1	33.6	22.9	23.7	21.1	34
1998	28.5	31.3	28.8	19.2	17.8	23.9	18.6	22.5	15.5	21	22.7	18.8
1999	57.2	70.7	59	42.6	31.8	46.7	34.4	42.6	25.5	35.3	35.2	33.3
2000	43.2	46.2	45.4	28.4	21.5	29.4	20	26.1	16.7	19.2	23.4	22.4
2001	23.6	20.6	22.1	12.8	12.5	12.3	9.4	11.7	6.8	8	11	9.4
2002	40.8	45.9	35.5	24	21.1	27.4	21	24.5	15.6	20.3	21.2	21
2003	31.3	34.8	38.4	22.9	20.3	25.7	19.4	25.9	13.9	16.4	16.1	21.1
2004	41.9	37.1	45.7	24.6	20.4	31	19.8	30	18.3	20.4	22.9	22.6
2005	19.6	20	26.7	11.4	11.3	13.4	10.7	11.5	8.3	12.5	12.6	11.3
2006	37.8	43.3	43.6	28.9	22.7	34.1	23.8	30.1	18.1	24.4	27.1	30.1

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	15e08s	15e09s	15f01s	15f14s	15f04s	15f05s	16g01s	15g02s	14g02s	13g01s	11e37s	11e36s
Latitude	44.288	44.051	43.932	43.954	43.757	43.629	42.765	42.013	42.181	42.321	44.437	44.533
Longitude	-115.655	-115.443	-115.666	-115.274	-115.239	-115.438	-116.900	-115.003	-114.287	-113.616	-111.993	-111.411
1961	10.2	20.2	21	8.8	18.5	25.4	9.9	7.7	11.3	13.1	8	20.4
1962	18.4	25	28.4	17.3	26.8	36.1	9.2	9.4	15.7	18.9	16.3	30.8
1963	4.7	16.1	9.8	0	20	25.6	0	3.9	6.9	8.4	5.5	12.6
1964	14.8	19.8	22.7	15.7	21.1	25.6	18.2	11.3	17.3	16.8	10.6	18.7
1965	23.8	38.9	48.5	28.4	38.7	58.6	20.2	13.2	23	23.1	22.4	34
1966	18.1	20.6	22.5	15.2	21	29.1	6.5	8.4	11.8	15	13.5	18.6
1967	17.2	25.4	30.4	15.3	29.3	39.8	15.6	13.6	11.8	14.1	17.8	24.3
1968	15.7	17.3	17.9	9.5	19.2	25.7	2.1	6	9	11.2	15.2	19.9
1969	29.7	37.4	46.6	26.2	38.1	52.1	30.6	17.1	17.5	17.6	34.1	30.2
1970	22.6	34.6	37.2	19	25.8	36	16.8	10.1	20.9	24.4	11.1	22.7
1971	27.9	33.4	44.2	23.9	37.2	48.6	15.5	10.9	19.8	25	22.4	30.6
1972	24	38.5	47.7	30.5	41.1	52.8	24.7	18.1	33.3	37.3	16.9	28.5
1973	13.2	22.8	24.3	11.2	19.5	26.1	7.9	11.4	14.8	14.5	12.3	18.4
1974	23.3	36.4	40.6	24.6	46.8	58.3	20.5	11.3	23.8	31.5	14	30.4
1975	20.4	27.2	32.1	20.9	27.2	37.3	17.4	12	18.9	20.5	19	21
1976	24.7	27.5	39.9	19	27.1	32.3	12.8	9	16.3	18.2	12.4	24.4
1977	3.7	4.6	0.3	2.2	4.6	4.7	1	4.9	3.3	0.5	3.1	6.6
1978	23.1	32.6	39.9	24.1	32.6	43.5	20	11.7	18.4	17.9	15.4	33.6
1979	15.9	20.1	22.4	13.3	20.2	25.8	18.8	13.5	20.5	14.4	11.5	20
1980	17.7	27.7	32.1	15.1	26.7	37.4	19.7	11.2	17.4	17.4	9.5	22.6
1981	13.3	17	13.9	7.4	15.1	21.3	6.2	2.8	9.1	6.6	10.8	15.8
1982	20.1	31.4	42.8	20	33.9	47.1	19.5	12.4	23	30.7	12.7	25.8
1983	23.6	31.7	38	20.3	30.8	41.3	26.9	13.2	19.5	23.1	22.1	27.7
1984	19.1	24	30.6	16.5	25.6	32.5	27.9	21.1	27.4	28.3	11.7	18.6
1985	16.6	22.1	26.1	14.2	23.6	29.9	15.2	13.5	16.8	15.5	12.1	20.6
1986	17.8	35.3	43.2	19.1	35.3	45.1	23.8	13	23.3	32.7	11	27.6
1987	9	12.3	14	7.9	14.2	17.3	10.3	7.6	9.5	11.1	6.4	12.5
1988	10.5	16.5	20.3	8.8	18.1	23.6	10.7	8.8	11.5	13.3	8.9	17.1
1989	11.9	22.3	27	11.6	24.1	31	28.9	14.3	19.6	22.1	17.8	26.7
1990	10.1	17.9	19	9.2	17.5	21	10.8	12.2	11.7	10.1	7.3	18.1
1991	5.6	11.2	13.7	7.5	11.3	14	9.2	9	11.1	10.6	4.8	11.5
1992	9.6	17.8	17.6	5.4	17.7	18	7.3	7.8	9.8	13.1	10.8	22.2
1993	16.9	26.8	30	13	27.5	35.8	26.1	13.6	18.7	27.6	16	26.6
1994	11.5	18.6	20.3	12.9	18.5	20.9	12.2	9.2	13.3	12.7	7.7	18.9
1995	15.9	24.7	31.8	14.4	28.8	34.4	20.9	10.3	13.7	16.3	19	32.5
1996	13.6	28	29.4	11.6	32.4	40.3	14.8	13	17.5	22.2	9.5	24.9
1997	21.5	37.6	39.6	17.5	42.9	58	24.2	16.3	26.4	40.2	16.9	45.2
1998	14	22	23.8	13.9	25.9	30.7	18.2	12.2	17.7	26.8	11.1	19.4
1999	19.3	36	39.9	19	36.6	44	28.9	12.4	19.1	22.4	16.4	33.1
2000	13	25.6	27.5	13.7	24.4	30	13.5	13.2	16.5	23.2	10.6	19.6
2001	6.6	12.4	14.3	6.6	13.9	17	8.9	10	12	12.2	6.9	13.5
2002	12.7	23	26.9	11.7	23.2	31.5	17.3	13.1	17.9	23.3	11.1	20.5
2003	10.7	19.9	20.6	8	22.1	25.8	7.4	6.9	10.1	11.4	8.4	16.4
2004	15.3	24	30.1	13.1	25.1	30.8	20.9	16.5	22.6	24	14	27.2
2005	8.1	11.9	13.4	5.6	14.6	19.3	8.7	8.6	13.7	14.7	12.1	20.4
2006	17.9	30.6	35	15.5	33.7	44.5	14.9	17.8	22.4	35.2	13.8	30.2

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	11e10s	11f02s	11f11s	12g17s	12g18s	11g30s	11g06s	11g33s	11g05s	11g01s	13d16s	14e01s
Latitude	44.420	43.570	43.209	42.757	42.260	42.525	42.361	42.413	42.562	42.953	45.670	44.472
Longitude	-111.385	-111.200	-111.688	-112.478	-112.125	-111.956	-111.561	-111.166	-111.298	-111.359	-113.953	-114.490
1961	11.6	10.7	8.8	11.7	7.5	14.1	14.4	6	9.9	6.5	11.5	13.6
1962	15.9	15.4	11.8	14.3	8.9	16.8	25.6	8.5	19.6	9.4	12.3	17.8
1963	7.7	7.5	8	8.3	4.4	8.9	16	5.5	13.5	5.6	8.7	13.7
1964	10.6	12.7	10.8	13	7	15.3	16.4	8.6	13.3	8.4	15.9	15.2
1965	18.2	19.1	18.9	14.4	15	24.6	36.1	15.4	24.7	14.3	20.3	31.6
1966	10.6	10.7	11.6	13.3	6.3	14.6	15.6	8.2	14.3	9.8	10.6	14.1
1967	15.6	16.1	16.7	14.7	9.2	21.1	24.3	11.9	17.5	11.6	15.7	17.6
1968	12	14.3	12.4	10.4	9.2	15.5	24.3	7.7	14.4	11.1	13.2	17.5
1969	20.8	16.7	20.4	18.1	14	23	30.3	12.5	19.6	15.6	17.2	26.5
1970	13.9	17.9	14.8	13.4	9.2	20.1	24	10.4	17.1	13.8	14.6	16.4
1971	18.5	16.2	19.4	17.1	12.3	25.2	35	14.7	24.1	15.6	18.8	23.8
1972	15.9	19.7	22.4	22.2	13.7	31.9	32.7	18.2	23.4	15.8	24.6	22.6
1973	11.3	12.8	14.9	13.7	10.7	17.9	19.2	7.7	15.5	9.6	10.3	12.3
1974	16	17.9	16.9	18.1	11	23.2	29.8	11.5	15.8	12.9	19.2	28.4
1975	14.3	15.7	13.1	19	11.8	20.1	24.7	11.5	17.5	12.1	16.8	17.9
1976	16.6	20.4	17.9	16.2	12.1	20.1	23.1	11.6	18.4	13.8	18.1	21.3
1977	5.7	4.5	2.9	4.7	0.3	4.2	2.3	2.8	4.7	2.6	5	3.8
1978	17.9	18.3	16.2	14.2	13.4	23.4	31.5	15	25.1	16.9	18.7	19.7
1979	14.9	18.9	13.3	13.2	13.9	20.1	25.5	12	16.9	16.5	14.5	11.9
1980	12	10.3	13.9	16.7	12.2	21.5	24.9	11.6	19.2	13.2	9.7	17.4
1981	11	8.5	7.4	8.3	3.2	7.7	7.4	5.7	8.2	5.8	12.5	12.1
1982	15.9	18.9	21.7	22	14.2	24	34.4	13.6	21.3	16.3	20.8	24.1
1983	17.8	14	17.4	17.7	10.7	19	25.5	10.4	14.7	11.4	17.1	18.6
1984	11.3	14.8	14.2	24.2	17.1	22.5	32.7	12.6	17.6	14.3	14.9	14.6
1985	13.4	13.5	12.1	14.1	8.7	16.2	21.4	12.7	13.8	12.2	12.9	16.1
1986	15.8	17.9	15.9	18.3	18.5	21.6	41	20.6	25.9	18	15.1	21.3
1987	7.7	8.7	7.9	8.9	3.6	10.5	11.7	5	8.6	7.3	8.5	11.1
1988	10.6	12.6	9.3	9.1	5.9	12.2	12.7	9.6	10.9	7.7	11.9	12.3
1989	15.7	16.1	16.1	16.8	12	17.5	17.6	9.9	12.4	11.9	14.1	14
1990	11.3	9	9.3	9.1	6.3	11.2	12	7	9.2	8.8	12.6	12.9
1991	8.5	10	10	11.5	5.6	11.9	13.5	5.4	8.2	8.4	11.8	10.7
1992	10.6	8.6	6.1	7.2	4.3	10	10.8	5.2	7.4	5.8	13.8	11.9
1993	14.9	14.3	13.1	17.9	12.6	19.6	22.8	8.8	12.4	13.3	12.6	14.5
1994	10.9	12.7	8.7	11.5	8.7	13.4	17.5	6.6	12.1	10.1	10	9.3
1995	18	14.7	10.6	12.4	9.2	16	20.2	7.9	11.1	9.9	13.7	15.8
1996	11.3	13	12.2	17.7	12.4	20.9	20.9	10.7	17.3	12.3	21.2	22.9
1997	21.7	22.6	20.4	22.2	19.9	28.4	33.9	12.2	21.4	18.1	25.7	29.8
1998	11.4	15.2	13.1	21	14.5	19.5	20.3	9.1	14.6	11.9	11.5	14.1
1999	17.5	15.4	14.4	17.3	11.3	18.3	20.6	10.8	15	13.5	20	24.7
2000	13.2	12.3	11.2	14.2	9.1	15.5	18.1	8.7	12	11.5	15.8	16.5
2001	7.9	9.4	8.3	11.3	7	9.1	12.4	4.8	7.5	7	8.4	8.6
2002	13.3	11.9	11.6	14.6	10.6	13.5	16.4	6.7	10.5	10.2	12.5	14.9
2003	11.2	11.5	9.4	10.5	7.4	12	14	6.8	11.5	9.9	15.6	13.2
2004	17.6	15.4	15.7	19.6	14.7	20	20.2	8.5	12.7	12.4	14.9	13.9
2005	11.6	9.6	9.1	10	9.7	17.2	18.6	7.5	10.8	8.8	8.7	9.9
2006	16.4	17.3	16.1	18.2	12.9	21.4	25.3	11.3	16.2	13.1	18.4	18.7

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	13e06s	13e27s	13f04s	13f09s	13f03s	14f02s	14f16s	14f19s	14f17s	14f12s	14f04s	14f08s
Latitude	44.415	44.019	43.610	43.626	43.744	43.861	43.711	43.769	43.877	43.875	43.799	43.603
Longitude	-113.398	-113.472	-113.931	-113.969	-113.938	-114.209	-114.159	-114.418	-114.673	-114.714	-114.853	-114.674
1961	6.7	7.3	5.5	9.4	10.4	3.4	7.4	6.5	11.3	12.9	19.1	13.9
1962	10.3	11.3	9.5	15.3	16.1	7.7	13.6	10.8	16.4	17.8	29.3	21.1
1963	5.6	5.8	5.7	8.9	9.7	4.4	9.5	8.7	11.7	13.2	22.4	17.2
1964	10.9	10.8	6.5	10.7	12.2	5.2	10.3	10.1	13.7	15.1	22.7	17.6
1965	20	26.4	17	24.7	25.5	16	22.2	21.1	27.7	28.6	50.4	34.1
1966	6.7	8.4	7.6	11.8	12	5.4	9.8	9.7	11.8	13.3	22.7	15.5
1967	13.3	18.4	12.1	18.6	22.2	10.9	15.5	13.8	16.6	17.9	30.7	18.9
1968	10.7	11.7	8.4	11.4	12.4	6.4	9.2	8.6	13.5	15	28.3	16.9
1969	19.6	23.4	22.5	27.5	29.7	12.3	21.7	20.3	23.8	24.8	45.2	31.4
1970	7.4	8.5	7.8	11.2	12.6	6	11.5	11.2	15	16.4	28.2	21.2
1971	11.2	16.8	14.8	20.5	21.6	10.3	15.8	16.7	23.2	24.3	41.3	30.4
1972	14.2	17.1	8.7	13.3	16.1	9.7	14.4	12.6	22	23.1	51.6	35.3
1973	6.9	8.9	8.8	12.1	10.7	4.2	10.1	8.9	10.8	12.4	20.4	19
1974	9.6	13.2	10.1	17.2	20	8.3	15.6	14	24.4	25.4	45.4	31.4
1975	9.6	9.4	9.7	13	11.4	7.7	10.5	11.5	17.3	18.6	29.2	20.8
1976	9.6	8.8	7.1	10.7	8.1	5.5	10	9.2	15.4	16.7	27.1	18.6
1977	1.2	2.4	0.8	2.3	1	0.2	3.1	1.4	2.1	4	4.7	2.9
1978	12.3	11.1	13.6	18.2	14.4	7.1	15.4	13.2	19.9	21.1	37	27.9
1979	8.6	9.6	7.8	9.9	9.1	6	9.3	8.3	10.8	12.4	23.3	15.7
1980	9.5	11.6	11.5	15.5	15.9	8.8	13.9	12.5	15.3	16.7	34.2	23.6
1981	6	12.7	7.4	10.6	12.4	6.6	9.8	8.8	11.6	13.1	19.4	15.7
1982	11.7	12.5	9.4	13.9	17.6	8.3	14.3	12.7	21.7	22.5	43.4	30.9
1983	11.7	15.2	16.1	20.6	19.1	10.5	16.3	15.6	20.3	20.3	35.9	28.1
1984	7.5	11.1	9.7	13.1	12.5	7.6	9.1	12.7	14.9	17.6	27.8	22.8
1985	6.7	11.2	8.3	12.3	11.1	6.6	9.5	11.8	14.7	16.5	25.5	18.3
1986	10.7	12.5	14.7	19	17.8	9.2	16.6	14.3	21.1	22.6	38.8	30.7
1987	5.3	5.9	3.5	4.6	5.4	3.4	4.8	4.7	7.8	8.7	14.7	10.3
1988	7.4	9.7	5.5	8.6	9.1	3.2	8.3	5.3	10.1	11.6	20.1	13.4
1989	8.6	10.3	9.6	14.3	12.1	6.5	10.5	10.8	13	13.9	22.8	19
1990	7.5	7.6	6.6	9.3	8.7	4.7	7	7.5	10.1	11.1	20.1	13
1991	4.9	3.4	0	4.3	3.5	2	3.9	3.4	5.4	6.5	13.1	7.3
1992	7.5	10.9	5.7	11.1	9.7	5.4	8.3	7.9	10	12.4	18	14.3
1993	10	13.6	11.5	16.7	14.7	8.8	13.1	14.5	16.5	18.8	26.8	21.3
1994	6.3	6.7	6.4	8.1	7.7	4.7	7.5	7.5	9	9.5	17.6	12.5
1995	10.4	11.5	10.7	15.4	15	8.4	12.8	13.8	18.1	19.4	30.5	23.4
1996	11	10.8	9.4	12.9	14.1	7.4	12.3	12.1	18.5	19	38.1	25.7
1997	14.8	16.1	13.2	22.4	21.9	11.9	21.2	19.3	27.3	29.9	48.4	33.2
1998	8	10.9	9.1	12.1	12.9	6.9	8.7	10.9	13	16.5	27.3	18.8
1999	12.6	16.4	13.3	18.5	19	10.5	15.2	16.6	21.6	22.4	37.3	26.1
2000	9.1	9.4	8.4	11.5	10.9	6.3	11.2	11	13.8	16.3	27.1	19.1
2001	4.1	8.3	5.3	7.7	7.1	3.7	6.6	5.6	7.6	10.5	13.7	11.7
2002	5.7	9.8	7.3	10	9.7	5.6	9	10.5	13.4	14.4	24.2	16.9
2003	5.3	9	9.3	12.7	12.4	6.9	10.6	10.7	14.4	16.2	24.8	17
2004	10.4	12.4	10.4	13.9	12.9	8.2	11.4	12.4	15	15.4	25.4	18.1
2005	6.2	8.9	6.8	10.2	8.8	5.4	7.2	7.9	9.8	13.3	15.4	13.2
2006	11.1	12.2	11.6	17.4	15.3	10.1	14.4	15.7	22.2	26	35	24.6

State	Idaho	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	14f11s	15A08S	14A12S	13A19S	13A24S	13A26S	13A15S	13A25S	12B12S	13B24S	13B22S
Latitude	43.484	48.571	48.909	48.802	48.434	48.303	48.131	48.157	47.917	47.685	47.428
Longitude	-114.827	115.446	114.863	113.857	113.937	113.329	113.023	113.946	112.824	113.962	113.775
1961	7.3	21	34.5	48.1	12.9	22.7	32	33.4	18.7	30.3	12.8
1962	12.7	15.6	29.7	39.7	14.1	21	24	27.9	16	32.3	17.9
1963	6.3	13	27.7	38	10.2	17	26.9	21.5	15	29.4	11.2
1964	7.2	13.8	31.7	46.4	12.9	19.5	27.5	30.1	18.4	29.9	13.2
1965	16.5	21.4	35.7	53.1	20.6	30.3	36.7	45.4	28.1	40.7	20.4
1966	9.4	19.1	29.9	45.9	13.2	24.4	26.8	28.5	20	25.9	12.8
1967	13.4	25.4	42.9	60	18.5	30.3	40.7	50.3	27.7	40.7	18.2
1968	9.5	14.9	27.8	40.6	13.3	20.5	32.1	30.4	17	30.4	11.3
1969	24.1	23.1	37.9	33.2	17.6	24.5	37	40.3	16.2	35.8	17.3
1970	13.1	17	27.2	36.4	14	23.9	31.1	33.4	16.1	32.8	16.4
1971	18.2	23.1	36.1	41.3	16.9	34.7	46.2	40.5	23.9	40.2	17
1972	15.1	28.1	43.5	60.2	22.3	36.2	55	47.9	29.8	43.5	23.4
1973	10	14.6	29.6	39.8	11.5	15.6	22.3	28.7	9.6	26.4	7.8
1974	15.3	28.6	44.5	50.5	20.1	28.7	48	57	21.7	43.4	18.5
1975	12.5	21.7	29.7	45.5	15.7	24.9	32.1	34.7	18	30.7	18.8
1976	11.6	21.4	29.8	50.8	14.2	23.6	43.5	33.1	22.2	30.4	15
1977	1.5	5.8	15.3	22.4	7.2	10.2	15.7	25.3	8.2	17.1	10.2
1978	16.1	16.1	30.5	36.6	14.3	25.2	32.4	37.3	22	38.2	19.3
1979	9.2	15.7	22.6	35.3	14.9	23.8	33.6	31.3	19.8	30	17
1980	12.9	13.4	26.2	32.9	9.4	17.4	23.5	26.3	14.9	29.5	9.4
1981	7.1	13.2	23.8	37.7	10.8	15.7	19.7	31.6	10.9	24.9	7.4
1982	13.3	21.3	31	43.9	15.7	29.3	34.2	34.6	22.6	32.4	15.5
1983	18.8	18.9	30.9	38.7	14.1	21.5	21	34.2	13.1	32.2	11.1
1984	15.7	8.7	21.6	29	9.2	12.9	17	30.7	9.6	24.7	9.2
1985	13.8	16.6	27.7	39.5	16.7	25.1	24.1	35.1	17.1	31.4	16.8
1986	16.9	14.5	26.3	32.4	12	19.9	31	31.5	19.7	30.5	14.7
1987	4.7	13.1	27.9	31.7	10.6	20.7	23.9	20.3	14.5	22.8	10.7
1988	6.3	10.8	16.6	25.2	9.3	13.8	20.2	22.7	13.3	20.2	12.5
1989	13.2	14.3	27.6	33.5	10.9	19.3	26.9	33.2	15.9	29	16.3
1990	7.4	19	36.9	47	14.3	30.5	38	33.8	22.5	36.5	13.1
1991	2.6	18.4	48	49.4	13.3	36	38.8	43.7	24.3	36.6	12.7
1992	5.3	14.1	25.5	30.8	13.4	20.9	23	33.1	14.6	27.9	10.4
1993	15.9	12.1	20.2	25.7	10.5	16.6	17	29.4	12.1	25.2	10.4
1994	8.4	11.9	23.6	33.9	12.9	19	21	26.7	14.5	23	10.9
1995	13.8	16.3	31.5	38.8	9.4	19.5	29.4	33.8	14.8	35.7	7.8
1996	12.1	19	43.5	49.1	12.2	26.7	34.4	37.4	21.7	37.6	10.9
1997	18	26	39.3	53.9	21.2	33.1	37.1	58.2	23.1	53.2	25.1
1998	12	11.9	25.7	30.7	8.8	14.2	18.4	25.5	12.7	23.6	9.4
1999	18.5	26.1	36.9	54	15.1	31	39.3	39.9	24.8	35.1	14.4
2000	12.9	15.3	25	33.9	13.1	19.3	23.5	31.6	16	27.1	13.4
2001	6.2	9.4	14.6	18.8	8.2	11	14.3	18	10.6	19.5	10.3
2002	9.8	17.1	34.8	41.9	11.4	21.7	29.7	32.6	16.4	28.3	12
2003	9.5	11.1	23.2	30.4	9.5	13.1	17.8	24.4	11.7	23	10
2004	12.5	13.2	26.6	32.8	15.1	18.7	23.2	29.9	15.3	26.3	11.6
2005	7.2	7.4	22	24.4	5.8	9.8	13.2	20.4	8.8	17.8	4.4
2006	18.3	15.5	34.2	43.9	13.6	23.6	27.8	41.7	16.6	34.7	12

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	13B07S	15C10S	12B14S	12B16S	13C38S	13C31S	09C01S	10C06S	10C09S	11C01S	12C13S
Latitude	47.273	46.975	47.082	47.057	46.883	46.871	46.789	46.780	46.793	46.560	46.435
Longitude	113.756	115.035	112.730	112.595	113.322	113.277	109.512	110.622	110.675	111.290	112.193
1961	42.7	42.3	27.1	6.1	4	7.5	6.3	10.1	4.4	9.5	3.5
1962	45.5	37.7	34	10.1	8	11.8	10.8	17.9	7.2	16.3	6.6
1963	36.6	29.3	19.8	5.9	4.3	8.8	13.7	15.5	5.8	10.7	5.8
1964	43.5	38.4	33.4	10.6	7	14.2	12.8	19.5	8.8	16.6	8.7
1965	52.5	52.8	44	10.8	7.2	13.7	12.1	23.8	11.1	17.1	8.2
1966	36	35.7	21.6	8.7	6	10.5	7.3	15.7	7.9	12.8	5.1
1967	52.5	46	47.5	7.1	6.1	15.6	12.8	24.8	12.4	18.1	7.4
1968	38.6	40.6	26.9	8	4.1	12.4	13.3	20.3	10.3	17.8	10.1
1969	45.4	48.1	39.2	13.3	8.4	12.8	7.4	17.5	9.4	18.1	12.6
1970	38.7	41.5	35.6	7.4	5	10.2	14	22.7	11.7	17.1	4.1
1971	50.3	59.9	58.8	15.4	4.4	11.4	12	22.1	10.5	22.9	8.2
1972	60.3	67.5	60.9	19.4	12.2	19.1	9	31	14.1	25.6	11.1
1973	30.7	30.1	19.2	7.4	3.1	7.2	7.9	11.3	4.8	11.2	5.1
1974	48.9	59.5	40.5	14.3	7.7	11.5	11	22	10.8	22.9	8.8
1975	47.8	42.9	27.5	9.8	7.8	13.4	11.7	18.5	9.7	18.1	7.7
1976	46.4	47.2	35.2	13.9	5.6	13.7	9.5	21.3	9.4	21.2	8.6
1977	25.3	14	11.6	4.4	3.4	5.5	10.7	14.1	8.6	7.2	3.9
1978	52.4	44.8	30.8	12.2	6.9	13.8	15.4	26	13.8	22.1	9.1
1979	41.1	38.2	29.4	12.9	8.2	12.3	11.4	20.3	10.4	19.6	8.8
1980	28.7	34	20.3	8.4	3.8	8.6	7.3	12.4	6	14.2	7
1981	29.8	27.2	19.8	6.7	0.3	6.2	6.2	14	4.1	14	5.3
1982	44.7	47.5	35.2	13.1	7	13.9	7.7	20.1	9.4	18.2	7.5
1983	36.8	37.9	22.1	8	4.9	8.5	7.5	14.1	5.8	16.8	6.3
1984	33.7	26.3	13.8	6	3.1	6.7	10.5	14.4	6.6	16.3	5.2
1985	36	38.2	27.6	12.1	4.7	9.7	11.9	17.5	9.5	15.7	6.5
1986	34.4	35.4	25.3	10.1	6.7	10.6	7.9	20.1	8.4	17.6	7.1
1987	27.1	27.3	16.6	7.6	3.6	6.2	5.5	8.8	4.6	12	4.7
1988	26.5	27.6	19.6	8.7	5.1	8.2	8.6	13.6	7.3	11.8	4.4
1989	43.8	32.2	23.7	10.9	7.3	10.1	8.3	15.9	7.8	15.2	6.1
1990	38.3	38.1	29	9.9	4.3	9.3	14.3	20.1	8.4	17.1	6
1991	49.3	42.3	32.8	10	4.4	10.7	8.8	16.6	6.4	13.8	5.5
1992	33.2	32.1	23.1	8.6	2	8.9	9.9	12.7	6.8	13.5	6
1993	26.3	25.5	17	9.6	5	8.1	9.4	15.6	8	13.4	5.9
1994	27.5	24	16	9.3	4	7.3	12.9	18.1	9.5	13.5	5.1
1995	27.2	33.7	22.8	6.8	3.2	7.5	8.9	14	6.2	17	4.4
1996	43.3	47.3	37.6	11.7	5.1	12.2	5.7	20.2	8.3	19.1	7.3
1997	55.4	56.6	36.8	16.9	8.9	15.5	12.4	23.6	13.7	22.9	8.7
1998	27.8	27.4	15.4	5.4	4.5	6.9	6.4	13.7	7.1	12.9	4.4
1999	45.8	56	39.2	14.6	6.2	12.8	10.9	22.9	10.6	20.7	6.2
2000	35.6	35.1	26	10.7	6.1	10.9	9	15.1	9.8	13	5.3
2001	22.2	17.6	14	7	4.9	7.7	8.9	10.9	5.5	9.6	5.3
2002	43.8	41.4	31	9.7	4.5	8	8.6	14.6	6.4	15.1	3.7
2003	27.7	23.4	20.3	6.8	4.2	8.7	11.3	14.5	7.9	15.5	6.3
2004	34.7	30.5	35.9	9.3	5.4	9.8	14	15.4	9.7	15.8	6.2
2005	23.6	18.7	16.9	0	1.7	5.8	6.1	12.1	5.6	8.8	4.7
2006	39.7	41	41.3	8.3	4.6	9.4	15	19	10.7	20.1	6.2

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	12C11S	13C33S	13C13S	14C12S	14C13S	13C03S	13C43S	13C44S	13D26S	10C08S	10C03S
Latitude	46.356	46.465	46.414	46.143	46.143	46.242	46.274	46.097	45.884	46.090	46.112
Longitude	112.262	113.394	113.431	114.505	114.448	113.773	113.164	113.130	113.326	110.434	110.470
1961	7.7	3.5	7.4	30.7	15.4	18.8	16.5	10.6	5.7	11	4.2
1962	13	5.8	9.6	35	16.2	21	18.7	13.2	8.6	15.2	7.5
1963	12.2	5.1	9.7	26.4	12.2	17.7	20	12.8	9.2	12.8	5.6
1964	16	6.5	11	35.2	17.7	19.7	18	12.6	6.4	16.4	7.9
1965	17.7	8	13.9	45.4	20.6	31.4	28.7	17.6	11.5	20.7	8.6
1966	9.1	5.6	8	25.7	10.4	16.5	13.8	8.8	4.7	11.6	4.5
1967	14.7	5.5	12.3	38.4	16.4	26.2	21.7	13.7	8.3	16.6	5.9
1968	14.6	5.5	11.8	34.8	16.6	24.2	23.1	15.5	9.1	16	7.2
1969	14.1	6	12.5	37.9	17.5	25	23	14.8	10.5	13.9	5.9
1970	11.2	3.9	8.9	35.3	16.8	19.8	17.1	10.2	7.6	18.2	7.9
1971	15.9	4.4	11.5	45.6	22.6	25.2	24.8	14.2	9.7	16.8	6.2
1972	16.5	9.8	18.6	58.2	29.7	39.2	26.2	16	15.1	15.3	7
1973	7.8	3.8	7.1	24.3	10.2	15.2	12.7	8	5.6	10.7	5.9
1974	14	6.6	12	50	24.2	25	18.6	13.4	10.4	14.7	4.6
1975	12.3	6.4	11.7	40.5	17.6	23.4	19.3	10.9	9.5	15.4	7
1976	17.3	7	16.4	47.3	21.8	28.7	25.8	16.8	9.4	16.3	6.5
1977	5.4	3.5	4.8	15.8	8.2	8.7	9.1	6.5	3.4	13	6.5
1978	15.2	5.9	12.7	43	19.6	26.3	24.2	12.8	12.6	19.4	10.4
1979	12.7	6	10.4	35.4	16.7	20.5	16.7	12.9	8	18.1	7.9
1980	10.8	4.5	8.1	29	14.6	17.5	13.9	9.7	6.7	11.7	5.4
1981	11.4	1.8	7.1	21.4	7.6	14.8	13.4	9.9	5	11.6	3.8
1982	14.4	5.5	13.3	45.3	23	28.6	20.9	13.2	11.2	14	5.7
1983	9.6	4.4	7.7	30.2	13.2	17.8	14.6	14.6	7.9	12.1	5.7
1984	6.9	3.7	7.1	24.8	11.3	12.7	14	8.9	4.9	15.4	6.1
1985	10.2	4	7.2	29.5	15.7	17.2	11.7	11.4	6.7	11.7	5.7
1986	12.3	4.5	9	28.4	15.5	19.7	20.8	12.2	8.3	12.9	4.7
1987	7.8	3.2	5.6	25	11.1	13.4	11.4	10.2	4.6	7.9	3.1
1988	8.1	4.7	8.2	28.6	14	16.1	12.5	8	6	10.3	4.1
1989	8.7	5.3	9.6	31.4	16	16.9	14	10.1	7.2	12.1	5.1
1990	12.1	3.6	9.2	36.2	16.3	19.1	16.3	9.4	5.9	14.7	3.5
1991	8.2	3.7	8.3	32.5	12.6	18	14.2	7.6	4.2	10.9	4.5
1992	10.2	4	9.2	30	11	17.2	15.4	8.9	7.1	11.7	5
1993	8.7	4.7	7.8	27	14.3	12.6	11.5	8.8	6.9	11	5.5
1994	8.5	3.1	8.5	23.3	13.3	11.5	11.7	8.4	5.2	9.7	4.1
1995	10.5	2.1	7.8	29.4	8.4	18.4	14.5	11.5	6.7	11.9	5.4
1996	13.8	3.9	13.9	42.3	13.1	28.9	26.4	12.6	11	15.8	5.1
1997	15.4	7.4	14.5	53.6	24.9	32.4	25.7	15.9	14.9	25.5	11.4
1998	10.5	3.5	6.6	28.2	13.3	16.6	14.8	9	5	11.5	5.5
1999	12	5.4	13.4	47.4	22	26.7	20.4	13.2	10.6	15	6.3
2000	8.9	4.2	8.6	36	17.6	18.3	16	7.4	8.6	9.7	4.9
2001	10	3.4	6.3	18.8	9.4	10.9	12.3	8.3	4.4	9.2	4.6
2002	7.8	3.2	6.1	36.4	14.8	17.9	13.8	7.7	5.5	10.6	4.8
2003	10.8	5.6	9.8	29.8	11.9	18.1	17.4	10.2	7.3	11.7	6
2004	9.4	4.8	8	35	15.9	16.3	16.4	10.3	7.9	13	7
2005	5.9	1.5	4.6	18.5	7.3	9.4	9.1	6.6	3.4	9.7	2.9
2006	12.1	4.1	8.9	42.5	19.2	21.3	17.6	11	9.1	16.1	7.1

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	14D02S	13D22S	13D10S	13E23S	12E07S	11E03S	11E24S	11D08S	11E35S	11E31S	11E07S
Latitude	45.731	45.693	45.165	44.994	44.793	44.589	44.786	45.018	44.508	44.586	44.658
Longitude	114.481	113.968	113.501	113.444	112.056	111.825	111.710	111.846	111.128	111.116	111.092
1961	9.3	17.2	8	6.4	6.2	6.4	6.2	13.6	30	17.4	5.9
1962	13.7	21.7	11.1	7.4	10.1	12.5	11.8	17.1	42.2	29	11.2
1963	9.1	19.6	9.2	7	6.8	7.1	7	10.3	20	11.5	4.1
1964	15.8	21	10.1	7.9	8	8.1	7.9	13.9	28.9	17.8	6.5
1965	18.1	30.2	15.9	16.9	14.2	18.4	17.7	22.1	43.1	28	11.2
1966	9.3	13.6	8	7.4	7.3	9.3	8	12.5	25.2	18.2	5.6
1967	16.3	24.4	11.8	8.3	9.6	13.7	11.9	15.2	30	23.4	15.8
1968	9.2	24.6	11.2	9.4	9	11.8	10.9	19	26.7	16.4	11.7
1969	13.9	29.5	14	10.9	14	26.7	21.6	18.5	43.7	30.3	18
1970	12.6	21.8	10.2	6.2	9.2	6.9	11.1	15.9	29.4	20.9	9.6
1971	15.1	32.7	12.9	11.5	14.4	15	17.3	21	41.2	29.4	18.6
1972	21.2	33.4	17.8	14.2	12.4	13	13.6	18.6	44.6	29.6	15.5
1973	8.3	15.4	7.8	6.2	8.2	7.5	8	12	25.9	15.7	8.7
1974	17.4	30.4	12	10.2	10.3	8.8	12.3	17.4	41.8	25.2	12.9
1975	17.6	26	12.9	11.4	8.5	11.8	11.9	17	29.4	19.2	9.9
1976	15.4	27.5	14.5	14	7.5	10.9	12.2	18.5	38.6	26.4	15.7
1977	6.5	7.3	4.2	4.1	4.2	3.2	4.5	8.5	10.7	8	3.2
1978	17.5	27.2	13.1	12.2	11.2	11.7	14.7	18.4	39	23.8	14.4
1979	15.5	20.4	10.9	9.9	8.9	11.5	11.8	12.3	32.3	23	14.4
1980	9.4	16.5	8.3	7.6	8.6	7.5	9.8	12.5	28.5	18.2	9.4
1981	9.3	17.9	8.6	6.8	6.2	8.9	8.9	10.8	23.3	14.5	7
1982	18	29.4	14.2	10.5	10.3	7.4	11.3	15.1	38.8	22.7	12
1983	10.6	21.4	9.8	6.1	10.7	13.6	13	15.4	35.2	22	13.3
1984	10.9	18.2	8.9	8.4	8.6	7.5	10.6	15.6	25.9	14	10.2
1985	11.9	18.9	9.4	7.4	6.4	9.1	8.6	11.9	28.2	18.3	11.7
1986	12.5	21.5	12.5	10.5	9.1	7.8	12	14.8	39.8	24.1	15.7
1987	8.1	13.2	7.7	6.8	5.8	5.1	7.2	12.9	18.9	12.3	6.2
1988	11.9	16.9	8.1	6.6	6.1	5	7.6	9.5	25.4	15.4	7.1
1989	12.7	19.7	9	7.6	9	9.7	10.4	11.2	35.8	24.2	13.1
1990	11.5	20.1	7.9	6.5	7.4	7.4	7.9	10.8	27.9	18.8	7.7
1991	9.8	16.6	6.7	6.7	5	4.9	6	11.9	21.7	13.9	6.1
1992	9.4	18.6	8.5	8.8	9	10.2	9.8	12.3	29.3	18.5	6.9
1993	9.8	1.6	7.3	6.2	10.2	11.7	13.3	12.9	33.9	20.1	14.4
1994	10.1	13.9	8.3	8.4	7	5.9	8.6	11.1	28	16.9	7.8
1995	9.9	20.6	10.8	9.6	9.3	10.6	13	15.3	46.7	26.3	9.3
1996	15.7	32.7	15.3	10.2	8.8	9.3	11.1	15.7	40.3	23.6	9.9
1997	19.4	33	17.1	12.4	12.6	12.7	16.5	18.9	61.3	36.5	17.4
1998	9.6	17.8	9.4	8.2	8	8.6	11.2	13.9	30.2	17	8.4
1999	14.3	27.9	13.3	9.2	9	13.8	14	17.1	46.5	32.4	14.1
2000	12.9	21.5	10.6	7.8	6.7	6.9	10.3	12.3	29.7	16.3	8.3
2001	7.8	12.3	5.4	7.1	8.8	6	8.5	10.6	20.3	11.2	4.8
2002	10.5	18.4	7.4	6.3	6.5	8.4	10.8	12.7	31.8	17.4	8.4
2003	10.2	20.7	11.2	10.1	6.6	6.7	8.6	12.2	26.7	14.6	7.5
2004	12.4	19.1	10	7.8	8.4	11	12.2	12	37.2	22.8	11.5
2005	6.2	12.1	5.1	6.2	6.4	9.6	8.7	9.7	27.7	15.7	7.7
2006	14	25.9	10.1	9.5	9	9.4	13.8	13.8	42.4	22.7	12.2

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Nevada
Station Id	11E30S	11E29S	11D19S	10D16S	10D13S	10D12S	09D16S	09D08S	09D06S	10D07S	15H01S
Latitude	44.611	44.962	45.274	45.401	45.504	45.218	45.194	45.046	45.062	45.006	41.834
Longitude	111.150	111.294	111.427	110.958	110.966	110.237	109.345	109.910	109.945	110.014	-115.452
1961	10.5	20.2	11.9	15.9	5.7	14.7	6.8	14	20.7	5.8	7.1
1962	20	24.2	22.3	22.7	8.9	20.8	24.5	23.9	36.7	8.1	20.5
1963	7	14.1	16.5	20.8	8.1	14.1	14.3	19	25.6	7.5	7.7
1964	11.4	22.8	17.6	21.2	12.9	17.8	10.7	19.1	32	7.5	11.5
1965	20.2	36.3	23.5	26.8	15.7	27.1	18.5	33	47	12.6	24.8
1966	11	17.2	9.7	14.6	7.4	12.8	7.4	20	23.6	5.3	10.5
1967	17.8	30.6	17.8	22	15.4	23.6	16.1	26.3	38.1	12.4	17.5
1968	14.1	23.3	23.4	26.3	15.8	21.4	16.6	21	30.1	11.1	12
1969	21.6	32.4	18.2	19.6	8.3	20.5	8.6	24	32.5	11.7	26.7
1970	12.7	22.8	20.3	24.6	12.5	16	12.5	23.5	31.6	11.9	18.3
1971	19.4	32.7	22.3	23.7	15.4	24.1	14.3	31.9	45.3	13.7	22.1
1972	20.9	29.7	19.1	20	10.3	21.1	23.6	29.4	44.6	14.7	25.4
1973	12.2	20.8	10.8	13.8	8.1	11.9	12.8	15.5	22.3	7.3	16.1
1974	17.7	29.3	21.3	20.4	8.4	20.4	9.8	24.8	37.4	9.2	17.2
1975	13.9	20.3	16.8	22.4	14	18.9	15.4	20.6	30.6	10.8	24.6
1976	19.3	26.3	20.4	24	15.6	24.6	16.1	27.4	39.2	15.1	18.3
1977	5.1	8.9	7.2	14.9	11.9	10.5	8.2	11.4	17.2	5.5	6.8
1978	19.2	27.9	21.1	23.3	9.4	22.7	9.5	30	37.6	16.1	20.5
1979	17.3	20.6	13.8	17.1	10.4	16.1	13.9	22.8	31.1	12.9	12.4
1980	12.3	19.1	13.6	14	10.9	15	12.4	17.6	25.6	8.4	19.4
1981	10.4	16.4	9.1	13.2	9.6	12.8	8.9	14.9	20.8	6.3	5.7
1982	15.7	24	19.3	18.6	9.6	19.6	9.6	23.7	33.1	10.2	23.6
1983	16.1	26.4	15	16.4	6.9	14	13.4	19.7	26	9.5	21.1
1984	10.7	21.2	14.8	18.3	8.9	13.1	12.5	15.2	22	7.2	30.4
1985	13.4	18	13.9	15.9	9.8	14.1	9.2	16.8	24.1	7.9	16.3
1986	17.9	24.2	16.4	16.4	8.5	20.4	13.8	24.8	34	11.2	20.3
1987	8.8	16.2	10	13.2	7.3	12.1	13.1	13.1	19.6	5.8	8.9
1988	10.3	14.4	10.3	14	8.3	12.1	7	13.4	21.6	7.2	12.7
1989	17	20.2	12	12.4	8.2	14	9.4	18.1	26.4	9.2	21
1990	11.2	21.1	13.6	17	9.2	17.8	11.3	19.1	30.4	9.4	13.7
1991	9.1	16.2	11.7	15.6	8.8	12.7	12.6	15.6	22.3	6.5	10.7
1992	12	19.8	11.4	13.9	7.1	15.2	9	18.4	24.5	9.5	10.8
1993	16	23	11.4	15.2	7.1	13.6	7.9	13.9	22.2	7.2	19
1994	11.6	17.9	10.4	15.6	7	14.7	13.3	17.2	23.9	8.3	11.5
1995	18.9	26.3	13.2	15	8.8	16.2	14.1	19.7	28.6	8.7	16
1996	14.9	28.2	20.3	20	7.9	22.6	15.9	30.2	40.3	12.7	20.9
1997	22.3	36.4	24.2	27.4	13.7	28.8	14.9	33.6	48.4	13.7	24.1
1998	11.7	20.6	13.5	15.8	7.5	15.5	10.4	18.8	24.2	7.4	12.9
1999	19.1	29.7	19.3	19	8.7	23.9	7.9	25.4	37	11.3	15.8
2000	12.1	20.3	13.6	15.4	7.4	16.8	8.3	21.2	27.8	9.4	14
2001	7.2	14.1	11.3	12.1	6.1	10.6	6.6	10.9	15.9	4.6	11.8
2002	12.3	20.4	14.9	16	7.1	15.8	4.8	15.2	23.2	5.6	15.7
2003	9.8	16.5	12.2	15.4	9.7	15.4	14.5	20.1	26.5	8.5	12.2
2004	16.4	24	14.4	13.4	8.7	13.9	10.5	15.5	25.7	6.4	20.5
2005	10.8	15.4	10.1	12.7	5.1	11.7	6.8	13	19.8	4.4	13.7
2006	13.6	27.3	18.2	19	8.1	20.7	8.8	22.8	35.7	9	22.6

Nevada	**State**	Nevada	Nevada	Nevada	Nevada	Nevada	Nevada	Nevada	New Mexico	New Mexico	New Mexico
15H04S	**Station Id**	17H02S	15J12S	15H24S	15J06S	19K04S	15H14S	15H09S	06n03s	05n11s	06n04s
41.762	**Latitude**	41.751	40.278	41.662	40.645	39.164	41.873	41.229	36.956	36.699	36.512
-115.693	**Longitude**	-117.532	-115.535	-115.324	-115.376	-119.897	-115.247	-116.029	-106.657	-105.341	-106.321
5.5	**1961**	6.3	13.8	5.5	8.2	11.3	11	0	6.1	5.1	8.2
9.7	**1962**	9.2	20.3	10.8	15.3	21.9	17.5	1.2	9.9	5.9	13.2
0.6	**1963**	0	5.6	0	5.2	4.3	8.1	0	9.7	4.8	7.6
9	**1964**	7.1	11.4	7.8	9.9	9.5	15.5	3.9	4.4	5	7.4
7.8	**1965**	7.5	16.9	9.2	14.9	19.9	21.4	3.6	13.9	7.9	15.1
5.8	**1966**	6.5	8	4.8	10.7	21.1	12	5	11.1	5.2	9.6
6.9	**1967**	7.5	9.7	8.8	13.4	25.8	15.3	6.5	4.5	3.3	7.3
3	**1968**	3.3	8	6	8.5	17.9	11.4	0	7.5	5.9	11.1
12.3	**1969**	13.7	21.6	16.4	19	49.9	18.4	11.5	15.1	5.5	14.9
9.7	**1970**	8.4	15.7	15.1	11	22.8	16.7	2.2	3.1	3.4	6.4
8.8	**1971**	7.3	6.5	11.8	9.9	17.2	22.8	1.9	6.4	4	7.2
14.2	**1972**	11.6	17.2	15.2	12.6	18.3	24.3	4.7	4.3	5.4	7.1
7	**1973**	7.8	13.4	9.7	12.1	25.8	15.6	5.8	9.6	7	11.7
12.1	**1974**	9.8	14.4	14.5	15	18.9	18.5	6.7	10.3	5.6	12.4
12.1	**1975**	11.8	18.8	15.1	24	24.8	20.1	8.9	10.5	7.7	14.6
8.9	**1976**	6.6	14.8	11.7	9.8	7.6	17.7	1.1	10.2	8.7	10.5
0.8	**1977**	1	4.3	3.1	4	4.6	7.3	0	2.2	3.8	3.5
10.1	**1978**	8.4	15	13	13.4	27.6	15.3	6.7	10.3	5.5	12.5
9.9	**1979**	8.8	15.7	13.4	14	16.7	16.5	8.9	16.4	10.2	16.9
9.6	**1980**	7.9	14.2	11	13.5	21.8	16.7	3	19.3	6.5	16.6
3	**1981**	3.4	6.6	4	4.6	11.3	6.2	0	3.6	3.1	4.1
10.3	**1982**	8.2	8.7	17.4	13.3	25.7	21.1	8	10.9	7.4	11.7
10.4	**1983**	11.5	14.8	14	15	40.9	15.1	12.2	9.9	6.9	12.3
17	**1984**	18.6	25.6	21.3	21.8	28.9	26.2	16.3	15.4	6.2	18.1
7.2	**1985**	12.6	11.6	9.1	10.8	15.9	16.8	2.4	10.1	6.6	14.4
12.2	**1986**	8.7	16	16.5	16.5	37.3	17.1	2.3	12.2	5	10.9
3.1	**1987**	5.1	6.9	5.4	8.4	11.6	11.8	0.8	7.7	9.9	10.9
5.4	**1988**	4.3	12.4	4.5	11.1	10.3	14.5	1.8	12.3	5.2	12.8
9.9	**1989**	12	14.8	15.4	13.1	18.8	19.1	10.2	11.0	9.5	11.6
7.7	**1990**	6.4	9.5	6.5	10.7	11.8	15.2	3.4	3.1	5	5.3
3.4	**1991**	5.6	7.9	5.4	8.5	4.5	14.1	0.2	9.2	6.2	11.3
4.1	**1992**	4.1	11.5	4.4	8.7	9.3	13.8	3	10.1	7.6	10.4
12.3	**1993**	12.1	16.1	14.1	17.3	31.8	19.4	10.3	18.4	12.4	15.5
4.8	**1994**	6	9.7	4.8	10.8	11.5	12.6	2.9	8.8	8.4	11.8
6.7	**1995**	7.9	15.3	9.9	8.3	31.1	15.1	3.4	7.9	6.2	13.4
10	**1996**	8.8	15	13.5	15.3	23.3	18.8	8.7	4.1	3.9	6.9
11.6	**1997**	8.1	21.4	20.8	20.7	32.2	23.7	9.1	13.3	8.5	13.3
9.5	**1998**	10.2	16.1	13.9	15	27.2	15.7	6.7	7.2	5.8	8.2
8.5	**1999**	11.4	13.9	10.1	12.9	31.4	16.6	5.2	5.3	4.8	6
8.3	**2000**	8.2	12.1	9.6	12.6	20.8	14.8	4.6	4.9	4.1	5.6
5	**2001**	4.4	11.2	6.3	9.9	11.6	14.4	5.2	10.7	7.9	9
11.1	**2002**	11.6	10.4	11.7	9.4	16.3	16.9	9.7	5.8	5.4	6.3
6.2	**2003**	4.3	9.2	4.6	11	15.3	10.2	0	7.8	6.6	10.1
10.8	**2004**	15.6	14.6	12.5	13.9	22	19.1	9.5	9.1	6.8	9.3
6.4	**2005**	6.3	19.8	6.7	12.8	27.5	13	5.9	12.9	8.7	12.1
12	**2006**	9	11.9	13.5	15.8	24.7	20	7.6	4.0	2	3.1

