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Finding the drivers for a non-steady state and large-scale stresses acting on the Saturnian magnetosphere

Ned Staniland, Michele Dougherty, and Adam Masters
Blackett Laboratory, Imperial College London, London, UK

In the inner region of Saturn's rotationally-dominated magnetosphere, the governing magnetic field contributors are the internal magnetic field and the magnetodisc current sheet. The equatorially confined plasma sourced predominantly by the moon Enceladus stretches Saturn's magnetic field lines into the characteristic 'magnetodisc' geometry. The extent of this effect varies due to both external and internal dynamical processes that perturb the system.

In this study, we use the complete dataset collected by the Cassini spacecraft to determine whether the magnetosphere is compressed, stretched or near some prescribed ground state. We find that there is an underlying dawn-dusk asymmetry in the ground state of Saturn's magnetosphere, where the field is more compressed at dusk compared to dawn. Whilst Saturn spent a significant period of the Cassini mission near its ground state, we find evidence for large-scale stresses acting on the system, including large compression events that coincide with the declining phase of the solar cycle. These results are then compared to propagated solar wind data. In addition, approximately two thirds of our dataset is well described by the internal field and current sheet models, signifying the system was in steady-state during these passes. We further discuss the drivers for the non-steady state periods at Saturn and what this implies for the global dynamics of Saturn's magnetosphere.