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Energy concentration and re-distribution in the magnetospheric boundary layers

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Basing on comparison of the Cluster, Interball and solar wind (SW) data we discuss extremely disturbed magnetosheath (MSH) regions either closer to the bow shock (BS), or ahead of magnetopause (MP), which provide an evidence for unprecedented kinetic energy concentration either in spikes ('plasma jets' with the energy density up to several times above that of the unshocked SW), or in average - in extended super- turbulent zones with several tens of the jets.
Between the BS and middle MSH extremely disturbed zones are regularly registered, preferably downstream of quasi-parallel and intermediate BS. These zones have longer duration (up to 2 hours) than that ahead high-latitude MP with similar features, called 'turbulent boundary layers' (TBL). While the TBL origin is rather clear identified with the MSH flow interaction with the cusp throat, the far MSH zones require further search for an energy source as the zones' duration far exceeds the period of eigen MSH waveguide modes. However, both super-disturbed zones have very close intensity and spectral characteristics. Our analysis of structure functions in the zones also revealed similar multifractal properties of the magnetic field and ion flux. Also the similar is fitting with the Log-Poisson cascade model. In the zones the MSH resonant perturbations at few mHz are often amplified, representing large amplitude Alfven waves with Poynting flux being nearly perpendicular to the streamlining MSH plasma flow. As the kinetic energy rising in the jets is opposite to the predictions of MHD for the transformation of SW kinetic energy into thermal energy at the BS, we discuss the dynamic feature of non-equilibrium processes due to the single jets, along with global energy re-distribution in the dayside MSH for the extended super-turbulent zones.
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