State	New Mexico	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon
Station Id	06p01s	21d01s	21d14s	21e06s	21e05s	21e07s	21e13s	22f43s	21f21s	22f04s	22f03s
Latitude	35.922	45.622	45.041	44.420	44.435	44.210	44.144	43.901	43.804	43.612	43.590
Longitude	-106.392	-121.704	-121.933	-121.857	-121.945	-121.873	-121.641	-122.031	-121.949	-122.118	-122.060
1961	9.8	4.9	7.3	14.7	7.3	24.8	15.2	15.2	19.9	9.8	18
1962	11.4	10.7	13.0	30.9	19.0	37.5	26.6	25.4	30.5	16.7	27.8
1963	7.7	0.0	0.0	0.0	0.0	10.6	0.0	3.4	8.0	1.9	6.8
1964	6	22.6	24.3	41.6	26.6	41.2	22.2	27.9	33.6	18.5	30.3
1965	12.1	15.9	20.8	39.4	25.0	48.0	25.4	36.5	39.3	24.3	38.5
1966	9	36.0	23.3	50.6	33.0	41.5	23.3	28.3	33.9	18.7	30.6
1967	4.9	18.5	14.5	33.7	21.0	34.9	17.0	25.6	28.4	16.9	28.1
1968	8.6	0.0	9.8	18.5	10.0	23.8	10.2	12.9	19.0	8.3	15.9
1969	8.2	44.2	27.4	55.6	36.7	52.0	29.6	35.7	42.7	23.8	37.7
1970	5.2	20.6	14.6	19.5	10.8	29.6	19.5	18.2	23.9	11.9	20.9
1971	4.7	19.1	23.3	47.4	30.8	55.3	24.0	38.7	45.5	25.8	40.6
1972	7.4	31.7	24.4	61.6	41.0	72.6	28.9	43.5	60.0	29.0	45.2
1973	10.2	6.8	8.5	13.5	6.5	20.2	9.0	13.6	16.0	8.8	16.6
1974	8.7	26.0	25.2	59.7	39.6	63.7	31.1	43.7	52.5	29.2	45.4
1975	11.4	27.5	14.5	39.7	25.2	50.4	26.2	33.7	41.4	22.4	35.8
1976	5.6	17.0	20.2	48.4	31.5	49.8	20.9	34.4	40.9	22.9	36.5
1977	5.2	3.6	6.6	8.1	2.6	9.3	2.9	2.9	6.9	1.5	6.2
1978	7	18.2	8.0	15.4	7.8	23.5	12.0	16.5	18.8	10.8	19.4
1979	15.4	22.1	13.2	29.9	9.9	33.6	13.8	17.9	16.8	11.7	20.7
1980	12.4	17.1	12.1	17.3	6.3	20.5	9.2	9.9	23.3	6.3	13.0
1981	5.4	0.4	0.0	8.8	1.6	13.8	4.5	2.9	13.9	2.7	8.5
1982	8.2	15.4	16.2	46.3	28.2	45.4	23.5	29.3	41.0	23.3	38.5
1983	12.2	20.8	11.1	27.8	17.1	32.6	19.3	25.5	31.8	17.1	29.4
1984	7.3	17.3	15.5	32.0	18.1	29.3	22.1	25.1	34.3	17.8	27.7
1985	13.1	30.3	19.0	40.7	30.2	46.9	21.7	37.7	42.0	24.1	37.0
1986	6.6	21.8	13.1	35.6	16.6	33.5	20.8	27.0	35.6	13.2	27.0
1987	15.4	17.1	7.3	35.1	18.1	32.0	16.3	25.0	29.0	15.0	25.5
1988	9.6	14.8	10.7	27.2	13.5	24.3	9.9	18.1	23.8	11.8	20.8
1989	8.7	22.3	15.3	42.8	26.2	59.5	13.8	40.2	34.2	26.9	39.1
1990	5.3	18.5	17.2	27.4	17.6	37.1	9.9	21.8	12.8	15.4	22.9
1991	8.6	3.0	0.3	16.3	2.3	19.1	5.4	11.2	14.1	5.8	12.7
1992	10.6	0.4	0.5	17.8	0.3	22.0	6.4	12.0	12.7	2.2	17.0
1993	14.2	26.2	19.0	41.7	24.2	43.7	20.6	33.9	38.8	29.7	32.6
1994	7.3	15.7	9.4	22.6	12.5	25.4	10.6	20.2	20.9	10.6	20.6
1995	11	13.6	8.7	34.0	11.5	32.0	16.0	20.4	30.7	14.6	19.9
1996	4.5	18.4	10.5	43.6	11.7	36.0	13.4	19.3	30.9	12.7	21.2
1997	12	25.1	15.8	42.1	17.8	51.1	24.5	32.0	38.7	19.5	32.1
1998	7.5	18.4	11.0	34.0	12.0	29.7	17.3	22.4	26.0	12.1	24.3
1999	3.7	21.6	22.3	62.1	34.4	64.3	36.8	51.2	51.1	29.8	44.8
2000	3	22.7	17.9	40.8	20.1	49.6	17.1	34.1	36.0	20.9	35.2
2001	11.9	14.5	6.8	19.5	6.4	21.1	8.8	19.4	16.9	12.6	18.3
2002	3.5	22.9	8.0	43.2	21.9	44.5	21.6	34.9	34.2	24.3	33.5
2003	7	3.0	0.9	15.3	3.4	18.5	5.4	6.7	19.3	3.3	15.6
2004	6.8	26.7	20.1	31.2	17.3	42.6	21.1	36.4	41.6	21.3	34.0
2005	13.1	2.2	1.9	8.7	0.4	15.9	6.3	9.0	18.5	4.1	13.2
2006	1.1	24.2	18.4	32.3	14.1	44.8	24.9	34.2	38.7	19.4	35.9

State	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon
Station Id	21f10s	22f14s	21f22s	23g09s	21f12s	22g21s	20g02s	20e02s	19e03s	19d02s	18d06s	18e18s
Latitude	43.512	43.449	43.226	42.724	42.956	42.053	42.696	44.429	44.447	45.191	45.275	44.210
Longitude	-121.980	-122.138	-121.806	-123.200	-121.181	-122.855	-120.802	-120.331	-119.930	-119.254	-118.848	-118.638
1961	6.3	19.5	5.3	0	6	18.2	15.8	4.5	9.8	14.6	9.4	8.5
1962	11.3	32.0	9.1	3.5	10.4	21.5	18.2	11.8	11.3	20.3	10.8	9.9
1963	0.0	5.1	0.0	0.0	0.0	6.4	5.4	0.0	2.5	4.2	5.7	2.1
1964	14.4	35.1	9.8	3.7	11.3	16.0	14.0	7.9	13.5	18.0	11.1	11.8
1965	14.2	45.6	12.0	3.9	13.9	24.0	22.0	9.0	18.3	30.6	18.2	16.0
1966	14.0	35.5	13.2	8.3	15.3	30.6	15.5	10.3	8.8	17.6	11.1	7.6
1967	12.6	32.2	10.5	0.0	12.1	26.1	18.5	8.7	11.3	22.1	10.4	9.9
1968	5.9	16.8	6.9	0.0	7.8	22.2	13.1	2.3	6.9	14.6	5.5	6
1969	18.6	44.6	15.2	18.4	17.7	44.9	25.1	11.8	15.1	26	14.2	13.2
1970	9.2	23.1	7.3	0.0	8.4	24.7	18.2	7.2	20.2	21.5	11.2	17.6
1971	12.8	48.3	11.6	6.0	13.3	23.2	17.6	7.7	14	21.4	9.6	12.2
1972	15.0	54.1	11.5	5.5	13.3	29.0	20.2	11.8	20.2	39.9	23.3	17.6
1973	5.3	17.6	6.8	0.8	7.7	17.2	11.6	5.5	9.9	11.3	7.9	8.6
1974	20.4	54.4	11.0	4.0	12.7	33.6	25.0	11.9	20.8	30.1	12.9	18.2
1975	16.7	42.2	12.0	7.6	13.8	27.3	17.4	12.4	19.2	25.6	11.3	16.8
1976	15.6	43.0	6.5	1.7	7.4	11.9	12.9	10.6	12.6	17.4	10.7	11.0
1977	0.3	4.5	1.3	1.3	1.3	4.8	3.1	1.6	0.0	3.5	5.1	0.0
1978	6.7	21.1	9.1	0.0	10.4	23.9	15.7	10.1	12.9	15.3	10.2	11.3
1979	9.7	16.3	5.1	4.7	5.7	13.1	9.8	11.1	17.7	19.0	13.7	12.2
1980	4.4	13.1	3.3	0.0	3.6	19.6	14.9	7.6	13.9	15.7	2.4	14.3
1981	0.0	6.8	0.0	0.5	1.6	11.0	8.9	3.8	6.8	9.5	3.5	4.8
1982	14.1	40.3	9.9	0.7	12.1	22.4	19.6	13.0	19.5	27.4	12.9	17.3
1983	14.6	34.4	12.5	5.2	18.6	45.3	25.6	15.7	23.8	30.5	12.4	17.8
1984	15.1	40.3	12.6	2.2	13.4	27.7	15.4	15.5	18.1	21.3	12.0	17.3
1985	15.0	35.9	8.5	7.8	11.6	27.7	17.3	11.1	17.1	22.3	12.6	10.5
1986	15.6	27.6	11.7	0.0	10.9	24.6	12.0	15.0	14.8	19.5	10.0	13.5
1987	10.7	31.4	8.8	2.2	10.1	21.3	7.4	12.3	11.9	19.1	12.8	8.6
1988	1.3	24.1	2.9	0.0	5.9	17.3	12.3	4.5	9.4	11.0	6.9	7.4
1989	14.8	41.6	10.3	10.0	10.0	24.1	20.1	10.1	14.9	23.0	16.3	13.4
1990	8.1	24.3	4.5	5.7	6.3	11.6	10.6	4.7	7.5	8.8	6.0	5.6
1991	0.0	15.4	0.3	0.0	0.4	9.2	4.6	1.2	4.1	8.0	3.5	0.8
1992	0.9	24.2	0.0	0.0	4.3	11.3	8.0	1.9	7.8	8.3	0.0	5.2
1993	23.2	46.9	18.3	16.4	17.9	35.5	21.2	15.6	21.0	24.4	10.9	15.1
1994	6.5	20.1	6.9	2.1	7.6	18.2	2.0	7.9	8.7	11.3	6.5	9.0
1995	8.8	28.0	6.2	0.0	6.4	30.4	14.3	6.6	12.6	20.4	2.2	9.8
1996	10.5	29.4	7.0	3.7	9.2	22.4	20.0	5.7	9.6	14.3	5.1	10.1
1997	13.5	40.3	7.3	0.6	6.2	22.0	25.1	8.6	13.4	17.6	5.1	13.9
1998	12.2	30.7	10.1	8.0	14.0	30.4	18.4	13.2	16.3	19.2	9.0	14.9
1999	23.3	55.7	16.9	14.7	23.6	35.0	27.4	13.2	19.5	26.0	9.5	16.0
2000	14.4	34.4	11.2	4.4	14.7	23.3	18.1	10.2	13.2	14.3	8.0	14.3
2001	5.4	19.6	5.3	3.2	4.2	11.6	8.7	6.8	7.0	10.0	5.9	8.6
2002	16.3	37.6	11.9	5.0	12.2	26.3	12.0	9.2	11.5	14.6	6.4	10.3
2003	0.0	22.0	5.1	0.0	5.1	21.2	11.8	6.6	10.8	12.6	2.0	4.3
2004	18.6	41.2	12.0	7.7	14.1	31.3	17.5	14.7	16.6	20.3	10.5	14.5
2005	5.4	18.3	5.6	0.0	8.9	16.3	12.9	6.5	11.7	7.9	2.6	4.1
2006	20.7	41.8	15.1	1.7	21.3	25.7	22.2	14.4	21.1	18.9	6.9	15.2

State	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon
Station Id	18e16s	18e09s	18e08s	18e05s	18e03s	18d08s	18d20s	18d04s	18d09s	18d19s	17d06s	17d07s
Latitude	44.248	44.656	44.764	44.831	44.869	45.191	45.364	45.558	45.146	45.697	45.272	45.077
Longitude	-118.517	-118.426	-118.312	-118.188	-118.114	-118.550	-118.467	-118.454	-118.219	-118.107	-117.687	-117.551
1961	11.6	9.7	8	14.1	7.6	3.1	9.2	0	8.3	14.6	15.9	14.8
1962	14.3	10.9	12.9	18.4	9.4	5.4	10.5	2.4	10.4	16.2	23.2	19.9
1963	6.9	2.3	2.6	7.6	0.0	0.0	5.7	0.0	3.5	4.6	4.9	5.5
1964	13.8	14.6	10.2	15.9	9.8	6.1	10.8	10.1	10.1	24.3	21.8	17.8
1965	24.2	16.8	13.8	28.4	15.4	8.6	17.6	6.0	12.5	22.0	29.6	29.1
1966	10.0	11.2	10.1	15.2	10.5	7.7	10.8	10.7	8.6	16.8	15.0	17.5
1967	12.3	10.4	9.2	15.1	10.2	5.0	10.1	4.0	8.8	16.7	24.1	21.5
1968	10.1	7.3	8.5	14.4	8.3	1.1	5.5	0	7.7	4.4	14	14.8
1969	18.5	16.8	14.1	21.7	14.7	6.4	13.7	11.6	14.4	22.2	21.4	25
1970	21.8	16.6	15	23.8	13.5	2.4	10.9	0	6.2	21.8	22.7	21
1971	16	14.1	14.2	19.6	11.5	2.6	9.4	0	7.8	18.9	28.6	20.8
1972	22.9	18.7	15	24.8	14.7	7.8	22.5	12.4	18.8	32	33.9	37.4
1973	11.8	9.6	8.0	13.1	6.1	2.3	7.7	0.0	4.0	9.7	13.8	11.9
1974	25.7	21.8	16.7	26.7	16.6	6.2	12.5	12.5	14.6	35.5	30.3	28.7
1975	18.2	17.7	13.9	21.6	13.7	7.4	11.0	8.3	11.0	19.0	29.6	24.7
1976	15.1	14.7	11.4	19.1	10.6	6.5	10.4	8.0	9.0	24.8	25.2	17.3
1977	1.5	0.4		2.0	0.0	1.9	5.1	2.5	0.5	2.2	8.9	4.9
1978	15.5	13.7	10.6	18.7	10.6	3.9	9.9	0.0	6.7	15.6	22.7	15.4
1979	18.6	14.9	14.6	20.5	12.4	8.6	14.3	12.7	6.5	23.8	22.0	20.5
1980	15.6	12.1	8.3	15.1	9.3	1.1	8.4	0.0	7.3	18.6	18.0	17.1
1981	6.9	6.6	3.9	11.0	2.0	0.4	3.1	0.0	2.0	11.3	11.2	6.1
1982	23.1	18.1	12.2	20.8	11.5	5.8	13.7	11.1	11.6	35.6	28.9	21.2
1983	21.5	20.8	14.7	24.3	13.3	2.3	9.8	0.3	8.7	31.5	22.3	26.2
1984	19.8	17.5	12.4	20.3	12.2	7.4	11.0	9.7	13.8	21.8	21.3	19.2
1985	18.0	15.3	11.0	15.3	11.1	9.1	12.9	13.6	10.5	28.4	26.1	21.6
1986	15.5	13.8	9.6	20.3	12.8	3.4	7.6	2.5	9.8	16.3	23.3	19.1
1987	9.8	11.1	7.8	12.0	6.2	6.3	12.3	6.5	8.8	19.0	20.0	14.0
1988	7.4	9.2	5.3	12.3	5.7	2.7	5.8	2.2	5.8	14.0	20.0	15.1
1989	21.3	17.3	13.3	20.6	12.4	12.3	17.1	18.5	13.3	31.2	28.4	25.3
1990	12.8	7.2	7.3	11.5	5.4	3.1	5.6	3.9	6.9	14.8	16.9	12.1
1991	9.0	5.5	2.0	8.6	2.8	0.8	1.9	0.0	2.3	9.4	18.6	13.5
1992	9.8	6.6	2.9	9.5	6.2	0.0	1.3	0.0	1.1	13.3	17.0	12.1
1993	19.3	11.5	13.4	18.5	12.7	6.0	9.3	15.8	10.1	25.0	21.2	22.1
1994	12.8	10.2	7.7	13.1	7.0	6.6	7.0	5.8	8.7	21.9	22.2	18.6
1995	13.0	10.8	6.4	14.8	9.5	0.0	5.8	0.9	5.6	22.3	20.9	18.2
1996	12.8	8.4	7.2	10.4	6.1	1.1	5.6	3.2	5.2	16.8	13.8	14.2
1997	18.2	15.8	9.6	17.8	10.0	4.5	7.4	4.4	10.2	34.5	31.2	22.9
1998	16.1	10.6	10.3	14.9	8.4	6.9	8.3	1.0	17.1	16.4	20.2	19.2
1999	25.5	14.6	16.3	24.1	15.7	5.8	7.8	9.1	11.6	28.9	26.7	24.8
2000	17.1	13.9	11.7	16.9	12.5	5.4	8.3	6.5	9.6	23.4	23.1	21.4
2001	10.2	7.2	7.1	8.6	6.0	5.5	4.9	2.2	6.9	14.4	13.5	9.5
2002	14.2	13.0	11.4	13.3	10.8	5.7	7.1	10.3	10.6	23.7	20.9	17.4
2003	9.1	8.1	5.0	7.9	5.0	2.3	5.4	2.9	5.7	12.9	17.4	11.3
2004	18.3	15.1	10.8	17.8	9.5	7.6	12.9	8.4	14.8	22.6	26.8	20.3
2005	6.7	5.9	6	5.7	5.4	0.3	3.3	0.3	5.5	6.6	10.2	8.4
2006	22.3	16.1	17.3	16.1	11	2.5	8.3	5.6	13.9	24.2	20.1	17.4

State	Oregon	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah
Station Id	17d02s	09j01s	09j05s	09m02s	10j10s	10j52s	10k01s	11h36s	11h37s	11h55s	11h57s	11j01s
Latitude	45.214	40.716	40.608	37.813	40.597	40.678	39.892	41.898	41.685	41.413	41.466	40.855
Longitude	-117.193	-109.544	-109.889	-109.488	-110.433	-110.949	-110.746	-111.630	-111.419	-111.538	-111.497	-111.048
1961	21.6	4.6	4.7	3.6	3.2	10.5	2.4	20.1	8.8	10.9	17.6	10.5
1962	23.8	13.6	15.3	12	14.6	27.3	14.4	35.4	18.1	21.2	31.3	21.4
1963	14.0	4	6.5	5.7	4.1	16.4	4.9	21.6	12.2	14.7	19.8	16.5
1964	18.7	4.9	4.8	2.1	5.4	11.8	2	25.1	11	13.3	19.6	13
1965	32.7	10.6	10.5	13.2	12.9	36.2	15.4	45.7	19.9	23.2	31.1	28.1
1966	19.3	10.6	11.1	15.5	10.1	16.9	11	30.2	17.9	21	27.1	18.4
1967	26.1	11.9	11.8	9.6	9.9	24.1	11.6	32.1	16.9	19.8	25	21.3
1968	21.6	9.7	9.4	16.7	10.9	20.5	11.9	25.5	12.7	15.3	22.6	17
1969	28.5	13.6	17.3	18.9	16.9	29.9	16.8	35.9	27	31	34	24.7
1970	20.2	7.5	6.3	4.4	6.8	18.1	5.2	32.3	16	18.8	24.1	16.6
1971	26.5	11.8	9.7	9.5	11.1	28.8	9.4	43.6	23.2	26.9	38.1	25.3
1972	28.2	13.7	12.8	10.1	11.1	28	13.7	43.8	23.4	27	35.9	23.4
1973	17.9	11.2	8.6	17.6	8.4	19.3	10.4	23.6	17.3	20.3	24	18.6
1974	34.5	6.6	5.9	13.1	8.3	21.8	6.4	33.7	21.7	25.1	30.9	22
1975	23.6	7.6	7.6	14	8.8	20.3	9.8	25.3	20.7	24.1	26.3	18
1976	20.1	10.7	7.8	13.1	8.3	19.5	7.6	27.1	16.8	19.7	24.9	17.6
1977	3.7	1.9	2.7	2.2	1.1	4.8	2	9.3	4.2	5.8	10.4	6.8
1978	22.4	9.4	10.3	14.7	10.7	27.4	11.1	35.2	21.5	24.9	29.1	21.4
1979	16.5	10.6	11.3	26.5	11	21.3	15.3	37.8	20.8	25.7	21.3	17.1
1980	21.4	14.4	15	23.6	15.8	30.6	16.3	32.9	19	23.1	25.9	25.9
1981	15.9	5.6	6.1	2.7	6.4	11.9	4.4	12.8	7.4	7	8.4	12.9
1982	20.8	8.5	8.1	8.9	10.4	28.3	12	41.3	23.5	19.5	25	25.9
1983	21.3	14.5	15	19	10.7	18	12.5	25.1	13	20	20.6	18.3
1984	19.8	12.7	9.7	11.7	9	28.2	8.7	40.6	24.8	25.5	31.8	20.8
1985	20.8	9.7	8.6	12.9	8.8	20.8	9.5	29.9	16.6	21.8	27.6	18.8
1986	25.1	10.6	12.8	12.9	16.8	41.6	17.3	45.4	29.1	34.6	34	34.7
1987	15.5	6.4	5	10.5	10.7	13.9	5	13.4	9.2	12.2	14.1	16.6
1988	17.3	4.1	5.4	10.7	6.9	15.3	6.6	20.6	13.6	14.7	20.3	14.5
1989	19.8	9.4	7	12.5	9.6	18.4	7.1	31.6	14.8	25.2	27.5	19.2
1990	18.0	7.8	7.6	5.5	9	14.6	8.4	21.2	11.9	11.6	19.6	14.7
1991	14.9	6.4	6.8	6.3	7.6	11.7	4.1	20.7	9.2	10.6	18.5	16.3
1992	15.4	7.5	6.1	16.2	6.2	8.7	7	15.9	8.8	9.3	18.5	14.8
1993	21.5	14.3	15	31.4	16.2	22.7	14.4	29	16.4	15.4	29.3	27.5
1994	20.8	8	7.6	11.2	10.4	11.8	7	20.9	12.6	13	18.2	18.5
1995	23.3	11.9	16.6	17.1	13.5	16.9	9.7	25.2	14.6	15.3	24.8	18.8
1996	22.2	6.1	5.8	3.4	12.2	26	9.1	38.3	20.7	17.9	31.4	24.6
1997	36.7	16	17.5	23.1	18.5	33.9	16.6	51.2	29.6	29.4	38.1	29.4
1998	21.3	8.8	8.2	11.3	15.4	17.9	10.2	37.6	18.2	16.6	25.9	19.1
1999	31.6	7	8.8	6.8	11.3	17.9	7.2	37.5	19.2	15.7	23.3	18.3
2000	22.9	7.6	9	7.8	9.5	18.6	9.7	29.3	11.9	13.2	17.5	17
2001	12.1	8.4	11.1	11.9	10.6	12.4	11.1	20.7	11.7	10.8	15.7	14.3
2002	20.3	4.9	5.2	5.7	6	13.4	4.5	25.1	15.1	10.7	16.2	14.8
2003	14.6	7.6	7.8	9.5	7.2	10.3	7.9	24.7	12.1	9.4	16.2	13.2
2004	18.5	12.3	12.4	16.5	11	16.8	11.3	29.2	15.6	14.8	21.6	16.7
2005	9.3	16.5	21.7	31.3	19.8	25.7	19.6	35.8	18.1	20	25	22.6
2006	21.8	4.7	7.7	2.9	8.7	24.7	7.8	46.9	21.5	19.9	27.3	22.8

State	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah
Station Id	11j02s	11j08s	11j21s	11j23s	11j52s	11j53s	11j57s	11j64s	11j65s	11k03s	11k09s	11k21s
Latitude	40.885	40.190	40.428	40.295	40.762	40.790	40.599	40.837	40.659	39.683	39.310	39.866
Longitude	-111.069	-111.220	-111.616	-111.256	-111.629	-111.118	-111.583	-111.709	-111.637	-111.318	-111.433	-111.283
1961	7.4	5.6	6.6	5	8.7	7.2	12.1	9.9	10.8	5.9	5.9	7.7
1962	12.9	19	26.8	20.2	14.8	13.1	25.2	25.9	28.8	24.6	16.1	21.6
1963	7.3	10.9	12.1	6.7	8.5	6.6	12.8	10.6	11.6	9.5	10.2	9.6
1964	9	10.1	16.4	7.4	11.4	8.3	14.4	12.1	13.2	9.8	7.6	10.7
1965	18	21.1	26.9	16.7	24.2	17.4	26.2	24.4	27	18.6	17.1	22.8
1966	11.9	14.7	20.8	14.1	11.8	11.7	20.8	18.2	20.1	13.5	12.6	15.5
1967	13.4	18.7	29.1	20.8	14.4	12.2	20.6	18.2	20.1	16.6	11	19.1
1968	12	16.3	21	15.3	16.3	12.5	20.9	16.8	18.5	15.9	14.9	14.8
1969	15.7	28.6	41.9	30.2	21.5	19.7	30	31.2	34.7	27.9	18.6	24.8
1970	11.3	15.5	12.9	9.8	16.2	10.4	19.3	17.2	19	15.5	11.5	16.1
1971	15.9	20	20.2	15.8	17.8	14.3	19.5	21.1	23.3	18.7	12.5	19
1972	15.5	20.2	23.4	17.8	20.4	15.2	23.1	25.5	28.3	16.3	10.8	17.7
1973	12.1	17.9	23.5	16	14.7	11.2	20.1	20	22.1	18.1	17.6	18.9
1974	14.4	18.6	17	16.2	19.9	14.3	22.6	19.4	21.5	20.3	15.7	20
1975	11.5	15.8	22.3	15	20.2	14.5	19.9	18.2	20.1	18.6	10.4	17.7
1976	12.9	14.3	24.8	15.8	16.3	11.7	20.7	16.4	18	16	8.1	17.3
1977	4.6	4.9	5.1	4.7	6	3.6	7.7	7	7.5	4.4	4.2	5.8
1978	12.3	20.2	23.8	18.8	18.4	11.8	24.2	21.9	24.2	21.3	18.5	25.2
1979	11.1	19.7	27.4	19.3	15.9	11.7	24	23.5	26.1	20.5	12.9	19.3
1980	16.5	23.5	35.2	20.3	17.3	15.5	28.4	24.8	27.5	23.3	16.9	22
1981	9.9	8.1	14	6.1	7.9	6.9	12.4	9.5	10.4	7.9	4	8.6
1982	15.3	20.8	23.3	14.6	17.3	13.5	25.8	22.6	25.1	23.3	16.1	20.3
1983	11.4	19	18.3	20.3	17.1	13.2	22.9	22.1	24.5	21.1	20	16.5
1984	12.4	24.3	21.6	19.8	26	15.1	24.7	23.2	25.7	25.3	20.3	21.1
1985	14.2	15.2	22.6	17	18.8	15.3	22.6	20.6	22.8	19.3	15	17.8
1986	18.3	24.1	34.8	26.5	18.3	15.5	27.7	25.6	28.4	27.3	16.3	23.8
1987	8.8	7.6	8.9	5.6	10.8	8.1	18.5	12.4	13.6	6.5	8.7	6.7
1988	10.9	12.2	8.4	12.4	11.2	9	12.9	10.7	11.7	14.5	7.7	11.4
1989	14.4	15.3	17	14.7	18.9	13.9	22.2	21.9	23.9	16.2	10.7	16.3
1990	12.5	12.7	19	11.3	11.9	11.9	20.5	14.7	15.8	13.5	7.3	15.2
1991	10.9	9.1	10.4	7.4	12.6	8.5	15.2	14.4	14.4	12.7	6	11
1992	11.2	8.2	10.3	6.8	7.2	7.3	14.1	12.4	13.8	10.1	9.6	7.7
1993	16.8	21.3	36.4	18.9	15.1	17.5	23.8	23.5	24.2	23.9	19.2	22.1
1994	9.3	10.6	15.3	11.4	11.3	9.1	15.5	16.7	15.2	15.5	8.6	10.7
1995	13.7	14.7	19.5	12.2	13.3	12.5	19.7	24.9	20.8	16.7	13.7	15.5
1996	11.9	18.6	18.8	19.7	16.8	16	23.2	27.7	24.9	18.8	11.1	19.1
1997	20.1	29.3	38.1	27	17.6	17.5	27.5	33.4	33.1	31.3	16.9	30
1998	13.8	16.6	20	14.9	13.9	13	20.5	27.2	24.1	18.2	12.3	17.6
1999	13.7	13.1	17	12.5	12.7	11.7	17.1	19.1	18.6	11.8	7.6	13
2000	11	13.6	15.8	14.1	12.3	11.2	15.7	22	20.5	15.5	10	14.6
2001	9.8	10.5	10.5	9.3	8.9	8.3	12.5	17.1	15.4	11.7	10.6	11.4
2002	10.6	10.7	11	8.5	11.8	9.1	13.9	17.7	20	10	7.1	9.5
2003	10	8.8	8.8	10.8	7.4	7.7	12.6	15.2	12.4	13.1	7.5	11.7
2004	11.7	16.5	21.3	16.6	15.4	9.9	18.6	27.6	22	14.7	13.2	16.6
2005	14.4	18.6	32.5	19.8	13	14	27.9	26.1	27.3	17.4	13.2	21.9
2006	14.3	18.2	20.2	19.4	16.4	12.8	25.2	30.1	27.1	17.4	10.6	17.8

State	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah
Station Id	11k22s	11k31s	11l01s	11l04s	11m03s	12l04s	12l06s	12l07s	12l15s	12m03s	12m13s	12m23s
Latitude	39.893	39.134	38.773	38.680	37.836	38.508	38.484	38.302	38.965	37.574	37.661	37.569
Longitude	-111.251	-111.437	-111.677	-111.598	-111.881	-112.019	-112.393	-112.357	-112.249	-112.900	-112.741	-112.838
1961	5.9	6.3	10.2	4.5	10.1	6	6.3	11.2	8.4	7.1	7	13.4
1962	15.5	17.5	14.7	8.7	10.4	11.3	10.6	15.1	17.3	19.7	16.4	27.5
1963	4.2	11.4	10.2	3.9	4.5	5.2	7	9.7	10.3	4.1	3.6	5.8
1964	7.9	7	11.9	4.1	4.4	6	7.4	7.5	12.7	7.1	6.3	9.9
1965	16.8	19.5	19.8	10.7	6.2	13.9	14	14.7	21.8	11.8	10.6	14.3
1966	10.5	11	10.3	7.1	11.2	9.8	11.1	13.4	14.6	19.1	14.6	25.8
1967	13.2	12.3	12.9	7.1	6.4	12	12.4	14.8	12.5	12.1	8.5	19.5
1968	10.9	13.1	13.3	9.6	12.4	11.6	12.8	13.1	18	14.8	14.1	22
1969	18.5	21	15.8	11.1	13	19.3	18	20.1	22.8	34.3	25.1	41.4
1970	11.2	14.5	16.9	10	6.6	10.6	12.8	14.8	15.8	7.7	6	10.9
1971	14.7	17.5	17.4	8.8	9.2	10	14	15.2	18.7	14	13.1	17.3
1972	12.1	15	15.8	10.7	10.5	10.5	11.6	13.6	14.1	14.5	13.5	22.7
1973	13.5	14.2	18.8	10.5	13.4	13	16.3	17.6	32.4	18	14.3	26.8
1974	15.7	17.5	21	11.3	7.6	14.5	16.4	15.1	29.5	13.5	9.3	16.1
1975	12.2	15.4	15.7	9.9	7.4	10.7	10.1	12.9	15.8	11.5	9	16.3
1976	13.1	9.7	12.6	6.9	7.7	8.7	12.7	11.3	14.4	16.4	13.3	18.7
1977	4.6	6.2	7.3	4.5	1.7	4.4	4.9	6.5	8.8	4.2	2.1	4.6
1978	16.2	22.8	16.9	11.5	11.2	10.2	12.9	17.3	27.8	19.6	11.6	21.4
1979	14.8	17.9	16.8	13.4	16.6	22.1	22.2	21.8	23.8	24.7	21.7	35.5
1980	14.5	19.1	17.9	11.7	13.8	15	18.6	23.5	23.8	25.5	18.1	30.5
1981	6.4	5.6	9.4	2.4	4.4	4.3	6.9	7.6	4.8	6.3	5.1	7.2
1982	16.5	19.1	18.1	11.4	11	13.2	13.7	18.1	18.4	11.8	9.4	16
1983	14.2	20.1	16.8	11	11.8	14	14.5	19.1	27.6	20.3	17.6	32.3
1984	15.3	22.6	20.1	12	8.9	15.5	20.3	20.8	41.7	10.1	15.6	15.5
1985	14.6	15.8	14	7.2	10.2	11.7	14.5	15.2	18.9	15.7	8.8	21.6
1986	16	22.6	12.9	11.1	7.4	10.3	12.6	20.8	16.3	11.9	10.9	18.1
1987	6.6	9	14.8	5	11.4	6.6	10.9	13.2	14.2	10	9.2	17
1988	7.7	10.7	12.2	6	9.2	9.7	11	14.5	13.1	11.7	11.1	18.9
1989	12	13.6	13.5	6.8	6.6	10.6	11.3	13	14.5	11.9	9	13.1
1990	9.9	8.2	10.5	5.3	6.5	5.6	8.9	6.5	12.5	7.6	6	12.3
1991	7.1	7.1	13.2	3.7	4.4	6.8	11	9.9	15.1	8.3	7	12.3
1992	5.7	10.3	11.3	4.6	11.6	6.3	10.1	11.4	12.3	8.9	9.5	16.8
1993	18.5	21.7	17.9	15.8	23.1	16.9	20.4	22.9	23.9	29.3	27.1	42
1994	9.2	10.1	11.5	5.7	6.7	8.8	11.2	10	17.8	11.6	9.2	15.7
1995	13.5	15.9	12.7	6.4	13.7	12.4	14.9	15.4	16.2	15.9	16.7	27.1
1996	13.2	20.4	13.3	7.3	4.8	11.3	11.7	14	14.6	9.7	8.4	14.1
1997	20.6	28.8	19.4	14.3	14	14.4	17	22.5	26.1	12.3	15.2	21.9
1998	13.9	17	16.8	6.3	10.2	13.9	14.9	17.5	28.4	14	12.1	23
1999	8.7	12	13.1	5.7	7.6	9.2	11.3	10.7	12.9	5.8	10.1	14
2000	7.5	13.3	12.2	7	7.4	9.8	12.9	12.2	21.1	11.2	9.6	14.5
2001	7.9	13	12.2	7.8	17.4	10.3	13.9	13	10.6	11	14	19.9
2002	7.4	10.6	9.6	6.4	2.8	8.5	6.8	6.7	12.7	4.8	5.1	8.2
2003	9.1	11.9	11.5	5.5	7	8	8.8	10.9	10.8	7.7	6.7	12.7
2004	12.9	15.9	15.7	9.1	12.2	13.4	14.9	13.7	22.4	16	13.8	23.2
2005	14.1	15.5	17.8	10.7	25.5	17.2	16.9	22.6	18.6	27.7	25.9	57.7
2006	12	17.3	12.4	7.7	4.1	9.4	10	11.8	12.5	8	8.3	13.5

State	Washington	Washington	Washington	Washington	Washington	Washington	Washington	Washington	Washington
Station Id	20b02s	19a02s	21c28s	21c38s	21b55s	20a23s	20a40s	20a09s	20a12s
Latitude	47.351	48.655	46.642	46.810	47.374	48.191	48.202	48.519	48.445
Longitude	-120.680	-119.838	-121.381	-121.331	-121.442	-120.919	-120.956	-120.736	-120.916
1961	16.9	12.1	19	21.9	54.3	45.1	37	38.1	46.9
1962	10.4	8.4	14.6	16.2	45.8	38.6	31.8	29.3	37
1963	4.4	5.4	10.4	10.7	25.2	27.3	22.7	22.7	24.7
1964	21.6	9.9	25.1	29.9	69.6	59.5	48.7	39.8	53.6
1965	21.6	11.1	25.9	31	70	45.2	37.1	39.7	38.9
1966	15.8	9.2	21.8	25.6	55.6	68.8	56.1	30.3	38.3
1967	15.1	13	21.3	24.9	52.4	62.6	51.1	49	51.3
1968	6.6	11.6	10.4	10.7	30.3	51.8	42.5	41.3	40.5
1969	21.3	16.4	30.4	36.8	65.5	66.9	54.6	44.2	56.2
1970	20	11.8	24.2	28.7	51	37.6	31	29.2	34.2
1971	23	13.3	31.6	38.5	74.7	78.3	63.8	51.8	59.2
1972	29.1	15.8	46.5	58	91.9	65.3	53.3	65	75.5
1973	8.6	8.4	11.4	12	29.2	46.2	37.9	29.7	38.5
1974	27	17.5	34.9	42.8	94.5	79.1	64.4	57	70.9
1975	21.9	12.1	27.1	32.5	65.9	63.9	52.2	47	60.5
1976	16	7.7	24.4	29.1	81.3	69.4	56.6	50.2	59.6
1977	3.1	0	3.5	1.7	18.2	18.7	15.8	12.5	11.3
1978	13.8	13.6	19	21.9	37.3	53.4	43.7	45.3	54.8
1979	17.2	5.2	22.8	19.9	52.8	39.6	32.6	28.1	23.6
1980	13.6	10.7	19.5	22.6	37	45.4	39.5	31.3	41.9
1981	5.3	11.1	19	2.7	21	41.2	33.9	24.6	27.7
1982	20.8	13.9	26.5	30.6	57.6	68.5	55.8	43.6	47.9
1983	19.1	15.2	24.6	29.2	44.2	63.2	51.6	39.4	40.3
1984	17.3	9.7	20.6	24.8	42.8	47.8	39.9	28	32.6
1985	16.1	6.4	22.6	26.9	58.7	44.4	34.3	33	37.4
1986	18.3	7.3	19.3	22.8	33.2	43.3	37.9	32	36.3
1987	15.7	7.8	16.1	20.5	42.3	48.2	40.5	30.3	38.6
1988	14.2	6.6	15.8	18.5	38.9	46.1	36.4	26.9	35
1989	14.5	7.9	17.8	22.1	46.8	49	37	26.6	38.1
1990	18.7	6.7	25.1	22.7	50.1	63.3	53.7	40.5	49.7
1991	7.3	4.9	12.9	13.4	34.9	72.2	63.5	51.7	51.7
1992	10.5	9.4	14.4	17.9	29.3	56.7	43.5	39.5	47.9
1993	11.2	8	17.5	17.2	31.4	29.3	28.3	21.8	26.1
1994	13.2	9.6	18.5	20.3	35.2	39.9	35.4	29	23.2
1995	19.3	13.5	22.7	24	41.3	64.1	47.8	48.6	35.4
1996	11.9	9.4	15.6	18.3	35.9	63	49.4	51.3	50.6
1997	20.9	15.8	45.9	41.1	73.9	65.2	57	46.6	60.6
1998	15.2	12.9	20	26.7	47.8	58	43.9	28.9	40.8
1999	18.2	14.4	29.7	49.4	76.4	77.6	62.9	53.2	65.9
2000	13.6	7.3	20.9	26.1	43.5	52.4	45	31.2	40.3
2001	8.7	4.4	10.5	14.1	25.9	26.2	23	18	22.9
2002	10.4	8.8	21.4	29.1	48.9	61.7	55.3	41.4	51.4
2003	11.2	9.8	12.8	16	27.3	40.8	27.3	25.9	30.1
2004	11.6	8.6	19.5	24.4	42.7	31.6	32.4	26	34.6
2005	1.2	4.7	2.8	2.6	7.1	25.6	19	11.1	14.5
2006	16.9	12.5	24.2	32.8	59.4	56	46.5	36.6	48.3

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	06H13S	06H19S	06H10S	06G01S	07F02S	06E03S	07E36S	07E23S	07E18S	07E12S	07E21S
Latitude	41.359	41.329	41.154	42.734	43.627	44.256	44.403	44.500	44.679	44.723	44.801
Longitude	-106.232	-106.502	-106.969	-106.319	-107.181	-106.980	-107.061	-107.429	-107.581	-107.400	-107.844
1961	13.3	9.2	20.6	10.5	10.1	5.1	10.3	11	11.1	10.3	13.9
1962	25	10.7	32.4	15.2	11.4	7.8	13.8	19.9	16.7	12.1	20.5
1963	15.2	9.3	20.4	9.8	9.8	4.6	9.2	16.8	13.2	13	18.2
1964	14.1	11.3	18.8	12.1	10.2	4.4	9.7	13.1	11.5	13.4	18
1965	22.5	10.4	32.2	11.7	13.8	5.9	14.4	23.1	19.3	15.7	22.2
1966	14.4	8.6	24.6	10.2	5.5	5.1	2.6	7.2	9.3	3.7	11.4
1967	22.5	10.6	30.2	15.5	14.7	5.3	12.8	13.5	17.6	13	18.1
1968	21.6	13.1	24.7	15.7	10.6	4.6	11.3	14.1	12.8	12.1	18.8
1969	16.3	8.6	29.7	11.7	7.6	4.6	9.7	12.9	13.2	7	14
1970	27.7	10.9	26.8	12.7	12.4	4.4	8.2	13.3	12.8	11.9	20.5
1971	32.1	15.4	39.1	10.2	10.2	5.4	9.7	17.3	19.3	12.2	20.1
1972	25.7	9.9	31.9	12.6	11.1	9.1	15.9	18.3	21.9	10.7	17.8
1973	16.5	9.8	24.1	13.4	9.3	4	3.6	8.8	9.8	4.9	13.3
1974	21.9	11	36.2	14.1	9.5	4.6	9.3	10.6	11.2	6.5	13.5
1975	19.8	10.3	22.8	11.3	10.1	5.7	11.3	13.9	16.6	13.2	18.9
1976	20.7	10.3	31.3	12.5	10.1	6.4	12.5	12.2	15	10.7	18
1977	6	5.9	7.1	10.3	11.3	2.4	7.1	8.5	12.6	11.1	18.7
1978	29.3	11.2	36	8.3	9.7	5.6	9.1	19.5	17.3	11	22.8
1979	29.1	11.3	42.3	9.3	6.6	5.6	6.7	10.9	14.5	7.5	18.1
1980	25.1	12.5	32.6	14	5.6	7.9	8.9	7.4	9.9	6.6	10
1981	7.8	4.8	8.1	5.6	7.6	4	5.2	6.9	6.8	4.3	9.1
1982	25.8	11.6	33.9	9.8	7.7	3.4	7.6	11.8	9.9	6.7	16.6
1983	14.8	11.1	27.8	15.5	9.2	4.2	8.7	11	13.3	8.3	17
1984	18.8	11.8	31.7	12.8	8.5	4.7	8.2	9.2	11.7	8.3	15.6
1985	14.7	7.5	23.6	11.5	8.6	3.3	7.8	9.9	11	8.2	12.6
1986	30.3	13.5	39.6	10.1	11.7	6.5	15.3	15.4	17.1	11.9	20
1987	14.6	5.3	18.1	11.8	8.2	6.2	6.7	9.9	11	7.1	11.8
1988	18.3	8.4	20.8	13.1	8.8	4	9.9	10.9	10.8	8.7	15.2
1989	14.2	10.4	21.2	7	8.6	3.4	6.1	7.5	9.7	5.6	12.8
1990	14.4	10.4	17.1	8.1	11.7	5	10.2	12.3	15.6	12.1	21.4
1991	11	7.5	17	11.1	8.2	5.9	9.4	11.3	12.9	10.6	14.9
1992	12	11	15.8	10.2	6.4	5.4	9.4	8.5	10.5	8.8	12.1
1993	15.8	10.9	28.9	12.2	6.3	4.8	8.2	8.6	10.9	7.3	12.4
1994	17.9	10.4	22.7	13.8	8	3.8	15.1	13.8	12.8	11.7	19.4
1995	10.9	7.1	24.3	9.8	13.7	6.2	12.5	11.5	11.9	10.3	11.6
1996	23.5	8.1	27.9	9.7	7.9	5.7	14	14.5	15	9.3	15.7
1997	30.4	13.5	36.6	18.1	12.6	6.6	15.2	15.4	15.9	12.1	19.3
1998	14.9	9.1	24.4	11.1	7.6	6.3	11.6	11.7	13.4	10.3	16.3
1999	18.3	11.5	24.2	9.6	7.3	4.5	12.5	15	14.3	8.6	17.6
2000	15.3	8.8	21.4	12	8.5	4.2	12.2	12.4	13.4	9.7	16.7
2001	14.2	8.2	19.7	9.4	6.3	3.6	7.6	8.5	8.1	6.1	11.2
2002	8.9	8.2	16.3	7.5	5.2	3.6	9.8	10.5	9.8	7.6	12.9
2003	12.3	10.8	20.4	7.9	5.1	6	10.3	11.8	11.9	9.3	14.6
2004	12.8	9.2	24.9	10.8	9.2	6.4	11.4	11.3	12.4	9.9	14.4
2005	14.1	8.7	29	8.1	4.6	4.4	9.9	10.4	10.5	7.8	11.7
2006	21	9.9	31.1	13.7	10.4	3.4	10.7	11.8	11.4	8.5	12.8

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	07E33S	08G03S	09G09S	09G03S	10G12S	10G08S	10G20S	10G13S	10G25S	10G15S	10G23S
Latitude	44.788	42.573	42.647	42.870	42.269	42.508	42.525	42.495	42.646	42.764	42.815
Longitude	-107.529	-108.843	-109.260	-109.095	-110.806	-110.910	-110.662	-110.532	-110.815	-110.591	-110.835
1961	7.7	7.6	6.5	8.6	8.3	7.6	15.3	7.2	14	14.4	18.6
1962	9.7	15.8	15.8	15.6	18.6	13.5	33.8	18.2	22.3	26.5	31.1
1963	10	13.2	7.9	8.4	10.8	9.2	19.6	11.7	12.3	16.6	31.9
1964	12.7	11.2	8.8	9.8	12.3	11.2	17.5	10.3	17.3	16.2	32.1
1965	12.8	22.8	19.6	18.8	22.9	20.4	42.6	24.4	29.5	35.4	49.3
1966	3.6	12.3	8.8	8.3	10.9	10.7	15.3	8.4	12.9	16.6	21.7
1967	11.3	16.2	10.6	14.8	14.6	14.5	27.7	14.4	20.1	23.9	38.6
1968	12.1	12.3	9	10.5	10.8	9.2	20.3	9.9	16.8	19.3	31.4
1969	7.9	17.1	16.9	11.7	17.6	16.3	25.3	15.2	20.1	24.9	23.6
1970	11.4	11.3	8.8	9.2	13.6	11.4	25.3	12.1	20.6	25.3	39.2
1971	9.7	21.2	19.1	19.4	20.1	19.9	36.5	20.1	27.3	31.6	58.1
1972	11.3	22.1	23.4	18.4	20.4	19.7	36.5	21.7	26.2	33.4	49.8
1973	6.9	12	8.1	9.8	10.3	9.1	16.1	9.4	17.3	17	25.4
1974	8	12.7	10.8	12.8	15.5	13.7	24.5	12.3	20.6	24.5	41.2
1975	12	10.5	12.2	11.3	15.7	12.8	21.8	14.1	20.6	21.5	39.2
1976	11	14.2	14.2	11.5	14.9	13.6	25.5	14.6	22	23.9	41.5
1977	11.7	5.9	3.4	4.3	3.1	3.3	5.2	1.1	6.5	5.1	0
1978	11.6	14.4	18.2	10.3	23	19.5	39.7	20.3	29.9	38.2	56
1979	9.8	15.7	16.3	11.9	16.9	14	21.6	15	16.5	20.5	28.2
1980	7.9	19.7	16.2	11.7	17.1	12.4	23.1	14.1	15.7	22.8	33.2
1981	5.7	10.5	5.5	8.4	6.3	6	12	5.5	9.7	9.6	7.8
1982	6.3	15.4	14.9	13.9	18.9	16.8	33.6	17.7	20	30.4	48.2
1983	8.4	12.7	13.6	11.9	13.3	10.8	18.8	9.2	22.1	18.6	38.3
1984	7.8	12.7	10.1	9.2	15.4	10.8	18.8	10.3	18.1	18	42.6
1985	8.8	10.4	9.5	9	10.7	8.9	16.1	8.6	15.1	17.7	21.6
1986	10.5	27.7	17.5	21.2	25.1	20	38.1	20.6	25.3	35.2	42.9
1987	7.8	12.6	10.3	15.6	8	6.9	15.3	7.5	13	13.3	4
1988	9.2	11	6.5	11.1	9.6	7.6	16.6	9	13.3	16.6	16.6
1989	6.4	11.5	9.5	9.4	12.8	10.5	20.6	11.5	16.8	18.8	29.9
1990	11.1	10.7	9.6	9.4	9.9	9.3	17	10.2	13.9	16	15.7
1991	9.5	10	9.9	9.1	9.6	7.4	14.2	8.1	13.3	13.4	29.7
1992	8.1	8.3	7	8.4	9.4	7.7	14.1	7.5	12.4	9.6	10
1993	7.6	12	11.1	10.2	13.3	10.6	19.4	11.1	15.4	15.4	33.6
1994	10.9	12	10.2	9.8	9.1	9.3	14.2	7.9	13.6	14.3	19
1995	8	15.9	12.6	14.8	12.4	10.9	18.6	9.1	16.7	15.5	32.3
1996	8.7	16.7	13.5	15.5	17.5	14.9	30.3	20.7	27.1	30	35.1
1997	10.7	23.7	17.3	15.1	21.7	19.9	33.1	20.8	26.6	32.2	43.9
1998	8.8	11.3	9	10.9	12.8	12.8	17.5	9.4	17.8	17.6	23.4
1999	6.9	16	14.2	14.7	14.9	14.3	25.6	15.1	21.7	24.7	31.3
2000	9	11.3	9.8	8.3	12	11.7	20.5	10.8	19.5	20.3	20.6
2001	6	8.2	8.7	5.5	8.9	7.3	14.3	7.8	13.9	12.8	14.3
2002	6.2	9.1	9.9	7.3	10.3	8.8	17	8.3	15	15.9	20.3
2003	8	9	8.4	9.2	10.4	9.4	18.6	9.5	18	16.8	23.3
2004	8.4	14.5	11.4	11	12.6	11.8	18.5	10.7	17.5	17.8	16.3
2005	5.8	16.9	13.4	12.2	14	10.2	19.7	11.7	14.2	15.1	22.2
2006	8	14	13.1	8.8	17.7	14.1	27.4	16	25.9	26.5	31.6

