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Case study of quasi-steady reconnection in Saturn's magnetotail, and update on our current understanding of mass transport and loss in Saturn's nightside magnetosphere

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Abstract

We present a case study of an event from August 20th (day 232) of 2006, as viewed by magnetic field, plasma, energetic particle and plasma wave sensors (MAG/CAPS/MIMI/RPWS) when the Cassini spacecraft was sampling the region near 32 Rs and 22 hours LT in Saturn's magnetotail. Cassini observed a strong northward-to-southward turning of the magnetic field, which is interpreted as the signature of dipolarization of the field as seen by the spacecraft planetward of the reconnection x-line. This event was accompanied by very rapid (up to ~1500 km s^{-1}) thermal plasma flow toward the planet. At energies above 28 keV, energetic hydrogen and oxygen ion flow bursts were observed to stream planetward from a reconnection site downtail of the spacecraft. Meanwhile a strong field-aligned beam of energetic hydrogen was also observed to stream tailward, likely from an ionospheric source. Saturn Kilometric Radiation emissions were stimulated shortly after the observation of the dipolarization. We discuss the field, plasma, energetic particle and radio observations in the context of the impact this reconnection event had on global magnetospheric dynamics.
We also discuss this event in terms of other recent studies of reconnection in Saturn's tail and update on the emerging picture concerning our understanding of how mass is transported and lost within Saturn's magnetosphere.