# Machine learning identification of magnetopause boundary layer signatures to constrain the location of the global reconnection line.

A. Ghisalberti, N. Aunai, B. Lavraud, B. Michotte de Welle, A. Jeandet

Magnetic reconnection is a key plasma process leading to the reconfiguration of magnetic field lines, during which magnetic energy is transferred to the plasma as kinetic and thermal energy. A paradigm, supported by evidence in simulations and in-situ data, is that magnetic reconnection happens along a global line called the X line. On the Earth's magnetopause, reconnection events have been identified locally, but the global position and shape of the X line are unknown. They strongly depend on solar wind and interplanetary magnetic field conditions, but the suspected causal relationship is yet not precisely understood despite its important impact on the overall dynamics of the magnetosphere.

A way to constrain the position and shape of the X line is to build a map of the global ion flow on the Earth's magnetopause, whose main source is expected to be magnetic reconnection in the global X-line paradigm.

This method requires extracting observations of the boundary layer from large amounts of complex time-series data. This has been made possible by the sheer volume of data collected by MMS and THEMIS missions over twenty years and the development of a supervised machine learning architecture to massively extract the boundary layer signatures from in-situ data.

In this work, we show the preliminary results of ion flow maps in the boundary layer, and the first constraints of where magnetic reconnection happens.