Using ATRAN Telluric Correction to Investigate the 3µm-Region

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Introduction

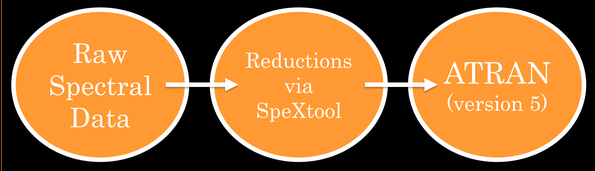
Small-bodies of the solar system, such as asteroids, provide an abundant amount of information about planetary formation and evolution. In particular, the characterization of asteroids is vital to understanding the distribution and abundance water throughout the solar system. Recent findings in asteroid spectroscopy have provided evidence for the surface presence of water-ice and hydroxyl, likely due to silicates on asteroid surfaces interacting with H+ ions from the solar wind.[1] To investigate surface hydration, astronomers analyze the 3 µm-region, where an absorption feature is exhibited. Atmospheric water, however, affects the quality of the data around this wavelength region, but a significant portion of the feature can be recovered by telluric correction routines, such as ATRAN[2]. ATRAN telluric correction code is employed to correct the spectra of nine asteroids and one Jovian moon, The results are presented to highlight a contribution to the collaboration.

Recent image of Near-Earth Asteroid, Bennu (Credit: NASA)

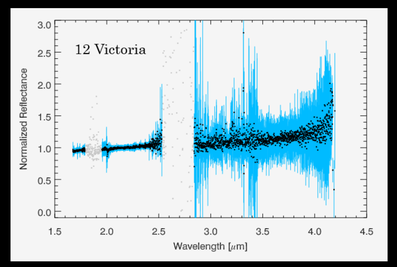
Many asteroids have been shown to exhibit water/hydration features. Of recent, the OSIRIS-Rex spacecraft observed evidence of phyllosilicates on the regolith of Bennu[4].

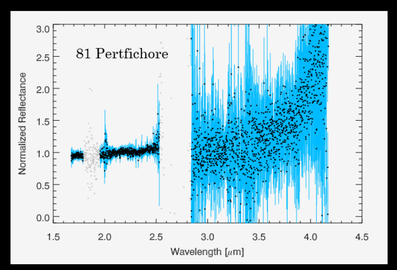
Methods

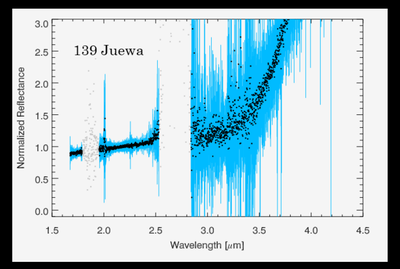
ATRAN is a telluric correction code that takes reduced spectral data and returns finalized 1-D spectra. The raw spectral data was from the SpeX instrument[5] on the Infrared Telescope Facility (IRTF) and was reduced using SpeXtool in IDL[6]. ATRAN is applied to the extracted spectra.

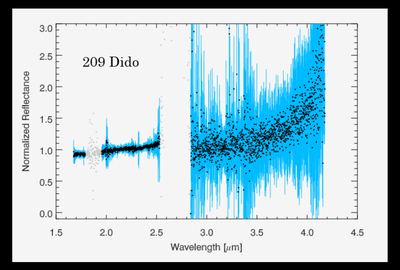


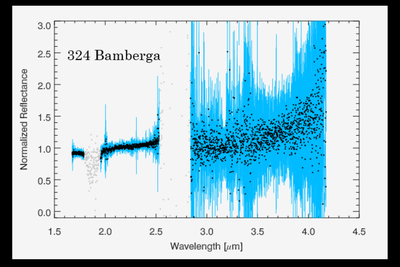
Results

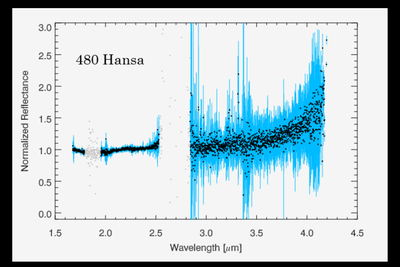


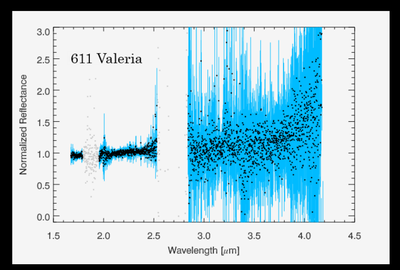


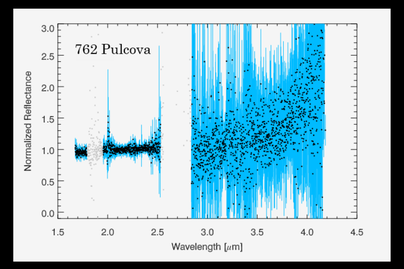


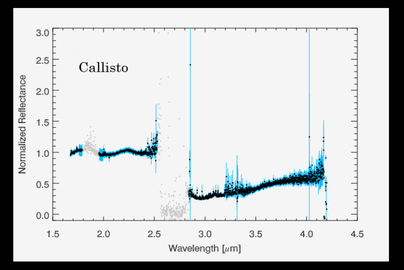












Analysis

Version 5 of ATRAN adequately corrects for atmospheric conditions for the nine asteroids and Callisto. Visual inspection does not reveal the presence of a 3-µm feature for the asteroids. The signal-to-noise longward of the 3µm-region frequently is quite small. In order to identify a feature, a more quantitative approach is required.

Future Work

- Apply ATRAN to spectral data from other asteroids and small-bodies
- Apply thermal tail corrections to the region after 3µm
- Determine band depth of feature if present.

References

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