Geophysical Research Abstracts
Vol. 17, EGU2015-4619, 2015
EGU General Assembly 2015

Properties of waves in the range of several Hz associated with interplanetary shocks

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The interplanetary (IP) shocks are often associated with high-frequency (several Hz) wave packets in both upstream and downstream regions. These waves could be resolved only in fast magnetic field data because the time resolution of plasma instruments is often insufficient for their detection. The BMSW instrument onboard the Spektr-R spacecraft measures solar wind parameters with a resolution of 32 ms and allows a detailed analysis of these waves. Since the magnetometer onboard Spektr R is not in operation, we compare its plasma observations with Wind fast magnetic field measurements. Our analysis of low-Mach-number fast forward shocks have shown that (1) the wavelengths of both upstream and downstream waves conserve over the spacecraft separation, (2) in the frequency range of 0.5–5 Hz, their wavelengths are directly proportional to the shock ramp thickness that is controlled by the ion thermal gyroradius, and (3) the phase shift between density and temperature variations within downstream wave packets is about 90°. These results emphasize a role of kinetic processes in the formation of low-Mach number shocks. We discuss a nature of these waves and their properties.