Observations and Theory of Mirror-Mode Structures in the Dawn-Side Magnetosphere

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Transport of ULF wave energy via large-scale wave modes is extremely important in terms of solar wind-magnetosphere-ionosphere coupling. In this paper, we present a study in which we fully characterise and diagnose large-scale ULF wave dynamics on a near-global scale. We present a study using a favourable radial alignment of the Cluster, Polar and geosynchronous satellites in the dusk sector during a high solar wind speed interval. We infer that magnetopause undulations observed by Cluster drove compressional waves, perhaps in the form of Kelvin-Helmholtz unstable magnetospheric waveguide modes that propagate inward from the magnetopause. These compressional waves couple to resonant field lines close to location of Polar and geosynchronous orbit, and are observed as a field line resonance on the ground. Further, we analyse the magnetopause boundary oscillations on both large- and small-scales using the minimum variance technique to identify the planar nature of the boundary layer/magnetopause. This has important implications for both the DoubleStar and THEMIS missions; together with measurements from other satellites such as Cluster, Geotail and the geosynchronous satellite fleet, flank and dayside conjunctions of these satellites will be able to characterise the full radial and multi-scale nature of Global ULF wave events. This technique is valuable for the investigation of tail phenomena excited via the same K-H activity at the flanks, for example in the boundary layer model for magnetospheric substorms.