Geophysical Research Abstracts
Vol. 15, EGU2013-3285-1, 2013
EGU General Assembly 2013
© Author(s) 2013. CC Attribution 3.0 License.

From 1AU solar wind turbulence backward to coronal turbulence: an inverse problem

Yue Dong (1), Andrea Verdini (2), and Roland Grappin (1)
(1) LPP, Ecole Polytechnique, Palaiseau, France, (2) SIDC, ROB, Bruxelles, Belgium

This work deals with the formation of the low-frequency spectrum of solar wind turbulence, including the so-called inertial range and the lower frequency 1/f range. Much is known on the turbulent state of the solar wind plasma at distances larger than 0.3 AU, but few is known on the turbulent state of the plasma at the sources of the wind, like the coronal plasma. Characterizing the turbulence state of plasma in the solar corona is thus an inverse problem.

To solve this inverse problem, we use the MHD expanding box model, which consists in incorporating in the MHD equations the effects of expansion on a turbulent plasma volume advected by a wind with constant (radial) velocity, by using comobile coordinates. In spite of its limitations (assumption of constant expansion), the model includes the basic effects of expansion (i) anisotropic damping of velocity and magnetic field (ii) weakening of nonlinear coupling in the perpendicular directions. The code allows in particular to follow the 3D turbulent evolution of the kinetic and magnetic energy spectra.

We present here for the first time numerical solutions of the expanding 3D MHD equations by starting with different initial conditions: we follow the turbulent evolution of the plasma box imbedded in a radial wind up to 1 AU and compare the final turbulent state with observations, thus allowing us to determine which initial conditions are acceptable. We vary three kinds of initial parameters: (1) spectral/components anisotropy (2) Alfvén species imbalance (3) kinetic/magnetic imbalance. The connection of the results with available models of the formation of coronal turbulence is discussed at the end.