AOGS 2005

The Mars Express Orbiter Radio Science Experiment (MaRS)

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As part of the Mars Express orbiter payload, MaRS is performing the following experiments: (a) the radio sounding of the neutral Martian atmosphere and ionosphere (occultation experiment) to derive vertical profiles of density, pressure and temperature in the altitude range from the surface to 50 km and to derive ionospheric electron density profiles from 80 km to over 1000 km as a function of latitude, longitude, local time and planetary season. More than 100 profiles of the atmosphere and ionosphere have been obtained during the first occultation season (April to mid August 2004) and further 28 occultations during the second season in December 2004. Quite a number of coordinated observations with SPICAM have been performed during both seasons in order to derive a combined density and temperature profile ranging from the surface to 150 km, (b) the determination of gravity anomalies in comparison with topographic 3D models for the investigation of the structure and evolution of the Martian crust and lithosphere in selected target areas. Several of these observations have been performed over Valles Marineris, Olympus Mons and Alba Patera, (c) the determination of temporal changes of the low degree and order global gravity field caused by seasonal mass exchange between the planetary poles, (d) the determination of dielectric and scattering properties of the Martian surface in specific target areas by a bistatic radar experiment which was performed twice in 2004 during the commissioning phase and (e) the precise determination of the mass and the low order gravity field of Phobos during close flybys in order to characterize its internal structure and origin. Next flybys are expected in May and June 2005. This presentation give an overview of the results obtained during the first year in orbit. MaRS relies on the observation of the phase, amplitude, polaristaion, and propagation times of radio signals transmitted from the spacecraft and received at ground station antennas on Earth. The radio signals are affected by the medium through which the signals propagate (atmospheres, inospheres, interplanetary medium, solar corona), by the gravitytional influence of the planet on the spacecraft and finally by the performance of the various systems involved both on the spacecraft and on ground.