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A comparison of Generic residue analysis and multi-spacecraft methods at the Earth's magnetopause: A statistical study

Chandrasekhar Reddy Anekallu (1,2) and Stein E. Haaland (3,3)

(1) Finnish Meteorological Institute/Ilmatieteen Laitos, Earth Observation Unit, Helsinki, Finland (chandrasekhar.anekallu@fmi.fi), (2) Department of Physics, University of Helsinki, Helsinki, Finland, (3) Max-Planck-Institute for Solar System Research, Katlenburg-Lindau, Germany, (4) Department of Physics and Technology, University of Bergen, Bergen, Norway

In the study of boundary layers in space it is important to have accurate information on the orientation and motion of these structures. One of the challenges is to separate the spatial and temporal variations of the structures due to single point measurements. One of the prime objectives of the ESA's Cluster mission was to study boundary layers in the solar terrestrial environment and an advantage of Cluster is its capability to utilize data from all four spacecraft to resolve such structures. However, due to breakdown of fundamental assumptions such as planarity, constancy in motion and linear variations, it is not always possible to utilize multi spacecraft methods. In this paper we show that an alternative approach - generic residue analysis, utilizing all available data, but not necessarily from all four spacecraft, can provide similar results without any strict requirements required by the multi spacecraft methods. We apply generic residue analysis method and multi-spacecraft methods such as constant velocity approach, constant thickness approach on a subset of magnetopause crossings from a list of about 10,000 magnetopause crossings identified using Cluster data during the years 2001 to 2008 and present a comparison of results from multi-spacecraft methods and generic residue analysis.