Mutual Impedance Probe measurements of the electrical conductivity of the atmosphere of Titan with the PWA-HASI instrument on board the HUYGENS Probe

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Mutual Impedance Probes (MIP) have been extensively used to measure the electron density and temperature of ionospheric and magnetospheric plasmas from resonances. In collisionnal media as planetary atmospheres there are no more resonances but amplitude and phase characteristics that allow to derive the conductivity due to free electrons. Such an instrument was on the HUYGENS Probe that descended through the atmosphere of Titan, January 14th, 2005. We describe the MIP, part of the Permittivity, Waves and Altimetry (PWA), a subsystem of the HUYGENS Atmospheric Structure Instrument (HASI). A first outstanding result was the measurement of a conductive ionospheric layer around the altitude of 60 km. Then difficulties occured in the data analysis to obtain precise quantitative values of the conductivity . One of the causes is that testing the instrument on Earth in Titan-like conditions is practically impossible. The models of the measurement system, including spacecraft geometry, hardware and software have been revisited for a better MIP data analysis leading to more accurate electron conductivity profiles.