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Current sheets and coherent structures in Ulysses dataset at 5 AU

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The method called PVI (Partial Variance of Increments) in its basic form, is applied to a one dimensional signal, such as a time series obtained in a high speed flow, as would be seen by a single spacecraft in the solar wind, or by a fixed probe in a wind tunnel. PVI is essentially a time series of the magnitude of a vector increment with a pre-chosen time lag, normalized by its average over selected period of time (see Greco et al. SSR, 2018 for details). It is a 'thresholding' method and once a threshold has been fixed on PVI signal, a collection, or hierarchy of events can be identified. The method is insensitive to the underlying mechanism that generates the coherent structures. Indeed, the method can be used to identify directional changes, magnitude changes, and any form of sharp gradient in the vector magnetic field B. The current-sheet method used in Li (2008) and Miao et al. (2011) can be used to identify the presence of current-sheet-like structures and by varying a time lag parameter in the method, one can also identify the width of the "current-sheet-like" structures (C/S). The method examines the angle between two unit magnetic field direction with a time-lag zeta. A pictorial way to view this is to assume a compass – the tips of the compass go through the data and lead to a series of angles. The angle will show an enhancement and maintain at the enhanced level upon crossing a current-sheet. The duration for the enhancement depends on both the time lag , and the intrinsic width of the current sheet.
By systematically varyng zeta, the dependence on zeta can be removed and we can therefore obtain the intrinsic width of the "current-sheet".
This work is a the comparison between the two methods. In particular, we focus on potential differences between the current sheets and intermittent structures detect by PVI technique.
Preliminary results obtained from Ulysses dataset indicate that C/S (with large rotation angles) is a subset of PVI structures and that the ratio of C/S to PVI is small in many analyzed periods. This may suggest that most PVI structures are generated in-situ through non-linear interactions – i.e. these PVI structures are intrinsic intermittent structures of the solar wind turbulence.