THREE-SPACECRAFT SPATIAL GRADIENT ESTIMATION: ACCURACY STUDIES AND VORTICITY CALCULATIONS

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In order to resolve fully the spatio-temporal variability of plasma processes from simultaneous measurements in near-Earth space, four sensors are required as provided e.g. by the FGM instruments on ESA's Cluster mission. To facilitate the analysis of three-point measurements, we recently introduced planar reciprocal vectors as a generic means to study the variability within the plane spanned by the three spacecraft, and proposed to use physical assumptions and geometrical constraints to estimate variations in the direction normal to that plane. This presentation deals with the accuracy and the robustness of the new analysis method. Synthetic data are used to study how deviations from the physical assumptions and geometrical constraints affect the gradient estimates, and the results are summarized in confidence maps. In particular, we validate the method by calculating spatial gradients of linear and non-linear model magnetic fields. Current sheet structures previously identified in the literature are re-analyzed through three-point electrical current density calculations. The vorticity of the plasma bulk flow is estimate using CIS data to study magnetospheric vortex structures.

Three-spacecraft techniques, spatial gradient estimations, current sheet structures

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