Geophysical Research Abstracts
Vol. 15, EGU2013-6253, 2013
EGU General Assembly 2013

A Global, Three-Ion Approach to the Ionospheric Outflow Problem

Daniel Welling (1), Michael Liemohn (1), Alex Glocer (2), Gabor Toth (1), Vania Jordanova (3), and Sorin Zaharia (3)

(1) University of Michigan, Atmospheric, Oceanic, and Space Sciences, Ann Arbor, United States, (2) NASA Goddard Space Flight Center, Greenbelt, United States, (3) Los Alamos National Laboratory, Los Alamos, United States

The terrestrial magnetosphere has three key populations: ionospheric hydrogen, ionospheric oxygen, and solar wind hydrogen. These populations enter the magnetosphere at different locations as the result of different dynamics and evolve independently throughout the system. As such, it is expected that the fraction of these populations that arrive at the ring current will arrive with different energy and density distributions and will contribute to the ring current to different degrees. Contemporary fluid models of the terrestrial magnetosphere neglect at least one of these populations by specifying two fluids or less. Such shortcomings complicate the use of MHD to study the effects of ionospheric outflow on the global system. To address these issues, a new three-ion version of the BATS-R-US global MHD model has been developed. This approach has already been shown to affect cusp dynamics and allow the geomagnetic mass spectrometer effect to manifest clearly between heavy oxygen and light hydrogen.
By including all three key populations, it is an effective way to investigate the effects of ionospheric outflow on the magnetosphere and ring current as well as study the balance between ionospheric and solar wind plasma contributions.

This work reviews this three-ion approach and focuses on recent results when the three-fluid BATS-R-US is coupled to other first principles codes. The three fluid MHD is one-way coupled to the Ring current Atmosphere interactions Model with Self-Consistent Magnetic field (RAM-SCB) in order to investigate how inner magnetosphere dynamics depend on the evolution of the three key plasma populations and their sources. Both an idealized event with simple solar wind features and a real world event using observed solar wind conditions are studied. Results will be compared to single fluid, multi-species simulations. Finally, initial results when outflow is driven in the MHD code via coupling to the Polar Wind Outflow Model (PWOM) will be shown and compared to results when simple inner boundary conditions dictate the ionospheric source.