Substorm SAPS/SAID and the Plasmasphere's Fine Structure

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The perturbed plasmasphere contains field-aligned density irregularities (ducts). Their presence is critical for the VLF wave generation, especially triggering, and thus for losses of the radiation belt (RB) electrons. It is established that the RB boundary is closely related to the innermost plasmapause location. Recent magnetically-conjugate Cluster/DMSP observations show that the outer boundary of substorm SAID co-locates with the plasmapause. We present further evidence of the intimate relation between post-substorm SAID, plasmapause, and the RB outer boundary. The data come from Cluster and DMSP satellite observations. Plasmaspheric irregularities, inferred from the Cluster/EFW probe-to-spacecraft potential and the Cluster/WHISPER instrument, are found to co-locate with small-scale variations of the EFW electric field. The irregularities develop soon after the substorm injection front arrived at the plasmapause.

Stormtime substorm injections lead to highly structured electromagnetic fields (SAPSWS) in the ring current-plasmasphere overlap. The SAPSW are observed by the CRRES electric field (EFI) and magnetic field (MFI) instruments in the dusk sector and are magnetically conjugate to highly structured SAPS in the top ionosphere. Presumably, these structures are generated at the leading edge of the ring current ion cloud by the current-convective instability amplified by ionospheric feedback. We report on CRRES observations of plasmaspheric density irregularities (likely ducts), inferred from the plasma wave experiment (PWE), which are associated with the SAPSWS events during the magnetic storm of 4-5 June 1991.