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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Review article: Wave analysis methods for space plasma experiment" *by* Yasuhito Narita

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The work is about a review of analysis methods commonly used in solar wind turbulence. The manuscript is nicely written, concise and surely appropriate for Nonlinear processes in Geophysics. The paper can be published almost in its present form. However, the quality of the paper can be improved taking into account the following comments.

1) Page 4, section about coherent structures (lines 31-36) The role of coherent structures such as current sheets and possible associated mechanisms such as magnetic reconnection should be further highlighted. This is a big topic for the community, since these structures are ubiquitous in the free solar wind as well as in magnetospheric plasma. In this regard, it would be very instructive to mention:

[] A. Greco, W. H. Matthaeus, S. Servidio, P. Chuychai, and P. Dmitruk, "Statistical

analysis of discontinuities in solar wind ACE data and comparison with intermittent MHD turbulence", The Astrophysical Journal Letters 691, L111 (2009).

Note that these structures populate signals at very high-cadence, on scales on the order of the electron skin depth, playing a role in the low frequency fluctuations (omega$\sim$0). Recently, this issue has been investigated in

[] A. Greco, S. Perri, S. Servidio, E. Yordanova, P. Veltri, "he complex structure of magnetic field discontinuities in the turbulent solar wind", The Astrophysical Journal Letters 823 (2), L39 (2016)

2) Page 5, equation (3) It would be more clear for the reader if the dependenc of "R" as a function of omega dependence is explicitly reported. Namley "R -> R(omega)".

3) Page 5, line 55, sentence: "by chopping the time interval into sub-intervals and averaging the matrix over the sub-intervals."

This "chopping" procedure, essentially, should have a more profound meaning. The ensemble averages, as in equation (2), consist of a large number of realizations, over several correlation length-scales (or correlation times), and over different experiments (solar wind dataset). This deals with the ergodic theorem, which is crucial in every turbulence measurement (see for example classic lecture notes and books on hydrodynamics). "Chopping" the data at very small scale, unfortunately, violates this ensemble average, leading to ephemeral results. Unfortunately this habit became today a classical analysis technique. Although I do not agree with these methods, it would be important for the reader to (at least) know the problem of the "violation of ergodicity".

4) Page 5, lines 66-68 It would be nice to mention here some of the works made by Tim Horbury and colleagues on the definition of local mean field. Together with this, note that the definition of local mean field and its interpretation in the framework of plasma turbulence has been questioned in:

[] W. H. Matthaeus et al., "Local anisotropy, higher order statistics, and turbulence

spectra", The Astrophysical Journal 750 (2), 103 (2012)

5) Page 10, equation 14. It would be very interesting to spend more words about "\delta omega", which is crucial for the sweeping effect and therefore for the Taylor hypothesis.

6) Eq. 23, page 12 It is important here to mention the first work about the measurement of magnetic helicity in the solar wind, namely

[] W. H. Matthaeus, M. L. Goldstein, "Measurement of the rugged invariants of magnetohydrodynamic turbulence in the solar wind", Journal of Geophysical Research, 87 (A8), 6011 (1982)

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