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Statistical study of the occurance rate of directional discontinuities in the heliosphere

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Using in situ high time resolution (6 second) magnetic field measurmenets in the solar wind, the waiting-time distributions of directional discontinuities (DDs) have been analyzed. With collecting very large statistical data base from the whole mission of Helios 1-2 and Ulysses, we had the opportunity to investigate those magnetic events in the heliosphere, covering heliographic latitude range from 80°S to 80°N and heliocentric distance range from 0.3 AU to 4.5 AU. We used an identification criteria of the events that is based on the spatial extent of the DDs rather, than on the time variation of the direction of the magnetic field vector. The shape of the probability density function for waiting-times can give information about the behavior of the driving process. If the series of the events occures randomly in time, than the distibution should be exponential. Our analysis did not confirm that the ellapsing time between subsequent DDs follows Poissionian statistic, Kolmogorov-Smirnov test resulted in a probability of less than 0.13% of the Poissonian process. About the spatial distribution of DDs in the heliosphere, we found that there is no significant latitudinal dependence in the waiting-time distribution. However, our investigation confirmed the earlier results that there is a significant radial gradient in occurance rate of DDs. The decrease of the number of DDs with distance from the Sun indicates that the DDs are formed close to the Sun and decay when travelling to larger distances. We suggest that the turbulance has a fragmentation effect which can causes this phenomenon.