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Coherent and turbulent cascades at magnetospheric boundaries: a way for Space Weather predictions

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Multipoint spacecraft measurements in the magnetosheath (MSH) by Cluster, Double Star, THEMIS, Interball, Geotail etc., demonstrate that coherent structures with magnetosonic Mach number up to 3 – Superfast Plasma Streams (SPS) – provide the cross-system means for normal and anomalous boundary dynamics, which can be critical for Space Weather predictions. The strongest SPS with the ram pressure over than that of the solar wind one in severaltimes, could lead to the long-range correlations between processes at magnetopause and bow shock, as well as between upstream and downstream MSH.
We discuss this anomalous MSH dynamics in view of the Space Weather features, including the MSH plasma flow stratification and boundary crossings at eigen frequencies of $\sim$ 1-4 mHz. Most often the
anomalous MSH dynamics is triggered by hot flow anomalies (HFA) generated by interaction of interplanetary discontinuities with bow shock. We also discuss another mechanisms as well, including especially foreshock for the horizontal magnetic fielsd in solar wind and parallel.
An appearance of the fast MSH and SPS, related with HFA, both near bow
shock and magnetopause. The HFA represent local obstacles for solar wind, and the multi-point data suggest the local flow balance causing the SPS generation and penetration into the flank magnetosphere.
The SPS look to be universal means for establishing of new equilibriums
between flowing plasmas, which looks suggestive also for astrophysical and fusion applications.