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	10G02S	10F17S	10F16S	09F23S	10F15S	10F29S	10F19S	08F01S	09F25S	09F08S	10F09S
Latitude	42.964	43.131	43.174	43.007	43.249	43.343	43.389	43.659	43.277	43.503	43.749
Longitude	-110.610	-110.202	-110.140	-109.759	-110.017	-110.435	-110.129	-109.010	-109.446	-109.752	-110.058
1961	18	6.2	7.6	7.6	7.1	10.1	10	5.8	5.5	5.8	16.2
1962	33.2	14.7	18.5	16.9	20.4	15.7	18.8	5	11.3	12.7	23.8
1963	14.3	8.2	13.7	10.2	10.3	10.6	10	4.3	6	8.6	18.6
1964	17.4	9.9	12.1	9.8	8.8	13.7	10	3.6	6	6.6	18.7
1965	38.7	19.8	26.1	19.9	19.7	24.9	23.9	6.1	12	13.1	28
1966	18	8.6	9.8	6.8	8.1	13.1	13.1	2.1	4.4	5	15
1967	29	12.5	16.6	10.4	11.8	18	13.1	4	9.5	9.9	22.6
1968	21.6	12.3	13.1	7.6	10.3	14.5	11.7	3.3	6.9	7.2	21.1
1969	28.4	16.2	20.7	15.4	16.2	18.7	13	3.1	7	10.8	23
1970	31.4	14.9	13.9	10.8	11.3	17.2	11.7	3.4	7	7.1	20.2
1971	41.8	16.4	23.6	18.9	21.9	23.1	20.4	4.4	14.3	15.1	28
1972	41.8	21.1	22.1	18.3	23.6	26.3	17.6	8.6	16.7	17.6	29.2
1973	13.7	9.1	8.8	9.6	8.1	11.9	7.4	3.3	5.5	5.3	14.6
1974	28.7	15.1	16.2	13.4	14	20.6	9.7	3.7	8.8	9	22.6
1975	26.5	12.1	15.2	10.4	11	14.4	8.7	4.6	8.7	9.2	20.6
1976	26.2	14.2	16.4	13.2	14.9	20.7	15.2	3.6	8.5	11.3	26.8
1977	5	3.9	4.3	4.4	2.3	4.2	3.3	2.2	1.3	1.7	9.8
1978	39.5	19.8	25.5	18.6	13.8	25.1	12	3.4	9.2	13.9	29.6
1979	27	14.8	16.6	12	15.9	18	12.4	3.7	8.4	8.5	19.5
1980	24.3	11	14.5	10.4	11.3	13.3	9.8	4	6.1	7.6	17.3
1981	11.1	5.3	9.1	6.2	5.4	8.3	7	3.9	5	6.4	15.5
1982	34.2	15.3	17.1	15.7	17.7	23.3	17	1.9	7.7	10.7	27.4
1983	17.6	8.7	8.4	9.6	9.1	15.4	10.7	3.4	6.5	7.8	19.8
1984	18.8	8.5	10.8	11.3	9.6	11.4	13	3.9	6.5	8.4	17.5
1985	17.8	8.1	10.9	8.2	8.6	12.9	9.5	2.1	4.6	7.8	18
1986	39.9	17.6	28.4	18.3	24.3	24.5	21.1	7.7	11.5	15.7	27.7
1987	14.8	9.5	11.3	9	10.1	10.7	7.2	5.8	9.2	9.4	17.3
1988	16.3	7	10	5	8.9	12.4	7.1	3.6	4	6.7	16.8
1989	19.1	9.6	13.8	8.2	10.6	16.6	10.1	3.2	5.3	9.1	20.8
1990	15.7	8.9	12	7.2	10.8	13	9.4	3.2	5.6	8	18.6
1991	14.3	7.8	9.9	8.1	7.5	8.5	9.2	4.4	5.5	8.5	17
1992	11.8	6.8	8.3	8.7	6.6	8.9	8.1	3.5	5.8	6.6	13.3
1993	16.3	9.8	12.3	10.3	10.1	16.8	10.2	3.9	5.4	7.2	16.2
1994	16.3	5.8	9.8	8.8	8.9	12.1	8.4	2.5	4.3	6.6	17.3
1995	17.6	6.3	10.2	9	9.3	13.7	10.6	5.7	5.4	8.2	18.7
1996	31.1	13	20.4	12.1	18.1	21.6	15.6	4.3	7.9	13.7	29.3
1997	36.7	15	25.4	16.4	21.4	26.9	19.1	6.8	9	15.2	30.5
1998	19.4	8.6	11.9	9.6	11.5	15	11.5	5.1	7.8	8.4	19.3
1999	26.2	12.6	16.9	12.4	14.5	19.5	14	5.2	8.4	12.5	26.1
2000	22.2	9.7	14.6	10.2	12.5	14.1	9	2.7	4.5	8.5	16.9
2001	12.8	6.7	10.2	9.4	7.6	10.6	8.1	2.8	2.9	6	14
2002	16.5	7.2	11.5	7.9	8.1	10.8	9.6	2.5	3.5	7.3	15.8
2003	15.8	7.6	12.5	9.7	8.7	11.6	8.5	5.4	6.3	7.6	17.7
2004	18.7	9.4	13.8	10.5	11.8	15.5	9.3	3.7	5.6	6.7	16.7
2005	16	6.8	11.2	9.4	9.5	11	9	2.8	6.2	6.6	13.2
2006	24.6	9.6	16.8	12.1	13.4	19.1	10.4	2.5	4.4	7.6	21.6

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	09F04S	10F23S	10F02S	10E17S	10E15S	10E12S	10E09S	10E07S	10E03S	10E20S
Latitude	43.697	43.519	43.946	44.152	44.126	44.134	44.209	44.369	44.719	44.478
Longitude	-109.670	-110.911	-110.447	-110.221	-110.834	-110.669	-110.666	-110.578	-110.511	-110.038
1961	7.2	18.1	10.4	15.6	22.1	13.5	22.9	13	8.6	8.9
1962	13.5	33.1	15.2	21.6	35.1	18.4	35.8	24.7	13.4	9.7
1963	11.9	17.8	10.8	16.1	17	11.7	19.4	12.2	8.8	9.7
1964	9	19.4	13.5	19.4	23.4	13.4	22.2	13.5	10.4	10
1965	19.6	30.8	23.2	31.5	39.9	21.8	41.3	29.8	18.9	16.6
1966	8.1	19.7	13	18.8	24.5	13.5	25.1	16.8	8.4	8.5
1967	11.5	26.7	17.2	24.1	29.7	16.3	32.8	22.3	13.6	10.9
1968	9.3	16.1	14.2	20.4	30.2	15.3	23.5	16.2	12.2	10.9
1969	11.5	32.9	17.8	24.8	32.8	18.3	35.4	26.9	14.7	12.9
1970	12.6	22.9	16.6	23.2	33.7	17.6	29.4	13.3	10.6	10.7
1971	16.5	33.1	21.7	29.5	42.9	22.8	45.4	27	13.6	16.1
1972	20.2	37.4	24.4	32.9	45.5	24	42.2	25.4	14.4	17.7
1973	6.5	19.3	11.9	17.5	25.1	13	23.3	11.5	10	8.8
1974	13.9	30	19.5	26.9	32.7	19.1	38	20.2	11.6	12.5
1975	12	25	14.1	20.3	29.7	15.2	26.9	13.4	10.2	11.4
1976	17.5	27.5	19.6	27	42.1	21.9	38.5	18.6	15.2	16.8
1977	2.8	8	5.2	9.2	9.3	5.1	7	2.3	5.2	5.4
1978	18.1	34.8	23.4	31.7	35.7	25.4	43.4	20.2	15.6	16.6
1979	12.8	29.3	17.2	24.1	35	19.7	29.7	15.3	11.9	11.1
1980	12	19.4	13.1	19	23.2	13.9	25.5	14.7	9.8	9.7
1981	8.4	12.8	8.2	15.5	18.8	10.2	16.3	8.8	6	6.8
1982	18.4	34.7	23.8	29.7	42.8	22.1	43.2	20.6	12.6	15.4
1983	9.5	25.5	14.1	24.8	32.5	16.9	30.2	15	9.2	9.9
1984	9.1	17.6	12.4	17.8	26.5	13.8	23.3	11.6	6.8	7.5
1985	8.8	18.6	13.6	18.5	26.6	15.5	26.1	18	9.2	10.2
1986	23.4	35.2	22.6	32.4	37.6	21.3	41.9	24.7	12.8	17
1987	11	15.9	10.8	16.8	15.6	8.8	16.5	8.4	6.4	5.6
1988	11.1	17.8	12.8	16.8	24	15.5	25.1	10.6	9	7.2
1989	12.9	25.8	16.8	22.3	29.4	16.9	31.4	13.6	10.8	10.9
1990	10.8	19.6	13.2	21.8	24.8	14	25.1	10.5	11.1	9.8
1991	9	16.1	8.6	17.7	20.7	11	19	7.9	8.1	8.8
1992	8.1	14.9	9.7	15	21	11.7	22.2	8.7	9.6	7.9
1993	8.4	21.9	13.2	19.1	27	15.4	25.2	13	11.8	7.9
1994	9.5	18.1	12.1	17.7	23.6	13.2	19.8	10.4	9.3	10.2
1995	10.6	21.6	17	25.9	31.5	16.6	31.4	15.5	12.7	10.3
1996	18.3	29	21.9	35.2	31.4	18.6	42	21	17.5	17.4
1997	21.7	37	26.6	39.1	40.4	25.6	48	28.6	21.4	18.7
1998	12.1	22.9	14.7	22.4	25.7	14.2	24	13.1	10.4	8.5
1999	15.1	29.6	22.4	33.1	38.4	20.7	36.8	21.4	16.4	14.9
2000	10.5	19.6	15.3	20.6	26.7	14.6	22.3	12.3	11	11.8
2001	7.4	14.8	8	15.7	18	9.4	14.9	6.1	7.6	6.1
2002	10	18.1	10.7	20.7	22.2	11.3	21.9	11	10.8	7.9
2003	13.2	18.5	16	22.2	25	14.9	26.8	11.2	10.5	11.2
2004	9.6	22	17.2	22.8	32.6	17.1	28.7	16.4	10.7	9.5
2005	7.8	18.7	11.1	18.6	20.9	10.3	19.2	11	7.5	7.3
2006	12.1	27.8	18.6	31.1	31.9	18.1	35.4	15.8	12.5	9.2

APPENDIX A.2

Western U.S. April 1st snowpack

State	Arizona	Arizona	Arizona	Arizona	Arizona	California	California	California	California	California	California
Station Id	09s01s	09s02s	10r04s	10s01s	11r03s	20h06s	20h13s	20k04s	20k05s	20l02s	19l05s
Latitude	33.979	33.921	34.312	33.812	34.941	41.582	41.236	39.453	39.428	38.999	38.608
Longitude	109.503	109.459	110.754	110.918	111.518	-120.303	-120.792	-120.293	-120.313	-120.130	-119.924
1961	5.3	5.2	2.8	1.1	2.2	18.4	12.6	9.0	23.3	17.3	20.6
1962	20.5	22.9	7.8	17.9	12.0	19.2	18.2	29.7	44.1	36.3	38.7
1963	3.1	3.9	0.0	0.0	0.0	5.3	3.3	2.2	26.0	10.7	21.1
1964	4.3	5.1	3.2	4.6	4.6	16.5	10.2	13.7	31.3	19.0	21.0
1965	11.0	13.4	2.0	0.0	5.6	16.3	5.5	23.2	50.8	32.5	41.8
1966	9.8	12.8	0.0	0.0	0.4	13.4	10.9	17.2	31.0	25.4	29.2
1967	0.1	0.7	1.2	0.4	0.4	14.9	17.2	35.9	60.4	38.3	45.8
1968	13.9	17.5	6.4	16.2	2.6	13.4	12.8	18.3	34.4	25.8	23.3
1969	11.3	14.6	3.7	8.6	8.9	24.3	20.7	48.9	65.4	57.8	60.6
1970	4.2	4.9	1.4	0.0	3.3	15.3	11.4	12.0	38.4	27.0	32.9
1971	0.0	0.0	0.0	0.0	0.0	22.0	18.6	32.1	55.2	35.9	41.2
1972	0.0	0.0	0.0	0.0	0.0	22.4	11.9	12.6	33.8	21.7	28.0
1973	19.5	23.8	18.4	23.7	25.5	19.9	14.6	25.2	42.6	32.7	39.5
1974	1.2	2.9	0.0	0.0	0.0	22.1	17.1	20.3	54.2	35.6	33.0
1975	11.8	14.7	5.1	2.9	7.2	25.2	20.9	29.9	43.2	37.7	39.2
1976	8.5	11.2	2.4	0.0	5.1	19.0	10.5	6.9	21.1	13.7	13.3
1977	2.2	1.7	2.0	0.2	0.0	9.8	5.6	4.2	12.8	10.5	9.3
1978	8.7	14.4	5.3	0.0	2.8	14.5	8.7	30.6	57.1	35.0	42.1
1979	21.6	27.1	13.0	15.3	13.0	13.6	12.3	17.1	22.6	21.0	33.7
1980	17.3	23.1	12.7	5.2	16.2	30.4	18.3	24.5	53.0	38.0	41.7
1981	6.0	6.9	1.1	0.0	1.2	14.5	3.7	7.5	22.6	18.9	21.7
1982	10.1	12.5	1.8	2.9	9.5	20.1	11.9	26.9	61.6	41.6	46.7
1983	17.1	21.1	5.5	12.8	15.6	24.8	24.1	45.4	66.5	60.8	63.6
1984	1.1	2.8	0.0	0.0	0.0	22.1	13.8	18.8	49.3	30.3	28.6
1985	10.3	14.8	0.0	0.0	8.3	20.6	18.8	17.8	35.0	28.6	32.0
1986	0.0	3.6	0.0	0.0	0.0	24.3	14.7	25.3	54.9	36.5	42.4
1987	16.1	12.0	0.0	0.0	5.7	16.6	11.2	9.5	23.0	15.2	15.1
1988	1.6	1.8	0.0	0.0	0.0	9.9	5.6	0.7	17.6	11.6	8.4
1989	0.0	0.0	0.0	0.0	0.0	25.5	17.5	19.4	47.5	30.3	31.5
1990	0.0	0.0	0.1	0.0	0.5	10.0	7.6	8.5	23.4	13.6	17.1
1991	12.5	12.6	9.2	9.8	10.5	12.5	5.6	8.1	26.8	21.4	20.9
1992	8.6	11.1	0.0	0.0	8.6	6.3	0.3	7.8	20.9	12.9	20.8
1993	14.3	20.1	0.0	0.0	7.5	24.6	16.7	33.2	59.5	47.5	43.4
1994	2.2	5.5	0.0	0.0	0.2	12.6	8.6	6.7	22.8	14.6	17.0
1995	3.9	10.6	0.0	0.0	0.0	28.6	22.9	36.5	70.1	46.5	56.6
1996	0.1	0.0	0.0	0.0	0.0	21.2	15.0	19.0	43.0	33.3	33.7
1997	2.0	2.9	0.0	0.0	0.2	17.8	8.5	15.5	55.1	28.1	33.8
1998	10.8	11.7	6.6	9.0	12.1	26.8	20.7	29.3	53.4	39.2	39.8
1999	0.0	0.0	0.0	0.0	0.0	26.6	20.1	26.1	59.6	45.8	35.9
2000	0.0	0.1	0.1	0.0	0.5	14.6	11.6	11.0	42.1	24.9	26.1
2001	6.4	5.1	0.0	0.0	0.0	8.3	4.0	5.5	21.7	12.3	17.9
2002	0.0	0.0	0.0	0.0	0.0	19.2	11.6	18.9	44.8	23.2	28.9
2003	7.4	7.4	0.0	0.0	0.1	11.9	3.2	6.2	43.4	16.4	21.7
2004	0.0	0.6	0.0	0.0	1.9	17.4	8.9	11.3	43.7	23.7	26.8
2005	9.9	14.8	0.0	0.0	8.8	18.1	10.6	23.2	49.1	39.5	46.1
2006	0.9	1.7	0.0	0.7	1.6	19.9	14.6	16.1	55.1	31.9	36.6

State	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado
Station Id	06j01s	06j15s	07k02s	06j03s	06j06s	05j04s	06k01s	06k06s	06k04s	07k01s	06l02s
Latitude	40.534	40.848	39.875	40.395	40.078	40.399	39.361	39.297	39.075	39.078	38.820
Longitude	-106.781	-106.969	-107.599	-106.604	-106.670	-105.848	-106.060	-106.607	-106.612	-107.144	-106.590
1961	15.0	14.1	13.1	18.1	9.2	5.8	11.5	4.9	11.1	11.7	8.4
1962	27.7	23.8	27.0	31.7	20.8	10.5	16.6	8.2	26.9	28.2	16.6
1963	16.6	12.6	8.7	23.3	9.6	6.1	10.1	5.0	11.8	12.6	8.7
1964	21.0	19.0	11.0	22.1	11.9	7.1	10.3	6.8	13.9	13.4	8.0
1965	28.6	25.6	25.5	33.1	17.5	12.8	22.0	13.3	26.0	30.3	17.8
1966	13.3	14.9	11.4	14.6	7.0	4.9	6.1	5.1	11.7	10.6	7.2
1967	20.3	18.2	14.1	23.8	13.0	9.9	11.9	4.9	15.6	14.8	11.3
1968	11.8	21.1	21.1	22.9	14.6	8.9	13.5	8.3	16.0	18.4	9.5
1969	23.1	22.6	20.9	23.2	14.6	9.4	10.2	10.1	14.2	26.5	14.0
1970	23.2	22.6	21.6	29.4	16.9	11.7	19.5	10.2	23.6	20.5	13.6
1971	25.1	25.4	24.7	33.0	17.4	11.0	12.7	10.0	20.5	18.5	9.4
1972	21.1	18.1	12.7	25.6	12.5	6.2	15.6	7.0	15.4	10.9	10.7
1973	21.1	16.3	20.3	18.2	12.8	7.6	11.6	8.4	14.6	19.9	8.8
1974	27.6	21.5	16.1	29.2	13.5	7.6	14.2	10.2	14.3	14.6	10.0
1975	25.9	23.7	23.9	31.2	18.1	8.4	18.9	12.1	20.5	24.9	13.0
1976	18.8	17.1	20.6	21.4	14.7	6.9	12.8	8.6	15.3	20.0	11.6
1977	12.0	10.2	8.9	15.8	6.0	4.2	7.7	4.2	9.3	6.0	2.4
1978	35.3	30.4	27.7	36.9	18.1	13.5	14.5	9.6	21.1	20.6	13.0
1979	28.6	27.4	21.1	26.1	15.2	12.0	16.6	11.4	23.9	27.2	15.5
1980	30.4	26.6	22.8	27.9	15.1	14.1	19.1	11.6	20.9	28.9	16.8
1981	14.1	11.6	11.0	12.0	6.7	6.4	8.2	4.9	10.9	9.4	6.2
1982	28.5	24.6	23.6	35.7	15.5	9.7	19.1	10.8	19.3	22.3	0.9
1983	26.2	18.1	22.3	25.0	13.1	10.0	11.7	9.1	16.6	20.3	9.1
1984	31.8	21.5	24.0	27.2	15.1	10.6	18.0	11.5	21.3	25.6	12.9
1985	25.1	20.3	21.5	23.6	13.5	8.3	13.8	10.6	17.8	20.0	12.7
1986	24.1	22.5	26.0	26.5	13.2	12.0	16.1	9.1	16.5	18.8	12.7
1987	14.2	13.3	15.9	15.7	9.4	5.4	17.1	7.2	15.8	15.3	10.7
1988	25.6	20.6	20.1	28.6	14.4	12.1	14.9	7.1	13.8	15.1	6.3
1989	20.6	18.8	16.9	22.1	11.3	7.5	13.2	6.9	14.5	18.5	9.7
1990	19.1	18.3	10.2	23.5	11.0	8.3	11.7	5.8	13.4	9.3	6.9
1991	22.2	18.0	19.0	25.5	11.7	9.5	11.2	8.7	16.2	17.1	10.6
1992	15.7	13.3	20.0	18.0	10.7	9.9	14.5	7.6	14.0	14.9	8.4
1993	23.1	19.8	21.7	25.0	13.7	11.9	15.0	13.0	19.7	25.9	16.4
1994	15.2	14.3	13.5	19.9	9.8	8.9	13.5	7.3	15.8	14.4	7.3
1995	18.3	17.5	16.8	21.7	12.1	6.2	16.0	11.3	18.7	24.1	15.0
1996	29.6	23.0	23.2	37.9	16.9	14.9	20.5	12.4	21.0	19.8	13.6
1997	25.0	26.2	25.0	28.3	12.3	10.2	21.1	8.9	20.1	20.0	14.8
1998	18.9	16.4	21.3	21.1	10.8	7.9	14.1	8.5	14.9	17.7	8.9
1999	14.6	15.0	12.4	18.5	8.1	5.7	13.4	2.8	13.5	8.5	9.1
2000	23.4	19.1	16.1	29.7	10.4	11.7	15.1	9.2	14.2	16.5	9.0
2001	15.9	17.0	12.3	20.9	10.9	9.4	15.0	6.2	14.3	12.0	7.7
2002	17.0	15.1	11.2	18.0	7.7	6.9	9.4	3.2	11.3	9.0	6.0
2003	21.0	17.9	14.1	22.5	10.8	12.0	14.4	7.3	16.2	13.1	9.6
2004	14.9	11.8	10.2	15.6	6.8	1.1	9.6	1.4	12.9	10.5	8.2
2005	21.1	21.8	15.0	19.1	10.6	8.2	14.0	6.2	15.3	24.1	10.4
2006	24.6	20.9	18.0	30.7	14.2	10.8	19.1	7.7	15.9	17.2	10.9

State	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado
Station Id	06m03s	07m05s	06j05s	05j10s	05j42s	05j08s	05k06s	06k08s	06j12s	06l03s	06k10s
Latitude	37.486	37.651	40.347	40.414	40.035	40.033	39.916	39.380	40.875	38.489	39.292
Longitude	-106.835	-107.806	-106.094	-105.820	-105.544	-105.576	-105.761	-106.197	-106.046	-106.340	-106.549
1961	25.5	12.2	9.4	16.8	12.1	15.1	9.2	14.0	16.3	14.3	8.5
1962	40.0	17.6	16.0	37.6	15.7	19.2	12.8	19.9	21.0	19.5	18.2
1963	22.3	6.2	8.7	20.8	11.9	14.8	9.4	12.6	11.1	13.7	9.3
1964	21.3	10.6	8.8	18.4	9.6	12.1	10.7	11.6	16.6	16.6	12.6
1965	49.1	17.0	12.9	32.1	20.0	24.4	14.8	19.7	22.2	20.8	15.8
1966	30.4	8.3	6.8	13.1	7.4	9.6	7.4	10.0	12.2	10.0	9.4
1967	24.8	2.8	11.9	22.5	10.1	12.6	11.4	15.5	15.0	11.2	15.1
1968	29.7	15.4	9.8	24.1	16.4	20.1	11.1	15.9	16.8	14.1	13.8
1969	38.6	20.0	12.3	23.0	9.8	12.3	11.1	13.1	15.4	14.0	13.5
1970	20.1	7.1	14.1	32.5	16.5	20.2	15.6	18.8	19.3	16.8	18.4
1971	16.4	3.3	14.1	32.4	14.0	17.2	16.5	18.4	22.1	15.0	18.2
1972	11.5	2.6	8.7	24.0	14.1	17.4	13.1	15.3	15.8	13.2	14.9
1973	39.5	21.7	10.6	21.2	10.4	13.1	11.5	13.1	15.5	16.7	14.2
1974	25.1	8.1	12.9	27.1	15.3	18.8	15.7	16.8	20.4	16.4	17.7
1975	42.7	22.2	12.8	25.7	14.6	18.0	14.4	17.4	16.2	19.9	17.1
1976	33.3	16.8	11.6	23.2	11.0	13.8	12.6	16.3	19.3	12.9	14.2
1977	8.7	0.1	7.1	11.8	6.0	7.9	7.7	10.6	10.0	7.9	7.5
1978	34.7	17.0	12.0	35.1	16.0	19.6	14.2	21.9	19.3	19.5	18.2
1979	60.1	30.7	15.1	29.0	14.1	17.4	15.1	16.0	22.1	18.5	16.7
1980	50.4	28.2	13.1	33.9	16.2	19.0	17.6	20.1	21.5	18.1	17.7
1981	16.6	3.9	7.2	13.3	7.1	8.6	8.1	10.3	11.6	9.8	9.5
1982	33.5	17.0	10.5	32.2	13.9	17.5	15.6	18.3	18.1	20.0	16.4
1983	42.0	15.5	11.3	28.3	13.8	15.7	18.1	16.3	19.1	17.8	15.6
1984	37.4	13.3	11.7	28.9	15.6	19.0	16.8	20.3	19.6	24.1	20.2
1985	48.2	18.5	9.6	25.8	10.4	13.3	13.2	14.5	16.1	17.3	15.9
1986	32.4	10.5	20.1	35.1	12.7	18.3	12.3	18.0	26.7	13.9	15.8
1987	34.5	18.3	8.0	19.1	11.2	14.2	10.5	14.6	11.6	16.6	11.5
1988	21.8	3.5	12.7	29.7	13.9	17.3	18.6	16.6	18.1	14.9	13.0
1989	37.4	8.0	13.1	24.6	8.6	14.0	14.4	14.3	14.0	11.8	11.1
1990	16.6	2.8	10.9	22.6	14.5	19.3	14.3	13.5	18.1	10.9	10.1
1991	32.6	15.6	13.8	18.3	9.4	12.6	13.0	14.1	15.0	12.1	12.3
1992	35.2	10.0	10.3	22.2	12.6	13.6	11.2	14.6	13.2	15.0	12.8
1993	46.2	21.7	17.9	29.2	12.3	18.2	16.7	19.5	18.5	20.3	18.0
1994	25.9	8.8	12.6	24.6	13.4	17.8	13.8	14.2	14.1	12.6	12.7
1995	44.2	13.2	11.4	21.3	8.8	12.7	15.4	16.5	11.3	17.6	16.3
1996	18.7	10.9	13.6	34.8	20.3	29.3	21.9	22.3	21.1	21.6	16.2
1997	41.7	10.1	17.9	28.9	14.1	20.0	16.0	18.6	21.7	19.4	17.7
1998	25.8	9.7	7.2	20.6	11.6	15.1	12.5	13.8	14.6	14.5	13.1
1999	21.1	0.0	11.4	23.6	7.6	12.5	11.6	14.8	15.0	11.4	10.4
2000	17.8	12.2	14.7	24.7	12.0	15.4	14.3	15.1	15.5	17.1	15.5
2001	32.6	9.5	11.7	21.6	8.8	12.8	14.7	15.3	11.7	14.5	11.3
2002	9.5	0.2	8.2	16.9	6.7	9.1	8.5	11.4	9.5	7.5	9.4
2003	25.9	7.3	15.7	27.8	15.6	17.8	17.5	16.6	17.9	17.1	13.2
2004	27.5	3.1	10.1	15.6	6.6	10.8	10.9	12.4	13.1	10.8	9.6
2005	53.2	16.9	13.1	19.9	11.2	12.7	14.1	13.7	14.2	17.7	12.3
2006	17.5	9.1	12.1	24.8	12.7	18.1	16.7	21.0	16.7	15.1	17.7

State	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado
Station Id	05j12s	07m12s	06j09s	05k14s	05k09s	06k40s	07k06s	07k09s	06l11s	05m07s	05m14s
Latitude	40.225	37.749	40.368	39.804	39.646	39.088	39.046	39.129	38.894	37.331	37.214
Longitude	-105.920	-107.689	-106.740	-105.778	-105.870	-106.542	-107.874	-107.288	-106.953	-105.067	-105.122
1961	5.4	16.3	18.9	16.7	15.7	5.2	20.7	10.2	8.9	10.0	12.2
1962	10.2	28.5	33.3	20.1	20.5	16.8	34.2	26.5	21.4	6.4	8.3
1963	7.5	15.0	18.4	13.6	15.8	5.5	16.3	13.8	11.3	2.8	4.3
1964	7.0	15.9	25.0	16.0	14.0	5.8	16.3	13.2	10.1	11.6	9.6
1965	12.8	29.7	31.7	21.6	26.3	15.9	26.5	23.7	24.7	8.5	12.5
1966	5.1	17.1	18.4	12.7	10.1	5.2	21.7	11.3	11.5	3.0	3.8
1967	8.2	16.9	20.6	16.2	16.3	6.9	24.5	15.5	15.0	1.5	3.8
1968	7.4	22.0	25.5	16.7	17.0	7.3	23.7	18.3	15.0	10.8	14.1
1969	8.3	26.1	25.7	13.4	15.2	6.0	34.8	23.7	17.8	7.8	9.4
1970	11.0	18.2	32.9	21.4	24.7	9.4	21.8	19.1	17.4	8.2	13.0
1971	8.5	15.3	37.3	19.5	23.0	8.7	23.8	15.6	14.8	3.4	4.1
1972	8.6	7.9	25.6	17.4	17.7	11.0	20.3	10.6	13.6	0.9	4.1
1973	5.8	24.9	22.6	15.0	11.7	8.3	27.2	22.3	13.6	9.1	11.7
1974	9.9	16.8	33.0	19.6	18.5	10.0	21.9	17.3	15.6	9.3	9.5
1975	8.8	30.3	30.8	17.6	21.4	13.1	29.8	26.5	17.8	9.7	14.3
1976	8.1	22.4	18.7	14.8	14.7	8.4	22.8	17.5	14.1	7.6	8.2
1977	4.5	3.8	12.5	12.8	10.5	2.0	9.8	9.0	6.2	5.8	6.4
1978	10.4	29.0	39.6	22.0	26.4	9.8	36.7	22.1	19.6	7.2	8.5
1979	11.7	31.1	29.4	18.1	18.3	15.3	33.6	26.8	22.2	8.5	11.1
1980	10.2	33.5	30.1	22.0	19.6	11.4	32.4	28.5	24.1	9.6	13.4
1981	4.3	7.3	16.5	11.7	8.7	6.7	15.2	12.6	8.5	2.4	4.6
1982	7.3	22.7	36.4	19.0	15.9	12.2	39.5	20.3	19.1	8.0	10.9
1983	7.6	19.5	31.5	21.5	18.8	8.5	38.8	22.6	14.5	11.0	16.0
1984	11.0	24.9	35.3	24.6	22.0	14.8	30.4	26.3	22.0	15.1	14.1
1985	6.6	23.1	26.8	19.1	15.3	10.7	33.9	23.8	19.0	7.6	12.4
1986	8.4	21.0	25.0	20.1	21.1	8.4	35.2	14.8	23.3	0.6	5.1
1987	4.8	21.3	18.1	16.3	12.0	9.0	31.4	14.2	15.4	14.7	17.1
1988	7.4	16.1	25.3	20.1	16.6	9.2	24.6	14.3	11.1	1.6	6.8
1989	5.4	25.5	24.6	18.7	12.4	8.7	29.3	17.8	13.1	2.1	9.8
1990	7.4	11.4	24.6	13.4	14.5	8.4	19.6	9.8	7.3	2.3	8.0
1991	8.8	23.8	25.3	18.1	11.6	10.1	26.8	15.9	12.4	5.4	12.8
1992	7.2	13.9	22.9	21.1	11.8	8.6	24.3	16.0	11.7	9.7	11.6
1993	10.8	30.3	28.1	22.7	20.2	13.4	42.0	27.4	24.0	14.7	18.9
1994	7.3	18.1	20.8	17.0	16.1	9.3	21.6	13.1	11.8	5.7	13.8
1995	6.3	30.5	24.6	14.8	16.5	13.2	33.8	24.8	20.6	3.7	12.9
1996	10.5	18.8	36.6	25.3	27.7	15.2	23.6	14.3	21.0	1.1	9.4
1997	9.5	25.5	36.6	19.7	20.5	12.6	33.6	22.4	19.1	0.1	12.0
1998	4.9	17.7	26.8	18.4	16.4	9.1	30.3	21.2	12.2	8.6	9.6
1999	3.5	18.2	22.9	14.0	15.9	6.6	20.7	9.1	10.2	0.0	2.2
2000	9.8	17.5	30.8	17.4	16.3	9.4	21.8	16.1	13.0	8.7	9.2
2001	7.1	18.4	20.5	18.5	15.4	9.7	18.1	13.9	10.9	3.8	11.1
2002	4.0	8.4	16.4	10.9	9.6	5.7	15.5	11.2	9.8	0.2	4.5
2003	11.8	15.4	25.3	20.5	20.1	9.3	22.7	15.6	13.4	7.1	11.3
2004	1.5	18.1	20.7	12.4	11.2	4.8	23.0	10.7	11.2	0.0	4.7
2005	8.0	28.0	21.8	16.4	12.2	8.8	46.9	25.6	17.9	13.9	17.7
2006	7.9	17.6	35.5	20.9	21.3	12.9	23.6	19.8	15.2	2.1	5.1

State	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Idaho	Idaho	Idaho
Station Id	05m03s	06m22s	06m17s	07m16s	07m14s	07m33s	07m29s	08m07s	16a04s	15b21s	15b02s
Latitude	37.209	37.019	37.479	37.722	37.847	37.892	37.799	37.892	48.057	47.532	47.458
Longitude	-105.200	-106.452	-106.802	-107.260	-107.727	-107.713	-107.924	-108.195	-116.231	-115.776	-115.706
1961	11.1	15.1	26.8	6.3	12.8	24.1	13.4	15.9	40.6	14.9	36.1
1962	11.4	32.0	41.7	9.0	16.5	32.4	19.2	23.1	43.3	18.2	41.1
1963	8.4	16.8	21.5	1.3	11.0	21.1	15.6	18.6	24.9	6.9	22.2
1964	9.2	20.3	20.3	4.0	11.5	20.6	11.2	13.2	47.9	17.8	40.4
1965	13.1	33.8	50.5	10.3	19.6	31.2	19.9	18.9	41.8	17.5	40.0
1966	12.1	25.6	36.6	4.4	11.5	20.6	13.0	12.8	38.4	13.8	33.6
1967	5.6	26.9	29.1	0.0	12.0	17.2	12.0	10.5	51.6	18.1	39.5
1968	10.9	21.8	30.8	8.3	17.6	28.5	16.8	15.4	31.7	6.8	27.6
1969	12.8	35.0	36.8	7.4	18.7	29.3	21.9	21.0	45.2	20.2	43.3
1970	10.1	16.2	26.8	2.2	14.9	25.8	14.6	16.7	37.9	13.4	33.2
1971	6.5	12.5	23.3	2.1	12.0	23.7	12.0	13.4	47.1	22.6	48.4
1972	8.9	10.8	26.8	3.5	11.2	24.0	11.3	10.7	46.0	24.1	54.3
1973	17.3	30.0	43.5	10.5	18.4	29.0	19.7	19.0	27.7	4.0	20.5
1974	9.0	25.0	28.0	2.4	11.4	20.3	14.6	16.8	58.5	20.8	46.1
1975	14.5	27.7	45.6	10.9	22.4	34.7	22.5	22.2	46.4	21.5	41.7
1976	9.5	25.6	34.9	6.0	14.9	26.9	15.8	20.7	41.7	18.6	38.4
1977	6.9	7.2	9.2	0.0	6.1	10.0	4.3	6.5	19.0	7.7	18.3
1978	17.2	32.8	29.9	4.6	19.9	32.6	20.3	21.3	33.1	10.5	31.7
1979	17.8	42.5	57.5	17.4	27.0	36.9	22.7	24.0	30.8	13.5	31.9
1980	17.6	48.4	50.1	9.4	20.8	31.1	22.2	25.2	27.9	9.7	26.0
1981	8.7	15.0	20.6	3.3	8.3	16.3	10.9	11.6	25.2	2.5	17.2
1982	12.2	35.0	45.6	3.7	16.1	32.6	18.8	22.8	43.4	15.5	37.0
1983	19.1	33.3	38.5	6.0	18.3	29.3	19.3	20.0	43.9	10.1	32.4
1984	17.5	35.8	31.6	5.9	18.5	30.5	20.0	7.7	28.6	7.0	25.0
1985	17.6	41.1	48.3	8.1	18.5	33.4	21.1	23.5	41.0	16.0	36.3
1986	6.7	26.6	40.5	7.4	14.4	21.8	16.6	18.3	22.0	5.6	25.7
1987	13.2	25.9	37.9	12.8	17.0	31.3	15.4	21.8	29.8	8.5	25.3
1988	9.3	21.8	23.6	2.7	10.2	21.3	9.1	11.3	27.1	8.0	25.3
1989	13.0	25.2	37.9	8.2	16.0	24.2	14.1	17.7	37.6	13.4	30.2
1990	11.4	13.8	19.0	3.3	7.1	12.9	7.1	7.2	39.7	11.1	33.8
1991	15.9	34.9	37.1	5.1	14.2	22.2	18.3	20.0	36.2	8.9	30.4
1992	17.6	27.6	27.8	7.8	14.8	25.9	17.0	18.6	28.9	0.0	23.4
1993	18.4	37.7	41.6	7.6	21.9	32.3	24.5	25.6	29.0	3.7	30.1
1994	14.8	26.8	26.9	3.6	11.2	19.3	11.5	15.2	24.6	7.5	21.4
1995	16.7	38.2	42.6	4.5	21.1	28.6	19.9	24.2	32.7	0.0	25.2
1996	8.7	21.7	20.2	0.6	15.1	25.6	15.0	13.8	30.5	7.8	25.6
1997	9.8	30.2	36.1	6.9	19.4	28.0	21.3	27.7	56.1	17.8	49.9
1998	13.1	24.9	32.1	6.2	13.6	21.1	13.4	17.9	27.5	7.7	25.3
1999	3.8	13.9	26.2	0.8	9.4	18.3	7.2	5.8	51.2	18.5	45.4
2000	12.2	15.8	17.5	5.2	14.9	22.1	16.2	14.3	40.2	13.7	31.7
2001	13.3	25.7	31.4	9.0	13.4	19.9	12.7	14.5	18.0	8.9	18.4
2002	6.3	11.1	10.0	0.0	7.6	14.6	5.9	7.4	44.2	19.9	44.9
2003	14.2	26.1	21.6	0.0	11.6	17.5	12.7	14.7	31.0	4.2	20.6
2004	7.4	22.2	30.8	0.2	14.1	21.1	12.7	10.2	37.2	9.9	25.8
2005	19.3	36.3	48.3	8.8	20.3	28.1	18.7	19.9	24.8	2.4	15.0
2006	8.7	18.7	20.8	4.5	13.5	22.4	13.0	13.0	36.4	9.7	30.0

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	15b14s	16c01s	16c20s	15c04s	15c06s	15c16s	15c09s	14c05s	14c04s	15d06s	15d01s
Latitude	47.072	46.950	46.840	46.566	46.481	46.764	46.563	46.634	46.466	45.697	45.189
Longitude	-115.958	-116.340	-116.122	-115.742	-115.634	-115.295	-115.288	-114.581	-114.633	-115.230	-115.973
1961	66.2	6.8	46.2	28.0	55.3	51.6	47.6	34.5	25.0	19.0	35.6
1962	71.0	15.4	49.8	37.3	59.3	58.2	53.8	42.8	29.2	12.2	40.6
1963	49.9	3.4	28.0	12.0	43.5	43.8	40.3	24.1	22.5	15.9	27.5
1964	78.2	21.4	59.6	39.2	67.3	60.4	55.8	43.3	32.1	33.3	33.3
1965	83.0	15.5	52.4	35.0	61.6	63.4	58.7	41.7	32.6	34.5	49.3
1966	59.6	11.4	44.3	22.9	49.6	47.1	43.4	30.2	26.4	22.1	31.9
1967	73.8	12.7	48.7	34.8	55.1	59.2	54.7	41.8	32.5	28.9	42.0
1968	57.7	4.5	30.1	15.5	42.4	49.2	45.3	26.5	24.9	28.6	31.4
1969	82.5	13.8	44.9	33.3	51.3	51.1	47.1	34.2	28.4	27.9	40.0
1970	57.5	11.5	45.8	27.4	53.4	52.5	48.4	33.4	23.6	24.0	37.9
1971	76.6	14.0	55.0	34.1	64.0	64.6	59.8	39.9	33.1	32.9	50.9
1972	92.6	20.1	62.0	50.1	77.7	83.1	77.1	56.0	43.7	39.6	43.9
1973	47.1	4.6	28.6	16.8	44.2	39.5	36.3	22.3	19.9	27.2	31.1
1974	107.5	20.9	70.4	44.4	66.4	64.3	59.5	45.4	35.3	43.1	60.8
1975	77.6	19.2	49.4	38.6	58.5	60.5	55.9	38.0	30.5	34.7	44.0
1976	69.5	17.8	51.3	35.0	58.5	59.1	54.6	42.1	34.6	34.5	39.0
1977	33.6	6.8	26.9	16.6	33.8	33.0	30.2	18.0	15.5	18.8	13.3
1978	55.6	6.8	31.4	21.2	45.3	49.9	46.0	31.0	27.2	26.0	36.6
1979	51.3	13.3	38.5	28.6	46.5	49.1	45.2	35.7	27.5	22.6	30.2
1980	51.0	6.8	34.3	18.8	42.4	44.9	41.3	29.0	25.1	20.9	44.5
1981	43.5	1.3	23.2	5.8	30.6	28.2	25.7	15.7	17.8	13.9	24.0
1982	71.2	14.3	46.0	33.0	60.4	58.5	54.1	37.7	34.9	30.7	48.2
1983	62.5	4.3	37.2	22.5	45.8	43.4	39.9	24.3	23.3	19.1	47.7
1984	54.0	9.6	39.2	22.5	45.8	45.5	41.9	22.6	23.0	30.5	37.1
1985	64.4	17.1	45.6	36.5	53.1	51.2	45.1	30.2	27.2	22.1	36.7
1986	49.7	5.4	28.6	17.0	37.5	41.3	34.7	23.5	24.6	18.8	32.6
1987	51.6	5.1	27.4	19.3	33.8	36.4	32.7	20.6	18.0	15.9	20.6
1988	46.7	7.0	29.9	18.5	37.2	40.4	39.2	26.2	24.0	22.3	27.5
1989	56.9	16.8	43.5	36.4	54.8	49.2	49.5	30.2	28.1	24.3	34.7
1990	54.1	11.1	38.1	22.8	46.4	49.4	42.9	28.7	24.3	20.4	22.1
1991	74.4	7.5	39.2	21.2	46.3	49.5	48.8	29.0	26.7	21.4	24.0
1992	49.7	0.0	28.3	6.4	34.4	37.8	34.3	18.2	18.5	14.3	18.1
1993	46.8	7.9	33.3	19.5	37.9	35.1	34.2	18.8	19.3	18.1	30.5
1994	34.7	6.8	23.5	16.8	30.0	30.1	30.2	18.4	17.0	18.4	18.3
1995	51.0	5.9	32.0	19.8	41.0	41.4	38.9	22.3	24.4	16.6	38.1
1996	53.9	7.0	28.8	16.9	39.9	45.7	46.2	33.9	30.5	26.6	37.5
1997	96.0	17.9	65.5	41.4	76.2	81.7	74.3	51.7	39.9	31.8	50.1
1998	41.4	4.4	27.0	20.8	32.0	36.3	33.8	20.5	20.0	17.4	26.4
1999	77.3	12.0	57.6	37.6	64.2	76.9	66.4	46.3	35.7	25.4	51.3
2000	57.1	10.8	46.4	33.7	52.3	53.2	53.5	31.8	24.8	22.1	33.1
2001	26.8	5.2	21.3	17.8	30.6	26.2	26.2	14.9	15.0	16.2	12.8
2002	74.1	18.3	52.9	39.3	54.4	60.2	47.7	34.1	27.8	19.8	36.3
2003	43.8	1.5	34.4	20.2	45.5	50.8	55.3	34.3	30.4	28.1	34.2
2004	47.7	6.2	36.6	27.2	45.6	41.8	47.4	25.5	22.9	18.4	29.4
2005	34.3	0.0	18.8	8.1	26.4	27.9	33.9	15.4	15.1	12.4	20.1
2006	54.3	5.7	33.7	26.3	44.7	49.2	49.5	32.3	26.4	22.4	42.1

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	16d08s	16d09s	16e11s	16e05s	16e10s	15e02s	15e04s	15e11s	15e08s	15e09s	15f01s
Latitude	45.072	45.043	44.952	44.771	44.606	44.626	44.545	44.303	44.288	44.051	43.932
Longitude	-116.454	-116.133	-116.143	-116.249	-116.980	-115.794	-115.563	-115.234	-115.655	-115.443	-115.666
1961	29.4	30.5	19.5	26.8	26.7	33.8	43.3	23.2	14.6	27.3	31.6
1962	29.2	33.3	21.7	33.4	24.6	39.2	43.2	27.8	22.1	32.9	36.0
1963	16.2	21.6	10.0	13.3	11.1	24.8	37.0	15.2	6.1	17.7	11.5
1964	28.0	28.4	21.3	26.1	23.5	31.2	40.4	26.3	22.0	31.1	34.3
1965	35.9	41.0	25.8	32.2	25.0	48.8	64.1	41.6	26.5	49.5	54.8
1966	26.8	29.5	18.8	28.2	19.8	29.7	40.2	24.1	19.3	28.4	28.0
1967	28.0	36.3	22.6	28.0	25.9	38.5	55.9	28.2	21.2	33.3	35.3
1968	22.3	27.5	17.5	18.3	19.3	27.2	34.2	22.8	16.8	26.8	21.7
1969	29.4	33.6	25.0	34.4	31.1	44.2	62.1	31.2	27.8	36.9	42.5
1970	31.1	32.4	22.6	29.9	29.0	41.7	54.5	29.8	25.2	35.3	40.3
1971	39.4	44.5	30.1	36.5	43.8	48.3	81.3	38.6	35.8	45.9	54.6
1972	29.7	39.7	24.0	32.5	30.7	46.2	60.0	39.6	20.9	47.1	56.8
1973	22.8	25.8	15.9	18.9	22.2	25.4	40.4	22.7	14.2	26.7	26.0
1974	41.0	47.6	27.6	35.2	39.2	51.9	88.6	42.6	26.8	50.7	51.8
1975	34.7	37.0	25.0	30.8	33.0	42.5	55.2	32.9	27.0	39.1	47.8
1976	28.5	31.9	22.0	30.1	22.8	40.7	49.1	31.1	24.6	36.8	43.7
1977	14.2	9.4	8.3	15.7	9.3	9.7	7.4	9.0	7.5	10.2	7.8
1978	20.3	30.8	20.9	29.9	26.2	40.4	52.3	30.5	17.7	36.1	37.9
1979	23.7	25.0	17.3	23.5	22.5	26.6	31.8	20.4	14.6	24.0	25.0
1980	22.3	39.2	19.7	24.0	25.0	41.1	55.7	30.7	22.9	36.3	39.6
1981	17.8	19.0	15.3	14.5	17.9	22.8	34.0	20.3	13.0	22.9	17.3
1982	32.1	39.4	23.1	27.8	33.6	47.8	67.4	34.7	21.8	38.6	49.8
1983	32.0	38.9	28.2	37.0	39.2	45.4	68.1	33.9	26.4	40.9	48.9
1984	27.1	30.2	22.8	20.8	28.9	31.4	42.5	26.4	20.6	30.7	38.0
1985	23.1	29.7	16.8	24.8	24.8	32.4	43.3	26.6	18.6	27.2	31.8
1986	21.1	30.3	17.3	24.2	22.3	43.0	51.2	31.3	14.1	38.8	45.8
1987	14.4	16.0	11.3	13.2	13.3	20.5	26.4	15.6	9.0	15.5	16.8
1988	16.3	18.6	12.9	16.6	14.8	19.8	31.8	18.8	10.5	21.5	26.7
1989	24.6	29.2	24.8	23.1	32.9	36.0	45.5	28.3	14.7	32.5	40.0
1990	16.2	20.1	11.4	14.9	14.0	22.1	29.9	18.2	9.0	20.2	20.0
1991	16.7	19.5	12.5	14.2	13.2	22.4	28.0	17.8	9.1	19.4	20.8
1992	7.9	17.6	11.2	11.2	5.7	25.9	31.9	16.3	5.8	18.2	18.9
1993	21.4	28.0	18.9	23.8	27.3	35.9	42.4	26.8	15.6	32.3	38.8
1994	13.3	17.9	12.7	14.2	14.0	20.7	23.4	15.7	10.3	19.4	20.7
1995	25.7	26.4	23.8	27.2	26.5	37.0	53.5	29.2	17.5	32.3	39.3
1996	20.6	32.9	16.8	21.2	16.1	35.5	54.8	31.5	15.0	33.3	33.0
1997	29.8	38.5	25.4	24.4	25.6	44.1	65.0	39.2	20.2	42.5	43.9
1998	18.4	24.7	16.1	23.8	22.9	31.9	39.6	20.3	12.6	23.6	24.4
1999	36.3	47.1	26.7	38.9	37.9	46.4	59.0	35.4	17.9	40.0	42.7
2000	21.7	30.6	18.1	21.8	25.9	31.3	38.7	24.3	12.6	28.7	30.7
2001	7.9	14.1	7.9	7.8	10.2	15.2	17.3	11.3	4.9	14.5	16.2
2002	26.0	33.2	19.5	25.3	27.1	29.4	38.4	25.7	13.7	28.2	32.2
2003	21.3	35.1	17.3	22.9	17.6	34.3	44.7	29.2	12.8	27.5	27.5
2004	17.3	31.2	17.9	17.6	19.3	28.1	34.5	20.2	11.2	23.6	32.1
2005	13.4	17.9	10.9	16.5	14.4	20.7	27.6	15.7	9.9	17.0	18.4
2006	30.0	37.2	22.2	30.6	36.6	42.7	55.4	33.9	19.7	36.8	40.9

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	15f14s	15f04s	15f05s	16g01s	16g07s	15g02s	14g02s	14g01s	13g01s	11e37s	11e36s
Latitude	43.954	43.757	43.629	42.765	42.600	42.013	42.181	42.164	42.321	44.437	44.533
Longitude	-115.274	-115.239	-115.438	-116.900	-116.559	-115.003	-114.287	-114.193	-113.616	-111.993	-111.411
1961	12.3	25.4	33.4	15.1	3.9	12.3	16.4	14.9	18.9	12.2	24.1
1962	20.9	34.9	43.5	18.1	4.6	13.9	22.7	26.2	26.3	21.3	33.5
1963	0.1	24.9	29.1	0.0	0.0	4.9	8.6	7.5	9.3	6.6	16.7
1964	22.4	29.3	32.9	20.5	9.2	13.2	21.2	21.6	22.4	17.2	26.8
1965	29.9	54.3	62.6	19.0	4.1	13.2	23.8	25.9	27.1	23.6	32.9
1966	12.7	24.6	34.8	5.7	1.1	8.4	11.9	10.7	12.5	15.2	22.2
1967	12.6	31.7	41.1	15.5	2.6	13.5	13.2	15.9	17.1	23.1	31.2
1968	7.3	21.3	23.3	3.6	0.0	6.8	10.5	11.9	14.5	18.9	22.4
1969	19.2	40.3	48.0	28.4	12.6	19.0	18.9	18.3	18.0	39.2	32.9
1970	19.4	33.3	42.7	18.8	5.2	12.2	23.3	25.6	24.4	17.2	27.5
1971	24.1	50.9	58.0	19.4	5.3	13.7	24.8	28.7	29.7	30.5	38.2
1972	31.1	45.1	51.9	24.6	4.2	14.7	33.4	40.5	40.1	21.3	29.5
1973	9.4	24.1	32.7	10.8	4.9	13.4	21.6	22.9	21.9	16.3	22.4
1974	26.1	55.8	67.8	22.5	4.3	9.9	25.2	33.9	35.5	20.8	44.7
1975	26.3	38.4	50.2	26.7	9.7	12.5	24.4	30.1	29.0	24.7	29.5
1976	23.6	33.8	39.6	18.5	8.2	10.2	22.0	27.4	26.9	16.1	32.3
1977	4.0	4.3	9.7	6.3	0.0	6.9	8.4	4.0	7.7	5.7	11.0
1978	20.5	36.2	44.9	13.1	4.1	12.1	19.2	19.0	23.1	16.0	31.9
1979	12.1	22.7	29.2	20.0	5.8	11.6	19.6	20.8	15.9	15.7	26.0
1980	18.8	35.0	43.5	26.6	8.0	14.7	21.5	22.3	23.1	16.9	28.1
1981	4.7	17.5	26.5	9.0	0.0	5.3	12.0	8.5	10.0	16.0	19.8
1982	21.8	48.4	55.7	25.5	10.3	17.7	28.1	41.1	38.3	19.3	36.5
1983	23.6	43.8	54.7	34.6	7.5	16.9	24.6	28.2	31.5	30.5	37.3
1984	19.3	31.3	38.3	35.7	11.5	23.3	32.0	47.7	33.5	15.2	24.6
1985	17.8	27.7	35.4	22.1	8.6	17.4	20.8	22.0	21.1	15.5	27.2
1986	16.6	39.5	50.8	22.1	2.3	10.4	19.1	19.5	35.6	13.7	34.0
1987	5.3	18.5	22.3	12.2	0.0	10.1	10.6	10.1	12.9	8.8	16.5
1988	11.8	22.6	28.2	14.4	0.0	12.5	16.1	12.0	20.1	9.6	22.0
1989	15.3	33.5	43.0	31.7	4.8	16.6	23.6	23.6	27.9	23.6	38.4
1990	7.5	19.7	23.9	7.8	1.0	12.5	10.2	8.0	12.4	9.4	20.3
1991	9.5	20.1	24.9	14.9	1.2	9.8	14.7	12.2	16.6	8.7	19.5
1992	0.0	18.0	19.2	0.0	0.0	3.0	3.6	5.5	12.2	11.3	23.5
1993	11.9	33.2	43.2	23.1	2.3	11.2	18.1	18.1	32.5	16.4	30.8
1994	12.0	18.9	21.1	10.4	0.0	7.2	11.6	9.3	12.7	8.0	19.9
1995	13.2	38.7	45.3	23.5	2.2	10.6	15.7	14.5	21.2	23.9	42.6
1996	11.8	37.3	44.9	17.4	5.8	15.6	21.2	20.0	28.4	12.9	32.3
1997	15.9	46.3	65.4	23.1	2.6	15.7	26.9	25.0	45.0	19.9	52.3
1998	12.2	28.4	34.2	17.2	4.2	13.2	18.2	15.8	30.9	12.9	25.4
1999	17.7	39.1	47.1	29.2	6.6	13.8	20.0	17.2	26.0	17.7	36.1
2000	13.9	27.7	33.7	13.9	6.0	16.0	18.5	15.1	27.0	13.4	23.8
2001	2.4	15.6	19.6	5.7	0.0	8.5	11.4	8.9	11.5	7.6	14.1
2002	11.7	27.4	38.2	18.7	6.4	14.8	20.9	19.4	27.4	12.7	24.4
2003	8.2	29.9	34.9	5.3	0.0	7.4	10.6	8.2	14.3	9.8	19.4
2004	7.0	23.5	33.9	11.5	1.2	11.3	20.2	14.8	24.6	14.5	27.0
2005	5.0	19.9	25.6	8.7	0.8	7.7	16.7	15.5	21.4	17.0	26.5
2006	15.6	39.7	51.3	19.7	10.9	21.6	28.2	26.3	44.7	18.6	37.1

