EPSC Abstracts
Vol. 8, EPSC2013-811, 2013
European Planetary Science Congress 2013

Chasing the center of the Saturnian plasma sheet

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Abstract

After 9 years in orbit around Saturn, Cassini has collected an enormous amount of *in-situ* and remote measurements, covering a significant part of the giant planet's magnetosphere, during different seasonal conditions. In this study we use particle and magnetic field data to provide a statistical approach to the average conditions of the Saturnian plasma sheet. In contrast to previous works, we determine plasma sheet intervals based on criteria incorporating the radial components of the magnetic field Br and the field root mean square (RMS), rather than the distance from the rotational equatorial plane that we now know that does not follow the plasma sheet as closely. This way, we minimize (as possible) effects related to the well monitored seasonal or periodic (short scale) displacement of the plasma sheet that is usually compared to the scale heights for most of the particle populations therein, we produce particle property maps (such as particle pressure and beta, spectral index, pressure gradient etc) that describe for the first time the actual center region of the Saturnian plasma sheet and we further compare pre to post-equinox behavior. Our final outcome will be in the form of long term statistical grid maps that follow the center region of the plasma sheet and reveal in what degree the measured dynamics should be attributed to local particle dynamics or to the motion of the plasma sheet as a structure. In addition, the accurate determination of the plasma sheet using essentially all date available since Saturn Orbit Insertion (SOI) in 2004, will give us the opportunity of looking closer into features that are still insufficiently explained, such as the systematic local time asymmetry observed in the particle energization or the radial plasma and energy transport, and provide a global, season-independed, magnetospheric map for Saturn.