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Magnetic rotations and compressions at the magnetopause: "C" and "non-C" hodograms

Gérard Belmont, Nicolas Dorville, and Laurence Rezeau
LPP, Ecole Polytechnique/CNRS, Space Physics, Palaiseau, France (gerard.belmont@lpp.polytechnique.fr)

The magnetopause layer separates two media with different magnetic fields and plasmas: the magnetosheath and the magnetosphere. This current sheet therefore generally involves a net rotation of the tangential magnetic field and/ or a net change in the modulus of this vector between the two sides. Furthermore, for the same global jump, the variation of the magnetic field inside the current layer can be more or less complex. From ISEE measurements, Berchem and Russell (1982) have sorted the crossing observations into two classes: "C sheets" and "S sheets", in which the tangential magnetic hodograms resemble the shapes of these two letters. This classification has been used again recently by Panov (2011), using Cluster data. In the first class, the main variation concerns the direction, which rotates in a single sense; if this rotation is accompanied by a modulus change, this one occurs approximately at the same place and at the same scale. In the second class, the two kinds of variations can be more separated, in position and scale and rotations can occur in opposite senses.
Dorville et al. (2014a) have shown that the first class can allow for the determination of an accurate normal direction and of a coordinate along this normal, enabling one to draw profiles of all quantities in the magnetopause. Dorville et al. (2014b) have analyzed in detail an example where the separation between the compressional and rotational features could be interpreted as the interaction between a slow shock and a rotational discontinuity. We extend here this analysis and show that the "non-C" cases are generally not "S-shaped" and that they can often be interpreted as a succession of relatively separated rotational and compressional features.

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