Turbulent properties of CME-driven sheath regions

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We have analysed magnetic field fluctuations in sheath regions ahead of interplanetary coronal mass ejections (CMEs). CME sheaths are one of the key drivers of space weather disturbances, but their detailed structure and formation are relatively poorly understood. The level of magnetic field fluctuations in sheaths is generally much higher than in the ambient solar wind. We compare fluctuation properties in different parts of a sheath observed at the orbit of Earth using by the Wind spacecraft. Our findings show that in general the transition from the preceding solar wind to the sheath generates new fluctuations that are mostly compressive and which increase intermittency. Spectral indices are mostly steeper than the -5/3 Kolmogorov index. The standard p-model did not show a good fit (in either the Kraichnan or Kolmogorov form), but the extended p-model was in a very good agreement. This suggests that turbulence may not be fully developed in CME sheaths in general. Our study also reveals that turbulent properties can vary considerably between different sheaths and in different subregions of the sheath, and can be significantly modified by the presence of small coherent structures. The findings support the view that sheath formation is a complex process with multiple physical mechanisms playing a role in generating the turbulence.