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	11e10s	11f02s	11f11s	12g17s	12g18s	11g32s	11g30s	11g06s	11g33s	11g05s	11g01s	13d16s
Latitude	44.420	43.570	43.209	42.757	42.260	42.051	42.525	42.361	42.413	42.562	42.953	45.670
Longitude	-111.385	43.570	-111.688	-112.478	-112.125	-111.602	-111.956	-111.561	-111.166	-111.298	-111.359	-113.953
1961	13.8	12.6	14.0	14.5	6.3	22.7	21.1	17.6	7.3	12.5	7.2	13.6
1962	18.0	17.9	17.9	19.8	12.0	33.3	24.7	30.9	17.0	22.0	11.5	16.6
1963	8.3	9.4	13.9	8.5	6.2	22.0	14.5	18.4	7.3	15.9	7.0	8.8
1964	14.5	18.2	18.1	18.1	15.8	26.7	26.5	27.2	12.8	19.7	11.8	22.9
1965	18.5	19.8	19.5	15.2	14.8	41.1	30.6	38.6	16.7	27.0	14.5	27.6
1966	10.9	12.4	10.5	10.8	6.7	23.1	19.2	18.9	9.5	16.1	9.7	11.3
1967	17.6	16.5	17.0	17.4	10.2	31.5	28.8	28.2	12.9	22.1	14.7	20.5
1968	12.5	15.9	14.0	14.4	11.1	31.2	26.3	27.8	9.4	17.3	13.1	15.2
1969	20.7	17.8	22.2	19.4	17.3	33.7	30.2	33.0	13.9	22.0	14.3	20.2
1970	17.4	20.9	18.5	15.0	11.5	29.3	28.1	27.8	11.0	20.6	14.4	19.8
1971	22.2	21.4	23.7	23.1	16.1	51.2	35.2	44.1	17.9	30.6	19.6	26.4
1972	14.8	20.6	19.1	23.3	7.7	42.6	34.4	37.2	18.3	26.5	17.4	28.5
1973	12.7	15.5	17.4	16.6	16.1	24.1	25.6	24.5	11.0	20.1	13.2	13.9
1974	19.8	21.5	19.1	20.7	10.8	38.1	28.1	33.0	11.6	17.1	16.1	24.4
1975	18.5	19.1	17.4	23.8	16.6	32.4	29.8	32.0	14.3	23.6	15.9	23.9
1976	19.1	23.5	23.2	21.5	15.4	34.7	30.2	31.2	16.2	26.2	18.5	21.5
1977	6.7	7.2	5.1	8.2	4.8	16.2	11.3	9.4	4.3	8.9	6.9	6.0
1978	16.4	18.8	14.8	13.8	9.9	37.2	24.9	33.1	16.0	24.6	17.6	20.5
1979	17.7	17.8	16.8	18.4	15.9	31.4	27.5	26.0	15.6	20.9	16.5	17.5
1980	14.6	13.9	17.3	19.4	15.7	36.1	31.3	30.8	13.4	22.7	14.2	13.3
1981	10.2	8.4	7.1	11.6	4.8	16.6	13.5	12.4	4.4	12.0	8.4	11.7
1982	21.3	21.8	25.6	28.5	18.6	37.7	31.6	43.6	18.3	28.0	20.6	24.1
1983	21.0	16.5	19.8	21.1	12.7	30.3	23.7	31.7	12.2	18.8	13.0	19.8
1984	15.6	17.8	16.8	27.7	20.3	34.1	29.8	38.3	14.1	21.0	16.8	20.8
1985	17.0	16.5	15.9	16.4	9.0	35.2	25.5	27.0	12.9	17.8	16.0	17.5
1986	16.1	14.2	11.3	16.5	11.4	41.3	24.3	42.6	16.3	24.3	14.0	15.9
1987	10.2	9.8	8.0	9.9	1.7	17.4	14.1	13.3	4.9	9.1	7.7	9.5
1988	12.2	13.8	10.9	10.2	7.0	20.7	16.4	17.0	11.0	13.0	9.7	14.2
1989	19.0	20.6	17.1	21.5	9.4	31.0	23.1	23.3	11.0	16.1	12.9	18.6
1990	12.4	8.8	8.7	10.4	0.0	19.1	13.3	14.6	5.1	9.5	8.8	14.1
1991	13.5	13.0	11.0	14.6	6.1	21.3	16.6	17.8	6.6	12.4	12.1	14.9
1992	8.8	7.8	3.2	5.1	0.0	15.1	10.1	13.4	0.1	6.6	1.0	14.2
1993	13.6	14.9	11.5	17.1	9.2	29.5	23.5	27.4	9.2	14.6	13.8	13.7
1994	10.5	12.9	7.9	10.0	1.8	22.4	14.6	17.5	6.0	12.1	7.6	11.3
1995	20.5	17.6	12.7	15.9	9.5	30.0	21.9	25.4	7.5	14.4	11.8	15.6
1996	14.3	16.6	14.6	22.1	12.3	36.7	25.7	24.7	11.3	20.4	15.4	23.5
1997	24.2	24.7	21.5	24.1	15.1	36.0	32.5	38.7	12.4	24.6	18.0	31.1
1998	13.3	15.9	12.6	21.4	11.7	29.8	22.9	22.6	9.0	15.6	13.3	13.2
1999	18.4	15.4	14.0	19.1	7.3	31.8	20.8	22.4	11.4	15.8	13.9	21.8
2000	15.0	14.1	12.0	18.0	9.1	24.5	17.6	20.5	8.5	13.9	12.4	16.3
2001	7.7	9.1	6.8	10.6	0.4	12.9	10.1	12.4	1.8	5.8	4.4	10.3
2002	14.5	13.4	12.1	18.2	7.8	22.2	15.8	18.5	6.8	11.7	9.5	14.5
2003	10.2	12.5	9.6	10.3	2.5	21.9	14.7	16.7	6.6	13.4	9.2	20.2
2004	13.0	12.5	10.7	18.9	6.0	19.1	19.6	18.3	3.7	8.6	8.2	14.0
2005	14.4	11.9	18.9	13.0	9.2	27.9	20.7	23.1	8.7	13.6	10.5	9.7
2006	18.4	20.6	18.7	23.0	15.2	42.1	26.6	31.4	12.1	19.3	15.3	20.8

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	14e01s	13e06s	13e27s	13f04s	13f09s	13f03s	14f02s	14f03s	14f16s	14f19s	14f17s
Latitude	44.472	44.415	44.019	43.610	43.626	43.744	43.861	43.824	43.711	43.769	43.877
Longitude	-114.490	-113.398	-113.472	-113.931	-113.969	-113.938	-114.209	-114.264	-114.159	-114.418	-114.673
1961	16.1	7.5	8.5	6.2	11.4	12.0	5.4	20.1	9.2	9.3	14.7
1962	21.0	12.2	13.7	13.5	18.3	18.5	9.9	25.5	15.0	13.7	19.9
1963	16.3	6.1	6.9	7.4	11.6	12.6	6.8	19.3	10.6	8.3	15.0
1964	19.3	14.1	15.7	11.2	13.5	15.7	7.7	21.0	12.2	13.6	19.6
1965	33.0	19.6	27.6	19.7	25.8	30.8	17.4	39.0	22.6	21.8	30.9
1966	16.3	7.3	11.4	10.3	13.4	15.7	7.2	21.1	10.7	12.1	14.5
1967	22.8	14.6	22.0	13.6	21.5	26.5	12.8	28.8	19.5	17.4	20.4
1968	18.3	11.5	13.2	8.9	13.0	13.2	6.6	16.3	9.8	9.1	15.2
1969	26.6	19.2	24.0	25.3	28.2	31.4	17.9	39.8	20.9	22.3	26.1
1970	19.4	12.3	13.2	11.1	14.8	17.5	7.9	26.2	14.0	13.0	17.9
1971	28.3	17.2	20.3	19.6	26.2	28.3	14.2	33.9	19.0	20.0	28.0
1972	27.4	13.8	18.3	7.3	15.0	17.9	8.4	30.1	15.0	13.7	24.7
1973	13.7	8.7	11.5	12.1	13.7	13.6	7.6	17.9	11.5	11.2	13.5
1974	34.7	15.8	20.3	14.8	23.2	28.5	11.6	41.8	20.2	18.6	30.6
1975	22.1	13.2	13.8	15.9	17.8	17.4	9.6	26.6	15.6	16.5	23.4
1976	24.9	12.3	13.1	10.4	13.4	12.6	8.9	24.7	13.7	12.7	20.0
1977	7.3	2.1	4.1	0.0	3.7	3.1	1.5	5.2	3.5	3.9	4.4
1978	18.9	12.6	11.9	13.7	17.5	15.0	7.2	23.7	6.2	14.5	18.3
1979	14.8	11.3	12.6	9.8	11.7	11.3	5.4	14.7	10.3	11.4	12.9
1980	20.1	10.5	13.4	16.4	18.9	19.1	9.9	25.6	16.2	15.3	19.1
1981	13.7	7.6	15.0	8.9	12.2	15.9	8.5	18.9	12.6	12.4	15.3
1982	28.8	16.6	21.1	14.6	22.6	25.3	11.3	36.1	19.3	16.1	26.0
1983	23.1	16.6	22.1	21.3	28.6	27.0	15.4	34.6	22.5	21.9	27.2
1984	19.5	11.0	13.3	12.2	16.3	15.9	10.0	19.1	11.6	16.0	18.1
1985	19.0	8.0	13.3	10.3	14.4	14.7	8.7	18.6	11.3	13.5	16.8
1986	22.8	11.7	15.1	13.5	20.3	21.8	10.7	33.1	17.3	17.5	23.1
1987	14.2	6.3	8.3	4.5	8.1	8.9	4.2	11.4	8.3	8.0	9.8
1988	15.9	9.8	10.8	3.1	9.0	10.7	3.8	14.3	8.7	7.6	11.9
1989	20.1	11.8	13.8	11.2	18.5	17.2	8.7	26.8	14.9	14.6	18.3
1990	14.7	8.1	9.9	4.7	10.5	10.2	5.3	13.1	8.0	9.3	11.4
1991	16.5	7.9	10.0	5.0	11.2	10.1	6.0	12.8	8.5	10.3	10.8
1992	12.9	7.3	12.0	0.0	11.2	11.0	4.8	13.3	7.4	5.6	10.4
1993	17.5	12.0	16.8	9.2	18.1	16.5	9.4	22.8	14.4	16.0	20.1
1994	10.2	6.2	6.7	3.3	7.7	7.9	3.8	10.9	6.5	7.3	8.9
1995	20.8	13.3	19.5	12.2	21.6	23.5	12.2	30.6	18.2	17.6	24.3
1996	27.2	11.8	13.4	10.8	14.6	16.7	9.3	26.3	14.1	13.8	20.4
1997	32.9	14.8	18.1	11.8	24.0	23.6	12.2	41.7	21.8	20.2	29.5
1998	15.7	8.9	12.4	10.0	14.2	14.8	7.5	19.0	10.6	11.5	14.7
1999	26.3	13.0	17.3	11.6	19.9	19.6	10.5	26.1	15.0	17.7	22.3
2000	18.5	8.3	11.6	8.2	13.4	12.7	6.9	19.0	12.1	12.2	15.3
2001	11.2	3.7	9.1	0.0	7.7	8.0	2.9	10.0	5.9	5.4	7.3
2002	18.2	5.9	10.6	7.1	12.2	12.0	7.1	17.9	11.7	11.7	15.0
2003	19.4	4.7	10.0	7.4	14.7	14.2	6.8	21.4	12.8	11.7	17.4
2004	14.6	7.0	10.2	4.4	10.3	12.9	3.6	18.7	8.1	10.2	13.2
2005	13.0	6.9	11.4	7.8	13.3	11.7	7.0	13.5	9.6	10.0	12.1
2006	22.1	14.3	15.8	15.0	23.5	18.9	13.0	30.1	18.1	20.0	25.8

State	Idaho	Idaho	Idaho	Idaho	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	14f12s	14f04s	14f08s	14f11s	15A08S	14A12S	13A19S	13A24S	13A26S	13A15S	13A25S
Latitude	43.875	43.799	43.603	43.484	48.571	48.909	48.802	48.434	48.303	48.131	48.157
Longitude	-114.714	-114.853	-114.674	-114.827	115.446	114.863	113.857	113.937	113.329	113.023	113.946
1961	16.1	26.5	18.2	5.1	24.3	39.1	54.6	14.8	26.5	35.1	38.1
1962	21.1	35.4	25.0	14.9	17.0	32.4	43.5	17.7	29.2	34.1	31.6
1963	16.4	30.9	17.6	4.8	14.3	27.8	38.8	11.8	19.6	28.6	28.6
1964	20.8	35.0	22.2	10.9	19.3	37.9	55.6	17.9	26.4	37.7	42.6
1965	31.7	55.2	38.8	15.9	23.4	40.3	60.0	22.4	38.6	42.7	51.5
1966	16.0	26.7	18.0	10.6	21.4	32.8	50.6	15.5	29.7	32.3	33.3
1967	21.6	38.4	24.8	11.5	28.6	51.2	71.6	21.5	35.8	41.5	54.3
1968	16.6	30.7	17.1	2.7	16.1	32.8	48.2	16.3	23.2	39.8	34.9
1969	27.1	48.0	34.0	23.2	25.1	38.7	37.7	18.8	27.7	36.7	43.2
1970	19.2	36.0	23.5	11.5	19.0	31.0	44.0	17.4	31.5	41.2	43.1
1971	28.9	52.8	42.8	19.7	28.3	42.3	49.7	20.6	42.2	56.6	50.2
1972	25.8	52.0	39.7	8.2	30.3	46.7	69.9	23.9	42.5	55.9	56.3
1973	15.0	25.3	19.3	9.8	16.5	32.8	44.0	13.9	21.2	24.1	34.9
1974	31.4	56.0	37.7	13.3	33.0	50.8	57.5	22.6	29.5	47.8	60.4
1975	24.4	43.1	29.8	15.9	27.1	35.0	51.4	17.1	31.2	42.2	40.3
1976	21.3	36.1	23.2	11.7	24.9	34.0	57.6	17.3	28.4	46.6	38.6
1977	6.3	9.7	4.7	0.0	10.1	20.1	33.6	11.7	15.7	24.7	35.2
1978	19.6	38.7	33.4	14.7	16.3	33.9	35.3	11.4	26.2	32.8	42.2
1979	14.4	25.9	18.8	8.4	17.6	25.0	39.1	16.0	29.4	41.0	37.0
1980	20.3	40.3	27.0	12.6	18.0	32.8	41.0	13.4	24.5	34.0	34.9
1981	16.7	25.5	19.4	0.0	14.8	28.7	42.8	12.0	18.2	27.1	41.6
1982	28.6	53.3	38.9	12.9	26.9	36.4	49.2	18.6	36.3	41.8	41.1
1983	28.0	46.9	38.7	19.3	21.8	35.0	42.2	16.8	25.3	26.1	43.2
1984	20.2	33.5	27.2	15.7	10.7	28.7	33.6	11.6	17.4	22.9	45.9
1985	17.0	30.0	21.8	14.1	18.3	32.0	44.5	19.1	30.0	28.8	41.5
1986	23.3	43.8	34.5	12.3	15.1	30.5	36.0	10.7	21.8	35.1	33.3
1987	12.8	19.1	14.7	2.2	16.5	35.4	38.1	13.7	25.7	30.3	30.1
1988	14.2	25.8	16.5	2.4	14.3	27.1	35.2	13.0	22.0	31.1	29.4
1989	19.3	34.3	27.0	12.7	18.8	39.3	43.4	16.0	26.0	35.1	43.3
1990	12.7	23.6	15.1	2.3	20.3	41.1	51.1	15.8	33.5	42.4	40.2
1991	12.1	21.6	15.1	5.7	23.1	55.4	55.3	16.6	42.1	46.2	49.9
1992	13.7	20.2	16.1	0.0	13.7	26.0	31.8	12.1	22.5	25.1	35.9
1993	23.2	34.6	27.1	11.7	13.4	19.9	29.0	10.9	21.3	22.0	33.6
1994	9.9	19.0	12.6	0.7	13.6	26.6	38.7	13.4	23.2	26.2	28.7
1995	28.2	43.3	33.7	12.2	17.8	38.6	45.7	11.2	20.5	31.5	39.1
1996	22.2	43.1	29.0	11.2	21.1	47.2	52.7	14.2	30.7	39.2	41.1
1997	32.4	52.2	36.8	14.8	32.6	48.0	65.7	24.7	42.2	46.3	72.2
1998	18.1	30.3	21.6	9.2	14.0	33.1	38.1	10.1	17.9	23.0	34.9
1999	24.4	38.9	28.4	15.1	29.0	43.0	58.8	15.8	35.3	44.8	45.4
2000	18.8	30.5	22.6	10.2	17.8	33.3	41.4	15.3	23.4	29.2	42.2
2001	12.0	16.3	13.2	0.0	11.0	19.8	24.0	10.3	14.1	18.9	24.5
2002	16.7	29.9	20.6	8.6	22.1	41.5	51.1	15.9	30.6	40.6	40.5
2003	20.5	34.8	23.4	4.6	16.4	33.1	41.8	14.0	21.7	30.7	36.2
2004	15.8	27.8	19.4	3.0	13.7	30.2	36.1	12.1	20.3	28.8	34.6
2005	17.3	21.0	17.0	6.5	9.0	28.8	31.0	7.1	15.0	19.4	30.9
2006	31.6	41.7	30.4	17.4	17.6	38.3	47.9	14.1	28.2	33.3	45.0

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	12B12S	13B24S	13B22S	13B07S	15C10S	12B14S	12B16S	13C38S	13C31S	09C01S	10C06S
Latitude	47.917	47.685	47.428	47.273	46.975	47.082	47.057	46.883	46.871	46.789	46.780
Longitude	112.824	113.962	113.775	113.756	115.035	112.730	112.595	113.322	113.277	109.512	110.622
1961	20.5	38.0	11.9	47.0	52.3	30.6	9.1	3.6	8.1	4.3	14.7
1962	19.6	41.3	19.8	52.0	51.3	38.1	12.3	9.8	14.4	11.9	21.7
1963	15.1	36.1	12.9	39.3	33.9	25.5	7.9	5.1	10.2	15.3	18.2
1964	23.2	39.8	16.4	56.2	50.4	47	12.4	7.5	15.1	15.7	25.7
1965	31.3	43.3	21.0	57.9	56.0	50.8	13.6	9	17	14.3	27.6
1966	21.4	31.1	11.0	38.9	43.4	25.5	10.5	4.3	11.2	6.5	17.3
1967	30.6	46.4	19.5	61.2	54.8	57.1	16.2	6.5	16.5	16.9	30
1968	19.6	35.2	9.0	43.0	46.3	31.8	9.3	4.4	15.1	14.4	23
1969	17.4	38.5	16.3	47.4	52.3	39.4	13.9	9.3	14.4	8.1	19
1970	20.9	43.0	21.6	52.3	48.6	36.9	10.7	6.7	12.1	21	28.3
1971	30.8	48.0	20.1	63.1	68.3	60.1	16.5	5.8	14	15.8	27.6
1972	35.3	54.8	25.1	68.7	80.7	68.7	18.9	10.4	23.6	10.5	34.8
1973	11.7	31.5	6.9	34.5	34.6	22.1	7.9	1.8	8.5	11.2	13.7
1974	26.9	49.6	20.4	55.0	68.8	50.5	14.6	8	15.3	14	26.3
1975	22.8	36.5	22.0	54.9	51.6	35.8	11.6	8.4	16.6	15.5	23.5
1976	25.2	37.4	18.4	55.9	54.7	41.3	15.5	6.8	16.7	11.2	23.7
1977	12.4	28.2	14.7	37.4	22.8	16.5	7.6	5	8.8	19.1	20
1978	23.5	41.7	16.1	53.3	46.8	32.7	11.6	0.7	13.5	15.7	28.3
1979	23.6	32.6	16.7	49.9	42.1	31.5	16.2	4.8	14	12.1	23
1980	20.2	39.4	13.8	38.2	41.4	25.8	10.2	4.8	12.8	11.9	17.9
1981	14.5	28.4	5.8	34.2	32.4	24	7.4	0.1	8.3	10.4	18.6
1982	28.4	43.3	17.1	57.2	56.6	43	14.2	8.8	21	11.1	25.2
1983	16.8	41.4	9.8	42.1	44.1	26.3	6.9	1	11.2	9.2	17.8
1984	12.3	35.3	9.7	42.2	34.7	19.5	8.1	0.5	10	16	19.6
1985	19.9	36.9	17.7	38.2	43.4	29.3	12.9	3.5	10.7	15.1	22.1
1986	21.3	35.4	8.8	38.9	40.9	28.4	9.4	0.7	10.1	8.2	21.8
1987	18.1	31.3	9.2	32.2	34.0	20.9	8.9	3.2	8.3	8.2	12.5
1988	19.2	27.4	15.0	39.7	37.6	26.3	10.5	1.8	10	13.2	17.7
1989	20.5	37.0	20.1	51.3	43.1	30.6	12.7	7.8	13.9	10.5	20.7
1990	23.6	43.2	12.4	43.6	41.7	32.8	10.9	2.5	12.6	17	24.1
1991	28.1	43.7	15.5	54.8	51.0	39.3	11.7	2.8	12.5	11.7	22.2
1992	15.9	30.5	5.2	34.7	33.9	23.8	8.1	0	8.4	7.4	14.2
1993	15.1	31.2	9.3	33.0	31.3	19.8	9.9	0	8.1	10	18.2
1994	16.2	25.9	9.1	30.6	29.3	18.4	10.8	0	8.3	13.1	20.5
1995	16.1	41.0	7.1	29.4	38.6	25.9	6.7	3.2	8.9	13.9	18.2
1996	26.0	43.5	14.1	49.4	52.0	39.3	12	4.3	14	10	24.1
1997	29.7	64.1	28.7	67.6	70.7	45	19.3	7.7	17.8	14.1	27.8
1998	14.0	30.6	8.3	33.7	31.4	17.8	6.2	1.6	9	8	17.8
1999	27.2	42.2	13.5	51.5	61.4	45.5	14.8	3.1	13.6	11.6	25.2
2000	18.2	35.0	13.7	43.4	39.8	29.9	11.5	7.2	11.9	12.7	18.9
2001	13.3	25.4	12.2	29.5	21.7	17.1	7.9	1.8	9.9	11.7	13.7
2002	24.7	36.1	15.5	53.2	55.4	42.1	14.4	5.4	11	11.5	19
2003	20.0	34.2	12.3	40.2	39.6	34.2	12.2	5.2	14.1	14	21.1
2004	16.8	29.2	15.1	39.4	34.5	39.7	9.5	5.4	9.8	14.1	18.7
2005	11.7	27.5	1.9	28.9	26.1	23.2	0	0.0	7.6	11.7	17.4
2006	18.4	39.2	10.3	45.3	46.6	43.8	6.2	4	11.4	18.7	22

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	10C09S	11C01S	12C13S	12C11S	13C33S	13C13S	14C12S	14C13S	13C03S	13C43S	13C44S
Latitude	46.793	46.560	46.435	46.356	46.465	46.414	46.143	46.143	46.242	46.274	46.097
Longitude	110.675	111.290	112.193	112.262	113.394	113.431	114.505	114.448	113.773	113.164	113.130
1961	6.4	13.9	5.3	11.3	4.8	9.9	39	18.6	22.4	19.1	12.4
1962	9.9	19.8	8.8	15.8	7.4	12.8	43.1	18.7	25.6	23.6	16.9
1963	7.3	14.3	7.3	16.3	6.1	12.8	30.7	12.3	20.4	22.8	15.2
1964	12	21.2	9.3	18.4	6.8	14.7	46	21.9	25.4	23.8	15.8
1965	12.4	20.8	11	22.4	8.1	17.4	52.7	22.8	34.4	31.5	21.2
1966	6.4	15.2	4.7	11	5.5	9.8	29.8	12.7	19.6	16.2	11
1967	14.8	21.1	10.6	16.3	7.8	15	44.7	20.3	29.6	26.2	16.7
1968	10.8	20.1	9.7	17.9	6.5	13.8	39.8	17.8	24.6	27.3	17.8
1969	9.5	18.6	9.9	16	6.4	14.1	40.2	19.2	27.7	25	17.5
1970	15.4	22.6	6.5	15.2	6.1	11.8	41.7	20	26.2	21.8	15.2
1971	13.6	28.8	10.1	19.1	5.2	14.4	54.4	27.2	31.9	25.9	18.6
1972	13.4	28.1	11.3	21.3	9	22.1	63.8	31	42.9	37.9	20.2
1973	5.7	13.2	7.4	11.4	5	9.3	28.6	12.7	17.8	15.9	11.6
1974	12.5	27.3	10.9	17.5	8.3	15.3	55.4	30.9	30.7	22.2	15.2
1975	12	21.1	10.5	15.7	8.1	14.1	47.3	22.7	30	22.2	15.2
1976	9.5	25.2	9.5	19.2	2.1	19	55.1	25.7	33.9	30.2	22.1
1977	12.1	11.8	6.9	9.7	4.9	7.8	24.3	13.5	11.4	14.2	10.8
1978	13.3	24	9	16.6	3.2	13.8	44	18.8	27.9	26.3	14.1
1979	11.1	22.6	10.4	15.4	8	12.6	39	15.6	23.5	20.4	15.3
1980	9.1	18.9	10.2	15.1	5.9	10.8	37	19	22.2	19.7	14.2
1981	5.6	18.7	8.8	15.4	3.2	10.2	24.7	7.9	18.3	17.6	13.7
1982	12	23	11.1	19	9.4	17.3	53.5	25.7	35	26.4	17.6
1983	6.2	22.7	7.8	12.9	4.6	10	35.2	14.2	22.3	19.5	17.8
1984	9.6	22	8.3	11.3	4.9	10.7	31.1	14.7	19.5	20.2	14.4
1985	11.6	20.3	8.2	12.7	5.8	9.8	34.6	17.8	20.1	15.7	15.9
1986	7.3	20.3	7.4	14.1	3.4	9.3	31.4	11.3	23.1	24.3	14.7
1987	5.9	14.3	6.5	10.7	2.5	8.2	29.5	12.4	15.7	15	12.4
1988	9.6	17.1	6.3	11.9	5.3	10.8	36	15.9	20.6	16.7	12.5
1989	10.5	19.9	9.4	12.5	6.7	13.1	40.3	19.5	24	19.2	14.8
1990	10.1	21	8.1	14.8	4.4	11.7	38	16.3	22.5	20.3	12.7
1991	10	17.9	8	12.2	4.9	10.5	38.4	15.8	23	18.3	12.9
1992	6.2	15.2	6	11.8	0.3	8.7	29.4	2.1	18.5	17.2	11.1
1993	7.9	16.1	6	10.9	3.7	8.8	31.5	12.7	16.6	13.9	11.8
1994	10.3	16.3	5.7	10.9	3	9.8	29	13	13.7	14.3	10.5
1995	7.7	21.7	5.6	14.1	1.2	9.3	32.1	11.2	21.4	18.8	15.2
1996	10.4	22.6	8.8	16.2	5.4	16.1	44	14.3	32.1	29.9	15.3
1997	15.2	27.1	9.5	18	7	18	55	31.9	39.5	31.2	18.6
1998	8.9	16.1	5.9	13.3	3	8.2	31.6	12.4	19.9	18.8	12.1
1999	10.5	23.2	6.8	14	4.9	15.3	54.6	21.2	31	23.6	16.4
2000	11.6	16.3	6.1	11	3.4	9.6	41.3	18	21.4	18.9	9.6
2001	7.3	13.1	7.3	12.3	3.8	8.3	23.6	9	13.1	15.2	11.6
2002	9	19	6.3	10.6	4.7	9.1	46.2	19.6	23.7	18.5	11.1
2003	9.9	20.4	8.9	14.4	5.3	12.9	45	17	25.5	23.6	13.8
2004	8.7	18	5.8	11.7	1	7.4	38.3	12	18.8	19.3	11.8
2005	8.4	13.8	7.2	9.1	2.6	7.3	23.4	6.8	12.4	12.4	10.5
2006	12.2	23	7.5	14.6	4.1	11.6	48.5	21.2	25.1	21.6	14.4

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	13D26S	10C08S	10C03S	14D02S	13D22S	13D19S	13D10S	13E23S	12E07S	11E03S	11E24S
Latitude	45.884	46.090	46.112	45.731	45.693	45.174	45.165	44.994	44.793	44.589	44.786
Longitude	113.326	110.434	110.470	114.481	113.968	113.584	113.501	113.444	112.056	111.825	111.710
1961	6.9	13.3	4.7	10.9	20.8	22.4	10	7.7	9.4	9.2	9.5
1962	9.9	17.6	7.3	15.6	25	34.2	12.4	8.5	11.5	14.1	13.4
1963	9.3	14.6	6.4	9	19.8	25.1	9.7	7.1	7.1	7.1	7.1
1964	7.9	20.4	9.7	19.6	26	32.7	11.8	9.8	10.1	10.3	10.3
1965	12.8	21.4	9.6	19.9	32.8	45.5	16.9	18.7	14.6	19.3	18.6
1966	5.8	15.1	6	10.5	18.6	22.6	8.8	9	7.8	10.1	8.7
1967	10.3	20.8	8.7	17.2	28.6	38.6	13.3	10.2	12.4	19	14.3
1968	9.6	19.1	10.1	10.4	27.3	35.4	12.8	10.1	10.5	13.6	12.6
1969	10.6	14.7	5.9	14.5	31.2	38.1	14.3	11.3	15	23.6	20.6
1970	10.7	23	10.7	16.2	27.8	36.7	13.7	9.6	11.4	13.2	14.6
1971	11.6	22.8	8.7	18.3	39.4	51.1	16.4	15.1	18.1	18.4	19.5
1972	15.7	19.5	7.3	24.9	38.3	53.1	18.7	15.6	13.4	14.1	16.4
1973	6	12.6	6.8	9.5	21.1	24.9	9.8	8.5	9.6	10.1	10.6
1974	12.7	20.7	6.8	23.1	39	49.8	15.7	13.8	15	17.4	18.5
1975	10.5	20.1	10.3	19.5	30.7	44	15.1	14.5	12.8	16.3	15.8
1976	11	19	8.2	16.7	32.9	47.9	17.3	17.3	10.4	13.6	14.7
1977	4.8	18.9	8.1	10.8	13	16.2	7.3	7	6.8	4.9	6.1
1978	10.3	21.2	8.7	18.2	29.7	40.5	13.9	13.3	12.4	10.9	15.4
1979	8.4	22.8	8.8	16.3	23.3	33.3	12.4	11.5	10	13.8	13.4
1980	7.8	19.1	9.7	12.5	20.3	26.2	11.4	10.5	11.3	10.8	12
1981	4.5	14.8	4.8	9.6	21.8	24.6	9.9	9.7	8.2	11.1	10.4
1982	12.4	19	8.1	21.6	34.9	41.1	16.5	14.1	17.2	13.6	18.2
1983	8.9	15.3	5.6	13	25.2	26.2	12.3	9.4	14.4	21.6	17.3
1984	6.7	21.9	8.8	13.5	24.2	33.5	11.6	12.3	12.2	9.7	14.5
1985	8	16.2	7.7	14.2	22.6	25.3	11.9	9.8	9.8	11.7	11.7
1986	7	16.1	3.5	12.8	24.5	36.2	13	11.9	11	8.4	13.3
1987	4.9	11	3.2	9.2	15.6	23.5	8.8	8.7	8.1	6.2	9.2
1988	7.1	14.4	6.2	14.7	21	26.2	10.1	10.4	8	6.4	9.9
1989	9.4	17.1	8.3	16	25	33	12.8	10.8	12.3	11.5	15
1990	6.4	18.9	4.6	12.4	22.6	23.2	10.1	8.4	9.5	9.9	9.8
1991	6.4	15.3	7.3	12.6	20.8	24.9	9.6	9.7	7.8	8.7	9.2
1992	5.1	13.8	2.8	8.5	19.8	27.4	9.6	9.8	10	10.3	10.9
1993	6.4	14.2	5.2	10.1	18.9	22.4	9.5	9	11.9	12.1	15.3
1994	5.6	11.9	3.8	10.9	15.8	22.3	9.1	9.3	7.9	6.5	9.6
1995	7.7	18.5	7.5	11	25.2	33.2	13.5	13.6	16.1	15.2	19.4
1996	12.1	20.1	8	17.1	35.5	37	16.6	13.1	11	12.3	13.9
1997	16.4	30	12	22.8	39.2	43.6	19.7	14.5	14.6	13.7	18.8
1998	6.1	14.9	5.8	10.3	20.4	24.2	10.2	9.4	9.6	10.4	14.1
1999	10.7	17.9	4.9	15.7	29.8	32.1	14.3	10.3	10.3	14.5	15.2
2000	8.9	13.4	5.7	14.4	23.7	29	11.6	9.2	9	9.3	13.6
2001	5.5	13.1	5.9	9.5	15	17.9	6.8	8.5	10.1	7.5	9.8
2002	6.9	14.1	6.1	13.8	22.9	24.3	9.1	8.4	7.8	9.7	12.6
2003	9.7	16.5	6.9	17.8	28.7	32.5	15.5	13.4	8.8	7.9	10.6
2004	4.8	15	3.7	11.9	20.1	23.7	9.2	7.8	9.7	10.5	13.2
2005	3.7	14.1	4.6	7.9	15.8	19.7	6.6	7.8	9.5	13.1	11.2
2006	9.9	20.4	8.8	16.3	31.2	30.6	11.9	11.8	11.9	13	16.6

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	11D08S	11E35S	11E31S	11E07S	11E30S	11E29S	11D19S	10D16S	10D13S	10D12S	09D16S
Latitude	45.018	44.508	44.586	44.658	44.611	44.962	45.274	45.401	45.504	45.218	45.194
Longitude	111.846	111.128	111.116	111.092	111.150	111.294	111.427	110.958	110.966	110.237	109.345
1961	16.1	35.7	20.9	7.2	13	24	14.6	19.8	7	17.4	9.1
1962	19.9	49.2	29.6	8.4	20.4	28.2	22.6	27.1	10.7	22.4	26
1963	14.3	22.7	13.6	4.9	8.7	16	17.8	24.5	8.2	16.3	16.5
1964	17.7	36.6	23.3	8.4	15.1	28.9	22.5	27.3	17.4	20	14.1
1965	22.8	48.8	29.1	11.1	20.4	41.1	24.4	31	18.4	27.5	22.8
1966	14.2	33.1	19.9	6.2	12.4	22.6	12.1	19.4	8	15.9	13.3
1967	22.1	38.1	26.7	20.9	21.3	38.9	23.6	27.7	20.1	27.2	22.6
1968	21.2	30.5	19.2	11.7	15.8	26.8	24.5	29.2	15.3	22.5	21.1
1969	20.3	45.3	32	18.6	24.6	33.6	19.2	22.1	8.3	21.6	11.3
1970	21.6	37.4	25.3	12.3	17.8	29	25	32.2	21.3	21.1	20.6
1971	27.5	52.2	36.6	21.8	25	41.4	24	31.4	21.2	31.6	22.6
1972	22.5	48.2	32.5	15.4	23.8	36.5	21.8	27	10.9	25	26.6
1973	16.9	31.4	19.5	10.9	14.5	26.5	12.9	19.6	14.2	16	21.4
1974	25.1	60.2	37.6	19.9	27.4	40.3	30.2	27.9	14	28.3	14.5
1975	21.7	38	25	12.9	17.6	27	20.9	29.3	20.3	23.9	19.5
1976	22.6	44.9	31.6	18.4	22.6	31.9	25	29.2	17.9	29.1	18.8
1977	14.3	17.8	12.5	5.2	8.4	14.9	12.7	22.6	20.4	15.7	15
1978	19.5	43.7	25.4	13.1	20	30.6	20.5	25.8	7.9	22.3	10.6
1979	14.3	36.2	26.1	15.4	19	26.5	15.5	21.2	14	19.6	19.6
1980	17.8	36.8	24.2	12.2	16.4	26.5	19.1	20.6	16	18	19.7
1981	14.6	27	17.2	7.1	12.5	21	11.2	17.2	12	14.4	12.8
1982	21.7	50.1	30.4	16.2	22	33.3	24	26.8	14.8	25.8	15.3
1983	19.6	42.4	27	15.8	18.5	32.5	21.2	23.2	12.9	17.5	19.3
1984	20.3	32.9	18.1	11.7	13.1	27.1	19.1	26	13.8	17.1	18
1985	15.4	36.5	24.5	15.1	18.2	23.2	19.1	20.6	12	18.6	13.1
1986	16.3	43.5	27.1	11	19.2	28.8	17.1	20.5	8.5	23.5	17
1987	15.1	23.3	15.8	8.3	11.5	20.1	12.5	17	10.3	14.8	18.1
1988	13.7	31.1	19.5	8.7	12.8	19.3	17.8	20.8	15.3	15.3	12.1
1989	16.1	51.2	34.2	17.5	21.7	28.8	17.6	19.2	12.6	20.2	13.4
1990	14.1	28.8	20.8	7.3	12.5	24.5	16.4	21.8	12.3	20.2	14.5
1991	15.4	32.2	21.1	8.3	14.1	23.4	16.6	21.1	12.3	17.4	17.3
1992	13.6	32.2	19.9	5.6	12.8	21.2	12.3	16.2	9.3	16.6	14.5
1993	15	36.3	22.1	14.4	16.9	27	14.3	18.4	8.7	17.2	10.6
1994	13.2	30.4	18.7	8.4	13	20	12.3	18.3	8.8	16.8	16.8
1995	21.1	58	33.4	11.2	22	35.1	18.6	20.5	11.7	20.9	17.1
1996	18.5	49	29	11.3	19	33.5	24.2	25.3	10.2	26.4	20.8
1997	21.7	69.9	42	18	25.6	41	28.4	31.7	16.5	33.2	18.1
1998	17.3	37.4	21	9.7	14.4	25.5	16.9	19.4	9.5	19.3	12.8
1999	18.6	50.5	31.3	14.7	20.9	32.2	22	21.9	11.1	26.2	10.9
2000	15.8	36.6	19.9	10.2	15	24.7	17.5	21.7	11.4	19.6	11.5
2001	13.1	23.8	13.1	5.3	8	17	13.7	16.8	9	13	9.7
2002	14.1	38.6	21.7	10.3	15.1	24.6	17	18.7	8.9	20.5	8.6
2003	16.7	31.7	18.8	6.5	11.2	22.7	17.3	21.6	13.1	20.9	20.9
2004	12.3	39.9	25	8.2	16.3	26.1	15.5	16.4	8.8	16.2	11.1
2005	13.1	33.1	19.2	10.1	13.7	19.8	14.4	18.6	8.6	16.0	11.3
2006	15.9	48.6	27.3	13.4	16.1	31.8	22.2	22.7	10	23.9	9.9

State	Montana	Montana	Montana	Nevada	Nevada	Nevada	Nevada	Nevada	Nevada	Nevada	Nevada
Station Id	09D08S	09D06S	10D07S	15H01S	15H04S	17K04S	17H02S	15J12S	15J01S	15H24S	15J06S
Latitude	45.046	45.062	45.006	41.834	41.762	39.292	41.751	40.278	40.893	41.662	40.645
Longitude	109.910	109.945	110.014	-115.452	-115.693	-117.114	-117.532	-115.535	-115.205	-115.324	-115.376
1961	18.9	27.8	7.5	13.6	7.7	17.8	8.4	21.8	17.1	8.5	14.5
1962	27.4	39.5	9.2	23.5	14.4	23.8	11.9	24.9	19.8	17.2	17.5
1963	20.3	29.6	7.5	10.4	0.0	10.3	0.0	11.6	6.7	2.3	10.2
1964	24.8	35.9	9.4	19.5	11.0	19.6	10.8	16.5	12.0	10.8	12.8
1965	34	48.5	13	26.2	8.7	15.4	6.1	20.0	11.8	11.7	16.3
1966	21.2	31	4.9	15.7	6.0	6.9	6.7	14.8	5.6	6.3	9.1
1967	32.5	47.5	15.4	19.8	6.4	14.6	6.1	14.9	14.2	5.9	14.4
1968	24.2	34.4	11.7	15.8	0.0	14.2	1.4	13.9	8.5	6.9	8.7
1969	26.2	35	11.8	28.0	11.0	22.5	16.2	28.5	15.3	18.2	19.6
1970	27.8	37.8	14.8	22.6	10.8	10.2	7.5	15.6	15.2	15.1	12.8
1971	36.4	55.2	16.1	28.2	12.7	12.6	8.7	18.6	16.7	12.7	14.2
1972	31.9	50.8	14.6	25.5	10.9	9.5	4.2	13.8	12.4	16.3	8.9
1973	17.6	26.1	8.3	22.9	8.9	35.0	8.5	23.5	13.8	11.5	17.3
1974	34.9	53.1	13.6	20.7	11.9	16.0	5.0	18.5	14.6	12.4	15.0
1975	26.6	39	13.3	29.1	15.7	28.2	16.3	22.1	26.2	15.6	26.7
1976	31.9	45.6	17.3	22.9	12.7	18.1	8.4	16.3	13.2	11.9	13.4
1977	16	23.9	6.7	10.3	3.1	15.4	2.8	11.4	11.2	3.6	10.8
1978	32.6	40.1	15.1	23.5	9.2	18.3	8.6	20.7	18.0	10.5	15.4
1979	26.2	35.6	13.9	19.1	10.1	19.3	7.9	19.9	22.0	11.8	12.7
1980	23.2	32.8	11.2	27.3	13.7	30.5	10.1	20.4	18.3	15.1	18.0
1981	16.5	23.8	7.4	12.8	2.0	11.9	3.6	12.3	10.4	5.8	9.3
1982	29.7	41.8	13.7	32.0	13.7	16.3	11.8	16.5	23.0	20.8	19.6
1983	23.1	30.1	10.9	28.3	15.7	31.6	16.6	22.6	27.5	17.3	19.5
1984	19.2	26.7	9.2	36.8	18.0	39.3	23.6	31.2	34.0	22.7	26.5
1985	21.8	30.2	10	24.3	9.1	24.5	15.2	14.4	14.6	12.0	16.0
1986	27.8	37.8	10.6	22.3	4.4	19.8	1.6	19.4	9.0	10.8	13.3
1987	16.2	23.4	7.4	14.3	2.3	13.6	6.8	12.8	10.7	6.4	12.4
1988	16.9	27.1	8.5	18.5	6.8	26.1	1.8	15.4	9.1	3.6	9.8
1989	27.4	39.5	12.7	27.8	10.5	19.5	12.7	18.7	19.9	17.8	14.6
1990	21.5	33.5	10.1	15.5	0.0	11.5	5.0	12.6	12.7	6.1	9.9
1991	21.4	29.6	9.4	15.0	2.4	11.9	8.1	12.1	12.4	8.6	13.0
1992	19.5	24.9	9.7	11.4	0.0	19.0	0.0	14.8	6.2	1.7	7.6
1993	17.8	26.7	8	22.8	8.4	15.9	7.9	18.0	13.3	11.7	14.6
1994	19	26.7	8.9	12.0	0.4	11.1	3.2	12.3	8.8	3.7	9.8
1995	24.9	34.6	9.4	20.0	3.9	24.9	7.8	20.0	13.1	7.8	10.4
1996	36.1	46.9	16.1	26.2	10.2	15.4	10.3	20.6	17.4	16.8	18.1
1997	38.2	55.2	15.9	26.0	8.4	13.1	5.7	21.3	11.9	19.1	16.5
1998	23.1	29.4	8	16.2	7.2	22.0	12.2	20.4	17.5	14.2	15.1
1999	27.8	40.1	11.7	18.8	8.0	16.4	11.9	16.3	11.3	10.4	11.0
2000	24.1	31.8	10.9	17.1	8.8	12.3	9.8	16.1	16.1	12.2	14.2
2001	13.2	18.8	4.4	13.5	2.0	18.7	1.7	15.0	7.5	5.3	7.0
2002	21	32.6	7.7	18.2	10.4	16.4	12.8	13.0	12.4	12.3	10.5
2003	26.8	36.4	11.2	16.1	2.0	11.6	0.0	10.9	9.3	3.5	8.9
2004	17.8	28.4	3.5	14.0	3.6	16.5	8.6	14.5	7.6	8.6	6.0
2005	17.0	24.8	6	18.4	7.7	26.2	10.3	24.0	17.8	8.9	14.9
2006	25.5	39	10.2	29.6	14.5	17.4	12.8	19.4	24.0	17.3	21.4

State	Nevada	Nevada	Nevada	Nevada	Nevada	New Mexico	New Mexico	New Mexico	New Mexico	Oregon
Station Id	19K04S	15H14S	15H03S	15H09S	14K05S	06n03s	05n11s	06n04s	06p01s	21d01s
Latitude	39.164	41.873	41.737	41.229	39.132	36.956	36.699	36.512	35.922	45.622
Longitude	-119.897	-115.247	-115.472	-116.029	-114.956	-106.657	-105.341	-106.321	-106.392	-121.704
1961	14.1	14.8	7.2	0.0	8.6	9.4	6.1	18.9	14.2	11.6
1962	28.8	22.5	16.9	4.3	22.4	11.9	10.0	13.6	12.7	27.8
1963	6.3	12.9	0.2	0.0	5.0	6.8	5.3	11.2	8.6	0.0
1964	12.2	20.3	9.7	6.7	9.2	8.2	6.8	10.9	6.9	27.5
1965	20.4	25.6	10.7	0.0	13.1	14.6	9.9	18.2	12.4	8.7
1966	21.1	15.5	4.7	0.3	10.8	6.2	5.3	11.1	7.0	36.6
1967	34.7	18.6	4.3	2.3	12.1	1.1	1.7	9.5	2.9	20.8
1968	20.7	14.8	5.3	0.0	7.5	7.4	9.8	13.5	11.4	0.0
1969	49.8	21.7	18.0	11.7	18.0	17.6	8.7	18.6	10.7	42.5
1970	23.0	20.9	14.6	0.0	7.2	5.6	6.1	11.4	9.1	15.0
1971	22.2	26.2	11.9	0.0	4.9	0.0	0.0	6.9	3.6	34.2
1972	14.4	24.4	15.9	0.0	0.0	0.5	1.4	7.3	5.9	10.5
1973	26.5	22.0	10.6	7.1	14.6	14.6	9.9	19.5	20.6	7.5
1974	28.5	20.6	11.6	0.0	6.7	7.4	5.2	11.1	9.8	30.3
1975	34.2	27.6	15.1	10.6	10.0	19.2	9.7	18.7	14.7	33.8
1976	10.7	23.3	10.9	0.0	5.6	9.0	8.6	12.4	6.4	25.4
1977	8.8	11.8	1.7	0.0	4.8	0.0	3.7	5.3	5.7	10.0
1978	33.5	18.4	9.4	0.0	19.7	13.3	7.8	19.0	8.2	5.3
1979	20.6	13.4	15.3	7.5	13.3	17.7	11.7	20.0	17.7	14.4
1980	28.3	22.8	12.6	2.7	14.8	24.5	10.5	22.1	14.5	23.5
1981	15.2	11.8	3.4	0.0	13.0	3.8	4.9	8.0	11.0	0.0
1982	34.8	28.2	19.3	10.4	19.1	16.1	9.3	15.7	9.9	14.4
1983	52.7	20.3	17.8	11.6	26.5	13.6	10.8	17.8	15.5	12.4
1984	29.0	31.7	25.3	16.3	15.5	13.2	8.7	21.6	7.5	15.4
1985	22.3	22.3	11.1	3.8	14.7	13.3	10.5	19.0	14.8	33.6
1986	38.0	19.6	8.8	0.0	11.7	7.1	2.1	13.3	3.8	17.3
1987	14.7	15.9	4.1	0.0	8.7	8.9	12.5	12.4	15.9	12.6
1988	4.9	20.8	4.4	0.0	7.3	9.4	4.9	13.5	6.9	15.7
1989	25.5	24.8	12.4	4.2	8.0	2.7	6.2	10.6	3.1	25.8
1990	11.2	17.8	6.8	0.0	6.0	3.2	7.4	8.4	4.3	14.9
1991	14.6	17.6	6.6	0.0	9.7	12.9	11.6	16.1	10.6	7.1
1992	11.2	16.0	0.0	0.0	12.4	12.0	10.0	17.3	12.6	0.0
1993	33.8	22.9	12.4	0.8	16.8	15.9	10.1	17.1	14.8	23.6
1994	10.3	13.7	4.8	0.0	10.8	7.5	9.6	13.9	8.0	15.3
1995	45.3	18.6	8.8	0.0	21.0	9.4	8.1	17.3	8.8	12.4
1996	34.2	24.0	14.2	6.3	10.6	1.5	1.5	9.3	3.1	18.7
1997	26.1	26.1	12.6	2.6	12.5	7.7	6.5	11.2	5.1	25.8
1998	32.1	19.0	11.9	2.9	19.8	6.6	7.1	10.3	8.6	16.4
1999	31.9	18.5	10.2	0.0	9.3	0.0	0.0	5.2	0.1	26.1
2000	22.0	18.4	11.8	1.6	14.2	5.4	7.4	8.5	4.5	22.9
2001	9.3	17.6	4.9	0.0	10.4	9.4	8.4	9.7	10.8	13.0
2002	19.2	20.5	11.2	5.8	8.4	0.8	0.0	4.9	0.0	26.7
2003	14.3	13.6	5.6	0.0	9.4	7.2	7.5	11.3	6.0	2.0
2004	19.0	19.7	7.3	0.0	8.1	0.6	0.0	6.7	0.3	22.4
2005	35.8	16.5	12.5	5.1	25.7	15.3	12.8	14.8	14.3	2.3
2006	35.3	24.8	18.7	9.6	15.4	4.2	4.1	6.6	0.8	26.9

