Uncertainties on Fields Gradients and Propagation Velocities Estimated From Multi-Spacecraft Missions

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Multi-spacecraft missions involving at least four spacecraft with identical instruments allow to estimate :
i/ three-dimensional spatial gradients of fields simultaneously measured by the different spacecraft
The estimation of the spatial gradient of a physical field relies generally upon the hypothesis of linear spatial variations of this field throughout the volume of the cluster of measurement points. Within this approximation the estimated gradient is unique whatever is the weighting of the different points of the cluster. However uncertainties affecting the estimated gradient depend upon the adopted weighting. Case studies will be discussed and simulated uncertainties will be compared with respect to weighting.
ii/ three-dimensional propagation velocities of waves or discontinuities
Propagation velocities of waves or discontinuities can be estimated by timing methods. Usually a reference spacecraft is chosen and only three pairs of non coplanar spacecraft are used, nevertheless results can be improved by considering all pairs of spacecraft and looking for the optimal weighting of all time delays. The optimal approach will be presented and applied to reanalyze some Bow-Shock crossings by CLUSTER.

Keywords: Multi-spacecraft data analysis, spatial gradients of fields, velocities of waves and discontinuities, uncertainties

