EGU21-1374
https://doi.org/10.5194/egusphere-egu21-1374
EGU General Assembly 2021

Seasonal Change in the Deep Atmosphere of Uranus, 1981 to 2012

Mark Hofstadter[1], Alexander Akins[1], and Byran Butler[2]
[1]Jet Propulsion Laboratory/California Institute of Technology, Pasadena, United States of America
(mark.hofstadter@jpl.nasa.gov)
[2]National Radio Astronomy Observatory, Socorro, United States of America

Our team is using radio observations of Uranus, collected with the Very Large Array (VLA) telescope, to track seasonal changes in the deep troposphere of Uranus between 1981 and the present. We previously reported on changes between 1981 and 1994, as the Southern Hemisphere moved from mid- to late-summer (Hofstadter and Butler 2003, Icarus 165, https://doi.org/10.1016/S0019-1035(03)00174-X). During that time, the distribution of opacity sources in the atmosphere (now thought primarily to be H_2S) changed in such a way as to suggest an increase in the strength of the planetary-scale circulation pattern in the 5 to 50 bar region of the atmosphere. More specifically, using wavelengths from 1 to 20 cm, we found that regions poleward of 45 degrees latitude in the Southern Hemisphere are significantly depleted in absorbers compared to more equatorial latitudes, down to a pressure of about 50 bars (which is near the top of where a liquid water cloud is expected to form). This opacity distribution could be explained by a planetary-scale circulation pattern, with absorber rich air parcels moving upward in equatorial regions, being depleted in absorbers by condensation at higher altitudes, and then moving poleward and descending, keeping the pole depleted in absorbers. We found that the opacity difference between the pole and equator increased between the 1980's and the 1990's, suggesting a strengthening of the assumed circulation pattern. Radio observations by our group and others since 1994 have shown that the Northern Hemisphere is roughly symmetric with the Southern, and that smaller-scale latitudinal banding exists (e.g., Molter et al. 2020 https://arxiv.org/abs/2010.11154).

We are currently analyzing additional Uranus data collected at the VLA, and will present results from a subset of those observations taken in 2012 (during Southern Fall). We will also discuss plans for extending the time line to the present. The complete data set will span half a uranian year, allowing all seasons to be observed. We will also discuss how the composition and chemistry of the ice giant planets (Uranus and Neptune) differ from those of the gas giants (Jupiter and Saturn).