



Water in the Giant Planets

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Water has been detected in the tropospheres of Jupiter (Larson et al., 1975) and Saturn (de Graauw et al., 1997) and in the upper atmospheres of the four giant planets (Feuchtgruber et al., 1997). Tropospheric water is believed to have been incorporated in the initial cores of the planets, while stratospheric water has an external origin, either local (satellites and/or rings) or interplanetary (comets or meteoroids).

Water is an important parameter for understanding the formation and evolution of the giant planets. Indeed, water is believed to have been a key element in their formation scenario, by making possible the accretion of big nuclei at large heliocentric distances ($R_h > 4$ UA), beyond the “ snow line ” where it condensed in the protoplanetary disk. Measuring the water mixing ratio in the interiors of the giant planets would be a key measurement for discriminating between various formation models (Owen and Encrenaz, 2003, 2006). In the case of Jupiter and Saturn, however, the O/H tropospheric ratio appears to be strongly depleted with respect to its value in the deeper levels, because of meteorological effects. Measuring the O/H ratio in the deep interiors of all giant planets will be a major objective for future missions.

References : de Graauw T. et al., *Astron. Astrophys.* 321, L13 ; Feuchtgruber H et al., *Nature* 389, 159 (1997) ; Larson H P et al ., *Astrophys. J.* 197, L137 ; Owen T and Encrenaz T, *Space Sci. Rev.* 106, 121 (2003) ; Owen T and Encrenaz T, submitted to *Plan. Space Sci.* (2006)