



Grad-Shafranov reconstruction of magnetic clouds at 1 AU

Alexey Isavnin (1), Emilia K. J. Kilpua (1), Hannu E. J. Koskinen (1,2)

(1) Department of Physics, University of Helsinki, Helsinki, Finland, (2) Finnish Meteorological Institute, Helsinki, Finland

Grad-Shafranov reconstruction (GSR) is a method of estimating the orientation (invariant axis) and cross section of magnetic flux ropes using the data from a single spacecraft, which can be applied to magnetic structures embedded into magnetopause or magnetic clouds. We develop a number of improvements of this technique and use it for analysis of interplanetary coronal mass ejections (ICMEs) registered at 1 AU by STEREO, WIND and ACE spacecraft during the minimum of 23rd solar cycle. The analysis is conducted not only for ideal localized ICME events but also for non-trivial cases of magnetic clouds in fast solar wind, followed by SIR, small flux ropes, etc. We also compare invariant axes of ICMEs derived from GSR with ones defined with minimum variance analysis method and show the constraints of both techniques when applied to complicated events.