



High-latitude field-aligned currents observed by Cassini in Saturn's magnetosphere

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In mid 2008, the Cassini spacecraft monitored the high latitude region (50° - 75°) of Saturn's magnetosphere near its periapsis passes at radial distances of 3-6 R_S . The magnetometer onboard Cassini recorded strong perturbations in the azimuthal component of the magnetic field during these passes suggesting passage of the spacecraft through strong sheets of field-aligned currents (FACs). The invariant latitude of the spacecraft was close to 70° and the local time was close to 00 hrs during the passages through the FACs. A statistical analysis of these currents shows that they are generated primarily by the global current circuit that enforces corotation on the outflowing plasma. The direction of the current is always directed away from the ionosphere and its strength is variable from pass to pass and is strongly ordered by the period determined by the SKR amplitude variations. We show that the variability of the FACs is caused by the superposition of two current systems, namely the corotation enforcement current system and a rotating partial ring current system which closes in the equatorial plane between the radial distances of 8 and 12 R_S .