Geophysical Research Abstracts
Vol. 21, EGU2019-4355, 2019
EGU General Assembly 2019

Solar wind fluctuations at the inertial and kinetic scales: Ion beta dependence

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We study the polarization properties of the velocity fluctuations in solar wind turbulence using high-resolution data from the Spektr-R spacecraft and compare the results with a similar analysis of magnetic field fluctuations recorded by Wind. The analysis performed in the mean magnetic field frame shows that the ratio of perpendicular to parallel velocity fluctuations in the inertial range is smaller than the equivalent ratio of magnetic fluctuations, but gradually increases throughout this range. In the kinetic range, there is a large decrease in the ratio, similar to the magnetic fluctuations. By contrast, the magnetic field fluctuations in the inertial range are constant. All these features including the dependence on plasma beta can be successfully captured in the model based on a combination of kinetic Alfvén waves and slow waves when incorporating a beta-dependent Alfvén to slow wave ratio similar to that observed in the solar wind. Since the mean field frame is more appropriate for the fluctuations of small amplitudes that are rare in the solar wind, we present analogous analysis in the minimum variance frame and discuss implications for the Debye mission suggested for a launch in frame of the ESA call for F-class mission.