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On the Existence of the Kolmogorov Inertial Range in the Terrestrial Magnetosheath Turbulence

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In solar wind, it is well established that at MHD scales the magnetic energy spectra generally follow the so-called Kolmogorov inertial range spectrum $f^{-5/3}$ in solar wind. In this study, we used three years data from the Cluster mission to statistically investigate the existence of the Kolmogorov inertial range in the whole magnetosheath, including flanks and subsolar regions. Statistical results show that Kolmogorov inertial range is not ubiquitous in the magnetosheath. Indeed, most spectra were found to be shallower than the Kolmogorov one and have a scaling $\sim f^{-1}$recalling the energy containing scales of solarwind turbulence. The Kolmogorov scaling is observed only faraway from the bow shock and in the flanks region. These results suggest that random-like fluctuations are generated behind the shock, which reach a fully developed turbulence state only after some time corresponding to their propagation (or advection) away from the shock. These fluctuations are shown to be essentially compressible and not Alfvenic as in the case of the solar wind. Implications on the new theoretical modeling of space plasma turbulence will be discussed.