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Andriopoulou, M., Roussos, E., Krupp, N., Paranicas, C., Thomsen, M., Krimigis, S., Dougherty, M.K., Glassmeier, K.-H., 2014, Spatial and temporal dependence of the convective electric field in Saturn's inner magnetosphere., Icarus, 229, 57-70, http://dx.doi.org/10.1016/j.icarus.2013.10.028

In the 10 years since Cassini entered orbit at Saturn much has been learned about the various dynamic processes occurring in Saturn's magnetosphere, yet the processes by which plasma is circulated within the magnetosphere are not completely understood.

Microsignatures or "wakes" are created as corotating charged particles are swept up by icy moons. As Cassini passes through one of these wake regions, which may survive for many hours in case of energetic electrons, they are detected, most commonly by the MIMI-LEMMS instrument as abrupt and narrow dropouts in the count-rates of its various energy channels. The position/placement of the wakes measured by LEMMS were sometimes found to be inside the radial distance of the moon's orbit, sometimes outside. The radial separation between the wake and the moon's orbit has been found to be as much as one Saturn radius, R_S, with the outward offsets occurring mainly on the dayside and inward offsets mainly on the nightside.

Most microsignatures are smoothly dispersed radial displacements as a function of the electron energy. Some, however, exhibit complex structures with abrupt changes in the displacement suggesting the occurrence of a magnetospheric dynamic event that develops over time scales shorter than the microsignature lifetime. It is unclear what kind of event could lead to these complex structures in microsignature profiles, but one possible explanation might be electric fields (or flows) induced by solar wind variability. No self-consistent model of the inner magnetosphere of Saturn currently exists that can account for such an explanation. Even advanced MHD models of Saturn's magnetosphere with boundary conditions specified near the locations where microsignatures are observed do not account for this. A different approach for the calculation of these fields is proposed using the magnetospheric model for Saturn developed by Khurana (2006).

The Khurana model is commonly used for Saturn's magnetosphere. Based on the Tsyganyenko model of Earth's magnetosphere it is adapted for Saturn with a best fit to in-situ Cassini measurements and so far it has been used for various activities, such field line tracing, flux mapping or charged particle tracking. The model is magnetostatic and therefore does not incorporate magnetospheric dynamics. Its output, however, is dependent on the solar wind dynamic pressure and therefore time series of different magnetic field configurations can be synthesized by the user. We will demonstrate how induced electric field maps can be obtained from the analysis of such time series, specifically a simulated solar wind pulse. The results will be considered in context with microsignature observations.