Geophysical Research Abstracts,
Vol. 11, EGU2009-4908, 2009
EGU General Assembly 2009

New techniques for determining field-aligned currents: The least-squares curlometer

J. De Keyser, F. Darrouzet, and E. Gamby
Belgian Institute for Space Aeronomy, Brussels, Belgium (Johan.DeKeyser@aeronomie.be)

Precise in situ measurement of field-aligned currents is difficult. The standard curlometer technique is based on applying the classical gradient computation algorithm to compute the derivatives of each magnetic field component. It requires exactly four simultaneous in situ measurements from four non-coplanar points. The standard curlometer has been used extensively in the context of ESA's Cluster mission. A least-squares curlometer has recently been proposed as an alternative. It is based on least-squares gradient computation of the gradients. This technique has several interesting features. It obtains not only the gradient, but also a realistic error estimate on that gradient. The technique works without any a priori limitation on the number of spacecraft or their configuration; it sorts out what data are relevant for computing a particular gradient by itself. In addition, it is straightforward to impose constraints. For instance, one can compute the gradients of the three magnetic field components while including the zero divergence constraint. This leads to a least-squares curlometer that satisfies the divergence-free condition by design. Such a curlometer is the appropriate tool for determining field-aligned currents. The availability of error estimates allows assessing the statistical significance of the current density vectors that are obtained.