State	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon
Station Id	21d04s	21d14s	21e06s	21e05s	21e13s	22e43s	21f21s	22f04s	22f03s	21f10s	22f14s
Latitude	45.464	45.041	44.420	44.435	44.144	43.901	43.804	43.612	43.590	43.512	43.449
Longitude	-121.704	-121.933	-121.857	-121.945	-121.641	-122.031	-121.949	-122.118	-122.060	-121.980	-122.138
1961	43.2	13.8	38.7	18.5	23.0	26.3	34.6	17.4	28.7	9.3	33.1
1962	51.8	18.5	52.6	30.9	35.2	39.1	44.2	26.0	40.9	13.6	48.7
1963	7.7	0.0	0.0	0.0	0.0	7.9	11.8	4.9	11.2	0.0	10.7
1964	69.8	26.9	58.1	35.8	26.8	41.2	46.0	27.5	42.9	17.3	51.3
1965	45.8	17.7	40.4	20.0	25.6	35.5	39.3	23.6	37.5	9.4	44.3
1966	64.4	26.6	60.7	38.0	28.2	37.4	43.2	24.9	39.3	12.9	46.6
1967	35.8	15.5	44.8	23.9	19.9	32.5	36.1	21.6	34.6	13.0	40.6
1968	19.1	0.0	20.9	2.6	10.4	15.0	20.2	9.7	17.9	3.1	19.3
1969	73.9	34.0	57.1	34.8	30.1	38.6	44.4	25.7	40.5	18.0	48.1
1970	39.6	11.8	26.3	7.4	19.8	21.7	26.9	14.2	24.3	10.5	27.4
1971	71.5	31.6	67.0	43.7	33.8	53.0	54.2	35.5	54.3	20.6	65.8
1972	69.5	22.8	57.8	35.4	28.0	41.2	56.4	27.5	42.9	7.4	51.3
1973	26.4	6.4	24.5	5.9	10.6	18.8	23.0	12.3	21.5	4.0	23.9
1974	92.0	30.0	66.5	43.3	35.4	48.7	61.6	32.6	50.2	21.5	60.5
1975	43.8	18.8	52.3	30.5	32.6	45.1	48.4	30.1	46.7	19.6	56.1
1976	60.0	22.4	46.9	25.8	25.6	41.7	50.0	27.8	43.4	15.4	51.8
1977	24.4	11.2	31.0	11.6	8.0	12.8	22.5	8.2	15.8	2.0	16.6
1978	21.4	0.0	0.0	0.0	7.1	10.9	16.2	6.9	13.9	0.0	14.2
1979	40.0	8.8	30.5	8.9	14.9	17.7	18.8	11.5	20.5	3.5	20.1
1980	48.9	13.2	26.3	8.6	9.4	12.9	30.5	8.3	15.9	1.9	16.8
1981	8.4	0.0	13.0	1.6	6.2	6.3	18.8	4.4	13.8	0.0	8.5
1982	48.1	13.7	53.5	31.0	29.3	38.2	46.2	27.7	44.6	15.2	48.4
1983	43.6	8.1	27.9	15.0	25.5	32.2	40.9	19.6	38.6	17.5	43.0
1984	48.2	9.6	39.9	16.6	25.1	30.7	44.2	22.3	35.6	12.1	51.1
1985	65.8	22.6	48.1	32.4	24.3	42.8	49.6	29.0	42.5	14.4	44.2
1986	37.3	6.2	33.9	8.6	19.8	27.4	38.8	8.6	26.8	4.1	34.1
1987	40.6	5.0	38.3	14.5	18.0	26.4	34.2	15.4	30.6	4.9	36.6
1988	45.3	13.5	35.6	12.1	14.5	23.1	31.7	14.4	25.7	0.0	32.9
1989	56.9	18.3	54.2	27.8	18.5	47.0	47.7	29.8	47.0	12.9	55.9
1990	45.4	12.5	29.9	8.3	9.3	22.6	15.1	15.9	24.9	0.6	30.0
1991	32.5	3.4	25.9	3.8	8.4	19.9	18.7	12.6	20.7	1.8	27.5
1992	9.4	0.0	10.9	0.8	5.3	0.3	12.5	0.0	11.3	0.0	25.6
1993	45.4	13.3	45.0	10.5	25.9	26.0	46.1	22.6	35.6	15.1	50.3
1994	41.3	6.1	27.5	6.3	10.9	21.6	23.7	11.2	21.4	0.0	22.5
1995	35.3	8.9	39.0	4.8	19.4	24.6	36.4	17.1	25.2	5.6	36.1
1996	37.6	9.6	48.3	0.0	16.1	19.5	34.9	12.1	21.5	2.3	35.2
1997	77.2	18.6	48.3	17.4	28.3	36.2	46.8	20.3	34.1	3.6	46.7
1998	50.2	8.9	35.1	5.5	17.8	22.6	29.6	11.6	25.0	11.8	35.2
1999	65.0	27.7	68.5	34.8	42.9	59.3	59.4	33.3	49.8	24.2	62.9
2000	52.9	18.7	45.4	14.7	18.8	36.1	42.3	23.2	38.6	10.2	40.0
2001	29.4	3.9	21.0	0.0	9.5	15.0	18.6	10.8	18.5	0.0	22.6
2002	73.0	0.0	53.8	21.4	26.4	37.5	43.2	30.0	42.2	12.8	46.0
2003	28.4	2.0	23.7	2.6	7.8	11.4	28.2	3.7	19.2	0.0	30.5
2004	49.3	15.1	27.8	0.0	22.2	33.6	46.5	18.0	34.9	6.3	45.9
2005	9.3	1.7	8.8	2.2	7.1	10.0	24.7	3.7	19.4	2.5	24.2
2006	53.0	21.6	39.5	17.0	27.2	42.2	45.6	26.0	43.5	22.6	48.8

State	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon
Station Id	22f18s	21f22s	23g09s	21f12s	22g21s	20g02s	20e02s	19e03s	19d02s	18d06s	18g01s
Latitude	43.188	43.226	42.724	42.956	42.053	42.696	44.429	44.447	45.191	45.275	42.753
Longitude	-122.140	-121.806	-123.200	-121.181	-122.855	-120.802	-120.331	-119.930	-119.254	-118.848	-118.688
1961	22.5	8.0	2.6	9.1	25.0	21.6	7.1	17.4	22.1	12.3	18.6
1962	28.2	11.2	6.7	12.9	28.7	25.0	15.8	18.7	31.5	14.7	19.4
1963	1.4	1.0	0.1	0.9	7.8	8.5	0.0	0.0	8.8	8.2	7.5
1964	26.5	11.4	7.6	13.2	22.3	18.1	9.1	22.3	26.5	14.7	21.0
1965	22.2	5.2	0.8	5.9	25.7	24.1	8.2	23.1	37.4	20.2	29.9
1966	29.7	12.7	4.7	14.7	36.1	18.6	8.4	14.1	24.0	12.2	9.5
1967	20.3	10.5	5.0	12.1	31.4	22.9	9.9	19.0	26.4	12.8	19.4
1968	12.7	1.8	0.0	1.8	23.1	12.9	0.0	9.2	13.0	4.3	6.4
1969	28.0	11.6	15.5	13.3	44.1	23.7	11.3	18.6	30.1	15.8	25.8
1970	16.8	3.5	0.0	3.9	27.4	20.5	7.4	24.9	27.4	14.0	22.3
1971	31.7	13.8	12.5	16.0	37.0	23.9	10.4	23.3	28.9	12.9	28.4
1972	26.1	4.2	0.0	4.7	27.2	20.7	7.8	19.0	42.4	19.7	25.9
1973	11.7	5.9	2.8	6.6	21.5	14.8	6.3	15.4	13.5	8.6	18.8
1974	32.3	11.4	5.3	13.2	45.6	27.9	11.3	24.4	34.9	14.0	23.6
1975	33.8	16.3	12.6	19.0	40.7	23.5	15.3	27.4	33.1	15.1	26.3
1976	25.4	7.1	2.4	8.1	19.4	16.5	11.1	22.7	23.1	14.1	19.5
1977	6.7	1.2	4.2	1.2	10.2	5.2	3.3	10.8	10.1	8.2	2.6
1978	11.3	3.3	0.0	3.6	25.8	12.8	5.7	14.0	18.1	9.3	18.8
1979	9.2	0.0	0.0	0.0	18.0	11.9	8.2	20.5	22.5	11.7	20.9
1980	10.8	1.4	2.0	1.4	23.4	19.5	9.0	20.2	21.4	6.7	33.8
1981	1.2	0.0	0.0	1.6	14.4	12.4	4.1	10.8	11.5	4.1	11.8
1982	21.8	8.2	2.8	13.9	32.5	23.0	13.9	24.3	35.3	17.8	32.5
1983	23.7	13.9	1.8	25.7	58.1	35.7	18.3	30.7	39.2	13.0	40.8
1984	19.1	9.2	0.0	8.3	35.2	19.1	15.0	23.6	29.9	14.6	32.1
1985	23.3	8.1	10.9	11.7	34.8	23.0	13.9	18.3	26.9	13.9	22.1
1986	4.8	2.1	0.0	4.4	25.3	18.1	11.2	14.4	21.0	3.5	19.8
1987	13.8	2.3	0.0	6.7	27.1	9.8	12.9	17.1	23.6	10.1	11.6
1988	0.0	0.0	0.0	0.0	18.1	13.8	1.5	10.0	15.1	7.0	9.2
1989	20.1	8.8	3.9	10.7	32.0	25.5	13.3	18.3	28.8	17.6	33.0
1990	3.4	0.0	0.0	2.1	15.3	12.3	2.6	6.6	10.0	3.1	5.7
1991	6.3	2.4	4.2	3.7	23.4	10.3	3.2	7.7	13.2	6.5	7.4
1992	0.0	0.0	0.0	0.0	12.5	9.0	0.0	1.4	1.3	0.0	0.0
1993	16.6	10.0	0.0	11.7	35.6	23.2	12.7	19.3	26.5	6.3	24.4
1994	3.5	0.0	0.0	0.0	19.4	11.4	2.8	7.5	11.8	0.8	12.5
1995	6.1	2.4	1.6	8.1	42.7	22.1	3.9	12.0	23.1	0.4	14.9
1996	1.0	0.7	0.0	6.5	25.5	22.7	4.5	11.4	18.6	3.1	20.8
1997	10.7	0.0	0.2	2.5	25.2	26.7	4.2	8.7	19.4	1.7	14.6
1998	11.6	5.4	1.3	9.1	34.8	23.2	10.2	15.7	22.2	7.0	17.6
1999	39.7	15.9	16.7	22.7	40.8	31.5	14.1	20.1	29.1	8.1	28.9
2000	18.5	6.1	0.5	11.9	30.8	19.7	11.1	15.6	15.7	9.0	16.4
2001	2.0	0.0	0.0	0.8	11.3	8.1	3.8	7.8	12.4	2.3	9.0
2002	15.9	6.6	2.4	9.7	30.8	13.0	7.7	9.9	15.9	6.7	19.0
2003	2.7	0.0	0.0	1.3	28.6	15.1	0.8	7.9	13.5	0.0	6.1
2004	10.8	2.2	0.1	5.8	32.9	16.0	9.2	11.5	17.7	1.5	11.9
2005	0.6	0.3	0.9	7.3	23.0	15.6	4.2	10.7	9.4	0.4	9.4
2006	22.2	16.2	8.0	23.6	37.9	28.7	17.0	25.2	23.6	9.0	15.4

State	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon	Oregon
Station Id	18g02s	18e18s	18e16s	18e09s	18e08s	18e05s	18e03s	18d08s	18d20s	18d04s	18d09s
Latitude	42.710	44.210	44.248	44.656	44.764	44.831	44.869	45.191	45.364	45.558	45.146
Longitude	-118.626	-118.638	-118.517	-118.426	-118.312	-118.188	-118.114	-118.550	-118.467	-118.454	-118.219
1961	27.1	10.1	15.6	16.0	10.8	17.8	9.7	2.3	12.0	1.8	12.0
1962	28.0	11.5	19.1	20.2	15.4	22.3	10.3	5.8	14.2	4.7	14.4
1963	14.5	0.0	7.4	5.7	0.4	7.2	0.1	0.0	8.0	0.0	7.1
1964	29.8	15.4	15.6	21.2	13.0	22.8	14.8	7.1	14.2	12.9	14.4
1965	39.8	16.2	24.5	20.5	14.1	25.5	17.6	6.6	19.5	2.4	13.8
1966	16.7	6.5	11.1	13.4	12.6	16.4	13.3	5.1	11.9	6.2	10.4
1967	28.0	11.8	17.8	16.2	10.4	15.9	12.1	4.1	12.4	0.0	10.5
1968	13.2	1.3	9.1	6.6	5.9	8.9	7.1	0.0	4.3	0.0	5.5
1969	35.2	11.4	18.4	19.3	14.1	21.3	15.0	4.7	15.3	11.1	15.5
1970	31.3	18.2	23.4	20.6	16.0	22.9	14.7	3.4	13.5	0.0	8.2
1971	38.2	16.5	23.0	23.0	21.1	23.7	14.5	3.2	12.5	3.9	10.8
1972	35.3	11.8	20.8	17.7	12.0	22.6	10.8	1.9	19.0	0.0	18.6
1973	27.3	7.9	12.5	14.0	7.7	12.7	6.9	2.0	8.4	0.0	4.9
1974	32.7	17.6	27.3	24.6	16.6	28.0	16.8	4.1	13.5	7.4	16.2
1975	35.8	21.0	25.1	27.1	18.4	25.7	16.0	6.1	14.6	6.4	14.3
1976	28.1	15.8	17.8	21.2	13.4	20.9	13.7	7.3	13.6	11.1	11.0
1977	9.0	2.9	5.8	9.0	6.0	7.4	3.3	4.6	8.0	7.2	5.9
1978	27.3	6.4	11.0	12.3	8.0	12.9	9.0	0.0	9.1	0.0	4.2
1979	29.6	14.0	20.1	16.9	14.1	24.1	12.3	4.8	13.0	2.6	8.1
1980	36.8	15.5	20.1	14.3	11.2	20.8	12.4	2.8	11.4	4.0	10.0
1981	16.0	1.3	13.8	9.7	1.8	15.4	0.6	1.1	4.9	0.0	1.6
1982	42.6	19.6	27.9	20.5	13.7	22.0	16.0	5.0	14.4	10.6	14.1
1983	49.8	22.1	27.2	20.6	13.3	30.9	19.6	0.8	9.9	0.0	8.7
1984	48.0	17.6	24.1	21.5	14.0	25.7	16.5	3.8	12.9	6.5	17.0
1985	26.1	12.4	21.1	19.6	11.6	19.0	13.1	8.1	14.4	11.6	12.7
1986	34.1	9.1	15.5	13.4	1.7	18.6	7.7	0.0	2.5	0.0	2.8
1987	22.8	8.7	10.7	11.8	3.8	12.7	4.7	0.8	10.6	0.0	8.7
1988	21.1	1.7	7.4	11.7	2.2	13.8	5.9	1.5	6.9	0.5	8.1
1989	41.5	15.6	25.1	21.3	12.0	22.6	13.7	4.1	16.8	12.9	15.6
1990	13.5	0.9	13.5	8.4	0.0	10.8	1.5	0.0	1.1	0.0	4.5
1991	21.4	3.4	13.2	7.2	1.4	13.4	5.1	0.7	3.0	0.0	3.2
1992	13.6	0.0	1.9	0.4	0.0	5.0	0.1	0.0	0.0	0.0	0.0
1993	39.2	9.9	18.0	3.8	8.0	20.2	12.0	0.0	5.5	5.5	7.8
1994	16.6	2.7	10.0	8.9	0.0	10.5	3.8	0.0	2.5	0.0	8.0
1995	38.5	8.3	16.1	11.9	3.3	16.7	4.0	0.0	2.2	0.8	7.6
1996	33.5	5.5	11.9	6.3	2.1	8.1	4.2	0.2	2.2	0.0	0.5
1997	38.7	8.0	17.0	11.2	3.4	18.1	6.6	0.0	4.4	0.0	11.3
1998	35.4	11.6	15.7	11.6	4.9	13.8	7.0	0.0	5.8	0.0	16.1
1999	39.1	14.6	26.2	14.2	13.5	23.4	15.9	2.7	6.4	3.7	11.8
2000	24.0	13.0	18.5	15.4	9.3	18.1	13.4	1.4	9.5	3.2	12.8
2001	17.9	4.9	9.0	7.8	0.4	6.6	3.4	0.0	0.0	0.0	5.5
2002	28.8	8.0	16.3	15.5	9.5	13.4	12.4	4.0	8.3	9.5	13.8
2003	19.1	1.6	11.3	10.8	0.0	8.9	0.6	0.0	1.8	0.0	6.0
2004	30.7	8.8	16.3	14.4	0.0	14.4	5.1	0.0	5.3	0.0	15.2
2005	20.8	3.4	7.6	7.8	0.2	4.7	3.4	0.1	0.4	0.0	6.0
2006	41.2	16.2	25.6	16.4	15.3	18.3	13.2	0.5	8.0	1.4	15.1

State	Oregon	Oregon	Oregon	Oregon	Utah	Utah	Utah	Utah	Utah	Utah	Utah
Station Id	18d19s	17d06s	17d07s	17d02s	11h36s	11h37s	11h08s	11h57s	11h55s	11j11s	11j64s
Latitude	45.697	45.272	45.077	45.214	41.898	41.685	41.376	41.466	41.413	40.975	40.837
Longitude	-118.107	-117.687	-117.551	-117.193	-111.630	-111.419	-111.944	-111.497	-111.538	-111.809	-111.709
1961	23.3	25.1	21.5	26.4	28.5	14.8	25.4	22.0	15.1	21.8	14.9
1962	22.4	27.6	29.9	29.8	48.1	24.5	53.3	36.7	28.1	35.4	28.5
1963	7.7	9.4	9.6	19.0	32.5	16.8	23.7	24.1	17.8	20.5	15.5
1964	32.6	30.1	25.5	25.0	34.5	19.2	31.1	28.2	21.0	23.9	18.2
1965	22.4	32.2	35.2	36.2	55.8	21.0	40.8	34.1	23.5	38.6	25.6
1966	22.4	17.6	23.2	21.9	34.9	18.0	33.0	27.2	19.4	22.1	15.5
1967	20.1	27.5	25.3	29.9	43.2	18.9	28.9	27.5	20.7	23.0	21.3
1968	2.4	15.9	13.3	23.4	34.0	18.1	32.5	25.4	19.6	30.5	15.7
1969	26.8	25.6	28.7	32.2	45.0	26.7	53.1	32.2	31.1	36.4	22.7
1970	24.8	31.3	26.3	24.8	40.3	19.8	35.4	27.0	21.8	30.3	20.6
1971	25.6	34.7	27.5	36.5	56.6	27.4	45.6	43.7	32.0	38.7	23.4
1972	28.1	37.9	39.7	31.5	56.2	23.7	45.6	36.7	27.1	37.6	26.4
1973	12.3	18.4	13.8	19.9	32.9	23.0	56.8	29.5	26.2	33.7	23.0
1974	40.6	35.8	33.0	40.9	42.5	22.2	38.2	34.5	25.0	30.9	24.6
1975	25.6	33.7	31.4	29.6	38.7	28.7	49.5	33.5	33.7	40.6	25.8
1976	30.8	30.9	22.4	27.0	44.6	22.3	40.1	28.8	25.1	34.2	19.0
1977	10.7	16.5	10.8	11.9	16.6	12.4	10.9	16.2	11.9	17.6	8.8
1978	12.4	24.1	18.0	22.8	42.1	25.0	53.8	31.6	28.8	38.8	24.1
1979	25.8	30.1	22.0	19.0	42.8	24.6	45.9	26.8	31.9	38.7	24.8
1980	28.2	23.9	23.0	25.6	40.7	24.8	56.3	32.7	29.5	43.4	35.1
1981	15.1	12.8	8.9	19.9	20.2	10.9	22.5	15.3	9.6	24.0	13.5
1982	42.1	35.4	28.2	31.0	52.8	30.9	53.1	33.6	26.0	44.1	32.8
1983	36.7	27.2	32.6	29.6	36.7	17.3	54.1	27.9	25.1	43.5	29.9
1984	20.6	28.5	23.9	28.6	47.3	27.4	68.7	37.2	27.7	38.3	26.8
1985	32.3	30.0	25.7	24.8	38.7	23.0	40.8	35.6	30.4	34.3	26.7
1986	13.5	25.1	17.6	27.7	53.2	32.6	60.3	39.0	38.5	43.0	30.2
1987	19.5	24.1	15.0	22.1	16.7	13.3	26.0	20.0	15.6	20.1	16.9
1988	18.3	26.3	18.1	22.3	26.9	17.2	21.0	25.6	18.3	16.1	13.9
1989	33.5	34.5	32.2	25.3	43.1	20.3	45.8	35.3	29.5	40.9	25.3
1990	14.7	18.6	15.1	22.5	24.3	13.8	24.6	22.4	11.0	23.7	16.4
1991	13.5	23.9	16.7	21.3	28.3	15.1	31.3	26.1	13.1	28.6	20.4
1992	0.0	9.9	4.5	17.0	16.9	8.8	17.2	18.8	5.9	21.1	12.9
1993	25.0	22.3	23.5	25.7	35.7	19.5	41.5	36.0	17.8	35.1	27.0
1994	20.8	20.5	15.1	23.0	26.8	15.8	26.8	24.8	16.0	25.7	19.7
1995	23.6	26.6	22.9	35.2	33.6	19.9	43.1	35.1	19.6	39.2	31.5
1996	17.7	16.5	15.2	24.7	42.2	25.1	37.5	37.1	21.1	34.0	32.6
1997	36.6	33.0	23.5	41.0	53.9	33.4	68.7	40.6	29.8	51.6	37.4
1998	17.4	20.5	20.5	24.0	41.6	19.9	53.5	30.2	18.7	43.5	31.9
1999	25.5	30.3	24.8	34.6	43.3	21.7	30.9	26.0	17.2	27.5	21.7
2000	26.7	27.7	24.2	25.6	34.5	16.3	36.4	21.4	15.3	39.2	27.1
2001	13.6	15.8	10.7	13.2	22.2	12.2	24.8	17.6	10.6	27.5	20.3
2002	29.8	21.8	20.0	25.8	29.3	18.0	32.8	23.0	13.4	34.0	24.1
2003	17.8	24.6	15.5	21.8	33.1	16.0	23.2	20.2	10.9	23.2	20.3
2004	21.7	26.7	17.9	22.1	27.8	13.5	33.3	21.3	11.8	40.9	28.2
2005	7.3	12.8	12.5	14.3	44.0	21.1	53.2	36.5	23.6	53.1	36.6
2006	27.5	26.1	24.0	29.9	56	25.6	18.8	18.9	25.6	53.2	41.7

State	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah
Station Id	11j52s	09m02s	11j65s	11j57s	11j21s	11k52s	11j02s	11j01s	11j53s	10j52s	09j01s
Latitude	40.762	37.813	40.659	40.599	40.428	39.930	40.885	40.855	40.790	40.678	40.716
Longitude	-111.629	-109.488	-111.637	-111.583	-111.616	-111.631	-111.069	-111.048	-111.118	-110.949	-109.544
1961	12.0	7.2	16.4	18.0	10.8	12.3	11.7	17.2	9.9	15.5	5.8
1962	19.1	14.7	31.6	30.0	30.1	25.7	16.9	26.8	17.9	31.7	17.3
1963	7.0	8.2	17.1	17.4	15.1	11.6	10.8	19.4	10.0	18.7	6.5
1964	17.1	5.1	20.1	21.3	16.9	18.0	14.8	20.2	14.7	18.9	7.0
1965	26.2	14.1	28.4	26.7	26.6	23.3	20.8	32.5	19.3	36.8	10.0
1966	9.7	14.3	17.0	21.2	21.4	18.2	13.4	21.6	10.4	19.4	10.8
1967	12.4	3.9	23.6	25.6	31.2	17.5	16.9	25.2	14.0	28.1	12.4
1968	18.6	19.7	17.3	25.9	24.9	21.1	14.7	21.3	14.8	24.1	13.9
1969	18.5	27.8	25.2	35.7	43.7	29.6	18.9	29.1	20.3	31.4	17.5
1970	17.1	9.1	22.8	24.1	18.0	21.4	15.0	22.1	13.6	22.5	11.9
1971	21.6	9.7	25.9	27.2	17.5	23.6	19.4	30.2	15.0	31.6	13.0
1972	16.1	0.5	29.3	26.8	18.9	11.5	16.4	25.7	12.6	30.5	11.8
1973	17.9	21.4	25.4	25.7	29.0	30.4	14.8	22.3	12.2	23.2	14.4
1974	17.5	9.4	27.3	23.6	17.9	23.4	16.0	24.7	12.4	26.0	7.1
1975	25.7	16.3	28.6	28.6	31.6	21.3	17.3	25.0	15.0	27.7	9.6
1976	19.1	13.2	21.0	25.9	26.5	22.7	16.5	22.3	14.3	24.3	12.1
1977	10.4	1.9	9.5	13.3	7.9	11.1	10.2	12.6	8.3	9.4	4.1
1978	22.0	19.5	26.7	28.0	32.3	27.8	14.3	24.9	14.9	29.1	13.7
1979	18.2	29.4	27.5	27.4	33.2	25.7	13.5	19.8	13.9	25.6	16.6
1980	23.8	27.3	39.0	35.5	40.5	27.5	20.4	30.7	19.6	37.2	19.0
1981	15.2	8.4	14.8	17.0	18.3	13.9	13.0	17.0	13.0	17.3	8.6
1982	25.1	10.5	36.4	36.3	39.2	27.9	20.6	31.9	17.3	36.8	14.1
1983	24.1	27.3	33.2	30.0	26.6	33.1	16.8	28.2	16.6	27.6	18.8
1984	30.7	10.5	29.8	27.5	27.0	38.9	16.6	25.3	18.6	32.0	14.9
1985	21.0	12.2	29.6	28.3	25.1	21.3	17.1	27.5	19.3	27.1	12.9
1986	15.2	11.9	33.6	31.8	39.6	20.8	21.6	39.0	15.7	46.5	10.9
1987	15.3	14.3	18.7	24.6	11.6	20.1	13.3	22.1	11.8	19.0	9.0
1988	12.9	9.0	15.3	17.2	10.7	21.3	14.3	20.9	11.0	19.4	5.5
1989	16.4	9.0	28.9	28.3	19.3	18.3	19.0	26.9	13.5	26.5	9.1
1990	10.3	5.1	19.2	24.9	21.7	19.5	14.6	18.9	13.2	17.4	8.4
1991	16.0	12.1	19.5	22.6	17.3	16.8	14.6	22.7	12.0	18.8	9.1
1992	3.9	20.8	14.5	17.5	10.1	9.9	12.9	18.8	6.3	10.3	8.1
1993	13.1	29.6	28.8	27.7	37.1	24.0	18.5	32.7	17.1	27.3	14.0
1994	10.9	9.4	17.7	19.7	18.1	15.7	11.6	23.0	8.1	14.0	9.1
1995	14.3	20.6	26.6	28.1	28.0	15.0	17.4	25.3	13.3	24.7	13.8
1996	19.6	1.8	28.8	28.2	22.1	19.3	17.6	29.6	20.4	31.7	8.5
1997	16.3	18.7	34.5	26.7	36.2	15.4	22.5	32.3	15.6	34.2	13.4
1998	15.5	13.6	29.2	25.5	23.2	18.4	16.3	23.7	14.3	21.0	12.0
1999	10.3	1.0	19.6	18.5	15.2	10.1	16.1	21.6	12.4	21.0	5.6
2000	14.1	13.4	27.4	19.7	18.0	13.8	13.6	22.5	13.1	22.0	11.1
2001	8.4	11.8	16.7	13.6	8.2	6.8	11.8	16.4	7.6	14.3	7.8
2002	15.3	3.1	26.7	19.3	13.9	12.2	16.3	20.9	13.4	17.0	6.7
2003	8.9	11.9	15.6	17.7	10.7	12.4	15.1	18.7	9.0	14.0	11.6
2004	8.7	7.7	18.0	15.4	16.7	11.8	11.3	16.1	6.4	15.8	5.7
2005	17.3	35.8	35.9	36.3	40.6	19.5	17.4	27.5	17.8	30.0	20.1
2006	22.7	8.1	35.9	33.7	26.3	20.9	18.4	29.7	16.6	30.6	9.8

State	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah
Station Id	09j05s	10j10s	10j18s	11j32s	11j23s	11j08s	10k01s	11k22s	11k21s	11k03s	11k09s
Latitude	40.608	40.597	40.549	40.357	40.295	40.190	39.892	39.893	39.866	39.683	39.310
Longitude	-109.889	-110.433	-110.693	-111.090	-111.256	-111.220	-110.746	-111.251	-111.283	-111.318	-111.433
1961	7.7	7.9	2.9	1.5	11.2	12.7	7.2	8.4	10.4	12.3	10.7
1962	18.2	19.3	11.6	15.6	24.5	24.4	19.6	18.1	25.4	29.0	22.5
1963	7.1	6.7	4.2	6.6	11.6	14.0	6.5	6.0	11.4	14.0	14.6
1964	6.3	8.1	5.1	8.2	14.6	17.9	6.4	12.1	15.7	16.4	11.1
1965	10.9	13.6	7.4	12.8	20.4	25.5	18.6	18.5	25.1	22.9	19.6
1966	11.2	10.9	5.4	6.4	14.7	15.9	12.4	10.2	13.3	14.5	11.1
1967	12.2	11.7	8.0	10.3	20.3	18.3	12.1	13.9	18.6	17.9	11.0
1968	10.3	12.8	8.6	10.1	18.8	20.8	13.7	15.0	18.6	20.9	16.9
1969	19.0	18.6	14.4	20.9	29.2	27.8	19.8	21.5	29.6	31.7	20.4
1970	8.4	9.3	5.9	8.1	13.0	18.2	8.5	13.8	17.8	18.9	16.7
1971	9.8	10.6	4.8	11.3	15.8	21.3	10.0	15.3	21.6	20.6	13.6
1972	11.0	10.2	3.8	4.8	11.3	18.0	12.2	12.2	16.0	12.8	9.9
1973	10.7	13.1	8.4	11.7	19.2	19.8	14.1	16.2	22.1	21.5	21.6
1974	6.4	8.3	4.8	6.5	14.1	18.0	6.4	14.9	18.8	19.6	15.5
1975	9.9	13.6	10.6	13.2	18.5	21.2	14.5	14.8	21.3	25.2	15.2
1976	9.1	9.5	5.8	10.5	16.2	15.9	8.9	15.2	18.4	16.4	9.9
1977	3.3	2.6	2.3	1.7	8.2	7.7	2.3	6.9	8.2	8.8	7.2
1978	12.9	11.9	9.1	13.7	23.6	24.9	15.9	16.0	24.8	27.8	21.5
1979	16.1	12.9	8.0	18.1	23.8	23.3	16.9	17.2	23.6	25.5	16.8
1980	19.6	19.4	12.3	20.3	25.6	28.0	19.6	21.6	27.7	30.8	20.8
1981	10.6	9.4	6.6	1.5	9.5	14.1	9.1	10.2	12.6	13.7	8.2
1982	15.2	15.8	8.6	12.7	20.1	26.1	17.1	20.6	25.1	28.8	20.3
1983	21.5	15.9	12.5	17.3	25.7	24.3	17.1	18.6	24.3	30.7	25.3
1984	12.5	9.4	8.7	17.8	23.1	29.4	11.7	20.3	24.8	31.4	25.1
1985	11.4	12.3	12.2	17.3	20.8	20.3	12.2	18.1	23.3	24.3	17.5
1986	17.5	19.6	10.9	9.7	24.6	23.0	19.1	16.1	26.0	30.1	20.8
1987	7.7	12.7	7.0	5.0	8.7	11.8	8.6	9.6	11.8	9.4	13.3
1988	7.5	8.2	5.1	7.3	15.2	14.4	9.3	11.5	14.7	16.9	11.0
1989	9.1	10.6	6.8	10.3	13.5	17.8	9.2	14.4	16.6	18.0	12.9
1990	11.2	11.9	6.6	6.9	11.1	12.8	10.4	12.2	18.8	16.9	10.2
1991	11.7	12.7	8.2	6.7	12.4	15.9	8.5	14.8	18.7	19.6	10.6
1992	8.5	7.9	3.9	4.5	6.2	6.9	9.1	9.0	8.0	12.0	12.8
1993	19.4	18.9	13.1	14.3	17.4	21.3	16.2	18.9	24.6	26.9	22.8
1994	8.9	10.5	5.1	6.7	10.3	10.1	7.2	11.5	13.3	18.0	10.8
1995	21.8	19.4	6.9	10.9	15.1	16.9	14.1	16.5	20.1	20.2	17.5
1996	8.2	15.2	10.8	12.7	23.9	22.4	12.0	16.0	24.3	23.8	13.2
1997	18.1	16.2	14.4	13.6	23.9	27.3	14.8	18.6	28.6	30.1	16.9
1998	11.8	17.7	9.0	7.9	16.3	18.6	12.6	15.7	19.9	20.5	15.8
1999	9.8	12.2	6.7	4.2	10.0	11.5	5.8	9.6	13.2	12.2	9.1
2000	12.0	12.0	8.7	6.4	17.8	17.2	12.1	9.0	19.0	18.0	13.0
2001	12.9	12.3	5.2	4.1	6.4	8.5	11.0	9.5	12.7	12.1	13.3
2002	7.7	7.6	4.7	3.4	10.4	12.9	4.8	8.9	14.6	12.2	9.7
2003	10.2	9.6	6.9	3.0	10.3	10.3	10.2	12.5	16.9	15.1	10.6
2004	10.8	10.6	3.6	3.3	9.8	10.5	5.6	9.5	11.5	9.5	11.7
2005	25.7	22.9	17.2	12.9	22.9	22.2	21.7	17.6	25.6	21.4	17.0
2006	13.6	13.2	12.2	14.4	24.7	23.7	12.8	17.6	24.3	23.1	16.4

State	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah
Station Id	11k31s	11k13s	11k15s	12l15s	11l01s	11l04s	12l04s	12l06s	12l07s	11m03s	12m13s
Latitude	39.134	39.137	39.046	38.965	38.773	38.680	38.508	38.484	38.302	37.836	37.661
Longitude	-111.437	-111.558	-111.469	-112.249	-111.677	-111.598	-112.019	-112.393	-112.357	-111.881	-112.741
1961	12.7	10.4	8.4	16.5	14.5	6.9	9.6	12.5	15.9	13.8	12.3
1962	22.3	19.5	20.1	26.4	19.9	11.6	16.8	19.2	21.4	14.0	21.2
1963	16.3	12.7	12.8	12.0	12.9	6.8	7.3	8.1	12.0	7.6	6.9
1964	10.5	11.2	6.4	19.0	17.2	6.0	10.8	15.8	10.7	6.1	10.0
1965	21.3	14.3	17.7	24.9	24.4	13.1	16.5	17.4	18.4	8.8	12.5
1966	11.1	5.3	11.0	13.0	11.5	4.9	10.5	13.1	14.6	10.7	10.2
1967	12.5	6.1	10.6	5.5	15.0	5.9	12.4	12.9	15.4	5.0	9.1
1968	16.1	13.8	19.3	26.1	18.6	12.3	15.0	19.4	17.5	13.2	14.9
1969	23.2	18.2	23.5	32.1	21.9	14.7	21.7	25.9	26.7	17.0	26.2
1970	18.4	12.8	17.4	27.8	21.7	12.4	14.1	16.6	18.0	9.7	9.1
1971	17.6	12.1	15.7	25.9	22.3	11.9	11.9	17.5	17.1	8.7	11.1
1972	13.0	0.1	9.5	0.0	16.0	7.8	7.4	7.5	13.4	8.7	6.1
1973	17.3	13.8	17.7	47.5	25.2	12.3	17.3	22.4	22.9	19.6	18.8
1974	18.7	14.7	18.2	29.2	23.3	12.7	14.3	17.2	15.8	8.0	6.4
1975	19.4	15.3	16.1	23.8	21.1	12.3	15.2	14.6	16.9	10.2	15.1
1976	11.1	10.4	9.8	16.5	16.5	8.7	12.0	17.0	13.9	9.6	15.0
1977	8.8	9.9	6.2	17.5	12.8	5.2	7.8	9.5	9.7	2.9	4.2
1978	24.4	18.4	24.7	46.8	22.0	15.0	15.4	19.5	27.3	14.9	16.2
1979	23.1	17.1	19.6	22.1	18.2	12.3	18.9	20.5	26.0	23.9	22.8
1980	27.8	18.0	24.6	28.8	22.4	15.8	21.6	25.6	29.7	19.6	23.0
1981	11.0	3.4	8.3	11.2	16.8	6.7	8.3	13.0	15.3	10.3	10.4
1982	28.7	14.8	20.3	27.3	25.6	15.0	17.8	21.3	26.9	16.3	17.8
1983	28.4	21.6	22.6	47.8	24.1	14.2	21.3	21.8	27.1	19.1	27.0
1984	30.1	22.1	26.3	51.1	29.5	18.1	21.6	28.5	26.2	11.8	21.3
1985	20.3	10.4	16.1	20.9	18.8	11.4	16.6	20.0	19.8	16.0	15.6
1986	22.3	7.8	15.4	21.8	17.3	11.2	13.4	15.2	24.6	9.2	12.0
1987	12.4	12.1	10.3	24.1	20.2	7.6	10.1	17.3	16.3	14.7	13.2
1988	13.6	11.3	9.0	23.4	20.5	7.8	13.3	14.3	16.4	11.8	13.3
1989	14.6	4.2	10.7	14.6	19.1	6.8	12.5	10.6	16.0	7.4	8.0
1990	11.2	7.2	6.7	23.1	16.0	6.4	8.1	11.3	10.2	6.8	8.2
1991	12.4	10.2	10.2	20.2	17.7	6.6	9.7	15.8	16.2	9.2	12.1
1992	15.3	5.5	11.3	16.7	16.1	7.1	10.1	14.2	16.5	18.3	16.5
1993	25.5	12.8	23.7	25.9	22.0	18.2	18.9	22.0	25.6	25.6	28.4
1994	11.4	4.0	7.0	20.0	13.3	6.0	9.3	13.5	11.2	8.7	10.7
1995	20.7	4.5	18.5	20.8	19.3	12.1	16.2	20.2	22.1	20.1	22.3
1996	25.4	9.9	16.5	23.9	17.6	9.4	14.1	14.9	15.5	6.3	12.1
1997	27.7	6.7	17.9	23.6	21.7	9.9	12.2	14.1	21.2	12.9	10.7
1998	19.6	9.1	14.7	31.2	20.5	6.9	16.0	17.7	23.1	14.0	16.6
1999	12.1	1.5	6.8	12.7	15.7	3.6	7.9	9.5	12.0	7.1	8.5
2000	17.7	7.5	11.2	25.5	15.6	8.8	11.6	15.3	13.8	10.9	13.2
2001	13.1	3.0	8.8	13.7	16.1	8.1	11.9	15.5	14.4	19.0	14.8
2002	13.3	6.0	8.5	16.8	12.9	6.7	9.3	8.3	7.5	2.4	5.8
2003	13.9	7.5	11.1	20.2	20.5	8.7	12.2	15.4	14.7	9.0	9.5
2004	11.3	0.3	9.1	18.1	17.3	5.6	11.0	10.0	14.5	10.9	10.1
2005	19.9	7.9	19.8	24.2	22.2	12.1	20.5	21.3	27.9	28.9	31.1
2006	23.9	12.2	19.1	21.4	18.1	10.9	14	15.9	17.3	10	15.5

State	Utah	Utah	Washington	Washington	Washington	Washington	Washington	Washington	Washington
Station Id	12m23s	12m03s	20b07s	20b02s	19a02s	21c28s	21c38s	21c35s	21b10s
Latitude	37.569	37.574	47.287	47.351	48.655	46.642	46.810	46.782	47.274
Longitude	-112.838	-112.900	-120.370	-120.680	-119.838	-121.381	-121.331	-121.747	-121.342
1961	19.7	10.4	18.3	15.1	11.4	27.7	33.4	90.3	47.3
1962	34.7	23.1	12.5	12.4	8.4	22	25.9	70.2	44.8
1963	10.3	7.2	7.6	2	5.7	11.1	11.6	52.6	18.1
1964	14.6	11.7	12.3	22.5	11.9	29.5	35.6	94.4	55.1
1965	21.5	14.3	12.8	17.3	12.1	29	35	73.5	46.8
1966	24.8	15.9	12.6	17.9	8.7	25	29.8	77.4	44
1967	21.3	12.0	12.4	11.2	15.3	24.6	29.3	86.4	44.5
1968	26.7	17.8	12.9	3	11.9	10.5	10.9	59.9	30.3
1969	43.8	34.5	13.6	21.9	10.7	29.9	36.2	79.3	57.4
1970	16.4	13.1	14.9	18.7	11.9	25.1	29.9	65.9	41.9
1971	18.9	12.0	16.5	29.5	17.5	40.2	49.7	111.9	75.1
1972	17.9	7.1	19.5	27.6	14.8	46.2	57.5	106.7	78.5
1973	36.9	26.0	8.7	7.2	9.4	13.1	14.2	52.2	25.1
1974	16.6	12.4	17.8	33	21.7	35.8	43.9	107.9	67.2
1975	24.8	19.3	14.4	23.8	13.6	31.7	38.6	84.3	58
1976	22.7	16.8	10.5	22.2	9.4	28.1	33.8	87.2	47.7
1977	8.6	6.1	3.4	7.3	3.8	9	8.8	40.1	21.4
1978	34.1	29.4	15.9	9.5	10.9	18.1	20.7	63.9	36.1
1979	45.0	32.8	8.1	12	3.7	18.2	21.3	58.8	36.3
1980	39.8	30.2	13.2	12.5	13.5	23.6	28	64	41.3
1981	13.4	13.2	6.6	0	10.6	17.3	3.3	39.1	11.1
1982	29.9	21.1	26.2	20.8	18.8	28.8	35.5	77.7	53.4
1983	45.5	32.4	18.6	21	19.2	28.8	32.8	85.2	36.3
1984	19.1	9.1	13.9	18.1	12	23.3	27.9	56.5	42.7
1985	31.1	19.6	11.2	19.8	8.1	25.9	31.5	71	52.3
1986	24.3	11.2	16.1	12.4	6.8	18.8	23.1	51.9	34.6
1987	23.0	17.8	8.9	14.4	8.5	17.3	23.6	58.2	41
1988	21.0	10.4	7.2	16.3	7.7	21.1	24	63	41.8
1989	17.4	3.9	13.2	18.6	10	21.1	29.7	82.9	48.8
1990	15.6	10.0	7.9	18.5	6.2	26.2	26.2	78.2	57.5
1991	21.3	17.4	10.8	12.2	6	17.9	19.5	67.4	38.4
1992	26.2	13.6	10.1	6.4	5.1	11.7	15.6	53.7	26.1
1993	45.9	29.6	12.4	12.5	8.1	17.9	21	55.1	33.1
1994	18.1	8.1	9.9	12.8	7.5	20.7	23.5	57.7	36.5
1995	40.5	24.7	17.4	18.8	16.1	24.5	25.4	72.5	49.9
1996	17.2	8.2	12.2	13.2	9.9	17.5	18	56.4	34.8
1997	20.7	4.5	17.5	24.2	17.9	40.3	51.7	108	80.4
1998	31.5	18.0	15.3	13.4	13.5	21.5	29.4	66.3	38.8
1999	13.1	0.3	20.5	18.7	15.7	35.1	56.3	99.2	63
2000	19.4	12.4	9.3	13.8	8.2	25.1	30	79.6	50.5
2001	22.5	8.5	9.9	6.5	6.4	11.9	15.9	42.5	27.7
2002	9.4	0.4	10.6	12.9	10.1	28	37.1	84.5	59.3
2003	17.1	7.9	12.7	6.4	9.4	17.6	21.6	53.1	31.6
2004	22.5	5.6	15.7	5.4	8	21.8	26.3	72.4	38
2005	66.3	33.4	7.3	2	5.4	4.1	5.4	33	9.1
2006	25	18.6	18.3	16.1	15	27.3	36.6	77.9	48.7

State	Washington	Washington	Washington	Washington	Washington	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	21b55s	20a23s	20a40s	20a09s	20a12s	06H13S	06H19S	06H10S	06G01S	07F02S
Latitude	47.374	48.191	48.202	48.519	48.445	41.359	41.329	41.154	42.734	43.627
Longitude	-121.442	-120.919	-120.956	-120.736	-120.916	-106.232	-106.502	-106.969	-106.319	-107.181
1961	59.5	65.2	53.2	48.2	54.7	21.4	10.5	24.7	15.6	12.6
1962	54.9	42.3	34.8	35.9	38.6	29.3	16.1	36.7	18.7	14.1
1963	28.9	34.4	28.4	27.5	26.9	19.1	8.1	24.6	11.8	12.1
1964	89.6	71.3	58.1	53.1	61.9	21.2	12.7	27.4	15.9	13.3
1965	72.5	65.4	53.4	45.7	49.8	30.2	14.4	36.2	14.7	15.6
1966	69.1	59.1	48.3	38.2	42.4	16.0	10.5	25.4	10.9	7.2
1967	64.2	78.1	63.6	55.5	58.3	26.4	10.3	33.2	16.3	15.6
1968	33.1	61.3	50.1	45.2	43.9	22.9	14.7	31.0	17.9	12.6
1969	65.5	76.5	62.3	47	56.3	19.9	11.4	34.8	14.6	10.4
1970	52.7	49.1	40.3	33.8	36.1	35.4	15.5	37.4	22.3	16.2
1971	93.7	89.6	72.9	64.1	72.3	42.8	19.6	45.3	15.8	12.7
1972	94.4	116.7	94.6	73.2	70.7	27.7	11.1	33.2	15.3	14.9
1973	33.7	45.4	37.3	33.5	33.8	19.1	12.5	30.2	20.4	10.0
1974	101.6	100	81.2	70.5	66.6	28.6	14.4	43.2	13.8	8.2
1975	72.6	78.4	63.9	51.3	59.6	27.4	15.0	33.1	13.3	13.6
1976	71	103.7	84.1	60.2	60.9	23.9	12.8	35.6	13.2	12.2
1977	36.6	28.4	23.6	24.4	20.2	11.7	10.6	16.4	14.9	18.3
1978	40.3	63.5	51.8	47.9	50.2	35.4	16.3	45.5	11.2	8.2
1979	52.6	46	37.7	30.3	27.2	28.9	13.1	42.2	13.9	7.9
1980	50.3	55.3	42.9	36	46.1	27.8	16.1	37.6	16.1	9.1
1981	22.8	38.6	31.8	24.8	27.2	11.3	7.6	15.0	10.2	10.4
1982	63.4	71	57.8	46.3	52	31.2	13.7	40.9	9.8	11.5
1983	49.7	65.8	53.7	45.2	48.3	23.8	16.8	38.0	22.3	12.7
1984	50.7	56.5	47.6	32.3	35.3	24.3	16.8	39.6	20.3	12.5
1985	70.9	51.2	36.5	39.2	42.5	20.1	13.3	31.1	13.2	10.8
1986	36.6	48	36.6	34.2	37.3	36.9	16.3	46.4	12.6	14.4
1987	47.7	55.6	44.2	37.2	44.4	16.6	7.4	21.6	17.1	11.8
1988	54.4	60.7	47.7	35	45.4	25.4	12.1	26.7	17.6	13.1
1989	60.2	60.1	45.9	34.8	49.5	20.1	15.0	27.8	8.8	11.8
1990	58	68.1	55.8	45.7	54.8	20.6	16.8	24.0	10.8	13.9
1991	46.2	84.3	71.6	59	60.8	15.8	12.0	25.7	16.9	11.7
1992	26.5	57.3	43.2	40.5	41.9	16.1	13.5	21.4	15.0	10.0
1993	35.3	34.6	32.2	26	27.6	23.0	13.7	35.9	14.5	8.2
1994	39.6	45.8	40.7	33	24.1	22.4	13.2	26.9	17.7	10.1
1995	43.9	75.1	55.6	53	40.3	14.8	9.8	31.9	11.3	15.2
1996	33.5	67.1	52.6	51.4	50.6	28.9	10.5	32.8	12.0	12.1
1997	93.3	82	70.6	56.4	72.8	35.2	13.6	39.7	21.2	17.3
1998	55.6	64.5	51.3	32.9	44.8	21.3	9.2	31.3	12.7	10.6
1999	86.6	88.5	71.6	61.7	72.1	17.9	11.4	28.0	10.3	10.4
2000	56.1	60.8	53.5	38.5	49.5	17.9	10.6	26.0	15.5	11.2
2001	36.1	34.1	29.4	23.1	26.6	17.0	9.3	23.6	11.6	8.6
2002	65.6	74.2	68.8	49	61.5	13.8	10.7	20.4	9.4	6.8
2003	41.6	55.6	42	35.9	40	18.0	13.9	29.3	14.7	8.8
2004	46.5	41.4	40	30.4	36.2	14.4	6.4	27.2	10.1	9.5
2005	16	30.8	25.6	15.6	13.8	17.3	12.1	33.0	11.3	7.8
2006	67.4	65.9	53.4	41.3	55.2	25.8	13.0	37.6	16.3	12.8

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	06E03S	07E36S	07E23S	07E18S	07E12S	07E21S	07E33S	08G03S	09G09S	09G03S	10G12S
Latitude	44.256	44.403	44.500	44.679	44.723	44.801	44.788	42.573	42.647	42.870	42.269
Longitude	-106.980	-107.061	-107.429	-107.581	-107.400	-107.844	-107.529	-108.843	-109.260	-109.095	-110.806
1961	5.8	12.3	13.4	12.2	10.0	16.9	8.7	10.2	11.5	12.8	10.3
1962	8.1	19.5	18.7	18.4	12.8	21.8	10.5	18.1	18.0	18.9	22.4
1963	5.1	10.3	14.5	14.6	12.8	21.5	11.8	15.3	9.9	11.4	11.5
1964	6.3	10.8	15.2	14.5	16.9	21.3	14.0	13.5	11.7	12.6	15.6
1965	6.6	15.4	22.0	21.9	18.9	24.5	13.8	24.1	20.7	21.2	24.8
1966	3.6	5.3	11.1	12.2	6.3	16.1	6.1	12.4	11.5	9.0	12.9
1967	7.2	12.8	16.4	20.4	15.3	21.8	13.2	18.1	14.0	18.9	16.2
1968	6.4	11.8	14.8	18.0	14.5	21.8	13.6	13.6	12.8	12.8	14.0
1969	4.2	10.3	12.9	15.0	9.1	17.5	8.1	18.5	19.1	15.1	19.8
1970	5.8	12.3	15.6	18.9	17.4	27.6	17.4	15.5	10.6	14.0	15.5
1971	8.1	16.4	21.5	21.8	15.1	26.0	12.7	23.4	23.4	23.3	25.3
1972	9.5	18.5	22.7	21.5	10.5	22.6	12.8	21.0	25.4	19.4	23.4
1973	5.4	12.8	10.6	13.7	9.9	19.8	10.4	14.8	9.7	11.6	13.5
1974	5.6	13.3	14.2	16.9	9.4	16.9	9.5	15.9	15.3	18.1	18.9
1975	6.2	12.8	18.3	19.5	14.6	24.5	14.1	13.9	14.6	14.1	20.5
1976	8.3	15.2	21.7	18.5	14.2	22.8	13.5	16.1	18.0	15.6	19.3
1977	5.4	13.5	8.9	18.2	17.5	24.4	19.1	10.5	5.6	9.3	6.5
1978	5.9	10.7	21.2	17.4	10.7	22.4	12.4	13.9	20.4	9.8	24.4
1979	6.6	9.6	15.3	16.1	9.6	20.5	11.7	15.9	19.2	14.9	17.7
1980	7.1	12.8	10.4	12.7	9.9	13.7	10.3	20.3	18.7	15.5	22.2
1981	4.0	8.3	8.4	8.2	7.4	11.7	8.6	11.6	8.0	12.3	8.9
1982	6.4	11.9	15.9	18.3	10.3	21.9	8.5	19.1	18.3	16.5	23.4
1983	5.9	11.9	13.2	14.0	10.9	19.3	11.3	17.3	15.4	17.8	17.6
1984	7.5	12.7	12.9	17.8	13.7	21.5	12.3	15.9	11.6	12.2	19.0
1985	4.8	10.1	12.6	14.7	10.2	16.6	11.1	13.0	12.4	12.7	13.9
1986	7.1	18.6	17.6	19.6	14.2	23.2	13.0	30.2	20.3	23.3	27.6
1987	7.0	10.0	12.1	15.2	9.6	16.4	11.6	16.0	11.8	18.3	9.3
1988	5.1	13.8	12.8	13.1	12.4	18.7	13.1	15.0	8.4	15.8	12.5
1989	4.7	9.1	11.9	14.0	8.3	17.3	9.1	16.0	12.9	12.3	16.8
1990	7.0	13.9	14.5	18.7	13.5	25.2	13.3	14.0	11.7	12.1	12.4
1991	8.4	13.1	14.8	17.3	13.5	19.2	11.9	14.4	12.8	13.2	12.4
1992	8.9	12.4	10.4	13.1	11.0	14.4	9.7	11.2	8.0	12.1	11.0
1993	5.0	10.4	11.5	12.7	8.9	15.3	9.6	14.1	13.4	12.0	17.7
1994	5.0	18.0	16.5	16.1	15.0	22.8	14.2	16.1	13.1	13.4	11.2
1995	6.8	15.0	15.1	16.3	11.1	16.9	10.0	19.4	17.0	17.9	15.9
1996	8.5	19.1	18.3	19.9	14.4	21.7	13.0	19.6	15.7	19.0	20.3
1997	7.0	17.8	17.9	19.1	14.7	22.3	14.0	24.9	19.1	17.1	24.1
1998	7.5	14.2	13.8	16.4	11.8	18.8	10.5	15.6	12.2	15.1	15.9
1999	4.3	15.2	17.0	16.5	10.3	19.7	8.8	17.7	16.3	16.7	17.1
2000	5.4	14.5	14.7	15.9	12.2	19.6	11.3	14.5	11.4	10.9	14.3
2001	5.1	9.9	11.3	10.6	8.1	14.3	8.4	9.1	9.8	6.3	10.5
2002	5.4	13.5	12.7	13.0	10.8	15.8	8.9	11.5	12.1	11.1	12.7
2003	9.7	16.5	15.9	17.3	15.2	19.4	12.5	14.5	12.0	14.7	13.8
2004	3.8	12.1	13.4	14.4	10.6	17.1	9.4	15.0	12.0	10.8	12.7
2005	6.6	14.0	13.8	14.1	11.4	15.5	9.3	19.6	15.4	14.1	17.5
2006	5.1	12.9	14.1	14.2	10.5	16.3	9.7	16.2	15.4	11.0	20.5

