EGU21-5595, updated on 14 Aug 2022
https://doi.org/10.5194/egusphere-egu21-5595
EGU General Assembly 2021

Spatial evolution of turbulent regions associated with stream interaction regions in the solar wind

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High-speed flows from coronal holes are separated from the surrounding solar wind by stream or corotating interaction regions (SIRs/CIRs). The latter have a complex dynamic structure, which is determined by turbulence, the presence of current sheets and magnetic islands/flux ropes/blobs/plasmoids. As the Sun rotates, SIRs along with high-speed flows propagate in the heliosphere. A SIR can be considered as a single large-scale object resembling a magnetic tube with walls of varying thickness. In this case, one can think not only about the speed of the plasma flow inside and near the given object, but also about its movement around the Sun as a whole. Because of this rotation, SIRs can cross the orbits of two separated spacecraft, which may allow one to study the spatial evolution of their structure. We have chosen the events when SIRs were sequentially detected by ACE and one of the STEREO spacecraft. In each case, a position of the Stream Interface (SI) was found, relative to which the position of other structures within the SIR was determined. Using a newly developed method for identifying current sheets [Khabarova et al. 2021], the SIR fine structure and the properties of turbulent plasma flow were studied. The estimates of the angular velocity of rotation SIR around the Sun are given. A model is constructed that describes the motion of SIRs in the heliosphere and their main large-scale properties.

Khabarova O., Sagitov T., Kislov R., Li G. (2021), http://arxiv.org/abs/2101.02804