Geophysical Research Abstracts
Vol. 21, EGU2019-10229, 2019
EGU General Assembly 2019

The thermal structure of Jupiter's troposphere revealed by the Juno microwave radiometer

Cheng Li (1), Andrew Ingersoll (1), Fabiano Oyafuso (2), Zhimeng Zhang (1), Shannon Brown (2), Steven Levin (2), and Scott Bolton (3)

(1) California Institute of Technology, (2) Jet Propulsion Laboratory, (3) Southwest Research Institute

The thermal structure of Jupiter's troposphere has been elusive because Jupiter's atmosphere is optically thick below 5 bars. During the last two years, the Juno microwave radiometer found that the thermal emission from Jupiter's troposphere is warmer than what was expected from an idealized adiabat, a consequence previously attributed to the nonuniform distribution of ammonia gas. Here we examine a new explanation that the excessive brightness temperature is due to the superadiabatic temperature gradient near the water condensation level. As demonstrated by a two-dimensional cloud-resolving simulation of Jupiter's atmosphere, the seemingly unstable temperature gradient is balanced by a negative gradient of the concentration of water vapor such that the density profile is still stably stratified. In addition, the mean profile of ammonia gas shows a depletion in the subcloud layer down to nearly 10 bars. These results are consistent with the Juno MWR observations.