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	10G08S	10G20S	10G13S	10G25S	10G15S	10G23S	10G02S	10F17S	10F16S	09F23S	09F21S
Latitude	42.508	42.525	42.495	42.646	42.764	42.815	42.964	43.131	43.174	43.007	43.113
Longitude	-110.910	-110.662	-110.532	-110.815	-110.591	-110.835	-110.610	-110.202	-110.140	-109.759	-109.949
1961	8.8	21.2	7.4	20.6	18.3	22.1	22.9	8.9	10.4	10.8	8.9
1962	17.8	39.7	19.9	30.5	30.8	34.9	38.7	17.4	21.7	19.7	14.5
1963	10.5	24.7	12.7	14.9	19.3	23.1	22.3	9.1	14.5	12.0	8.7
1964	15.1	24.6	14.6	25.5	22.3	26.2	25.3	12.6	16.0	12.4	10.2
1965	18.0	43.2	25.6	32.6	39.7	43.9	38.1	21.0	28.5	21.9	17.5
1966	10.2	20.3	9.4	16.3	20.1	24.0	22.9	9.6	10.6	8.8	6.3
1967	16.1	33.4	17.2	24.8	28.8	32.8	35.7	15.5	18.2	13.6	9.8
1968	11.3	25.8	11.9	19.8	21.5	25.4	27.7	12.8	15.1	12.0	9.5
1969	16.5	30.1	16.4	25.5	24.5	28.5	33.8	15.5	19.7	16.9	12.8
1970	14.2	29.3	13.7	22.7	27.2	31.2	31.4	15.7	17.2	12.8	10.4
1971	24.3	42.4	25.0	31.9	39.7	43.9	44.8	20.4	27.3	21.3	16.5
1972	20.4	42.6	22.5	29.8	37.3	41.4	43.6	21.9	27.1	20.7	19.8
1973	12.5	21.3	10.9	19.8	18.7	22.5	21.6	10.6	11.3	12.2	10.0
1974	16.8	34.3	16.6	33.2	32.0	36.1	45.6	17.8	19.5	15.4	12.6
1975	18.2	28.2	16.8	31.9	26.5	30.5	31.4	16.2	18.0	13.4	12.0
1976	20.6	36.0	19.5	36.7	34.2	38.4	43.9	19.6	21.1	16.9	12.6
1977	6.8	9.4	4.3	12.3	8.1	11.8	8.6	6.8	6.4	7.1	5.4
1978	19.9	39.1	20.9	36.8	40.1	44.3	39.5	21.3	26.7	20.7	17.1
1979	16.8	25.3	15.8	24.1	24.5	28.5	28.5	15.8	19.0	14.0	11.6
1980	14.9	29.0	17.2	31.7	29.4	33.4	39.5	15.7	18.5	12.8	10.6
1981	8.5	14.2	5.2	14.2	10.7	11.3	13.8	5.3	12.9	8.4	5.9
1982	21.3	35.8	22.1	36.7	36.0	40.2	41.1	17.2	20.8	20.3	14.9
1983	14.3	24.8	12.4	27.0	21.3	34.1	22.8	12.1	13.3	12.9	10.4
1984	12.9	22.6	11.0	24.0	20.3	40.4	22.5	9.6	12.5	12.7	8.3
1985	11.5	19.8	10.5	17.3	23.6	25.9	21.1	10.4	13.3	10.5	6.9
1986	20.0	42.7	20.8	23.1	39.0	40.5	44.6	18.5	29.3	18.5	16.5
1987	7.6	17.1	8.8	14.7	16.0	18.3	17.1	10.9	13.0	10.5	9.6
1988	9.8	21.3	12.4	18.1	22.1	22.5	20.6	9.0	13.1	6.8	8.0
1989	13.2	30.2	14.7	22.6	27.0	35.6	26.6	12.8	19.3	11.9	10.7
1990	10.5	20.4	12.1	16.0	18.3	22.0	18.2	10.5	14.5	9.7	10.4
1991	10.3	19.9	10.3	17.8	17.6	26.4	19.9	9.8	14.1	10.8	9.7
1992	7.5	15.8	8.2	14.1	11.0	19.7	13.3	7.1	8.3	9.9	7.5
1993	12.8	27.1	14.4	21.6	22.0	28.2	22.6	12.0	16.3	13.2	10.7
1994	10.9	16.9	9.4	16.0	16.2	23.5	18.9	7.4	11.2	10.1	7.8
1995	13.3	26.0	11.6	22.1	20.5	31.0	24.0	8.7	13.6	13.8	9.5
1996	17.1	35.1	24.0	31.3	34.1	35.9	35.3	16.6	23.9	15.0	15.4
1997	21.6	36.8	23.5	31.2	36.9	40.8	41.5	16.9	27.4	18.2	15.3
1998	15.3	21.8	12.3	21.0	21.8	27.9	24.3	12.5	16.6	12.7	10.6
1999	16.2	29.6	16.4	25.0	29.2	34.1	29.0	13.9	18.6	14.0	12.5
2000	13.4	22.5	12.3	23.0	22.7	30.2	24.9	11.7	17.7	12.2	10.9
2001	7.6	16.9	8.8	15.6	15.4	18.4	15.5	7.9	11.3	11.0	8.8
2002	11.2	20.4	9.8	17.9	20.4	23.9	21.0	9.2	14.5	10.0	9.0
2003	12.0	25.9	13.7	23.2	25.0	29.8	23.0	10.8	17.3	13.6	10.9
2004	11.3	21.2	11.2	17.6	17.3	23.3	20.1	9.7	12.9	10.9	9.0
2005	13.5	24.2	13.8	20.0	20.0	26.9	19.1	9.4	15.1	12.3	11.2
2006	16.7	31.4	18.7	29.5	30.5	36.1	28.5	11.1	19.9	14.3	11.0

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	10F15S	10F29S	10F19S	08F01S	09F25S	09F08S	10F09S	09F04S	10F23S	10F02S	10E17S
Latitude	43.249	43.343	43.389	43.659	43.277	43.503	43.749	43.697	43.519	43.946	44.152
Longitude	-110.017	-110.435	-110.129	-109.010	-109.446	-109.752	-110.058	-109.670	-110.911	-110.447	-110.221
1961	8.9	10.9	12.2	7.3	7.7	7.6	20.3	8.8	20.9	11.0	18.8
1962	14.5	18.8	20.9	7.9	11.9	15.2	27.9	15.0	35.5	17.9	26.7
1963	8.7	11.0	11.7	6.1	8.6	10.0	20.6	12.0	17.4	11.1	18.9
1964	10.2	18.0	21.6	5.8	7.4	8.6	25.4	10.6	25.7	17.2	26.0
1965	17.5	27.8	24.2	7.9	14.3	15.9	32.8	21.9	38.0	25.7	35.8
1966	6.3	15.3	11.0	3.2	5.5	6.8	18.0	8.6	19.7	14.9	23.3
1967	9.8	20.2	17.6	4.9	11.2	12.5	26.5	12.3	32.6	19.1	28.2
1968	9.5	15.9	10.7	4.5	8.6	8.9	23.4	10.0	25.7	15.4	23.8
1969	12.8	18.6	14.8	4.1	8.6	10.9	25.0	11.3	35.7	17.7	26.5
1970	10.4	20.1	14.8	5.8	9.5	9.4	25.1	14.5	26.7	19.1	28.1
1971	16.5	30.0	23.7	5.1	16.7	19.8	36.3	19.7	40.8	27.7	38.0
1972	19.8	27.8	21.6	10.1	17.1	18.2	34.0	21.7	38.7	25.7	35.8
1973	10.0	13.6	10.5	6.2	5.9	6.6	17.1	7.6	23.3	13.4	21.5
1974	12.6	27.1	18.1	4.6	13.0	14.1	31.9	17.8	40.3	25.2	35.1
1975	12.0	18.8	13.8	5.1	10.9	11.7	26.0	14.5	34.7	17.9	26.7
1976	12.6	26.6	18.3	4.9	13.0	16.2	32.3	20.6	35.0	24.7	34.6
1977	5.4	6.3	7.0	4.8	4.2	4.8	14.1	4.2	14.2	7.0	14.2
1978	17.1	24.8	16.3	2.5	9.4	16.6	30.1	18.1	39.8	23.2	32.8
1979	11.6	19.6	13.8	6.1	9.6	9.5	24.4	13.2	32.0	18.6	27.6
1980	10.6	17.2	11.7	5.8	9.0	11.6	22.5	14.5	24.8	16.6	25.2
1981	5.9	8.5	9.0	5.6	7.7	8.8	18.5	8.9	15.9	8.2	18.6
1982	14.9	26.7	20.1	2.9	10.1	13.5	35.6	20.2	44.0	26.5	34.7
1983	10.4	17.8	13.3	4.9	7.7	10.9	24.6	11.5	35.3	17.1	32.0
1984	8.3	15.7	14.0	6.3	7.8	10.2	21.6	10.6	24.5	14.3	21.6
1985	6.9	16.2	11.5	3.1	6.2	10.2	21.1	10.8	22.8	15.9	24.1
1986	16.5	24.5	20.6	7.7	11.0	16.1	30.3	23.6	37.8	21.6	36.7
1987	9.6	11.6	8.7	8.2	10.6	10.8	20.3	14.4	17.3	11.6	19.0
1988	8.0	14.2	9.6	4.8	5.9	9.3	21.0	13.5	22.6	14.6	21.6
1989	10.7	22.5	14.6	3.9	7.4	13.4	28.2	18.6	36.7	21.1	32.4
1990	10.4	14.3	11.8	4.7	6.9	9.7	21.6	12.6	22.2	14.4	25.0
1991	9.7	12.0	13.2	5.9	7.2	11.8	23.1	12.7	22.9	12.3	25.9
1992	7.5	8.5	9.1	7.4	7.2	7.5	14.7	9.3	16.7	6.3	16.4
1993	10.7	19.7	13.1	5.4	6.7	9.5	20.6	11.9	27.7	13.9	23.2
1994	7.8	12.7	9.9	4.0	5.7	8.5	19.3	11.1	19.5	11.9	19.9
1995	9.5	16.6	14.6	7.2	7.7	11.3	23.8	13.7	29.0	21.5	34.2
1996	15.4	23.2	18.6	5.8	9.9	15.9	33.4	21.4	33.4	25.0	40.6
1997	15.3	29.1	22.5	8.1	10.1	17.9	34.8	23.9	43.0	30.1	45.2
1998	10.6	16.8	14.6	7.5	10.6	11.2	23.3	15.0	26.6	16.2	27.8
1999	12.5	21.7	16.0	6.0	9.8	14.7	28.8	16.0	32.7	23.8	36.4
2000	10.9	15.0	11.1	4.4	5.9	10.4	21.4	12.6	23.2	17.6	25.4
2001	8.8	10.9	9.7	3.5	3.1	7.6	16.7	8.5	16.3	8.0	19.1
2002	9.0	12.6	13.0	4.6	5.3	10.3	20.9	14.2	21.8	13.3	27.4
2003	10.9	14.9	13.2	7.2	8.8	10.2	24.4	18.2	25.2	20.6	31.6
2004	9.0	13.9	9.8	3.5	1.8	6.5	18.1	10.8	23.6	14.3	24.6
2005	10.6	13.1	10.5	4.2	7.2	8.1	16.5	9.7	22.6	12.0	22.9
2006	14.8	21.1	12.5	3.3	5.8	9.3	24.7	13.8	34.3	20.8	35.0

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	10E15S	10E12S	10E09S	10E07S	10E03S	10E20S	09E10S
Latitude	44.126	44.134	44.209	44.369	44.719	44.478	44.943
Longitude	-110.834	-110.669	-110.666	-110.578	-110.511	-110.038	-109.567
1961	28.3	16.2	30.3	15.7	11.6	10.4	18.7
1962	41.5	21.2	42.7	29.5	16.9	8.8	26.3
1963	20.9	13.0	21.8	12.3	10.8	9.9	19.9
1964	33.5	18.5	31.3	18.8	14.0	13.4	23.9
1965	44.7	23.6	44.2	32.8	21.2	14.5	32.1
1966	28.5	16.1	29.2	21.1	11.4	9.7	20.8
1967	35.5	18.6	38.6	27.1	18.8	15.2	31.2
1968	34.4	17.4	27.6	18.8	13.4	11.8	21.3
1969	34.7	19.3	35.8	27.8	15.7	13.1	24.4
1970	40.2	21.2	35.9	18.7	14.2	14.7	25.1
1971	54.5	28.0	56.0	35.9	18.2	19.5	36.8
1972	48.5	25.3	49.1	27.2	17.6	16.4	32.0
1973	29.7	15.1	27.1	14.7	11.4	10.2	17.9
1974	51.9	24.4	51.8	28.8	17.0	16.6	33.9
1975	38.4	19.6	36.8	17.7	12.6	13.7	24.7
1976	53.7	27.6	49.4	25.0	18.8	20.0	29.9
1977	16.0	7.9	12.6	5.8	6.4	6.8	14.5
1978	45.3	26.3	43.9	20.7	15.8	14.3	26.7
1979	40.3	21.7	34.3	20.2	14.3	11.1	22.2
1980	31.4	18.5	35.1	20.6	13.1	13.2	21.8
1981	23.3	10.8	18.5	10.8	6.6	7.4	17.4
1982	53.3	26.3	54.0	25.2	18.7	16.2	25.9
1983	40.5	18.4	37.5	17.8	11.4	10.3	22.0
1984	33.9	15.9	28.9	14.4	9.5	9.5	16.7
1985	31.4	18.4	32.6	22.8	12.0	9.5	19.9
1986	39.1	22.7	46.1	28.2	13.8	15.2	28.0
1987	18.6	10.4	18.3	10.1	7.3	6.8	13.8
1988	28.5	17.1	29.4	13.3	9.8	9.2	17.7
1989	41.1	23.3	44.6	19.6	18.6	15.7	25.3
1990	27.4	14.7	27.2	11.4	11.5	11.4	22.7
1991	29.5	15.5	29.0	13.5	11.9	12.7	21.3
1992	21.6	10.5	22.8	9.8	11.7	8.5	18.4
1993	31.8	16.3	29.2	14.5	13.6	8.2	16.0
1994	24.7	13.1	21.0	11.6	10.5	11.2	19.2
1995	39.5	20.3	41.0	20.5	16.8	13.0	24.1
1996	37.9	21.3	48.3	25.7	21.6	19.8	36.4
1997	46.1	29.1	53.0	32.6	23.6	20.5	35.4
1998	30.8	16.8	30.2	16.0	12.5	10.6	19.3
1999	43.1	22.6	40.8	23.6	17.9	16.4	26.3
2000	32.5	17.3	26.7	14.6	13.0	13.4	21.0
2001	20.6	10.2	16.7	7.6	8.8	8.3	11.9
2002	28.3	13.9	29.6	15.4	12.9	10.6	21.2
2003	31.5	14.7	33.8	15.7	13.4	14.1	26.5
2004	34.3	15.6	29.0	14.5	10.8	7.9	18.7
2005	24.7	11.8	23.4	13.8	9.3	9.1	14.9
2006	38.3	21.4	41.1	19.3	14.8	10.7	21.4

APPENDIX A.3

Western U.S. May 1st snowpack

State	California	California	California	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado
Station Id	20h06s	20h13s	19l05s	05j04s	05j08s	05j10s	05k06s	05k09s	05k14s	05m03s	05m07s
Latitude	41.582	41.236	38.608	40.399	40.033	40.414	39.916	39.646	39.804	37.209	37.331
Longitude	-120.303	-120.792	-119.924	-105.848	-105.576	-105.820	-105.761	-105.870	-105.778	-105.200	-105.067
1961	11.1	1.9	15.3	5.7	21.1	22	14.1	18.4	18.1	8.5	4.2
1962	4.6	1.1	30.1	6.7	18	31.1	12.7	20.5	19.2	0	0.5
1963	10.6	5.4	27.7	1.1	17.1	20.1	8.2	11.7	12.3	0	0
1964	12.6	4.1	15.5	6.7	17.1	24.8	14.3	18.7	17.3	2	4.5
1965	12.2	1.3	42.1	10.2	26.9	35.5	17.2	27.3	23.7	9.5	3.4
1966	6.5	0	19.1	1.3	11.4	14.5	10.1	9.9	12.5	4.8	1.2
1967	23.1	23	54.9	7.4	16.3	26.5	14.1	17.6	16.6	0	0
1968	7.5	0	19.1	10.6	24.2	30	16.5	18.6	18.7	9.3	11
1969	19.4	10.1	55.3	5.4	14.9	20.7	12.1	13.4	11.4	3.5	0
1970	15.8	8.7	33.7	11	28.3	37.8	19.7	28.8	29.2	7.1	8.9
1971	21.3	12.5	36.6	9.4	23.6	35.5	18.9	23.8	23.8	0	0
1972	18.6	2.2	26.8	2.2	20.2	29.2	13.5	20.2	20	0	0
1973	18	3.5	36.3	8.4	21.8	28.1	17.1	15.7	19.8	6.7	15.7
1974	22.8	16.9	40.3	7.1	23	31.3	19.5	25.3	24.9	4.4	0
1975	32.8	24	42.9	8.7	20.3	27.7	15.5	20.3	19.6	0.3	5
1976	17.5	4.1	12.9	5.1	18.5	23.2	12.6	17.1	17.3	8.8	0
1977	0	0	3.6	0	11.9	13.9	9.6	11.8	13.6	2.2	1.9
1978	17.7	7.1	44.8	8.7	23.3	36.1	14.9	25.6	22.2	6.5	0
1979	13.3	8.6	31.5	12	18.9	33.9	16.1	18	20.6	7.7	0
1980	17	10.1	38.6	11.8	25.6	37	19.1	20.9	25.1	6.3	10.7
1981	0.7	0	19.4	0	6	8	2.8	0.5	9.4	0	0.5
1982	16	11.6	51	6.5	21.3	35.3	16.3	20.6	22.5	1.9	0
1983	25.9	24.4	61.9	13.3	19.6	34.7	21.6	24	28.3	9.8	15.2
1984	22.8	10.8	31.3	14.1	24.8	35.6	24.8	25.1	30.8	2.9	12
1985	5.1	1	28.4	4.1	15	28.2	13	16	20.3	1.8	2.2
1986	19.6	4.4	39.2	10.9	22.1	40	15.2	24.1	24.8	6.7	0.4
1987	1	0	10.8	0	13.8	14.2	7.8	5.2	14	9.5	11.3
1988	6.3	0	0	4.2	19.1	31.1	18.1	16.1	22.1	0	0
1989	12	0.7	28	0	14.4	21.7	11.2	9.5	16.8	0	0
1990	0	0	13.8	3.8	23.8	25.1	15.7	15.4	15.1	1	1.9
1991	16.2	2	21.8	6.8	15	20.9	16.2	12.5	23.7	0.8	3
1992	0.5	0	13.2	1.5	12	19.3	9.8	10.2	20.3	4.9	0
1993	24.2	9.9	44.6	11.6	23.3	35.5	20.4	23.2	30.4	5.8	8
1994	4.3	0.6	16.6	4.4	20.4	22.8	14.7	15.1	19.5	2.7	5.4
1995	29.4	18.5	61.4	5.5	21.4	28.7	20.1	21	19.9	7	7.3
1996	15.1	5.3	34.2	11.7	33.8	36.4	23.3	29	30.1	0	0
1997	10.2	0	26.8	12.1	30.3	34.7	20.5	23.5	30.6	0.1	0
1998	21.8	15.5	41.1	3.2	19.4	22.1	13.6	16.3	23.2	3.8	3.4
1999	19.8	9.9	38.4	3	21	24.9	14.4	18.4	21.6	3.2	5.5
2000	0	0	23	5	15.5	21.6	15	13.8	18	2.1	0.8
2001	10	0	19.9	3.6	14.3	19.8	14.2	13	19.9	7.4	0
2002	12.2	1.1	23.8	0	7.6	11.1	1.1	0.4	6.4	0	0
2003	17.4	6.4	30.1	10.3	20	27.6	19.7	21.6	24.2	6.4	0
2004	2.5	0	21.5	0	16.8	15.5	8.6	9.5	14.1	9.7	1.2
2005	16	1.6	45.7	4	17	20.4	16.8	11.4	19.1	7.8	8.4
2006	17	10.4	42.6	0	18.5	21.5	14.4	14.9	22.3	0	0

State	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado
Station Id	05m14s	06j01s	06j03s	06j05s	06j06s	06j09s	06j12s	06j15s	06k04s	06k06s	06k08s
Latitude	37.214	40.534	40.395	40.347	40.078	40.368	40.875	40.848	39.075	39.297	39.380
Longitude	-105.122	-106.781	-106.604	-106.094	-106.670	-106.740	-106.046	-106.969	-106.612	-106.607	-106.197
1961	5.9	14.5	22.9	14.3	11.3	25.6	15.6	15.8	18.3	4.2	16.7
1962	2.6	14.8	26.1	15.1	10.7	29	22.3	16.9	18.9	2.2	21.6
1963	0	11.9	24.8	8.9	0	20.9	9.5	14.1	9.6	0	13.5
1964	0	19.4	26.4	10.9	11.4	28.1	16	20.6	17.9	5.3	16.1
1965	6.5	23.5	31.5	13.8	11.6	30.4	22.3	22	22.2	8.5	24.1
1966	0	3.8	12.5	9.6	0.9	15	14.5	10.7	10.2	0	11.4
1967	0	13	21.3	14.5	7.7	19.3	15	17.9	16.7	0	20
1968	11.3	25.4	26.1	14.4	15.8	31.4	20.2	22.4	18	6.4	20.3
1969	0	11.7	17.9	12.8	3.7	23	11.7	15.7	9.6	0	15.5
1970	8.6	25	33.3	16.6	16.9	39.6	18.2	22.6	19.9	9	23.1
1971	0	21.7	30	14	13	39.5	22.2	20.4	17.7	3.1	18.3
1972	0	12.8	21.8	10.5	6.1	27.3	17.9	13.3	14.9	0	19.5
1973	10.6	22.7	23.9	14.7	15.2	31.8	23.3	19	17.5	9.3	18
1974	1.3	31.2	30.3	14.9	12.9	44	25.6	23.7	16.5	3.8	21.6
1975	8.6	23.5	30.8	14.4	16.2	32.5	17.2	22.5	18.1	7.1	21.1
1976	1.3	14.9	17.1	12.4	8.5	23.3	21.7	16.1	14.9	2.8	18.5
1977	1.1	2.2	6.9	7.1	0	6.7	10.2	4.6	8.3	0	13.6
1978	1.4	33	33.7	13.2	14.2	40.8	20.5	24.7	18.9	3	24.1
1979	1.6	27.7	20.6	17.5	14.2	31.6	25.2	20.6	19	5.1	17.7
1980	12.5	25.5	26.5	14.9	11.3	30.4	23.5	17.1	21.7	7.9	23.7
1981	0	0	0	3.5	0	9.4	4.2	0	2	0	11.1
1982	2	23	33.7	11.5	13	39.8	18.8	20	19	5.5	20.5
1983	14.8	28.3	27.1	14.3	12.2	40.3	25.7	20.3	18.5	6.4	19.3
1984	9.7	35.3	29.1	15.4	15.7	38.8	23.6	24.1	24.1	9.1	25.9
1985	5.5	18.6	20.6	12.4	8.9	30.8	16.5	13.8	16	5.2	18.3
1986	3.5	18.3	21.5	22.8	8	28.9	29	15.2	17.1	0.2	21.3
1987	12	0	1.7	7.7	0	12.6	8.1	0.9	11.8	0	15.2
1988	0	16.3	21.3	13.9	7.9	24.1	17.6	9.7	7.4	0	18.3
1989	0	6.4	12.4	14.3	0.3	21.7	10	9.5	9.7	0	18
1990	6.6	7.6	10.2	12.7	0.6	23.1	17.6	11.5	14	1	17.5
1991	9	21.2	25.7	17.2	12.3	30.6	17.6	15.4	17.1	5.1	17.9
1992	1	0.2	4.1	9.4	0	19.4	9.6	0	10	0	16.9
1993	15	28.7	27.9	22.5	13	38.6	20.9	19.5	23.7	7.9	22.8
1994	14.4	10.2	15.9	15.4	5.6	22.1	14.5	11.2	15.9	1.9	16.4
1995	15.4	21	23.8	16.9	11.3	32.6	14.5	17.9	24.2	7.9	21.4
1996	1.3	21.8	33.7	16.6	11.7	42.2	24	20	21.4	6.3	27
1997	13.8	21.7	28.6	24.1	10.3	44.9	26.5	25.2	23	2.1	23.8
1998	10.8	13.8	13.6	9.4	8.3	30	14.8	11.5	15.4	1.2	15.5
1999	7.2	11.1	16.3	14.9	4.4	27.3	19.4	14.5	17.8	0	20
2000	2.4	11.4	17.1	17.1	2.3	28.6	14	7.1	10.9	0	18.6
2001	5.2	6.6	11.4	14	2.9	18.5	13.9	9.3	11.3	0	18.1
2002	0	2.6	1.7	7	0	10.9	6.3	0.7	2.5	0	9.2
2003	5.5	20.1	18.3	21.1	8.7	29.5	18.3	12.9	15.9	0	21.1
2004	10.6	4.5	6.7	12.7	0	18	13.9	1.4	12.6	0	16.2
2005	14.5	15.1	11.7	16.1	4.9	21.7	14.9	13.8	13.6	0	17.3
2006	0	10.8	20.7	13.2	3.1	27.1	13.6	6.1	12.1	0	23.4

State	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado
Station Id	06k10s	06k40s	06l02s	06l03s	06l11s	06m03s	06m17s	06m22s	07k01s	07k02s	07k06s
Latitude	39.292	39.088	38.820	38.489	38.894	37.486	37.479	37.019	39.078	39.875	39.046
Longitude	-106.549	-106.542	-106.590	-106.340	-106.953	-106.835	-106.802	-106.452	-107.144	-107.599	-107.874
1961	11.3	7.9	8.2	14.7	13.9	27.1	30.2	22.9	16.4	16.1	30
1962	19	9.3	11.7	16.6	17	35.8	40.6	27.8	13.6	14.7	33
1963	10.3	1.8	0.9	7.2	12.3	12.7	23	3	6.4	1.1	18
1964	14.2	6.4	8.1	18.1	15.7	25.3	22	19.2	18.4	21.5	26
1965	15.6	5.2	15.8	20.8	20.6	49.5	55.6	39.5	22.8	21	35
1966	7	0.8	5.5	8	0	23.3	35.1	15.9	6.7	2.6	26
1967	14.6	6.8	4.4	7.1	0	21.2	31.9	19.2	8.9	10.8	32
1968	15.1	8.7	8.8	13.9	16.9	34.5	36.2	28.3	19.9	25	31
1969	9.1	2.7	6.2	9.9	13.8	29.7	35.9	29.6	11	8.9	34
1970	19.4	1.1	12.4	16.3	16.9	21.9	31.4	20.2	19.8	24.3	31
1971	16.2	8.2	4	13.3	12.5	9.1	26.3	5.9	10.7	16.9	26
1972	16.6	0.9	4.6	8.6	11.5	8.1	30.3	0	8.1	8	21
1973	18.4	2	8.6	19.1	13.9	42.5	49.3	31.7	21.9	22.4	35
1974	19.8	0.9	7.5	16.7	14.7	20.3	29.2	17.6	11.3	23.8	27
1975	17.3	2.6	11.3	21.4	17.3	45.5	47.1	41.3	20.1	26	37
1976	15.9	6.6	7.2	10.4	12.5	31.8	38.5	18.5	12.1	17.7	31
1977	6.4	0.3	0	5.5	5.3	1.6	11.7	0	0	1.6	9
1978	19.3	5.5	9	17.9	18.9	28.5	32.8	27.9	15.1	23.9	43
1979	15.6	2.3	9.7	16.3	21	55.9	62.1	48.5	20.8	19.5	37
1980	16.9	5	13.4	20.5	21	44.7	48.7	50.9	22.2	18.4	34
1981	6.8	0	0	0.1	5.7	9.3	20.4	0	0	2.2	11
1982	17	1.6	0	18	15.9	33.3	45.8	28.5	15.6	18.8	36
1983	16.7	0.3	6.9	22.3	16.8	43.4	43.7	36	20.5	24.6	46
1984	21	8.1	11.7	25.3	23	37.8	35.1	32.4	22.7	28.5	37
1985	16.4	9.4	3.5	16.6	14.9	50.5	56.3	42.7	16.2	19.3	37
1986	15.1	9.3	6.7	12.8	19.8	38.7	50.3	28.6	14.4	23.5	37
1987	9.1	3.6	1.3	12.7	8.2	32.2	40.9	20.3	4.6	9	28
1988	11	3	0	11.5	8.8	17.1	25.3	14.7	7	14.1	25
1989	7.6	3.5	0	1.9	5.5	28.2	34.5	10.5	6.7	7.7	23
1990	9.9	0.1	1	12.5	7.5	20.8	28.9	11.4	7.5	8.1	22
1991	16.2	1.4	7.8	11.7	12.3	27.9	40.5	27.5	14.7	22.7	28
1992	8.2	4.6	0	8.8	4.3	23.3	25.3	13	1.9	10.2	20
1993	20.1	6.8	13	18.8	23.3	41.1	45.5	34.8	23.9	25.5	47
1994	13.8	0.2	6.1	14.7	10.6	29.8	34.9	31.8	13	12.9	26
1995	21.6	6.6	17.7	20.4	22.3	44.7	48	40	24.7	20.9	38
1996	15.5	5.5	9.8	19.2	16.9	14.8	21.9	10.5	13.8	22.1	26
1997	21.1	3.7	11.3	22.9	18.3	43.1	42.5	29.1	18.3	28.4	39
1998	15.8	1.9	7.1	18.6	11.9	29.5	35.3	24.9	17.2	24.4	36
1999	15.3	8.8	9	13.2	12.1	29.8	36.4	16	5.7	16.6	29
2000	15	6.2	2.1	9.2	6.3	9.9	17.2	4.7	6.5	7.8	18
2001	11.6	7.8	2	8.3	6	34.8	39.8	26.3	3.4	8.9	21
2002	5.7	0	0	0	0.8	0	10.3	0	0	0	10
2003	13.8	8.7	3.7	13.1	9.3	22.5	23.9	20.4	6.7	12.6	23
2004	11.3	4.9	4.8	13.9	8.9	25.7	36.3	18.5	5.9	7.9	27
2005	14.1	6.9	7.6	16	15.4	50.6	49.3	31.7	18.1	11.6	44
2006	16.2	7.2	3.3	7.2	7	14.9	25.7	11.8	2.8	10	22

State	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Colorado	Idaho	Idaho	Idaho
Station Id	07k09s	07m05s	07m12s	07m14s	07m16s	07m29s	07m33s	08m07s	15b21s	15b02s	15b14s
Latitude	39.129	37.651	37.749	37.847	37.722	37.799	37.892	37.892	47.532	47.458	47.072
Longitude	-107.288	-107.806	-107.689	-107.727	-107.260	-107.924	-107.713	-108.195	-115.776	-115.706	-115.958
1961	13.4	2.9	19.1	13.8	0.3	15.5	25.9	8.5	14	36	74.6
1962	15.9	1	21.6	11.7	0	17.6	28.9	10.9	11	29.5	65.3
1963	0	0	13.4	1.5	0	9.2	17.1	1.3	7.8	22.7	49.9
1964	16.3	4.7	20.6	12.7	0	15.6	22.1	8.6	16.5	41.3	81
1965	24.5	9.6	31.5	18.8	3.8	19.6	34.1	11.9	13	33.7	77.4
1966	5.9	0.8	16.4	11.7	0	13.3	18.4	2.8	10	27.4	55.6
1967	11.4	0	0	0	0	7	17.9	1	15.9	40.1	72.1
1968	20.4	10.7	27	22.6	6.8	24.2	33.9	12	9.7	26.7	62.4
1969	10.7	4.9	22.4	13	0	21.6	25.6	6.7	13.3	34.4	79.6
1970	21.6	2.4	24.5	16.6	0	17	30.3	11.5	15.9	40	64.1
1971	12.2	0	12.8	6.6	0	8.8	25.3	1.5	15.2	41.5	88.8
1972	0	0	11.3	3.8	0	4.1	21.4	0	20.8	51.2	91.6
1973	25.7	17.2	27.9	22.2	9.6	22	33.5	14.3	0	15.9	45.6
1974	17.1	0	18.2	10.6	0	18.5	23.8	7.3	18.5	45.1	107.6
1975	26.2	18.5	35	25.5	10.3	28.1	41.2	17.7	22.1	43.6	73.5
1976	14.1	0	17.4	13	1.5	9.8	28.7	8.9	15.9	36.6	73
1977	0	0	0	0	0	0	5.2	0	0	8.2	26.7
1978	17.5	0	25.6	17.1	0.8	20.6	35.1	8.9	6.7	28.4	56.3
1979	26	19.5	32.4	23.3	11.3	24	40.4	14.6	10.6	27.1	59.2
1980	24.7	16.5	30.8	19.6	7.4	22.4	32.6	15.6	0.8	16.8	44.5
1981	0	0	0	0	0	4.2	10.4	0	0	13.8	40.7
1982	12.8	2.2	25.7	14.2	0	18.5	31	11.1	11	38.7	78.1
1983	22.6	11.4	24.1	19.8	4.4	24.3	35.3	15.4	5.3	28.5	60.8
1984	26.8	5.2	23.9	22.6	2.7	16.8	42.3	0	2.9	22.9	58.6
1985	18.6	3.5	28.2	14.6	3.7	18.8	35.8	11.1	8.6	29.9	65.7
1986	10.3	0	25.7	13.6	1.7	18.1	25.6	9.8	1.3	22.8	49
1987	3.2	1.3	18.1	11.9	6.4	16.1	30.1	9.7	0	11.3	41.6
1988	7.3	0	11.9	5.2	0	6.1	22	0	0	14.6	38.4
1989	5	0	19.2	3.6	0	7.1	16.4	0	0	22.3	55.7
1990	3.3	0	13.9	7.8	1.3	10.1	20.1	2.4	0	27.6	52.3
1991	15.9	0	18.6	10.1	0	12.4	25.7	6.7	0	28.8	77
1992	2.5	0	7.3	4.3	0	9.5	19.6	2	0	14.3	45.3
1993	25.8	6.5	29	20.5	0.7	22.5	30.2	15.5	0	29	53.4
1994	12.9	2.1	21.9	11.9	0.6	12.3	21.7	12	0	13.5	29.4
1995	26.1	2.2	33.6	22	0.4	21.1	31.6	21.6	0	23.2	54.1
1996	10.2	0	17.8	10.7	0	11.3	23.5	2.6	0	24.6	60.2
1997	18.6	1	26.7	19.2	1.3	22.8	34.3	20.4	4.4	49.1	102.8
1998	22.5	3.2	21.1	12.9	1.1	14.6	25	10.6	1.5	18.7	38.2
1999	9.8	1.6	23	10.7	1.2	10.2	26.4	1.9	13.4	41.6	73
2000	6.3	0	9.4	4.3	0	9.1	18.8	0	5.9	26	50.6
2001	6	0	18.4	10.8	1.8	11.2	22.7	0.8	6.3	17.7	31.1
2002	0	0	0	0	0	0	5.3	0	12.9	43.8	76.8
2003	10.4	0	10.8	6.6	0	9.7	17.3	0	0	17.7	43.9
2004	3.9	0.5	20	13.4	0	13.3	25.3	3.9	1.4	19.7	38.6
2005	18.6	4	24.3	18.4	3.2	16.5	30.3	7.6	0	10.9	33.9
2006	6.7	0	10.8	6.3	0	5.4	17.6	0	2	22.3	53.5

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	16c01s	16c20s	15c04s	15c06s	15c16s	15c09s	14c05s	14c04s	15d06s	15d01s	16d09s
Latitude	46.950	46.840	46.566	46.481	46.764	46.563	46.634	46.466	45.697	45.189	45.043
Longitude	-116.340	-116.122	-115.742	-115.634	-115.295	-115.288	-114.581	-114.633	-115.230	-115.973	-116.133
1961	0	46.4	23.5	61.1	62.4	56	29.8	24.6	24.3	31.4	25.7
1962	1.3	38.6	22.4	51.5	54.7	46.6	35.8	30	18.7	30.5	26.3
1963	0	29.7	10.9	41.5	45.6	35.4	21.5	21	21.8	26	23.7
1964	11.7	60	39.9	72.6	65.3	59.6	44.6	38.5	36.5	29.7	27.9
1965	0	40.6	24.8	61.3	62.5	56.1	38.4	36	35.5	45.4	32
1966	0	35.2	9.9	47.2	46.6	36.7	22.4	21.9	22.6	27.6	27.8
1967	4.7	50.3	29.4	54.5	58.6	51.3	39.7	33.7	34.2	47.8	40.9
1968	0	33.7	15	48.2	56.6	48.9	29.8	29	32.1	25.2	21.1
1969	3.2	37.6	18.9	47.7	52.6	44	26.1	24.6	22.5	38.2	32.1
1970	8.3	49.1	31.9	56.4	56.1	48.3	36.3	30.4	40	39.3	33.2
1971	7.2	54.6	29.8	66.3	65.9	60.2	43.8	36.8	37.2	46.4	39.8
1972	16	56.5	45.9	82.4	80.4	78	53.9	44.9	43.5	46.2	39.7
1973	0	28.7	13.7	43.2	44.9	34.6	15.2	17.6	23.7	28.4	22.3
1974	12.3	62.2	44.1	73.7	70.8	66.3	42.8	36.4	36.8	61.3	49.6
1975	11.4	53.6	39.1	64.9	64.1	58.1	40.7	34.9	42.5	46	39.2
1976	11.7	49.6	28.7	61.9	60.5	53.7	37.7	36.8	34.8	36.6	32
1977	0	17.9	0.7	23.2	33.8	21	8.5	8.8	14.1	4.2	0
1978	0	27	10.6	42.8	52.3	43.6	27.1	27.2	23.7	38.7	30.3
1979	7.1	39.6	27.7	52.8	54	45.7	32.8	28.2	27.4	29	23.4
1980	0	23.7	0.5	33.5	41.5	30.5	18.4	18.8	16	35.7	31.6
1981	0	20.4	0	27.6	34.4	21.8	10.3	17.5	13.3	16.1	12.2
1982	9.2	45	30.5	64.1	63.2	57	35.5	41	34.2	55.6	46.8
1983	0	32.1	14.2	45.3	48.7	39.3	17.1	22	20.1	45.8	41.3
1984	1.3	38.8	20.3	48.1	53.6	45.3	20.3	23.5	33.9	40.3	31.4
1985	8.1	39.9	22.8	50.2	52.8	40.2	24.8	25	18.3	28	24.6
1986	0	25.5	8.6	38.3	43.5	34.1	16.8	23	21.5	29.5	21.1
1987	0	12.9	0	19.3	32.1	18.3	4.4	9.1	8.1	6	2.2
1988	0	18.3	0.8	29	39.1	29.3	14.2	18.6	21.3	18.3	12
1989	6.8	32.6	18.8	46.6	48.7	42.1	21.6	22.6	21.8	30	23.4
1990	0	31.4	8.3	40.3	48.9	32.2	14.8	17.8	13.5	8.9	6.9
1991	0	38.2	14.1	45.9	51.7	47	25.5	27.8	22.8	25.6	20.4
1992	0	20.5	0	27.3	37.5	33	11.4	17.1	10.3	5.7	5
1993	0	34.8	15.4	42.9	42.9	42.5	14.8	21.1	23.3	34.3	32.2
1994	0	15.2	3.9	23.3	28.9	23.5	8.5	12.4	13.3	9.3	9.9
1995	0	30.9	14	41.5	45	39.3	18.1	25.3	20.2	38	25
1996	0	30	8.6	42	54.1	49.3	31	32.3	27	36.1	28.9
1997	7.8	67.3	34.5	80	91.6	82.5	54.3	43.8	33.3	44.8	34.1
1998	0	19.6	9.8	28.3	35.3	27.5	14	17.8	16.8	23.3	21.5
1999	0	49.8	30.6	60.4	77.7	61	38.2	31.5	21.6	45.7	42
2000	0	35.1	16.6	41.6	49.6	42.6	19.5	15.5	12.7	19.7	20.5
2001	0	21.2	13.4	31.2	29.3	27.4	13.1	15.9	17.2	11.2	14.2
2002	6	49.8	28.6	53.1	63.8	47	29.1	28.1	17.1	30.5	29.8
2003	0	28.3	12.8	42.8	50	53.8	26.5	27.1	27.8	33.9	35.6
2004	0	25.8	12.6	37.8	40.4	36.9	12.9	14.8	10.7	16.5	20.7
2005	0	15.1	0.5	25	28.7	31	12.3	14.3	12.2	14.5	14.5
2006	0	30.1	14.5	42.1	54.7	47	25.8	24.2	19	41.8	34.7

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	16e11s	16e05s	15e02s	15e04s	15e11s	15e08s	15e09s	15f01s	15f14s	15f04s	15f05s
Latitude	44.952	44.771	44.626	44.545	44.303	44.288	44.051	43.932	43.954	43.757	43.629
Longitude	-116.143	-116.249	-115.794	-115.563	-115.234	-115.655	-115.443	-115.666	-115.274	-115.239	-115.438
1961	15	16	32.3	43.1	22.2	2.3	27.6	29.3	1.7	25.2	35.2
1962	11.8	16.4	31.3	45.3	22.3	8.1	27.7	27.6	1.8	29.7	40.1
1963	11.2	12.5	26.7	50.4	14.7	3.4	19	18.5	1.7	29.2	40.2
1964	20.4	17.7	30.5	47	25.3	13.2	31.3	33.4	9.5	30.7	38.1
1965	23.2	19	46.7	71.2	39.7	19.4	47.9	50.5	13.9	47.3	63.4
1966	13.8	17.8	28.3	38.9	23.7	8.7	29.3	26.7	2.7	25.2	35
1967	25.2	31.4	44.1	67.8	30.2	18	36.8	40.3	7.9	38.4	49.9
1968	16.7	12.6	25.9	39.2	14.9	8.1	19.2	18.8	1.7	21.7	28.3
1969	17.5	21.8	39.1	55.8	28.2	14.7	34.5	37.5	1.7	37.9	47.9
1970	22.5	22.7	40.4	57.8	31.1	22.7	38	41.7	12.3	35.6	48.3
1971	26.9	28.2	48.3	77.5	38.3	27.6	46.2	51.8	9.1	48	60.6
1972	25.1	27.5	50.2	67.2	37.9	16.9	45.8	57.4	19	48.2	60.8
1973	12.2	13.1	25.2	37.9	20.6	6.5	25.8	25.1	1.7	26.5	34.6
1974	28.9	35.7	58.1	81.8	41.9	16.8	50.4	51.2	10.6	47.9	62.9
1975	26	27.1	45.8	62	34.2	27.8	41.5	50	18.1	46	55.7
1976	20.9	21.1	41.1	51.2	31.6	11.3	38.5	44.3	11.7	36.8	45.4
1977	0	0	3.8	0.2	0	0	0	0	0	0	0
1978	20.3	19.7	42.1	55.7	29.7	7	36.3	40.3	9.2	38.3	50.5
1979	15.3	14.1	30	35	18.2	2.6	23	24.6	0	22.5	31
1980	14.2	20.7	38.9	51	26	6.4	32	33.4	4.7	30.6	44.3
1981	7.1	4.7	24	30.7	16.1	0	20.4	12.6	0	14.5	23.8
1982	22.4	0	52.8	77.5	39.6	14	39.9	52.3	15	49	61.5
1983	22	40.8	45	69.3	34.2	14.8	43.4	47.4	14.2	47.3	59.6
1984	22.8	24.3	34.7	46.8	28.2	11	33.9	40.2	11.6	35.5	43.7
1985	8.2	15.7	28.6	39.5	20.8	2.6	25.1	29.2	2.3	24	32.2
1986	10.8	15.9	40.8	47.1	26.8	0	38.9	43.5	0.7	39.2	54.2
1987	0	0	11	15.3	5.9	0	7.8	4.4	0	8.3	13.2
1988	4.5	6.6	19	26.9	12.5	0	18.7	19.6	0	18.8	26.2
1989	17.8	13.1	31.3	41.6	22.3	1.1	28.8	33.8	0	30	41.6
1990	3	2.4	17.2	23.3	13.3	0	15.2	13.8	0	15.8	20.2
1991	10.4	12.8	26	30.5	20.1	0	20.9	21.6	2	22.2	29.1
1992	0	0	18.8	25.6	9	0	11.1	3.2	0	13.6	16.3
1993	17.9	25.8	43	50.7	29.6	9.4	36.8	39.6	5.2	38.7	51.4
1994	5.1	3.4	16.3	18.3	10.6	0	14.9	13.8	0	16.4	18.3
1995	18.7	24.8	36	55.8	29.2	6.5	33.9	35.9	0	40.2	48.9
1996	13.4	13.8	35.8	61.3	33.3	5.6	35.4	31.1	0	39.3	47.6
1997	19.2	18.4	44.3	69.6	37.8	8.8	41.1	39.2	5.1	46.5	70.5
1998	9.6	19.1	27.6	35.1	18.5	1.3	21.3	19.1	0	28.1	33.3
1999	19	37.8	40.4	55.1	29.1	6	35.4	35	4	37.3	46.6
2000	7.3	7.7	22.5	29.9	15.3	0	21	17.6	0	22.9	30.5
2001	5.2	4.7	15.5	17.8	10.7	0	15	12.1	0	16	19.4
2002	12.1	20.5	26.3	37.6	21.7	1	24.9	25.4	0	26.8	37.1
2003	16.6	18.8	35	47.9	29.1	2.6	28.9	24.7	0	32.1	38.2
2004	10.1	3.4	19.2	26.1	10.4	0	15.2	20.3	0	6.4	28.7
2005	6.4	11.2	18.7	25.6	12.1	0	16.4	13.7	0	16.4	26
2006	16.7	28	41.2	55.3	29.9	5.7	35.3	35.5	1.6	39.9	56.4

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho
Station Id	16g01s	14g02s	14g01s	13g01s	11e10s	11f02s	11g06s	11g33s	11g05s	13d16s	14e01s	13f09s
Latitude	42.765	42.181	42.164	42.321	44.420	43.570	42.361	42.413	42.562	45.670	44.472	43.626
Longitude	-116.900	-114.287	-114.193	-113.616	-111.385	43.570	-111.561	-111.166	-111.298	-113.953	-114.490	-113.969
1961	1.3	10.5	0	10.9	12	7.6	16.4	0	8.7	12.2	17.4	9.1
1962	0	8.8	5.9	11.8	11.7	5	21.4	0	12.3	7.5	18.5	10.4
1963	0	7.5	1.9	19.2	11.5	12.2	25.5	6	19.9	10.1	19.8	13.6
1964	13.6	20.6	17.1	23.5	13.3	15.2	30	8.1	18.4	22.4	22.3	13.8
1965	11.3	21	12.2	28	14.6	11.5	39	11.1	24.7	19.8	34	24.9
1966	0	2.7	0	2.7	8	0	13.5	3.3	6.7	6.7	13.3	10
1967	19.2	14.5	14.4	19.7	18.6	15.7	36.5	11.6	28.8	22.3	28.7	24
1968	0	8.5	0.1	6.6	9.9	12.8	30.3	0	12.8	17.4	18.2	9
1969	5.6	8.5	5.6	6.8	12.8	8.1	27.8	0	16.8	11.9	26	21.7
1970	19.1	25.9	20.7	35.1	19.4	23.2	33.4	9.8	20.7	25.1	23.8	14.1
1971	3.4	24.2	19.3	31.8	18.8	19.3	46.1	14.1	29.8	20.5	31.1	19.5
1972	15.6	30.6	24.8	34.8	11	14.5	36.4	11.1	25.9	26.9	28.8	13.7
1973	1.3	16.7	12.8	19.6	12.5	14.8	29	10.3	18.4	12.9	15.5	12.2
1974	10	24.3	19.3	25.1	17.5	19	35.2	0	16.5	22.3	33.3	16.2
1975	20.8	30.3	24.5	26.7	21.7	21.5	33.7	14.9	27.3	28.5	26.9	21.6
1976	7	23.1	18.3	24.6	18.7	22.7	34.2	3.9	25	20.2	26.8	14
1977	0	4.9	2.6	0	0	0	3.1	0	0	4.6	4.7	6.2
1978	9.9	14.6	11	20.6	15.1	9.4	36.8	10.1	17.6	14.3	21.5	18.4
1979	13.9	19.9	16.8	12.5	13.1	14.4	23.4	7	13.5	13.2	15.6	10.6
1980	10.5	6.9	4.3	15.4	0	0	23.7	5.8	10.3	4.2	19.6	13.5
1981	0	6.3	3.8	0.1	0	0	4.6	0	0	5.1	14.5	6.5
1982	15	21	34	34.7	17.2	20.9	45.2	14.8	26	26.2	33.8	20.5
1983	30.7	24	29.2	32.8	15.3	14.3	36.3	8.5	20.1	15.8	24.8	24.1
1984	36.4	35	55.4	41.9	13.6	14.6	41.8	10.6	22	15.8	21.5	15.3
1985	0.2	6.6	5.8	8.9	10.2	5	18.9	0	4.4	9.9	16.3	6
1986	13.1	7.8	10.6	36	8.4	9.1	44.6	9.2	23.6	12.4	26.1	12.7
1987	0	0	0	0	0	0	0.2	0	0	0	8.4	0
1988	0	0.5	0.3	3.7	0.8	5.3	11.4	0	0.7	7.9	16.3	0
1989	5.9	6.9	6.3	18.3	12.4	7.3	15.4	0	3.5	10.9	18.8	10.6
1990	0	0.6	0.6	1.7	0	0.1	5.2	0	0.2	5.5	13.4	1.2
1991	9.5	11.9	10.6	19	7.2	10.1	20.1	0	10.6	15.1	19.9	12.7
1992	0	0	0	0	0	0	1.6	0	0	7.5	11.8	0
1993	18.3	15.6	15.4	34.1	9.5	12.5	31.8	3.9	13.3	11.7	21.9	19
1994	0	7.2	2.4	9.1	0	3.3	9.6	0	2.3	5.1	9.1	4
1995	16	13.3	9.5	21.7	9	11.8	22.2	0	9	15.6	25.2	19.5
1996	7.6	14.2	11.9	28.1	7.1	13.6	22.8	1.7	15.6	20.6	29.3	13.5
1997	11.1	23.5	18.6	42.7	11.9	19	38.4	6.1	19.6	30.1	35.6	21.6
1998	7.9	11.9	8.9	27.2	6.1	11.6	18.6	0	8.5	10.5	18.1	12.2
1999	17.3	18.6	16	28.5	9.5	9.4	20.5	2.1	11.3	17.7	27.7	15.9
2000	0	3.9	0	13.9	0	0	9.5	0	0	8.3	15.7	5.7
2001	0	4.8	2.1	6.2	0	1.4	8.5	0	0	9.2	14.4	4.1
2002	2.8	12.2	9.5	19.8	5.2	4.9	12.3	0	0	11.3	20.2	7.8
2003	1.9	8.5	5.6	13.3	1.6	4.5	8.5	0	0.8	16.7	22.5	15.2
2004	0	9.7	4.5	16.9	0	0	7.7	0	0	3	10.7	0.6
2005	1.1	14.3	12.9	20.3	4.8	4.8	20.7	0	5.7	4.9	14.3	12.6
2006	8.6	19.8	16.7	37.6	10.1	8.2	26	0	7.5	12	24.9	22.1

