Project Details

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Project Title:
Modeling ionospheric outflow in geophysically relevant coordinate systems

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Summary:
The outflow of ions provides an important coupling and transfer of mass and momentum between the auroral ionospheres and the outer magnetosphere. The transport of energized ionospheric ions to the tail requires hours, and allows for the possibility of long-term feedback effects between the magnetosphere and ionosphere. Such effects are interesting and perhaps crucial to understanding the development of substorms. The main obstacle is the fact that measurements of outflow (from low-altitude spacecraft) are performed relative to coordinate systems, which are only loosely related to the instantaneous configuration of the magnetosphere, e.g. MLT and ILAT. By contrast, one could imagine measuring the location and magnitude of ion outflows with respect to the instantaneous locations and strengths of field-aligned current systems. Such an ordering would allow outflow measurements to be used directly as either a ``boundary condition'' input for models or as ``ground truth'' for those capable of computing outflow.
We propose the adaptation of an existing, automated FAC-finding algorithm (developed for the FAST spacecraft) to the purpose of providing instantaneous, globally relevant coordinates, particularly with respect to the field-aligned current system, for observations of ion outflows onboard the Polar spacecraft. These observations will be crucial to differentiating ion outflow signatures during the development of substorms and storms, and will be able to differentiate changes in the outflows driven by periods of sustained southward IMF versus periods of predominant dawn/dusk IMF. Such dependencies cannot be derived by the present statistical studies that use MLT and ILAT only. The work will make an additional advance in that it will be used to provide crucial boundary conditions to global multi-fluid modeling that will then map the observed flows out into the magnetosphere. These global models will then be able to quantitatively determine their importance relative to that of the solar wind in the mass loading of critical regions of the magnetosphere, including the ring current, plasma sheet, and low latitude boundary layer.

Publication References:

no references