Geophysical Research Abstracts
Vol. 21, EGU2019-16171-1, 2019
EGU General Assembly 2019

The atmospheric structure of the Ice Giant planets from in situ measurements by an entry probe

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The atmosphere of Uranus and Neptune, the ice giants planets of our Solar System were probed by the Voyager 2 during its flyby in 1986 and 1989 respectively. The atmospheric temperature profiles were primarily retrieved from the Voyager radio occultations [Lindal et al. 1987; Lindal et al., 1990]; while both ground based and Voyager thermal infrared, solar and stellar occultation observations further constrained the atmospheric thermal structure [e.g. Marley & McKay 1999].
In situ measurements by an atmospheric entry probe allow for sounding atmospheric regions not reachable from remote sensing observations and for investigating of the atmospheric composition, structure and dynamics down deep into the atmosphere. The atmospheric profiles retrieved along the spacecraft's trajectory provide a snapshot of the atmospheric structure and constraint the atmospheric stability, dynamics and its effect on the atmospheric chemistry. The variations in the density, pressure and temperature profiles provide information on the atmospheric stability and stratification, on the presence of winds, thermal tides, wave and turbulence in the atmosphere. The presence of condensation, cloud and aerosols layers can be detected by the estimation of the temperature lapse rate, that, on the other side, could also help to distinguish between saturated, unsaturated, stable and conditionally stable regions. Moreover in situ measurements of the atmospheric electricity can contribute to the study of the moist convective processes, cloud formation and characterization, and allow for detection of possible electrical discharges, i.e. lightings.
The scientific objectives, measurements and expected results for an Atmospheric Structure Instrument (ASI) for an entry probe at the Ice Giant planets will be presented and discussed in the framework of the opportunity for an NASA-ESA joint mission to Uranus, Neptune and their moons.

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