State	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Idaho	Montana
Station Id	13f03s	14f02s	14f03s	14f16s	14f19s	14f17s	14f12s	14f04s	14f08s	14f11s	15A08S
Latitude	43.744	43.861	43.824	43.711	43.769	43.877	43.875	43.799	43.603	43.484	48.571
Longitude	-113.938	-114.209	-114.264	-114.159	-114.418	-114.673	-114.714	-114.853	-114.674	-114.827	115.446
1961	13.4	2.9	16.1	5.6	6.2	12.5	16.9	27.1	20.6	0	24.8
1962	14.5	2.9	17.8	5.1	5.8	13.8	18.2	32.4	19.2	0	15.6
1963	17.2	8.5	21	9.1	8.5	16.3	20.8	34.2	22.4	0	15.4
1964	17.3	6.2	22.2	9.7	10	17.3	21.8	34	20.9	2.1	17.9
1965	26.4	10.3	33.5	21.1	15.8	31.1	35.7	53.5	43.1	0	23.3
1966	14.2	2.9	12.1	3	4.6	9.3	13.7	20	19.3	0	20.9
1967	25.7	14.1	42.9	17.5	16.5	24.1	28.6	44.6	34	0	28.9
1968	13.4	0	10.3	4.5	4.1	12.3	16.8	30.5	16.2	0	19.7
1969	23.8	6.5	28.7	10.2	12.8	21.4	25.9	38.3	22.8	0	22
1970	17.6	4.5	25.9	14.8	10.6	20.1	24.6	40.8	25.8	0	20.5
1971	21.9	2.9	35.8	16.6	12.5	27.9	32.4	52.6	45.5	4.7	25.6
1972	16.5	2.6	30.6	12.6	10	24.5	29	55.4	34	1.7	31.8
1973	10.3	3.1	15	5.5	6	11.7	16.1	26.9	21.4	0	14.3
1974	26.4	0	42.5	17.7	11.3	31	35.6	61.6	41.2	0	31
1975	20.4	12.7	31.3	18.1	16.6	27.9	32.4	48.4	32.3	12.1	28.4
1976	16.2	7.2	28.1	9.9	8.7	19.8	24.3	41.9	25.5	0	21.9
1977	11.1	0	0	0	0	0	0	4.8	6.7	0	1.3
1978	18	3	26.1	12.5	10	21.9	26.4	44.2	35.9	0	13.5
1979	14.2	4.8	15.9	8.1	6.8	11.8	16.2	29.4	22.1	0	15.5
1980	17.7	5.4	19.2	7.9	8.6	14.6	19	40	25.6	0	9
1981	13.6	0	13.1	4.9	4.8	11.8	16.2	25.3	18.3	0	11.1
1982	23.5	8	35	17.4	17.6	27.4	32	57.3	42.3	6.8	24.5
1983	27.2	13.2	35.5	19.3	16.9	26.5	28.3	49.5	40.2	8	20.2
1984	18.3	9.1	21.8	10.3	11.5	19.5	23.1	37.2	30.3	7.2	9
1985	10.4	0	11.7	0	5.7	12.5	16.4	26.7	19.3	0	15.8
1986	20.8	2.3	29.5	11	7	20.1	24.8	46	35.2	0	13.7
1987	4.1	0	0	0	0	1.6	4.7	12.8	8.3	0	9.8
1988	8.8	0	10.7	0	0	7	11.5	24.8	17	0	9.3
1989	13.2	0	21.3	6.3	7.8	14.2	16	33	24.5	0	15.1
1990	7	0	7.8	0	0	5.4	9.8	23.5	16.1	0	18.3
1991	12.2	2.1	13.4	8.2	4.6	11.4	14.2	25.4	18.4	0	22.5
1992	4.5	0	5.1	0	0	2.5	9	17.8	14.6	0	7.2
1993	17.5	6.4	25.7	13.7	12	21.5	25.8	41.3	31.4	0	12.7
1994	8	0	7.1	1.5	0	4.6	7.3	18.3	12.2	0	9
1995	24.2	7.7	31.6	15.3	13.3	24.1	30.4	49	36.4	0	17.5
1996	18.3	3.5	26.4	11.7	9.7	20.4	23.7	45.8	33.6	0	19.4
1997	23.1	3.1	37.6	17.8	13.6	27.3	33.6	57.9	39.5	0	35.6
1998	14.8	1.4	17	7.7	6.3	13.1	18.3	31.1	22.5	0	8.4
1999	20.3	6.3	23.3	10.5	12.3	20.3	24.5	42.1	29.7	0	23.9
2000	11.1	0	12.7	3.3	2.2	8.3	15.1	29.3	21.3	0	13.8
2001	7.5	0	6.8	0	0	4.5	12.2	17	14.1	0	10.9
2002	12.5	0	14.5	5.8	6.6	11.3	15.8	32.3	21.6	0	18.8
2003	16.6	3	23.2	11.4	6.2	17.1	23	39.7	27.6	0	13.1
2004	10.9	0	18.3	0	0	6.7	11.5	23.3	18.1	0	5
2005	13.6	0	12.1	5.7	2.6	9.2	17	21.2	18.1	0	5.4
2006	23.3	6.2	32.6	15.7	14.6	25.7	34.7	48.3	36.1	0	12.2

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	14A12S	14A11S	13A19S	13A24S	13A26S	13A15S	13A25S	12B12S	13B24S	13B22S	13B07S
Latitude	48.909	48.915	48.802	48.434	48.303	48.131	48.157	47.917	47.685	47.428	47.273
Longitude	114.863	114.767	113.857	113.937	113.329	113.023	113.946	112.824	113.962	113.775	113.756
1961	40.5	15.6	58	10.2	31.4	36.6	42.3	22	47.4	6.1	58.5
1962	32.7	11.2	43.3	8.2	29.2	30.3	32.6	16.5	41.2	6.9	51.5
1963	30	14.9	40.6	5.7	23.1	30.7	30.8	16.9	40.2	2	41.6
1964	38.5	8	57.1	11.7	31	43.5	50.8	26.9	43.3	9.9	61.1
1965	38	12.1	57.3	15.2	40.2	47.1	51.7	33.2	50.2	9.6	57.9
1966	31.8	9	48	6.6	28.3	33.9	35	19.8	33.3	2.6	38.5
1967	47.1	17.5	68.6	14.4	43.3	47.7	56.3	32.4	51.6	12.6	62
1968	34.7	8.7	51	8.3	26.4	42.2	37.8	16	40	0	46.3
1969	38.5	9.9	42.7	5.8	24.7	35.9	38.3	16.2	39.8	2	42.2
1970	34.2	13.6	50.8	11.8	39.9	51.4	51.2	28.5	46.9	17.2	55.8
1971	39.6	14.8	56.9	11.3	46.4	46.8	50.3	32.4	48.4	11.4	60
1972	49.1	18.7	74.6	17	50.8	62.3	64.2	38.8	57.5	15.5	73.2
1973	37.7	5.2	47.9	7.8	18.4	29.5	33.8	14.4	34.6	0	33.3
1974	54.7	16.6	62.2	16.3	31.5	44.7	66.9	27	61.7	5	60.1
1975	37.2	12.9	53.5	11.8	34.9	51.4	44.8	25	42.8	18	59.7
1976	32.9	10.6	59.2	11.8	27.9	54.4	45.1	30	40.6	4.9	54.7
1977	17.3	0	29.7	0	7	16.5	32.6	10.3	27	2.9	30.8
1978	41.4	9.8	42.2	3.7	25.9	35.8	50.1	23.7	48.5	2.5	54.9
1979	29.8	8.6	42.5	10.9	35.1	45	42	25.2	43	13.1	48.5
1980	30.8	2.5	36.7	0.2	16	30.1	33.3	17.1	36.5	2	29.4
1981	33.2	1.4	46.2	3.3	14	27.4	47.9	11.9	38.6	0	35.9
1982	40.1	13.5	53.1	13.4	39.3	47.8	47.8	30	46.5	13.4	58.2
1983	39.7	10.9	42.2	11.4	24.3	26.5	49.8	17	41.8	0.6	37.1
1984	30.8	3.3	32.9	6.1	17.6	27.4	52.3	15	36.3	1.1	41.8
1985	33.9	11.7	44.5	12.4	26.7	30.6	47.5	18.9	37.8	5.2	36.7
1986	33.7	0.2	38.5	4	19.6	33.5	38.6	20	40	0	42.7
1987	34.9	0	35.9	0.2	13.1	23.4	26.3	12	28.1	0	22.9
1988	26.4	0	34.4	3.3	17	28.6	29.1	18.1	26.8	0	32.7
1989	40.1	7.6	44.3	4.1	27.3	38.4	46	21.6	38.2	7.8	51.5
1990	42	1.6	46.7	6.1	26.6	39.2	43.7	21.8	47.2	1.1	40.4
1991	56.2	9.9	62.5	9.9	46.5	56.6	54.8	33.2	47.9	7.1	56.7
1992	26	0.1	31.9	0.6	13.8	20.1	33.4	12.1	30.4	0	35
1993	23.5	0.2	35.5	6.5	22.5	26.9	46.9	16.8	43.1	3.5	38.4
1994	26.3	2.2	35.6	3.8	20.7	25.4	26.8	15.6	28.5	0.1	30.1
1995	43.4	4.3	49.7	4.3	20.3	34.8	46.3	19.2	47.9	0	31
1996	54.8	8.5	58.5	8.6	29.8	41	48.6	25.4	51.5	8	55.2
1997	47.6	17.3	66.9	18.1	40.2	49.1	64.9	29.9	71.1	22.3	68.1
1998	33.2	2.4	36	0.3	12.1	20.6	33.6	12.4	35.3	0	30.2
1999	43.8	9	58.3	7.9	33	47	44.4	27.5	42	5.3	46.3
2000	33.4	7.3	40.5	7.8	17.6	24.8	42.1	14.3	34.7	4.6	36.3
2001	24	6.6	29.8	6.9	17.2	24.4	32.1	16.5	30.3	7.5	32.9
2002	48	10.5	56.9	7.6	34.1	48	45.6	26.5	41.5	8.9	59.7
2003	36.1	9.4	43.1	5.9	17.3	27.4	37	16.9	36	2.4	40.4
2004	30	0.8	37.2	0	11	24.9	34.2	14.7	31.2	0	28.7
2005	29.6	0	31.8	0	12.3	21.5	32	12.3	32.8	0	26.3
2006	40.2	4.2	45.3	0.7	21.9	32.6	47.4	15.6	46.2	0	47

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	15C10S	12B14S	12B16S	13C38S	13C31S	09C01S	10C06S	10C09S	11C01S	12C13S	12C11S
Latitude	46.975	47.082	47.057	46.883	46.871	46.789	46.780	46.793	46.560	46.435	46.356
Longitude	115.035	112.730	112.595	113.322	113.277	109.512	110.622	110.675	111.290	112.193	112.262
1961	56.6	41.3	12.4	2.2	8.3	6.5	20.7	8.6	20.3	4.7	16.5
1962	45.3	39.2	9.4	5.4	11.9	9.2	15.7	7	15.1	0.9	12.1
1963	36.5	31	9.3	0	10	19.4	21.2	8.6	17.2	7.4	19.7
1964	55.6	57.4	14.5	6.9	14.2	19.8	26.8	13.2	24.3	10.3	21.1
1965	57	52.3	14.3	2.9	14.8	15.9	29.2	13.3	23.3	7.3	22.9
1966	42.1	30.2	11.6	2.1	4.5	8.2	20.3	5.2	18.2	3	12
1967	58.2	61.8	19.9	6.3	20.8	18.9	34.6	16.6	28.7	11	21.8
1968	46.3	35.2	9	2.2	11.5	14.5	24.5	7.2	22.1	10.1	19.8
1969	47.6	38.3	10.2	1.7	12	2.8	17.8	0	17.3	2.8	17.8
1970	56.2	42.9	17.8	7.4	14.2	26.6	33.7	17.3	26.1	12.4	23.1
1971	69.9	59.2	11.5	0	10.5	12	31.4	10.5	30.8	8.7	22.8
1972	84.3	73.5	12.9	3	23.6	8.8	34.9	9.9	29.2	8.8	23.3
1973	32.1	23	0	0	4.4	18.7	16.5	6	17.1	9.6	14.8
1974	71.3	46.9	4.9	0	7.9	11.6	26.1	7.8	30.4	8.9	19.6
1975	55.8	42.1	12.8	8.2	24.3	18.5	27.7	13.6	26.3	16.2	23
1976	55.9	40.9	13.4	0	13.4	6.6	27.8	6	28.1	8.5	24.8
1977	13.6	4.5	0	0	0	11.5	19	1.8	12.3	0	8.6
1978	46.2	33	4.6	0	8.2	9.9	28.3	7.2	26.8	6.4	16.8
1979	43.2	36.1	12.7	0	12.6	12.6	26.6	10	24.4	11.3	19.7
1980	35.7	16.9	0.6	0	2.2	0.5	14.1	0	14.9	5.8	14.2
1981	33.3	20.1	0.2	0	2.8	4.6	18.6	0	18.5	4.2	16.4
1982	62.3	44	12.4	2.4	17.3	8.9	24.8	10.5	27.2	11.2	22.6
1983	41.6	25.5	1.7	0	6.3	5.4	19	5	24	8.1	15.8
1984	36.7	21.2	5.2	0	10.2	14.3	23	6.6	24.2	9.2	14.6
1985	45.8	28	6.6	0	4	11.7	21.5	4.3	18	3.7	13
1986	40.1	25.4	1.2	0.3	6.2	2.1	25.7	0.2	20.8	6.1	15.3
1987	29	8.6	0	0	0	0	8.7	0	5.6	0.2	11.8
1988	35	23.2	3	0	0.6	8.1	20	3.1	16.2	5.4	15.1
1989	40.5	30.6	7.6	0	7.9	7.3	23.8	6.9	20.8	6.7	14.5
1990	40.8	25.8	2.7	0	3.9	12.2	25	0.9	20.6	3.1	16
1991	55.4	37.9	6.9	0	9.5	20.3	30.9	12.4	22.8	9.4	16.3
1992	33.6	16.6	0	0	0.5	0	16.5	0.4	14.6	0	12.1
1993	34.2	21.2	1.1	0	8.3	6.4	22.4	7.3	22.4	7.1	16.4
1994	27.5	15.2	1.9	0	2.5	4.6	20.7	4.6	17	4.4	12.6
1995	40.8	25.7	0	0	9.2	15.2	23	8	26.9	7.1	19
1996	58.2	43	8.5	0	11	9	27	8	25.3	7.6	18
1997	76.7	43.1	13	0	16.4	17.1	30.6	13.4	31.4	10.4	20.6
1998	31.5	12.3	0	0	4.9	2.4	16.8	4.5	16	4.2	12.1
1999	63	39.8	7.5	0	9	12.2	26.3	5.3	22.7	6.4	15.8
2000	36.4	22.6	1.5	0	3.2	9.1	18.8	3.1	12.2	1	11.2
2001	25.3	16.7	4.2	0	7.1	11.3	14.2	4.1	14	6.8	14.4
2002	57.9	45.8	9.8	0	7.4	12.5	21.4	6.8	22.5	6.5	12.9
2003	40	31.4	4.9	0	10.3	11.8	23.2	5.9	23.5	7.2	17.5
2004	31.2	25.7	0	0	2.2	10.4	18.6	0	16.2	2.5	14.5
2005	28.4	21.3	0	0	8.6	14.7	20.5	6.6	15.1	8	12.4
2006	48.7	42.9	0	0	8.3	15.8	23.4	3	23.6	5.8	19.1

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	13C33S	13C13S	14C12S	14C13S	13C03S	13C43S	13C44S	13D26S	10C08S	10C03S	14D02S
Latitude	46.465	46.414	46.143	46.143	46.242	46.274	46.097	45.884	46.090	46.112	45.731
Longitude	113.394	113.431	114.505	114.448	113.773	113.164	113.130	113.326	110.434	110.470	114.481
1961	5	11.5	43.7	20.4	25.8	26	17.4	2.3	17.1	2.5	9.8
1962	6.1	9.9	40.2	13.5	25	21.5	14.7	3.3	16.9	2	6
1963	6	13.5	33.2	14.8	25.3	27.5	18.8	5.5	15.6	4.3	7.8
1964	6.4	16.4	51.3	25.1	29.3	26.7	18.4	6.9	21.4	7	18.1
1965	7.1	7.6	48.6	21.8	38.7	35.8	21.1	5.7	25	8.3	14.5
1966	2.2	10.3	26.1	8.2	19.8	18.5	14.7	0	18.1	2.8	4.8
1967	9	19.7	45.9	21.1	32.5	31.1	21.7	11.1	23	8.1	16.4
1968	5.9	13.2	40.4	5	25.9	30.3	19.9	1.8	20.2	6.8	7.9
1969	5.1	11.7	40.4	15.6	25.3	25.7	16.8	2	13.9	0	5.7
1970	7.2	16	48.9	22	31.5	27.7	20.6	5.6	25.6	10.1	15.4
1971	3.4	14.6	53.4	19.2	34.7	31.2	21.3	5.8	26	6.7	15.6
1972	7.9	23.4	69.8	29.3	47.1	38	21.9	11.2	20.6	4.4	21.9
1973	0	9.2	28.7	8.4	18.5	19.1	17.3	0	16.9	6.6	6.8
1974	0	13.8	54	26.9	33	28	15.9	4.8	22.8	1.8	17.4
1975	10.3	19.5	52.6	27.3	36.7	28.7	22.4	9	22.5	10.3	19.5
1976	6	21.2	54.1	20.4	35.4	32.8	22.4	5.1	22.8	6.3	13.5
1977	0	2.4	17.1	0.1	5.4	10.7	10.5	0	16	0	1.7
1978	0	13.3	44.7	6	27.6	30.2	13.5	0	22.2	3.4	11.7
1979	3.4	13.8	39.3	6.2	26.6	24.8	16	4.1	25.7	6.3	14
1980	0	6.9	32.3	6.8	19.9	17.8	13.3	0	14.6	0	5
1981	0.2	6.4	24	0.9	16.6	19.6	13.5	0	16.3	0	4.7
1982	5	17.5	56.2	23	38.9	30.8	19.8	8.8	21.9	6.6	20
1983	0	9.1	33.2	4.5	22.5	21.2	19.6	3.3	15.9	1	9.8
1984	0.6	11.7	33.5	11	21.8	24.5	18.1	1.7	24.7	5.5	12.5
1985	0	6.6	32.6	6.7	19.9	16.9	15.3	0	13.5	0	8.7
1986	0	8.7	31	2.4	25	26.8	17.1	0	17.1	0.4	10.5
1987	0	0.1	22.3	0	13.1	12.6	8.5	0	3.5	0	1.8
1988	0	8.5	31.4	2.6	21.3	19.5	13.6	0	16.5	0.8	10.7
1989	0	9.7	34.7	5.7	23.4	20	15.8	0.7	20.6	4.4	9.7
1990	0.2	4.7	33.2	0.2	22	21.8	12.1	0.6	20.2	1.1	6.2
1991	3	11.3	41	8.6	26.2	22.5	18.2	3.4	24.9	9.4	11.8
1992	0	1.4	27.4	0	17.6	18.3	10.7	0	17.5	0.5	1.7
1993	0	10.9	34.3	4.3	22.3	20.2	17.3	1.1	21.9	5.8	8.1
1994	0	5.2	23.3	0	14.1	16.4	10.9	1.2	10.8	0	6.1
1995	0.3	11.9	32.7	2.8	24.9	24.4	20.9	3.2	26.5	8.7	10.4
1996	0	16.9	45.4	4.9	36	34.7	18.4	7	24.2	6	16
1997	4.1	18.5	59.9	24.8	42.6	36.7	23.8	12.6	35	11.5	21.4
1998	0	7.2	29.3	0.3	20.4	19.3	12.7	1.2	14.9	0	8
1999	0.2	11.8	51.4	10.2	29.8	25.3	18.5	5.1	19.9	0.5	12.3
2000	0	2.3	31.9	0	18.2	17.3	8.1	0	12.5	0	7.1
2001	0.8	7.7	23.4	2	15.1	17.7	14.4	0.2	13.4	0.6	7.4
2002	0.2	8.6	43.2	10.3	24.8	20.5	14.3	1.5	17.2	3	10.6
2003	0.1	11.2	41.5	6.8	27.2	28	17.7	5	18.8	1.2	14.7
2004	0	0.9	28.6	0	17.6	20.7	12.7	0	13.9	0	4.6
2005	0	8.5	22.7	0	13	15.3	15.4	0	15.8	0	4.9
2006	0	8.5	43.4	9.8	23.1	23.6	17.2	0	21.9	0	10.1

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana
Station Id	13D22S	13D10S	13E23S	12E07S	11E03S	11E24S	11D08S	11E35S	11E31S	11E07S	11E30S
Latitude	45.693	45.165	44.994	44.793	44.589	44.786	45.018	44.508	44.586	44.658	44.611
Longitude	113.968	113.501	113.444	112.056	111.825	111.710	111.846	111.128	111.116	111.092	111.150
1961	22.8	9.8	8.4	12	5.7	7.9	22.2	49.2	23.2	4.4	14.4
1962	18	4.2	8	8.9	6.1	7	19.5	48.5	24	4.2	13.1
1963	23.9	8.1	8.6	11.3	7.2	9.4	16.5	25.5	16.9	3.9	10.8
1964	29.8	12.5	11.2	13.3	10.2	12.1	20.4	38.6	23.4	6.5	15.2
1965	33.5	15.7	17.9	15.3	17.3	17.4	24.2	52.4	27.2	8.8	18.6
1966	18.6	4.1	8.2	9.2	7.4	9.9	17.9	44.8	19	1.6	11.4
1967	31.8	16.5	10.6	14.9	19.6	18	23.8	39.2	27.9	19.4	21.6
1968	26.7	9.4	10.3	12.2	9.4	14.7	22.2	36.4	18.8	5.5	14
1969	29.6	9.1	11	13.1	12.8	12.3	19.5	46.9	28.7	8	16.6
1970	33.8	15.4	11.4	14.2	10.4	13.3	27.3	45.4	29.4	14.1	18.4
1971	44	19.5	16.2	18.3	17.7	20.5	27.4	57.4	37.2	17.5	24.1
1972	42	19.9	16.6	14.6	10.5	17.7	23.7	49.7	33	9.9	22.1
1973	22	9.1	8.4	12.4	8.3	13	20.2	35	21.3	8.4	14.9
1974	39.8	13.9	14	13.9	10.7	16.9	24.6	63.9	36.6	10.7	22.5
1975	37	18.2	19.2	17.5	19	19.9	28.9	45.4	30	14.6	21.4
1976	37.9	19.1	19.6	13.2	13.1	16.7	26	43.7	32.8	15.5	22.6
1977	10.8	0.2	1.1	4.4	0	1.2	13.8	7	3.4	0	0.5
1978	30.9	12.3	14.3	14.5	11.4	19.1	21.1	47.3	26	6.4	17.8
1979	25.1	13.3	15.5	10.8	8.1	14.5	16.5	36.2	23.7	8.7	16.1
1980	16.8	4.4	5.8	7.8	1	7.6	14.2	32.7	17.3	0	9.5
1981	20.2	4.6	6	6.3	1.8	7.8	15.1	21	10.9	0	3.8
1982	35.2	15.4	15	19	10.4	18.7	23.3	52.2	31.4	14.8	22.8
1983	24.3	11.8	9.9	14.1	19.3	17.2	20.3	38.1	24.8	8.7	16.2
1984	22.2	12.8	15.5	15.1	11.1	16.5	24.9	36.9	18.9	9.3	14.2
1985	20	6	5.8	8.2	4	9.4	13	35.2	21.3	4.6	15.9
1986	25.3	10.9	13	12.6	8.3	15.9	19.5	47.3	26.7	3.9	19.7
1987	8.8	0.1	0.8	4.5	0	3.3	7.1	9.9	5.9	0	2.9
1988	20.1	7.4	9.2	9.5	0.2	10.6	13.8	33.6	19.3	0	10.6
1989	22.5	7.9	8.6	11.3	7.6	13.2	15.6	48.5	31.4	8.6	18.1
1990	21.1	4.1	4.9	9.6	3.4	8	13.6	25.8	17.6	0	7.3
1991	25.1	11	12.1	11.3	7.7	11.2	21.3	34.1	22.9	2.9	15.5
1992	20	3.4	5.4	7.4	2.9	8.1	13.6	29.8	15.4	0	4.6
1993	22.9	11.5	12.9	16.3	14.8	19.6	20.6	45.4	25.7	7.4	19.8
1994	15.6	6.2	7.5	7.2	0	7.6	12.7	30	16.8	0	9.7
1995	30.5	16.6	18	19.4	15.1	21.9	26.4	64.9	35.6	7.2	24.3
1996	39.3	19	14.9	14.1	11.6	16.2	23.1	50.1	30.6	5.4	19.8
1997	42.9	19.6	17.4	16.3	14.9	19.9	25.7	73.4	42.7	7.4	22.8
1998	22.6	10.1	10.7	11.1	10.5	14.9	18.9	38.7	20.2	0	14.9
1999	28.7	13	11.5	11.3	14.8	17.2	21.2	53.3	30.4	7.2	20.5
2000	21.1	5.2	4.8	8.2	3.5	12	16.1	34.4	16	0	9.5
2001	17.3	6.5	10.2	12	5.3	10.4	14.9	25.5	12.2	0	8.3
2002	25.2	7.8	9.7	9.8	8.4	13.9	15.5	41.1	23.6	1.5	15.3
2003	28.9	14	15.1	12.2	7.6	14.1	20.8	37.7	20.7	0	11.1
2004	19.5	2.1	3.8	10.3	6.9	12.3	12.5	36.7	21.7	0	13.4
2005	13	5.2	9.6	11.1	12.5	10.9	14.4	34.2	19.6	0	12.2
2006	24.2	9.2	11.5	13.1	10.6	16.9	17.6	55.9	28.5	2	14.2

State	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Montana	Nevada	Nevada
Station Id	11E29S	11D19S	10D16S	10D13S	10D12S	09D16S	09D08S	09D06S	10D07S	15H01S	15H04S
Latitude	44.962	45.274	45.401	45.504	45.218	45.194	45.046	45.062	45.006	41.834	41.762
Longitude	111.294	111.427	110.958	110.966	110.237	109.345	109.910	109.945	110.014	-115.452	-115.693
1961	33.1	16.4	25.8	7	21.8	16.1	22.5	34.1	6.7	12.2	0
1962	27.8	14	27.2	6.2	21.6	25.4	24.7	37.3	4.2	25	0
1963	18	19.5	27.4	8.4	20.9	22.7	24.4	37.1	7.3	18.1	0
1964	30.5	24.8	29.2	18.2	24.4	24.8	28	42.9	8.2	17.3	2.5
1965	44.1	26.5	34.1	11.7	30.4	23.8	34.6	52.8	10	21.6	0
1966	30.6	15.2	25.6	8.3	17.7	22.5	22.1	33.6	3.7	9.5	0
1967	42.2	26	31.1	20	30.8	23.4	33.3	52.3	15.8	26.8	0
1968	31.3	29	33.1	16.3	26.4	24.8	25.4	33.2	10.1	12.8	0
1969	34.8	17.3	27.3	4.3	22.6	15.6	23.4	36.4	7.4	20.5	0
1970	35.2	31.6	41.3	27.9	26.8	24.6	29.8	44.2	18	26	5.4
1971	45.5	30.5	36.7	17.2	34.8	29.8	34.5	59.2	14.2	23.5	0.1
1972	37.6	24.8	29.7	9.8	28.3	26.6	32.7	54.2	11.7	24.2	4.3
1973	33.1	20.2	29.3	23.9	20.1	31.3	21.9	33.4	10.1	23	4.5
1974	41.3	31.3	34.5	13.3	31	18.6	34.2	55.2	11.3	18.3	0.9
1975	33.3	26.5	35.6	23.7	30.4	24.5	31.2	45.6	14.9	34	17.6
1976	38.4	26.7	36.4	18.9	33.1	26.7	34.7	50.2	16.6	27.4	3.2
1977	13.8	8.2	19	1.2	12.8	11.6	11.5	21.7	0	6.3	0
1978	36	25.8	30.4	0.6	22.6	11.8	33.9	43.7	9.7	28.4	2.9
1979	29.6	19.7	27.2	8.4	22.3	22.8	28.1	37.4	11.6	16.5	5.3
1980	22.8	17.7	19.5	4.4	18.2	16.1	20.2	29.4	3.6	17	0
1981	21.9	13.2	19	4.3	16	10	18	24	0	7.2	0
1982	40	29.6	33.2	12.5	28.8	18.2	34.1	47.1	12.6	30.3	6
1983	34.5	21.5	25.7	9.1	20.4	23.4	23.9	31.4	7.7	29.8	11.5
1984	33.2	24	32.6	15.5	21.6	28.2	22.8	31.4	7.9	42.5	14.1
1985	22	13.6	14.8	1	17.6	11.3	22.8	28.1	1.9	15.2	0
1986	34	19.3	25.8	5.1	26.7	20.8	31.1	40.1	4.4	18	0
1987	14.4	4.5	12.6	0	11.8	13.2	12.9	20.3	0	2.3	0
1988	22.4	13.1	23	9.3	17.3	16.1	19.9	30.5	4.1	9.6	0
1989	30.7	17.8	22.4	8.4	20.4	17.6	28.1	39.5	6.6	19.1	0
1990	24.8	17	25	8.6	22	16.8	24.3	34.9	0.3	7	0
1991	29.3	24.3	31.6	16.3	24.5	29.9	26	34.3	10.4	20.3	0
1992	22.5	14.3	21.1	4.5	18.2	13.5	22.9	31.8	3	0	0
1993	34.3	20.8	28	12.3	21.5	19.2	23.3	33.1	7.8	25	0
1994	21.7	11	20.8	4.7	14.9	19.1	20	26.8	0.5	12	0
1995	39.7	26.2	29.3	15.7	25.5	25.6	29	38.9	7.7	22.3	0
1996	38.7	29.5	32.1	11.3	30.2	21.8	39.5	50.6	13	23.3	0
1997	46	32.1	37.6	17.2	35.9	21.6	42.5	59.6	12.4	25.7	0
1998	28.4	19.2	22.8	8.6	19.7	14.4	22.2	28.2	2.2	15.2	0
1999	36.3	23.1	24.3	9.7	28.3	19.1	30.1	43.7	6.3	19.7	0
2000	24.8	17.4	22.9	7.4	20.7	11.9	25.3	31.1	0.2	8.3	0
2001	19.3	14.8	20.1	6.9	15.3	10.2	15.4	21.7	0.2	11.1	0
2002	27.4	18.7	20.4	5.7	24.2	13.8	23.8	37.1	0.7	15.7	0
2003	29.2	20	24.5	10.9	23.9	20.3	29.1	39.1	4.4	19.3	0
2004	28.2	12.3	17.2	4.8	16.7	12.2	19	28.2	0	8.7	0
2005	22.5	15	22.7	9.1	16.2	16.3	18.7	26.3	0	22.5	0
2006	33.5	24.2	24.9	6.1	25.1	11.8	28	44.5	0	26.1	1

State	Nevada	Oregon	Oregon	Oregon	Oregon	Utah	Utah	Utah	Utah	Utah	Utah
Station Id	15H14S	21e05s	22e43s	21f21s	22f14s	**09j01s**	**09j05s**	**09m02s**	**10j10s**	**10j52s**	**10k01s**
Latitude	41.873	44.435	43.901	43.804	43.449	**40.716**	**40.608**	**37.813**	**40.597**	**40.678**	**39.892**
Longitude	-115.247	-121.945	-122.031	-121.949	-122.138	**-109.544**	**-109.889**	**-109.488**	**-110.433**	**-110.949**	**-110.746**
1961	12.8	10.4	19.2	30.7	24.4	5.2	8.3	3.4	7.1	15.2	3.9
1962	20.7	9.9	21.2	39.9	26.8	11.3	12.6	2.6	14.9	30.2	8.8
1963	16.9	6.3	9.6	17.1	12.6	8.9	9.9	0.7	10.5	28.5	7.7
1964	21.9	27.4	37.6	48.6	46.9	9.6	9.9	4.2	13.2	23.9	10.7
1965	23.6	0	19.3	34.7	24.6	15.5	14.9	14	17.8	39.6	20.3
1966	9.4	13.7	26.5	37	33.4	7.1	9.1	0.6	7.7	17.2	5
1967	21	22.9	34.4	40	43	12.4	12.7	0	13.9	31	10.4
1968	16.6	0	6.7	17.8	9.1	17.9	14	16	16.6	29.1	17.1
1969	18.5	20.9	33.4	45.9	41.8	12.5	17.4	13.8	17.9	30.5	12.9
1970	26.7	3.4	24.2	33	30.5	13.4	7.5	10.3	11.1	25.3	9.9
1971	28.6	36.5	52.2	57.7	64.8	9.1	9.4	0	10.5	32.8	4.7
1972	25.1	29.1	40.6	65.9	50.6	9.2	10.1	0	11.2	34	8.3
1973	20.8	0	10.5	21.2	13.8	16.4	15.4	21.4	16.6	26.6	16.7
1974	22.9	38.5	51.6	65.8	64	10.6	7.6	0	6.8	33.1	1.7
1975	31.2	27.7	50.4	54.3	62.5	12.1	13.6	16.5	15.4	33.3	16.4
1976	24.1	31	42.1	53.8	52.4	13.5	12.2	2.6	11.6	24.9	8.7
1977	0	0	4.8	17.8	6.8	0	0	0	0	5.5	0
1978	17.9	0	7	17.3	9.5	11.2	14	9.7	12.4	32.4	14
1979	18.3	1.8	21.8	25.6	27.7	10.8	16	21.9	10.7	26	15.9
1980	15.5	0	8.5	30.5	11.4	15	17.6	21.9	16	36	13.8
1981	9	0	0	19.5	5.7	0	5	0	4.3	15.5	0
1982	24.1	28.3	38.8	52.3	55.7	9	9.8	2	14	37.1	8.5
1983	23.3	1.1	28.7	43.1	49.9	17.8	28.4	22.3	20.1	30.6	20.5
1984	37.5	11.9	35.1	51.8	61.4	14.2	15.8	7.6	12.8	37.2	11.6
1985	17.6	17	34.2	48	47.6	0	9.9	5.3	6.9	22.6	3
1986	19.1	0	25.1	42.2	39.6	10.5	19.5	0	21.6	51.9	17.6
1987	7.9	0	5	31.4	34.8	0	3.8	0	7.3	11.1	0
1988	13.6	0.3	15.5	33.6	26.8	0	6.5	0	5.6	16.1	3.8
1989	19.1	0	32.6	47.1	57.1	0	5.1	0	2.7	26.5	0
1990	13.9	0	3.6	13.6	26.2	0	10.2	0.1	13.5	18.4	0.2
1991	23.4	0	21.5	22.6	34.8	8	17.4	1.9	12.1	20.9	7.3
1992	11.3	0	0	10.8	18.4	0	1.5	2.4	0.3	4.2	0
1993	27.4	0	25.2	51.8	59.4	10.5	16.7	18.4	15.8	30.6	11.1
1994	15.5	0	12.4	23.9	24	2.6	8.9	4.2	9.3	14.2	2.7
1995	21.4	0	21.3	41.6	43.8	12.2	23.6	10.6	23.8	29.9	12.8
1996	24.5	0	12.8	37.2	38	1.5	6.4	0	12.8	36.3	7
1997	30.9	0	30.4	48.6	49.7	12.7	18.5	12.6	12.6	37.9	13.3
1998	19.5	0	15.5	30.2	38.2	9.6	15.2	8	18.7	23.9	11.5
1999	20.9	17.1	55.7	64.2	66.7	10.2	17.9	1.6	15.3	25.2	4.7
2000	15.9	0	18	40.1	39.4	1.4	4.7	0	5.1	19.2	0
2001	17	0	12.4	18.8	25.8	4.4	10.8	0	13.5	14.4	6.7
2002	21.1	0	21.6	45.1	47.9	0	0	0	0.8	13.4	0
2003	18.5	0	11.5	31.8	34.6	0	4.7	0	8.6	12.4	2.9
2004	18.5	0	19.2	46.8	48.3	0	6.3	0.8	8.5	15.1	0.1
2005	19.6	0	5.4	24	26.8	12.2	22.6	25.6	21.3	32.4	17
2006	23.2	0	35.9	43	52.1	0.4	7.3	0	10.4	33.2	3.3

State	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah
Station Id	**11h08s**	**11h36s**	**11h37s**	**11h55s**	**11h57s**	**11j01s**	**11j02s**	**11j11s**	**11j21s**	**11j23s**	**11j52s**
Latitude	**41.376**	**41.898**	**41.685**	**41.413**	**41.466**	**40.855**	**40.885**	**40.975**	**40.428**	**40.295**	**40.762**
Longitude	**-111.944**	**-111.630**	**-111.419**	**-111.538**	**-111.497**	**-111.048**	**-111.069**	**-111.809**	**-111.616**	**-111.256**	**-111.629**
1961	20.4	21	10.8	9.9	19.9	17.5	9.3	19.4	6.5	0	0
1962	41.3	28	15.4	15.9	29	21.5	8.1	26.7	18.2	9.4	0
1963	36	34.1	21.9	24.7	31.5	31.6	15.8	29.6	20.8	11.9	10.9
1964	35.9	36.9	20.4	22.7	31.5	24.5	16.5	28.4	18.6	13.4	17.8
1965	44.2	50.8	21.7	24.3	36.4	34.7	19.5	35.5	24.7	12.2	12.7
1966	20.8	27.5	12.1	11.6	22.3	18.4	5.9	19.9	13	0	0
1967	41.4	50.4	24.7	28.3	35.8	29.2	19.3	31.7	37	19.9	13.1
1968	36.5	36.5	19	20.8	29.6	27.7	17.6	34.5	26.6	19.4	20.5
1969	46.3	36.7	24.7	28.5	31.7	26.9	13.1	36.1	34.2	16.4	5.7
1970	38.2	41.6	22.3	25.1	30.4	23.8	15	36.1	19.6	11.6	17.6
1971	43	56.2	25.2	29	43.4	29.8	14.7	37	15	6.1	7.8
1972	47.6	60.9	24.7	28.5	41.4	30.3	18.5	44	15	0	12.8
1973	56.2	36.7	24.2	27.8	30.9	26.5	16.6	36.2	29.8	16.5	15.4
1974	39.4	46.4	23.2	26.4	36.5	33.7	21.2	35.1	15.9	14.4	17.5
1975	54.6	43.2	30.8	36.5	35.6	31.4	20.8	46.1	34.6	18.7	28.4
1976	39.5	41.6	20.4	22.6	30	22.9	14.1	35.9	20.1	11.2	10.9
1977	0	0	0	0	0	7.7	2.4	10.7	0	0	0
1978	59.2	38.7	23.4	26.6	32.7	25.6	10.8	44.2	34.9	19.4	20.1
1979	43	36.4	18	22.8	27.8	20.6	12.6	33.7	20.5	16.8	6.7
1980	42.2	31.5	16.8	19.3	25.5	25.5	12.9	32.4	34.2	13.3	8.6
1981	10.6	5	0.3	4.9	8.1	17.6	3.9	13.8	9.1	0	0
1982	47.9	50	28.2	24.2	33.1	33.4	18.4	35.5	31.8	13.2	16.8
1983	62.6	42	21	31.3	34.1	33.7	18.8	49.9	31.7	25.1	24
1984	73.2	49	29.1	29.5	40.8	25.8	16.8	48.4	25.7	20.6	30.4
1985	26.6	31.3	15.6	14.9	25.5	21.1	5.3	25.9	7.1	3.9	0
1986	58.7	48.3	32.5	39.3	46.3	44.9	20.8	47.3	34.4	24.1	14.6
1987	8.9	3.6	2.1	0	9.4	16.1	0	7.3	0	0	0
1988	16.8	20	9.6	8.5	18.1	16.1	4.7	9.4	2	0	0
1989	31.3	35.7	13	16.7	25.9	24.5	8	27.3	2.1	0	0
1990	10.1	13.5	6.2	0.9	13.8	14.6	1.9	12	6.9	0	0
1991	32	28.3	14.5	14.1	29.7	26.9	14.2	32.8	12.1	7.7	11.2
1992	0	5.3	0	0	3.8	7.6	0	0.6	0	0	0
1993	36.2	40.5	18.4	17.4	38.4	37.1	16.3	36.5	29.1	10	6.9
1994	18.5	22.6	13.5	10.7	20.9	21.7	6	23.1	10.2	1.2	0
1995	43.3	33.5	20.5	17	38.2	29.1	15.1	40.9	25.1	12.3	9.8
1996	36.5	41.9	24.1	18.6	39.7	30.6	16.1	35.8	17.4	16.5	12
1997	63.8	55	34.3	26.7	42.5	35	17.4	50.5	26.6	17.1	9.2
1998	54.6	39.5	17.7	14.7	28.1	23.9	11.5	41.5	19.3	10.8	10.1
1999	32.5	46.7	25.2	16.2	35.8	27	14.6	32.9	12.4	4.7	7.1
2000	23.3	23.3	7.4	4	12.3	18.2	5	27.5	4.4	0	0
2001	20.4	17.1	7.4	4.7	15.3	14.5	4.7	28.7	3.9	0	0
2002	25.9	24.1	14.2	9.7	21.5	17	7	31.7	0.8	0	0
2003	13.5	25.6	10.7	5.1	13.5	15.7	6.4	22.5	1.7	0	0
2004	22.5	21	10.2	3.7	19.2	13.2	4.3	34.1	2.4	0	0
2005	51.2	45.1	21.5	17.4	32.2	26.3	13.2	49.2	37.7	12.1	8.7
2006	49.3	51.8	22.7	15.4	34.1	27.9	11.3	50.5	20.8	10.3	9.9

State	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah	Utah
Station Id	**11j53s**	**11j57s**	**11k03s**	**11k09s**	**11k13s**	**11k21s**	**11k22s**	**11k31s**	**11k52s**	**11l01s**	**11l04s**
Latitude	**40.790**	**40.599**	**39.683**	**39.310**	**39.137**	**39.866**	**39.893**	**39.134**	**39.930**	**38.773**	**38.680**
Longitude	**-111.118**	**-111.583**	**-111.318**	**-111.433**	**-111.558**	**-111.283**	**-111.251**	**-111.437**	**-111.631**	**-111.677**	**-111.598**
1961	0.7	15.8	9.1	10.9	8	8.3	4.4	12.4	8.3	17.9	6.6
1962	5.9	29.3	22.1	18.2	9	18.8	10.7	18.5	14.5	19.8	7.1
1963	7.5	26.3	17.8	19.5	8	15.4	5.8	17.3	11.9	15.4	4.4
1964	13.8	25.8	18.5	13.1	10	18.2	10.3	13.9	18	21.1	7.6
1965	18.1	30.4	23.7	21.9	9	26.2	15.1	24.8	20.8	27.2	11.4
1966	0	17.8	5.9	8.9	0	5.5	0.9	5.4	2.6	10.5	0
1967	13.6	28.3	20	13.9	4	21.7	12.3	15.5	17.8	17.2	7.1
1968	16.9	34.1	25.5	22.7	16	21.7	15.2	19.9	25	26	13.6
1969	10.7	34.6	21.5	16.3	8	22.2	13.7	20.7	16.5	22.7	9.6
1970	14	28	21.5	17.9	10	21.1	13.8	20.7	22.6	26.4	13.1
1971	6.9	25.2	15.4	12.5	2	15.7	8.7	15.7	8.4	22.5	6.6
1972	6.1	32.3	10	10.7	0	13.6	5.8	8.6	7	15.6	1.5
1973	12	29.1	22.1	21.6	16	25.7	16.6	20.8	36.1	29	13.1
1974	15.5	30.7	22.3	17.9	11	21.6	15.8	20.7	27.3	29.2	14.2
1975	18.7	33.6	27.6	19.2	16	25.4	16	22.8	27	27.3	15.1
1976	7.5	26.7	14.8	10.5	5	16.4	9.9	11.9	17.5	19	7.2
1977	0	2.7	0	2.6	0	0	0	0	0	8.8	0
1978	7.3	34.9	28.7	21.4	9	23.6	13.4	26.9	24.2	22.9	10.8
1979	5	30.3	23.5	17.9	12	19.5	13.6	20.4	18	21.4	11.1
1980	11.2	36	22.8	20.5	5	21.5	6.3	24.1	12.8	23	11.8
1981	0	10.3	4.8	7.1	0	1.5	0	1.5	0	10.1	1.1
1982	9.4	39.5	21.2	19.5	5	20.8	14	23.6	16.8	20.8	11.3
1983	14.6	34.6	33.2	31.5	22	24.1	16.1	31.6	33.1	31.2	15.2
1984	16	31.7	34.1	31.9	24	27.4	17.6	31.5	40.3	37.8	18.6
1985	4.3	20.5	6.8	13.2	0	14.8	3	10.8	5.4	21.1	5.4
1986	15	35	15.6	24.6	0	26.1	8.5	22.1	17.5	21.8	6.3
1987	0	14.3	0	7.8	0	0	0	5.5	0	17.4	0
1988	0.9	14.2	7.5	12.5	0	6	0	10.8	7.1	18.9	6
1989	0	21.4	0	5.2	0	2.5	0	1.3	0	13.6	0
1990	0	19.1	2.5	8.1	0	12.1	0	6.7	0	17.5	0
1991	9.3	26.6	21.4	13	6	17.7	13.5	13.8	16.5	22	6.4
1992	0	6.8	0	4.9	0	0	0	1.4	0	10.2	0
1993	14	31.8	22.2	22.1	1	21	7.3	20.3	15	23.3	11.6
1994	1.2	16.7	11.5	11.2	0	6.3	2	8.6	6.1	17	1.3
1995	8	30.8	20.7	23.5	0	23.8	11.8	22	18	28.1	14.5
1996	14.6	29.9	20.6	12.5	0	21.1	10.4	20.4	12.7	18.6	6.8
1997	8.2	29.5	29.1	21.3	0	25.5	11.2	27.5	9	26.6	9.2
1998	8.7	25.2	17.8	16.6	3	16.4	7.7	17.8	15.1	24.4	5.4
1999	9.4	23.6	15.8	15.1	0	16.4	6.4	13.9	7.3	21.1	2.6
2000	0	6.4	6.6	8.9	0	5.6	0	5.5	0	12	0
2001	0	13.1	4.7	11	0	6.4	0	9	0	16.7	1.1
2002	2.3	11.9	2.4	5.2	0	3.3	0	0.7	0	10.8	0
2003	0	11.6	10.6	11.2	0	12.1	3.8	9.4	1.9	20.5	1.6
2004	0	10.5	1	14	0	6.2	0	8	0	22	0
2005	9.1	35.2	16.7	17.7	0	24.4	7.3	16	12.8	23.9	6.8
2006	5.7	31.2	17.6	16.7	1	19	5.6	21.4	8.3	14	1.9

State	Utah	Utah	Utah	Utah	Utah	Utah	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	**11m03s**	**12l04s**	**12l07s**	**12l15s**	**12m13s**	**12m23s**	06H13S	06H19S	06H10S	06G01S	07F02S
Latitude	**37.836**	**38.508**	**38.302**	**38.965**	**37.661**	**37.569**	41.359	41.329	41.154	42.734	43.627
Longitude	**-111.881**	**-112.019**	**-112.357**	**-112.249**	**-112.741**	**-112.838**	-106.232	-106.502	-106.969	-106.319	-107.181
1961	13	9.6	16.8	13.4	0.8	17.2	24.3	11.5	30.2	15	17.8
1962	6.6	11.5	19.3	13.4	0	21.6	28	10.7	36	8.8	13
1963	9.4	8	14.6	8.9	5.6	18.4	24.2	10.2	36.5	15.1	20
1964	8.4	11.8	16.1	21.4	6.2	19.4	27.6	16.3	36.3	28.5	25
1965	15.6	18	22.9	20.4	15.9	30.6	34.5	14.2	49.6	13.9	19.4
1966	0.6	0	13.1	0	0	21.2	14.9	9.5	28.3	14.1	14.6
1967	9.5	14.6	19.1	10	13.7	29.9	30.7	11	42.8	18.8	22.6
1968	13	18.1	20.6	35.2	8.7	26.8	30.1	20.1	40	26.3	17.8
1969	11.5	18.2	25.7	26.2	13.2	41	19.9	12.9	41.3	17.5	14.1
1970	10.1	15.6	20.8	26.6	6.9	18.5	40.8	16.6	50.8	29.2	23.7
1971	4.9	9.6	17	10.1	0	16.2	49.2	18.7	53.5	20.1	18.4
1972	3	2.7	14.1	0	0	18.6	33.9	12.6	38.5	18.6	19.7
1973	16.4	19	25.9	46.3	20.3	36.5	30.5	16.7	41.1	37.5	25.7
1974	5.7	15.9	20.3	33.1	0	16.3	36.3	18.3	53.3	22.8	8.6
1975	11.6	18.1	21.8	36	14.8	30.1	30.2	14.3	44.9	17.1	21
1976	8.3	12.6	14.7	13.6	4.7	22.7	30.7	13.9	42.8	19.3	15.6
1977	0	0	7.3	0	0	0	17	10.1	15.6	17	24.6
1978	12.3	13.6	28.1	36.9	8.6	37.9	40.1	16.6	51.5	13.4	18.3
1979	20.6	17.6	28.1	20.4	24	44	37.1	12.2	46.5	14.7	9.1
1980	16.6	15.8	31.2	18.4	14.1	38.3	32.8	13.4	42.5	16.7	0
1981	4.4	0	14.7	7.2	0	16.9	11.5	3.1	10	4.1	6.2
1982	11.1	11.9	25.1	16.6	8.9	24.4	35.9	15	48.3	14.8	13.4
1983	21	25.3	31.9	54.7	27.8	50.5	28.9	19.6	44.9	26.8	14.1
1984	6.8	23	29	72.7	15.8	18.5	32.6	21.1	47.5	28.7	19.5
1985	12.8	6	23	11.5	3.7	25.3	24.3	9.5	33.7	13.3	11.4
1986	4.9	11.7	28.1	27.4	3.2	19.8	39.5	12.8	55.6	20.3	16.6
1987	9.2	0	16.7	7.6	0.9	18.2	10.6	0.4	19.3	11.4	8.1
1988	9.8	11.5	20	19.1	7.3	25.2	26.8	6.4	33.4	17	12.9
1989	0	0	12.4	0	0	1.1	19.9	0.4	0	3.1	9.2
1990	3.2	2.6	13.8	17.2	0	16.2	23.5	11.5	29.8	11.2	17.5
1991	7.7	10.3	18.3	21.8	9.1	20.5	20.3	11.1	32.3	19.9	18.9
1992	9.6	0	15.6	0	0	16.3	14.5	4.2	20.2	6.7	6.7
1993	21	14.8	26	19.4	14.6	39.7	30.3	16.5	43.7	27	13
1994	9.1	6.8	15.5	23.2	2.1	17.6	24.8	6.2	31.2	14.8	8.6
1995	19.3	15.9	26.8	25.6	17.9	40.6	21	10.3	38.7	16	19.6
1996	0	7.5	17.2	18.2	0	10.2	34.6	10.8	40.5	19.5	16.6
1997	12.8	11.1	24.6	24.2	3.5	18.1	41.8	10.2	47.9	24	18.4
1998	14.7	14.7	26.7	29.5	13	32	24.4	3	35.1	10.2	11.8
1999	9.2	9.8	17.8	17.9	9.4	15.7	27.8	9.6	36.9	13.7	16.3
2000	0	0	14.1	6.2	0	8.8	16.1	3	27.8	12.9	10
2001	16.2	4.5	16.7	4.5	4.8	19	21.2	4.5	29.6	8.8	6.5
2002	0	0	8.3	2.5	0	0	13	2.4	22.9	3.5	6.4
2003	4.4	4.7	16.2	17.5	0	18.6	18.9	11.2	34.5	11.4	7.6
2004	10.5	6.7	18.1	13.4	2	21	16.8	0	32.6	6.7	7.7
2005	26.5	17.6	33.6	22.9	27.3	69.1	18.5	7.4	38.4	9.7	9.3
2006	2.9	6.5	19.8	13.2	2.9	23	24.3	1	41.5	12	11.5

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	07E23S	07E18S	07E12S	07E21S	07E33S	08G03S	09G09S	09G03S	10G12S	10G08S	10G20S
Latitude	44.500	44.679	44.723	44.801	44.788	42.573	42.647	42.870	42.269	42.508	42.525
Longitude	-107.429	-107.581	-107.400	-107.844	-107.529	-108.843	-109.260	-109.095	-110.806	-110.910	-110.662
1961	14.5	16.2	12.5	21.3	11.5	12.3	10.3	14.6	8.1	4.7	20.3
1962	19.2	18.2	12	21.7	9.7	17.1	14.3	17.5	16.2	9.4	36.7
1963	21.4	20.9	15	23.6	13.9	18.1	15.6	17.6	13.5	12.8	29.9
1964	19.2	19.3	21.1	27.5	20.4	17.7	14	16.2	16.4	14.8	30.6
1965	23.4	25	19.9	28.9	16	24.6	21.6	24	24.7	16.3	42.4
1966	14.3	15.3	12	21.4	11.2	12	8.9	10.8	10.1	6.3	18.8
1967	21.3	24.9	19.5	25.8	19	23.6	18.7	24.3	18.8	16.1	38.4
1968	17.2	20.1	16.5	26.2	15.9	17.9	12	16.3	15.1	10.1	29.5
1969	13.9	15.3	11.4	18	13.1	18.9	12.9	17.9	17.5	8.2	24.9
1970	18.2	23.4	21	30.8	20.2	19.6	12.7	19.8	15.9	14.5	31.9
1971	22	23.7	18.5	30.4	14.5	30.8	23.2	29.6	26.2	24.4	50.7
1972	22.1	26.1	13.7	25.2	14.1	28.8	23.4	25.5	24.7	19.7	47.6
1973	15.2	18.9	17.9	27.3	19.7	20.5	10.9	17.8	13.5	13	22.3
1974	15.7	20.8	15	23.6	16.8	21.9	18	27.3	14.5	13.2	37.1
1975	19.9	22.6	17.9	30.7	17.6	18.9	19.8	18.9	22	20.3	33.8
1976	20.4	23.9	16	26.4	16.2	18.4	18.5	19.9	21.2	18.7	37.3
1977	14.8	17.8	15.9	31.6	17.1	6.9	1	8.2	0	0.4	4.1
1978	20.9	19	14.5	28.9	14.7	16.1	21.4	8.4	24.2	17.8	41.5
1979	15.8	14	11.4	24.1	12.7	17.2	13.5	17.1	13.1	12.8	25.8
1980	9.2	11.1	7.3	14.3	9	22.8	12.9	16.1	12.5	8.8	24.5
1981	9.9	8.6	2.5	11.9	3.6	5.2	4.7	11.8	0	0	11.1
1982	17.9	17.6	11.7	24.7	8.6	20.8	19.8	18.8	21.3	13.3	38.3
1983	16.8	14.9	12.3	20.5	12.1	23.3	17.8	25.7	18.8	16.1	31.9
1984	16.4	22.6	17.5	25.9	19	20.3	15.2	18	21.3	13.1	26.4
1985	10.2	14.1	8.3	17.3	10.6	9.9	5.1	15.2	8.6	2.1	17.8
1986	21.6	22	14.2	27.3	13.7	35.7	22.3	28.3	27.9	19.1	49.8
1987	4.2	9.4	2.8	16	7.9	8.9	4.4	13.9	0	0	11.6
1988	19	12.9	12.1	22.1	14.4	12.4	6	14.7	7.2	1.3	20.6
1989	14.7	14.3	6.9	19.6	8.6	10.4	6.7	10.5	9.6	3.4	30.8
1990	20.4	20.4	18	30.4	15.7	12.7	9.6	13.9	4.8	0.8	22.4
1991	21.1	23.2	18.2	26.6	16.6	19.2	15.4	21	12.7	8.6	21.7
1992	14.9	14.6	7.8	20.2	8.7	3.1	0	8	1.6	0	10
1993	15	16.4	12.7	19.7	12.3	17.2	15.4	17	18.7	12.4	34.5
1994	15.7	16	11.2	23	13.5	14.9	10	12.3	6.7	4.3	16.6
1995	20.8	19.8	14.4	22.2	12.9	21.5	18.3	23.3	14.2	11	30.3
1996	19.8	23.9	15.8	26	15.3	20.1	16.1	21	17.6	14.6	39.3
1997	20.9	21.7	18.3	25.9	16.4	27.7	18.1	22	22.8	20.2	41
1998	15.8	20	12.5	22.2	12.1	15.9	11.9	19.2	12.7	11.3	22.1
1999	18.3	20.8	14.6	21.7	11.1	25	16.4	28.3	16.9	14.4	36
2000	15.8	17.4	11.6	22.1	12.1	12	8.1	9.4	7.4	4.3	20.1
2001	13.1	12.3	6.7	17	8.2	8.4	8.8	6.1	6	2	18.8
2002	16.1	16.1	11	18.5	10.2	11.4	12.3	11.5	10.8	6.8	24.5
2003	16.1	17.6	14.1	18.9	13.1	10.4	9.2	13.2	8.9	4.2	24.6
2004	14.9	16.7	8.5	18.5	9.4	16	10.6	16.5	6.1	3.7	21.2
2005	15.5	14.6	11.8	16.9	10.8	19.6	14.4	17.8	14.8	10.2	25.8
2006	15.4	13.9	7.6	14.9	9.9	13.1	10.8	10.6	14.2	9.5	33.9

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	10G13S	10G15S	10G23S	10F17S	10F16S	09F23S	09F21S	10F15S	10F19S	08F01S	09F08S
Latitude	42.495	42.764	42.815	43.131	43.174	43.007	43.113	43.249	43.389	43.659	43.503
Longitude	-110.532	-110.591	-110.835	-110.202	-110.140	-109.759	-109.949	-110.017	-110.129	-109.010	-109.752
1961	8.3	14.8	18.2	12.3	8.6	11.6	6.4	5.4	12.2	5.5	5.8
1962	15	24.5	30.5	18.5	17.2	18.7	9.9	9.8	14.3	5.7	13.1
1963	15.8	25.1	20.5	15.8	19.5	15.8	11.7	13.7	14.9	7.4	10.2
1964	15.6	25.3	20	14.5	15.4	16.8	10.1	10.7	12	6.9	8
1965	19.2	38.7	39.6	19.1	26.7	22.9	15.4	18.8	18.6	7.4	16.7
1966	8.8	17.2	20.5	10.4	6.8	10.3	6.8	5.6	10.6	1.2	4.5
1967	17.1	30.4	27.9	17.3	16.2	17.4	9.7	13.5	17.4	6.6	13.6
1968	13.1	24.7	23.1	17.6	15	14.1	9.4	4.9	8.3	4.1	7.6
1969	11.4	18.7	28.9	13.7	12.7	10.7	7.4	6.3	11.1	2.7	7.6
1970	15.2	30.8	29.3	20	17.8	17.9	12.5	14.9	15.2	7.2	11.6
1971	22	45.6	35.7	24.5	28.3	25.4	17.9	25	23.4	6	21.1
1972	20.7	39.1	37.5	21.5	24.6	19.6	15.4	16.7	17.9	8.3	19.8
1973	11.9	20.1	20.9	13.7	11.1	12.2	10.5	10.7	9.5	7.2	5.5
1974	15.2	32.4	28.5	19.4	18.7	15.6	11.5	14.2	17.4	4.7	13.9
1975	17.9	30.8	25.4	21.7	21.3	18.7	13.3	14.6	16.1	1.7	14
1976	17.9	32.6	27.9	18.5	17	18.5	9.9	14.2	15.3	7.3	17
1977	0	0	8.7	0	0	4.1	0	0	1.7	0.7	0
1978	17.3	43.9	42.4	22.4	25	22.3	12.5	15.7	11.7	0	14.4
1979	12.4	22.3	24.4	16.5	16.2	8.2	10.4	10.7	12	5.5	7
1980	13.4	26.1	26.7	16	15.1	7.1	7.3	9.4	11.3	0	7.7
1981	0	9.8	8.6	0	4.7	3.7	0	0	3.2	2.2	4.2
1982	21.5	37.9	34.4	21.9	23.4	17.5	15.2	22.3	20	0	13.3
1983	14.3	25.3	26.5	15.4	12.6	15.8	9	13	15	6.4	11.7
1984	11.5	24.9	31.8	14	15.7	14	9.1	9.4	14.1	8	14.4
1985	6.9	20.3	19.3	9	7.6	5.4	4.4	5.6	8.4	0	5.5
1986	20.1	36.8	37.1	19.6	29.4	22.6	14.3	17.8	23.3	6.6	16.5
1987	2.7	3.5	15.8	5.1	1	3.9	0.2	0	5	0	2.7
1988	8.5	15.6	17.6	7.6	6	5.6	3.2	1.9	7.9	0.3	5.3
1989	9.7	20.3	27.1	9.9	11.7	8.5	4.2	6.1	12.4	1.1	10
1990	7.5	11.5	19.3	8.8	8.6	9.1	6.8	6.4	11	0.7	8.4
1991	10.8	18.9	18.6	10.4	11.5	12.5	8.8	7.2	14.7	7.1	13
1992	0	4.4	17	0.7	0	5.5	0	0	4.2	0	1.2
1993	15.6	26.9	21.7	13	15.1	15.5	10.4	9.1	14.3	5.7	10.2
1994	7.4	11.7	21.4	5.9	6	8.3	2.9	2.9	9	0	6.1
1995	10.5	20.8	24.4	10.4	11.9	15.6	7.4	5.8	16.5	11.1	15.5
1996	23.2	33.8	30.8	16.6	21.7	15	12.9	16.6	19.8	5.7	17.6
1997	21.2	35	35.5	16.4	23.3	18.6	12	19.1	23.2	6.9	19.5
1998	11.9	17.6	22.7	12.3	15.2	11.6	7.4	8.6	15.3	6.5	10.7
1999	20.4	32	29.9	15	17.6	16.1	12.9	12.6	16.8	10.6	19.1
2000	6.9	12	24.6	8.3	8.6	8.1	3.2	3	7.9	0	6.9
2001	5.9	12	15.5	6.4	6.9	11.1	3.8	1.5	8.9	0	5
2002	6.3	18.3	18.1	9.1	11.2	11.4	6.9	3.6	13.2	0	9
2003	6.9	16.4	22.2	7.7	8.7	10.7	5.4	4	10.8	0.7	6.4
2004	5.6	9.7	24.4	6.4	4.8	6.6	1.1	0.4	7.4	0.9	5.6
2005	11.6	15.2	19.7	4.1	9.9	12.7	8.7	3.7	10.6	2.3	7.5
2006	13.9	25.2	30.6	2.9	12.2	12.6	4.1	4.1	10.5	0	4.1

State	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming	Wyoming
Station Id	10F09S	09F04S	10E15S	10E09S	10E03S	10E20S
Latitude	43.749	43.697	44.126	44.209	44.719	44.478
Longitude	-110.058	-109.670	-110.834	-110.666	-110.511	-110.038
1961	25.5	8.9	26.3	32.7	6.9	8
1962	28.7	10.8	31.2	37.4	12.7	1.9
1963	27.7	13.3	28.4	29.7	11.6	11.5
1964	29	10	33.2	31.2	13.2	9
1965	37.1	20.9	40.7	47.9	22.4	13.6
1966	21.8	7.3	25.7	29.8	9.8	8.8
1967	30.9	12.3	39.1	40.7	21.8	13.6
1968	25.8	7.5	34.1	27.7	11.6	5.1
1969	25.4	7.2	26.6	31.6	11.4	0
1970	31.8	15.4	44.7	40	16.8	18.1
1971	40.8	20.6	53.9	55.1	19.1	17
1972	37.1	22.2	47.8	51.4	15.7	10.8
1973	22.4	7.2	31.1	31.2	10.7	8.3
1974	34.9	15.9	52.4	54.1	17.5	10.8
1975	33.4	16.8	45.3	41.9	15.5	15
1976	35	18.5	54.4	49.8	18.5	15.2
1977	13.9	1.1	3	5	0	0
1978	33.1	15.7	43.5	43.3	14.2	10.6
1979	26.2	11.1	41.2	35.2	9.7	5.6
1980	26.5	11.2	22.3	29.6	0	2.8
1981	19.1	4	16	15.5	2.3	0
1982	40.2	20.6	53.9	57.5	20.2	10.8
1983	27.8	12.7	40.1	36.9	10.1	9.5
1984	26.5	10.8	34.3	30	7.7	4.8
1985	19.8	3.8	27.9	28.6	6.9	0
1986	34.1	20.1	39.2	44.4	14.3	9.1
1987	17.6	4.6	4.1	5.5	0	0
1988	23	7.9	23.3	25.3	8.7	3.1
1989	29	13.4	34.9	41.4	11.2	10
1990	24.5	12.7	18	23	3.4	3.9
1991	28.4	14.7	31.6	29.9	13.8	13.7
1992	17.4	8	12.1	18.1	4.1	0.8
1993	25.7	13.5	36.8	33.9	16.1	9.2
1994	19.4	10.8	17.6	16.7	6	4.7
1995	29.1	18.4	38.9	42.2	16.8	12.4
1996	35.2	22.7	38.6	49.1	20.5	17.9
1997	37.4	24.2	47.8	54.4	22	16.5
1998	25.2	16.1	29.1	29.4	10.7	5.4
1999	32.1	17.9	41.3	39.4	16	10.9
2000	23.3	10.6	20.5	19.7	8.3	4.2
2001	17.5	8.1	18	15.9	9.1	5.3
2002	24.3	15.6	26.1	30.7	12.9	8.1
2003	24.4	16.9	29.3	31.4	12.3	9.1
2004	19.5	12.1	22.2	22.5	5.6	0
2005	18.2	11.4	19.1	20.1	7	3.9
2006	26	13.5	35.6	42.6	10.8	1.7

APPENDIX A.4

Adour-Garonne annual streamflow

Sta. Order	1	2	3	4	5	6	7	8	9
Station #	**Q3120010**	**Q7002910**	**Q7412910**	**Q9164610**	**P0190010**	**P0364010**	**P1154010**	**P1502510**	**P3021010**
1961	115987	65032	106556	10296	26789	4938	7718	17351	5932
1962	77861	56339	112407	7704	26335	5521	7618	16470	5879
1963	95116	63224	122341	7603	27614	6156	7459	21054	5456
1964	61043	40424	77813	6431	17444	4302	4791	13300	3109
1965	129555	71735	141710	12378	37075	8921	9296	25600	6449
1966	137137	84279	161540	11986	32204	6720	9109	21482	6875
1967	79480	57734	102530	8181	24288	4615	6768	14983	4635
1968	102303	70331	125004	9486	35664	6331	10317	19252	6802
1969	118205	63121	116275	9580	34071	6516	10682	23013	6537
1970	103675	67894	117016	8359	31265	5872	8523	18427	5738
1971	135225	78019	136781	8560	24667	5254	6796	16119	4606
1972	118963	76730	117633	8171	20672	4518	6199	13262	4001
1973	90665	62071	102033	8136	22031	4524	6661	12767	4638
1974	130784	89640	147235	10354	30157	6134	9213	18043	5990
1975	105982	63573	116600	7546	25065	4754	7442	14892	4634
1976	111406	58047	114485	7591	25481	4873	7270	13566	4661
1977	141469	70315	139315	7686	40922	7096	12020	20761	6956
1978	153812	84045	157196	10957	28421	6507	8384	16735	5197
1979	141657	87191	156399	11365	37429	8385	11103	23013	6864
1980	133727	73963	141018	10059	36611	6221	10459	21645	6118
1981	150281	88376	173174	11967	39066	9042	9345	22647	7557
1982	157672	85728	169729	11423	31297	6693	8317	17326	5489
1983	85818	57220	107877	9484	29655	5522	7685	17541	4973
1984	127464	71363	146798	10524	29888	6419	8702	20883	6841
1985	118292	48365	101881	6926	21546	3631	5959	12190	3705
1986	114942	67281	149315	9261	25955	5308	8559	17969	5039
1987	87258	60041	120436	7693	30184	5142	7495	16884	4892
1988	131893	59767	133493	8822	37106	6598	9203	19127	5583
1989	70934	36376	69185	4943	16689	2997	4521	9362	3099
1990	66307	47326	87833	6163	22314	4421	5947	15120	4177
1991	90150	57755	108222	7077	16807	3486	5015	11302	3172
1992	154894	83951	152045	9831	31170	5883	7723	19778	5485
1993	91383	53591	102851	7198	23034	4379	7330	17155	5411
1994	137820	75152	138631	8985	41704	8166	10870	25115	7243
1995	94503	65819	114377	5519	31207	5930	8461	19471	5703
1996	106721	71859	133556	7812	24607	4770	7214	14467	4635
1997	94348	48170	102638	6777	19784	4342	6185	13587	3436
1998	114231	55788	113688	7899	29744	4784	7755	16571	5398
1999	117506	57321	127034	8652	27632	5252	7467	19863	5531
2000	136996	55934	127553	8063	30183	5248	9136	20316	6869
2001	120294	48993	96423	6111	33071	5149	9442	19031	6438
2002	69957	66349	134204	7321	21194	4185	6049	13940	4633
2003	85634	59230	128415	6926	22055	4107	5555	12644	3598
2004	94818	56338	115917	7529	26376	4874	6555	15567	4262
2005	54737	48211	92152	6850	19867	3474	4622	10077	3031
2006	57344	43832	83246	4860	25733	5176	8269	15910	4858

Sta. Order	10	11	12	13	14	15	16	17	18
Station #	**P3502510**	**P5140010**	**O0015310**	**O1115010**	**O1900010**	**O3121010**	**O3141010**	**O4102510**	**O5292510**
1961	11016	293761	1385	1436	228881	14359	28791	1516	22750
1962	12381	306189	1213	1247	195054	16701	29814	2448	24202
1963	11311	336586	1503	1740	241052	34092	52679	2533	30216
1964	7784	215782	879	1262	151988	31239	46864	2466	20907
1965	15268	391247	1803	1892	242945	27021	46298	3202	35659
1966	15800	444856	1666	1485	272097	23806	43047	2638	34067
1967	10077	274618	1294	1623	172618	14509	26987	1291	15361
1968	15719	367813	1734	1659	233179	17268	30225	1375	21819
1969	16374	434634	1210	1240	194281	28942	54206	3263	35025
1970	14126	345199	1814	1648	228371	18596	35622	1547	27529
1971	11924	334869	1698	1466	275565	21702	43396	2154	24062
1972	9394	264747	1987	1670	313527	30097	54508	3615	18878
1973	10086	243541	1423	1188	183238	20032	38003	1314	13979
1974	13212	347821	2554	1974	340083	23295	42655	1650	33057
1975	11160	298198	2058	1833	233786	18492	35938	1081	20747
1976	9421	256293	1848	1539	192405	33574	57323	1754	24663
1977	17566	482177	2034	1696	291386	31946	53230	2033	28327
1978	12342	390776	2407	1821	353775	21936	42489	1504	29710
1979	15736	440198	2072	1742	262749	23381	44144	2355	32920
1980	14815	424771	1926	1574	233316	18709	37647	2065	28451
1981	16070	415860	2143	2118	286008	19688	39445	1962	33779
1982	11313	374244	1897	1735	259173	31604	42385	2517	27498
1983	13498	351113	1383	1109	163630	17225	28489	1359	21223
1984	14194	351158	1825	1506	220733	28042	41362	2253	24387
1985	11064	266924	1656	1318	183714	10709	23713	1002	23815
1986	12442	310442	1469	1333	185603	22367	37478	1761	23808
1987	12355	289628	1698	1707	196257	19734	34638	2286	19191
1988	15408	406837	1781	1517	226460	20134	35039	1514	27741
1989	5441	182743	1052	1106	107076	9791	18544	1382	12812
1990	9203	217423	1135	1191	119910	10201	19545	850	12801
1991	9183	213848	1595	1527	182453	12714	20397	1169	11427
1992	11263	388198	2145	1790	268159	17127	32275	1840	28395
1993	14221	302833	1358	1385	193069	19008	30810	2112	15466
1994	19768	492788	1942	1949	256004	34122	50199	2143	35371
1995	16018	346136	1772	1767	212910	27690	32687	1984	20921
1996	14162	305772	1889	1765	263901	46255	59909	4324	25692
1997	11863	250207	884	1625	148031	17286	24764	2146	12349
1998	12005	323063	1507	1482	176551	17212	24257	1039	17286
1999	13108	331020	1471	1422	198820	22802	32273	1927	27397
2000	14736	389267	1406	1313	189311	23012	32070	1317	21435
2001	14646	415287	1388	1264	180492	15328	26775	1066	18858
2002	10048	254114	2235	1745	214088	18505	24583	1560	12162
2003	8256	256813	2047	1727	213800	23312	33615	2671	15814
2004	8980	298965	1809	1618	221795	14810	28572	1642	20858
2005	6812	212267	1603	1524	191857	6616	15278	1486	8625
2006	11600	274379	994	1043	123522	12349	26383	1843	15067

Sta. Order	19	20	21	22	23	24	25
Station #	**O5344010**	**O5572910**	**O7131510**	**O7272510**	**O7354010**	**O7502510**	**O7635010**
1961	1042	18659	26281	7044	3839	25906	4563
1962	1357	18836	27369	6700	3915	22850	4115
1963	1750	22752	46684	13448	5329	40366	5569
1964	1140	15100	29762	8175	3633	24035	3131
1965	1985	27173	43526	13414	7496	47250	6542
1966	1620	29723	39188	10481	4735	36445	5556
1967	853	12955	20359	7170	2859	22906	3449
1968	1003	17028	28584	8828	4503	31319	5308
1969	1908	29382	43610	12266	5293	38239	6407
1970	1371	25102	31759	9761	4352	31541	5639
1971	1422	16329	35192	11820	5114	35586	3878
1972	1374	16971	30260	8754	4442	28540	3381
1973	946	10722	26637	8936	3420	27428	2991
1974	1568	25659	37478	10829	5657	36538	4801
1975	1203	18889	29832	8793	3591	28133	3725
1976	1467	20714	37366	10556	5175	33269	3450
1977	1419	23622	45382	14742	5827	46738	4920
1978	1509	27487	34743	11948	5268	33946	4174
1979	1684	28976	42873	13182	6497	42068	5489
1980	1380	23266	34160	15956	5530	35602	5590
1981	1828	26305	39255	11251	6121	38780	6494
1982	1427	21204	36818	11505	4598	36158	4884
1983	1116	19820	30314	10616	4695	33752	3911
1984	1710	18580	36676	11474	4015	33670	5275
1985	941	19868	23963	7636	3113	23222	3133
1986	1205	17233	31247	9765	5120	32729	4786
1987	1054	13016	24712	7954	3194	24908	3478
1988	1181	23540	33279	12121	6042	39451	4456
1989	691	11294	16669	5650	2730	19046	2175
1990	756	10124	19967	4478	2456	19894	3887
1991	714	9749	19444	5217	2191	18218	3260
1992	1493	24269	33481	10714	4714	35611	4581
1993	977	12579	21580	8084	3397	26392	3363
1994	2072	26707	46564	14776	6506	48045	5906
1995	1388	18542	30665	7215	4148	30429	4884
1996	2492	20315	45588	11301	4405	36995	4224
1997	869	10964	18908	4959	2827	19243	3879
1998	926	15307	26691	7223	3212	26001	4364
1999	1567	25982	31096	7268	3618	28926	4821
2000	1166	18823	35647	8809	3916	32039	4584
2001	1170	15270	30221	8538	4299	33969	3795
2002	896	8424	18555	5476	2616	18368	2685
2003	1152	13232	30511	8684	4299	27545	2923
2004	1230	17840	31414	10878	4309	32347	3574
2005	557	6631	12899	7790	2643	18904	2533
2006	832	11978	22973	6887	3119	22362	3508

APPENDIX A.5

Adour-Garonne November-March streamflow

Sta. Order	1	2	3	4	5	6	7	8	9
Station #	Q3120010	Q7002910	Q7412910	Q9164610	P0190010	P0364010	P1154010	P1502510	P3021010
1961	63644	37854	73768	5685	23616	4805	7348	16043	5254
1962	59900	29658	67457	5678	16449	4308	5361	14032	4285
1963	47549	25999	50322	3969	13918	3135	3592	10686	2613
1964	57984	30562	64693	7504	13271	3144	4328	9569	2915
1965	123715	47404	103898	7874	29259	6901	7338	21483	5322
1966	78563	41466	81407	7485	21243	4652	6475	15487	4574
1967	66471	40932	84287	7957	21317	3549	5991	11267	4047
1968	82378	33712	66218	5225	20685	4201	6875	14920	3940
1969	82307	41310	85984	8038	27519	5305	8528	18300	5684
1970	71458	34646	69165	4996	16552	3295	4344	10682	3024
1971	92590	38411	71105	6196	13809	3151	4478	10388	2728
1972	61369	29089	54533	5312	14065	2495	4062	8403	2686
1973	75865	37534	65784	5225	14653	3558	5730	10596	3675
1974	85065	50064	94606	6760	23461	3991	6744	13061	4080
1975	51614	27251	58737	5221	11274	2160	2862	6518	2306
1976	99010	33085	63668	4134	33333	5661	10791	17563	5857
1977	110849	46243	102593	8404	23068	5159	7376	14313	4572
1978	86387	41590	77578	6955	21809	5388	6997	14107	4265
1979	72659	35483	71010	5482	26256	4808	8891	15463	5114
1980	90480	51784	110197	8654	22899	5171	5536	12632	4133
1981	122962	52300	104882	8678	23470	5141	6659	12780	4177
1982	99619	46328	97107	7976	24865	5061	7323	16401	4692
1983	77223	30669	69443	5967	18391	3871	5707	12994	4283
1984	100174	34444	79784	5379	17624	3641	5450	12173	3699
1985	85184	28975	76281	5737	16323	3583	5971	11475	3452
1986	63821	42925	100188	7042	15815	2963	4387	10976	2793
1987	101089	39275	98009	7203	28605	5512	7866	16108	4684
1988	51831	17094	38821	3341	14132	2637	3914	8731	2716
1989	29853	26984	51243	3280	12140	2749	3267	7492	2384
1990	61506	27893	55108	4078	14738	2886	4468	9496	2746
1991	52607	25555	49265	4223	9921	2315	3084	7901	2177
1992	79651	36611	67665	4896	13776	2705	4798	9491	3052
1993	124333	48051	100619	7789	29002	5441	8765	19220	5561
1994	82729	45037	90317	4971	29668	5292	7735	18557	5076
1995	60478	35997	66082	3364	16471	3260	5037	9660	3315
1996	66233	40624	85992	5756	14298	2735	3982	8144	2591
1997	89357	31557	71580	5068	22644	4227	6317	13903	3781
1998	76879	33584	83504	6700	19553	3400	5186	12682	3669
1999	74382	30350	70967	4654	18838	3723	5719	13459	4198
2000	128111	37981	82914	5412	28587	4986	8719	19769	6024
2001	27000	21878	43403	2686	10011	1886	2941	6541	2208
2002	74534	48922	110745	7044	20418	3458	5391	11264	3834
2003	66187	39220	87754	5445	21753	4509	5757	14264	3490
2004	35136	29079	59058	4721	16199	3035	3452	8322	2454
2005	44110	26987	58959	4524	18022	3749	5412	11548	3386

Sta. Order	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Station #	**P3502510**	**P5140010**	**O0015310**	**O1115010**	**O1900010**	**O3121010**	**O3141010**	**O4102510**	**O5292510**
1961	10604	252369	645	344	102348	13860	25172	1630	20927
1962	8658	208758	733	348	116349	20428	32100	2298	23828
1963	5866	173588	472	363	94717	31070	40879	2074	17544
1964	6240	148726	773	372	106045	11128	18591	1886	11663
1965	13777	385093	909	475	164377	20108	35594	1709	35245
1966	9920	281719	989	357	137633	16489	29139	1759	21416
1967	9115	211640	929	463	113484	8193	14724	653	12068
1968	10534	265949	677	361	118164	20032	33555	2255	23014
1969	13739	306747	987	273	132954	17322	31804	1337	27450
1970	7052	201911	877	325	136984	15972	31565	1625	16191
1971	6668	183984	971	248	160626	19812	36122	2338	17720
1972	6061	166108	666	208	94743	9918	18689	864	9256
1973	8461	204623	1051	260	148764	26841	45552	1701	18637
1974	10311	262605	1300	466	156897	15736	27492	874	21250
1975	4769	110716	977	265	95664	11325	19160	1112	8952
1976	13382	380998	894	428	110449	24350	42293	1276	25552
1977	10714	309301	1131	314	189088	20347	34406	1395	24710
1978	9811	267888	966	254	121349	12891	24592	1280	18107
1979	12007	329404	1000	326	121593	9678	21548	1767	24497
1980	8847	263835	1330	494	181396	11219	21098	1350	19653
1981	10057	283480	1099	386	157035	14664	28306	1881	23082
1982	11437	318218	1033	374	133715	27010	30205	1580	24484
1983	7324	217907	822	278	102652	9285	16229	1226	14839
1984	10186	237596	1012	380	114192	19744	28214	1415	21131
1985	8773	207881	876	299	106927	11462	20059	970	17224
1986	6215	166491	1057	487	117966	16193	25876	1345	14641
1987	12613	316075	1014	413	126996	18033	29672	1957	24455
1988	5066	146608	451	237	58905	6246	11074	685	10175
1989	3852	110605	521	335	50271	6868	11579	993	5934
1990	8211	180671	716	385	84578	11851	17181	868	9826
1991	4300	134298	639	295	71437	4419	8280	687	7959
1992	8500	193064	925	514	132327	10432	18206	1280	13919
1993	13938	369386	1326	484	180528	15349	26613	1452	28371
1994	12620	328176	1021	515	125947	20330	24098	950	20172
1995	9148	208278	880	458	126588	37815	44323	3688	15339
1996	7076	153831	940	738	135871	18885	26573	1940	15652
1997	9130	236065	678	477	81889	19893	23073	1846	14490
1998	8908	219416	993	311	120274	10356	15594	889	14540
1999	9638	237486	768	349	97430	11140	15043	1101	17872
2000	12609	363724	877	500	115743	16507	25027	1095	18246
2001	5221	127516	718	338	64455	5758	7681	672	5254
2002	7824	221364	1717	645	165346	15407	21940	1801	14185
2003	8005	245990	1205	594	135540	23808	34017	2446	19697
2004	5576	142416	973	356	108887	2879	7488	468	6635
2005	7670	170018	664	326	83412	7781	18062	1792	12846

Sta. Order	19	20	21	22	23	24	25
Station #	O5344010	O5572910	O7131510	O7272510	O7354010	O7502510	O7635010
1961	1162	15454	25461	6256	4241	24326	4167
1962	1443	18023	29766	6771	3373	23080	3550
1963	976	11830	25321	7413	2535	19775	2360
1964	723	9151	16954	4558	2657	15951	2565
1965	1667	29322	39164	10408	5481	37699	5517
1966	1245	18048	24931	6440	3493	23495	3921
1967	635	9336	16104	5327	2674	18852	2884
1968	1144	17265	26184	6105	3816	23053	4205
1969	1442	23843	31780	8507	4403	29869	5496
1970	1179	10614	23771	8011	3695	24309	2739
1971	1128	13873	22688	6597	3461	21816	2549
1972	656	7626	13000	3876	2195	13907	1976
1973	1128	14133	32028	9145	3870	27645	2825
1974	1086	17646	22975	5960	2745	20235	2995
1975	625	8779	12461	3334	1595	11676	1741
1976	1333	20847	38484	11786	5583	38110	4155
1977	1338	20825	30360	9960	4658	29797	3500
1978	921	16348	25917	8708	4686	28331	3400
1979	1261	20445	26234	8901	4281	27238	3904
1980	1235	15125	21717	7827	4108	24093	3575
1981	1256	17714	25345	6842	3969	25147	3818
1982	1257	20737	31049	9465	4660	31737	4075
1983	929	12512	17500	4847	2329	17037	3242
1984	1143	16747	26552	8017	3244	23847	3087
1985	847	12528	21502	7043	4488	24715	3592
1986	873	10511	17213	5060	1402	14935	2155
1987	1137	18347	27936	8574	5003	29997	3905
1988	518	9196	12202	3926	2369	14797	1913
1989	455	5230	9815	2588	1595	11602	2047
1990	563	7838	17386	4249	2105	16512	2851
1991	553	6782	11038	2978	1230	10713	2081
1992	811	12679	16558	4837	2141	16828	2417
1993	1550	22458	28263	8600	4165	31011	4502
1994	1278	16671	27607	7864	3808	29257	4206
1995	1544	11377	29787	6451	3449	24335	2755
1996	1258	14679	22773	5950	2504	20146	2663
1997	907	10946	20363	5222	3150	21298	3728
1998	871	14834	17170	3663	1729	15509	3284
1999	958	16491	18432	4175	2705	19530	3019
2000	1016	14319	33404	8077	4714	32896	4267
2001	438	3473	7345	2169	954	8192	1451
2002	962	11417	21079	6171	2969	21055	2396
2003	1367	16722	34453	9627	4778	31127	3211
2004	485	4934	10009	5898	1907	14520	2007
2005	814	9962	19580	6211	3278	20486	2862

APPENDIX A.6

UCRB and Great Basin April-July streamflow

Stat Id	09299500	09310500	09330500	10174500	10234500	10128500	10131000
1961	1458354240	315582048	359328960	794456640	477247680	1872408960	252936864
1962	3370127040	1814088960	1178625600	2345535360	1065052800	5943162240	1349395200
1963	1813752000	846607680	514788480	823236480	518996160	4081155840	765374400
1964	2541974400	1128608640	634996800	1267868160	778740480	5416813440	1742627520
1965	3607251840	1594157760	1109514240	2262237120	981132480	7222478400	2664463680
1966	2102086080	858807360	417070080	1713813120	576780480	4195791360	1145041920
1967	3296669760	1359486720	562775040	2426405760	1095543360	6599206080	2312478720
1968	3258109440	1431604800	835617600	2459203200	1321617600	5921510400	2010700800
1969	3185118720	1844138880	1167203520	4664727360	1581681600	6385893120	2002864320
1970	2436505920	1312735680	1004019840	997712640	1008365760	4973616000	1696835520
1971	2639528640	1302557760	715366080	1060344000	816048000	6218372160	2344144320
1972	2584820160	746046720	405578880	912574080	291936960	5739258240	2333612160
1973	3351533760	1808066880	1071342720	3976603200	1729270080	4920609600	2438786880
1974	1249352640	1158019200	932601600	722805120	818596800	6133242240	2814816960
1975	3907431360	1769731200	1075636800	1629599040	875543040	6946776000	2403717120
1976	2027842560	851947200	409475520	1115320320	457591680	4346835840	1334292480
1977	1061657280	193469472	154336320	469488960	266336640	1593371520	200657952
1978	2135168640	1860338880	930260160	2219736960	1430023680	5942246400	1758214080
1979	1897344000	1395757440	1138190400	4654480320	1906113600	3975393600	654886080
1980	3008949120	2451798720	1465231680	5247685440	2348507520	5552280000	2101904640
1981	1898061120	726917760	385058880	1354777920	871534080	4122774720	1355901120
1982	2753542080	1713890880	1150588800	2569250880	1370243520	7067727360	2681881920
1983	4867067520	3069368640	1997136000	5754507840	2925789120	7722578880	4475554560
1984	2492147520	2961671040	1865842560	2049071040	2276233920	7672078080	3762676800
1985	2200037760	1722936960	1375669440	2702920320	1451511360	5853790080	2622931200
1986	3851772480	2347738560	1069407360	1888297920	1516890240	9408355200	4795761600
1987	2564619840	600143040	554480640	1616587200	951618240	3073956480	835937280
1988	1179722880	1050425280	550791360	2160397440	1113929280	2629445760	593533440
1989	915969600	626607360	271416960	744508800	505310400	3671818560	908746560
1990	1931575680	764640000	268349760	700971840	461177280	3653017920	630720000
1991	1874508480	1019165760	579899520	905696640	770567040	4105313280	1104105600
1992	1428727680	385655040	489801600	1278434880	700401600	2233414080	456909120
1993	2191285440	1760322240	1087551360	4778040960	1519404480	7417077120	2962932480
1994	1488283200	640846080	364728960	1148368320	639351360	3470938560	789376320
1995	4623065280	2269045440	1239770880	4364064000	1932076800	7389964800	2374989120
1996	1809768960	1479427200	871240320	779042880	662195520	5849971200	1994137920
1997	2564827200	1878698880	1104338880	1421824320	1505839680	6825902400	2605167360
1998	3809194560	1580618880	1102991040	3588805440	1838678400	6331599360	2703265920
1999	3403149120	1156921920	815797440	1553178240	984277440	5880047040	2561544000
2000	1684713600	712013760	526633920	1008279360	633113280	3341122560	646799040
2001	2682918720	733717440	721267200	1822806720	830727360	3092463360	663949440
2002	698025600	533600352	372548160	402840000	303687360	2929754880	708591456

APPENDIX B

METHODS

APPENDIX B.1

Singular Value Decomposition Matlab code

```
% Program script for the SVD analysis

clc
clear

% disp('Sheet is changed? ')
% disp(' ')
sheet = 3; % Period
snowdate = 1; % Snow reading date

temp1 = xlsread('StdSSTALL.xls',sheet);  %import standardized ssts.
snot1 = xlsread('stdSwe6.xlsx',1);   %inport standardized swe
[stations years] = size(snot1); %input('Enter the number of years: ');
t = temp1';
s = snot1';


%calculating covariance
covar_ts = (1/years) * t' * s;

% svd calculation
[left, eigs, right] = svd(covar_ts);

% Get the number of modes by calculating
% the square covariance and check for values >10
eigenvalues = diag(eigs);
square_eig = eigenvalues.^2;            %squares of the values
sum_sq_eig = sum(square_eig) ;          %sum of the squares
square_cov = square_eig./sum_sq_eig;    %square covariance
sign_num = find(square_cov >= 0.11);    %find values greater than 10%
sign_num_val = square_cov(sign_num);
num_modes = 3; %numel(sign_num);            %How many values greater
than 10%
%num_modes = input('Number of modes to run: '); %manual entry of #of
modes

% Export square covariance date to an excel file

xlswrite('SQF.xlsx',square_cov, sheet);

% Getting temporal expansion
for i = 1:num_modes; %num_modes;
    a = left(:,i);
    left_exp = t*a;                     %Create a matrix of left
    left_exp_mat(:,i) = left_exp;        %left temporal expansions

    b = right(:,i);
    right_exp = s*b;                    %create a matrix of right
    right_exp_mat(:,i) = right_exp;     %right temporal expansions
end

% Export temporal expansions matrices to excel files

xlswrite('RTES.xlsx',right_exp_mat,sheet);
xlswrite('LTES.xlsx',left_exp_mat, sheet);

% Getting Left heterogenous correlation

sign_p =0.95;% input('Significance (in decimal, eg 0.90 for 90%): ');
sign_p = 1 - sign_p;
```

```
[rrt cct] = size(t);
[rrs ccs] = size(s);

for n = 1:num_modes;
    rht = right_exp_mat(:,n);

    for m = 1:cct;

    left_heter = [t(:,m) rht];    % left heterogenous correlations
figure

    [r,p] = corrcoef(left_heter); %Compute sample correlation and p-
values.
    [k,l] = find(p<sign_p);         % Find significant correlations.
     pp = [k,l];                   % Display their (row,col) indices.
     if isempty(pp)
     rl = 0;
    else
     rl = r(1,2);
     end
    bbb(n,m) = rl;
    r = r(1,2);
    all_left(n,m) = r;
     end

end
    left_corr_values = bbb';
    all_left_correl = all_left';

 %Getting Right heterogeneous correlation

 for u = 1:num_modes;
    lht = left_exp_mat(:,u);

    for v = 1:ccs;

    right_heter = [s(:,v) lht];    % right heterogenous correlations
figure

    [rr,pr] = corrcoef(right_heter); %Compute sample correlation and p-
values.
    [kr,lr] = find(pr<sign_p);         % Find significant correlations.
     ppr = [kr,lr];                   % Display their (row,col) indices.
     if isempty(ppr)
     rrs = 0;
    else
     rrs = rr(1,2);
     end
    bbbr(u,v) = rrs;
    rr = rr(1,2);
    corr_valz(u,v) = rr;
     end

end
    right_corr_values = bbbr';
    all_corr_valz = corr_valz';

 %Export significant correlation values to excel files
```

```
      xlswrite('Q_correl.xlsx',right_corr_values, sheet);
      xlswrite('SST_correl.xlsx',left_corr_values, sheet);
      xlswrite('all_Q_correl.xlsx',all_corr_valz, sheet);
      xlswrite('all_sst_correl.xlsx',all_left_correl, sheet);


% Information to display
num_mode_val = 100.* sign_num_val';
mode_total = sum(num_mode_val);
num_m_val = [num_modes mode_total];

fprintf('There are %3.0f modes for this analysis and account for %3.0f
percent. \n',num_m_val)
display(['The square covariance fractions over 10% are ' int2str
(num_mode_val) ' percent.'])
disp(' ')



%MAPPING SECTION
%BELOW MAPPING SECTION.
looper = 1;
while looper == 1;          % Loop to view figures of different modes.

% Select what to view, Contour of SST or Snotel Correlations

graph2view = input('Which view do you want(sst = 1 or snotel = 2)? ');
if graph2view == 2
nm = input('Enter the mode to view: ');
str_latlong = xlsread('stdSwe6.xlsx',2);%stream latitude and longitude
snlat = str_latlong(:,1); %xlsread('LatQ.xls'); %
snlong = str_latlong(:,2); %xlsread('LongQ.xls'); %
%snvalues = xlsread('rsvalue.xls');
latlim = [ 25 50];  % Latitude map limits
lonlim = [-125 -100]; %and longitude map limits [-125 -100]

figure
ax = usamap(latlim,lonlim);
axis off
setm
(gca,'frame','off','grid','off','meridianlabel','off','parallellabel','o
ff')
states = shaperead('usastatehi',...
'UseGeoCoords', true, 'BoundingBox', [lonlim', latlim']);
faceColors = makesymbolspec('Polygon',...
{'INDEX', [1 numel(states)], ...
'FaceColor', white(numel(states))}); %polcmap will assign random colors
for states

geoshow(ax, states , 'SymbolSpec',faceColors)
snvalues = right_corr_values;
array1 = [snlat snlong snvalues(:,nm)];
[rows colms]=size(array1);
for i = 1:rows;
    if array1(i,3)>0
        snotlats = array1(i,1);
        snotlongs = array1(i,2);
        size_c = abs(array1(i,3))*100;
        scatterm(snotlats,snotlongs,size_c,'filled','red')
```

```
    elseif array1(i,3)<0
        snotlats = array1(i,1);
        snotlongs = array1(i,2);
        size_c = abs(array1(i,3))*100;
        scatterm(snotlats,snotlongs,size_c,'filled','blue')
    else
        snotlats = array1(i,1);
        snotlongs = array1(i,2);
        plotm(snotlats,snotlongs,'k.')
    end
end

for k = 1:numel(states)
labelPointIsWithinLimits =...
latlim(1) < states(k).LabelLat &&...
latlim(2) > states(k).LabelLat &&...
lonlim(1) < states(k).LabelLon &&...
lonlim(2) > states(k).LabelLon;
if labelPointIsWithinLimits
textm(states(k).LabelLat,...
states(k).LabelLon, states(k).Name, 'HorizontalAlignment', 'center')
end

end


% SSTs contour Mapping

% contour mapping
elseif graph2view ==1           %contours

%% Load the data and extract the (x,y,z) information:

lat_long = xlsread('Sstlatlon.xlsx'); % SST latitude and longitude
x = lat_long(:,2); %x = xlsread('Lon.xls'); %
y = lat_long(:,1); %y = xlsread('Lat.xls'); % % %
nn = input('Enter the mode to view: ');
z = left_corr_values(:,nn);%all_left_correl
% Determine the minimum and the maximum x and y values:
xmin = min(x); ymin = min(y);
xmax = max(x); ymax = max(y);
% Define the resolution of the grid:
xres=17;
yres=9;
% Define the range and spacing of the x- and y-coordinates,
% and then fit them into X and Y
% xv = linspace(xmin, xmax, xres);
% yv = linspace(ymin, ymax, yres);

xv = xmin:5:xmax; %linspace(xmin, xmax, xres);
yv = ymin:5:ymax; %linspace(ymin, ymax, yres);

[Xinterp,Yinterp] = meshgrid(xv,yv);
% Calculate Z in the X-Y interpolation space, which is an
% evenly spaced grid:
[xi,yi,Zinterp] = griddata(x,y,z,Xinterp,Yinterp);
%axesm ('MapProjection','miller')
%gridm on
load coast
latlim = [ -30 70];
```

```
lonlim =[120 -80] ;%[115 -108];
figure
worldmap(latlim,lonlim);
axis off
setm
(gca,'mapprojection','miller','frame','off','grid','on','meridianlabel',
'on','parallellabel','on')

surfm(yi,xi,Zinterp);
patchm(lat,long, 'k') %plotm patchm

%[c,h] = contourm(yi,xi,Zinterp,'k');

%[c,h] = contourfm(yi,xi,Zinterp); %-0.6:0.04:0.6
contourcmap(-0.6:0.1:0.6,'jet','colorbar','on','location','horizontal')


% load('MyColormaps3','sstmap')
% set(gcf,'Colormap',sstmap);
%h1 = clabelm(c,h);

% if anything else
else
    disp('Not an acceptable choice.')
end
disp(' ')
looper = input('Do you want to print another figure? (yes = 1, no =
0)');
end
disp(' ')
disp('I guess you are done for now...')
```

APPENDIX B.2

Matlab Code to create the input files for the non-parametric forecasting program

```
clear
clc
% This program will create the input files ( Q and 3 predictors)
% for the KFC program.
% 1st Step:  Create a folder for each streamflow station. The folder
% name is the climate period and streamflow station number
% e.g.  JFM910900 for streamflow station 910900, JFM period
% 2nd Step: Create the streamflow input file (Q) and move it to the
folder
% 3rd Step: Create the climate input files (SOI, PDO, TES) and move
% them to the folder
% Loop through the same process for all streamflow stations.


col1 = 1960:2001;                       %years in column 1
filex = xlsread('index_comp.xls',3);    %sheet containing predictor
climate Data
Qs = xlsread('stdSwe6.xlsx',3);      % sheet containing Q data
numQ = 6;                              % number of streams

for stream = 1:numQ;
    Q = Qs(:,stream);
    Qtable = [col1' Q];

%folder creation
name_first = 'JASOND1 SWE';  % Period
sheetint = int2str(stream);
folder_name = [name_first sheetint];
mkdir(folder_name);
% end of folder creation

% create stream text file

 stream_namo ='SWE.TXT';                 % streamflow input file
 fid = fopen(stream_namo,'wt');
 fprintf(fid,'%6.0f %6.2f \n',Qtable');
 fclose(fid);

 movefile(stream_namo, folder_name);

 %end stream text file creation

for i = 1:3
col2 = filex(:,i);
table = [col1' col2];                   %matrix creation

if i == 1
    name_first = 'SST';                 %naming scheme
elseif i == 2
    name_first = 'ENSO';
elseif i == 3
    name_first = 'PDO';
end
namefile = [name_first '.TXT' ];        %climate input file

fid = fopen(namefile,'wt');
fprintf(fid,'%6.0f %6.2f \n',table');
fclose(fid);

movefile(namefile, folder_name);
```

```
fid = fopen('SSTJFM.SUM','wt');  % SST file from Kernel model
fclose(fid);
movefile('SSTJFM.SUM', folder_name);
end
end
% end
```

APPENDIX B.3

Matlab Code to read the output files of the non-parametric forecasting program and create exceedence probability curves

```
clear
clc
% This program will read the output files from the non-parametric
forecasting
% program and create the appropriate exceedance probability curves.

Years = 1961:2002;              % Years of records
%Qz = xlsread('Qstations.xls',2);
% Directory of streamflow station
% dir1 = 'JFM';
%
% %for i = 1:4
% dir2 = [dir1 int2str(Qz(i))];
% folder =[dir1 '/' dir2 '/'];% 'JFM/JFM9152500/';
folder = 'AMJJAS1 SWE1';
% Output files import
LEPTE = dlmread([folder '/LEPTEJFM.SUM'], '',1,0); %LEPTE file
climUl = numel(Years);  % Climatology first reading
climLl = 100 + climUl;  % Climatology last reading
CLIM = dlmread([folder '/CLIMJFM.SUM'], '',[climUl,0, climLl,1]); %CLIM
file
CLIM = flipud(CLIM);                     % CLIM in descending order
TEST = dlmread([folder '/TESTJFM.SUM']);          % TEST file
% End of output files import

% Output files processing
% LEPTE file processing
SK = LEPTE(:,7);                % Skills column
MaxYr = max(SK);                 % Maximum skill
MinYr = min(SK);                 % Minimum Skill
MxYrTh = find(SK==MaxYr);        % Row number for Max Skill Year
MnYrTh = find(SK==MinYr);        % Row number for Min Skill Year
GoodYr = Years(MxYrTh);          % Corresponding Max skill Year
BadYr = Years(MnYrTh) ;          % Corresponding Min skill Year

Predictor1 = LEPTE(MxYrTh, 1);
Predictor2 = LEPTE(MxYrTh, 2);
Predictor3 = LEPTE(MxYrTh, 3);
Goodpred = [Predictor1, Predictor2, Predictor3];

Predictor1B = LEPTE(MnYrTh, 1);
Predictor2B = LEPTE(MnYrTh, 2);
Predictor3B = LEPTE(MnYrTh, 3);

Badpred = [Predictor1B, Predictor2B, Predictor3B];
display('Predictor Weights - Good Forecast: ')
disp(Goodpred)
display('Predictor Weights - Bad Forecast: ')
disp(Badpred)

% CLIM file processing
climX = CLIM(1:100,1);
climY = CLIM(1:100,2); %/1000;

% TEST file processing
GdYr = find(TEST(:,1)==MxYrTh);
BdYr = find(TEST(:,1)==MnYrTh);

GdYrObs = TEST(GdYr,3); %/1000;    %Observed Good year
GdYrMdl = TEST(GdYr,5); %/1000;    %Model Good year
```

```
BdYrObs = TEST(BdYr,3); %/1000;    %Observed Bad year
BdYrMdl = TEST(BdYr,5); %/1000;    %Model Bad year

% End of  file processing

%Plotting


subplot(2,1,1)
plot(climX,climY,'--',climX,GdYrObs,'-..',climX,GdYrMdl)
legend('Climate','Observed','Model')
xlabel('Exceedence probability (%)')
ylabel('SWE (in)')
%title(['Good Forecast ' int2str(GoodYr)],'FontWeight','bold')
title([folder ' Good Forecast, Year: ' int2str(GoodYr),'  Skill = '
int2str(MaxYr) '%'],'FontWeight','bold')
subplot(2,1,2)
plot(climX,climY,'--',climX,BdYrObs,'-..',climX,BdYrMdl)
legend('Climate','Observed','Model')
xlabel('Exceedence probability (%)')
ylabel('SWE (in)')
%title(['Bad Forecast ' int2str(BadYr)],'FontWeight','bold')
title([folder ' Bad Forecast, Year: ' int2str(BadYr),'  Skill = '
int2str(MinYr) '%'],'FontWeight','bold')
% End of plot

% Save figure
saveas(gcf,[folder '.bmp']);
movefile([folder '.bmp'],folder);
%end
% fprintf('%5.0f \t %10.3f \n',CLIM2')
% fprintf('%5.0f \t %10.3f \t %10.3f \t %10.3f \t %10.3f \n',TEST')
```

VITA

Abdoul Aziz Oubeidillah was born in Chouani Hambou, in the Comoros Islands. After finishing high school in his home country, he attended Minnesota State University, Mankato, from where he received a Bachelor's Degree in Electrical Engineering in 2000. He later attended the University of Wyoming for his Master's degree before transferring to the University of Tennessee, Knoxville to pursue his PhD in civil and environmental engineering.