Data Assimilation of Space-Based and Ground-Based Observations, and Empirical Models Into a Plasmasphere Model

***Anders M. Jorgensen*[1], *John Wise*[1], *Janos Lichtenberger*[2], *Balazs Heilig*[3], *Massimo Vellante*[4], *Jan Reda*[5], *Reiner H. W. Fridel*[6], *Michael G. Henderson*[6], *Daniel M. Ober*[7], *Athanasios Boudouridis*[8], *Eftyhia Zesta*[9], *Peter J. Chi*[10]**

[1]New Mexico Institute of Mining and Technology, Socorro, NM, USA
e-mail anders@nmt.edu

[2]Eötvös University, Budapest, Hungary

[3]MFGI, Budapest, Hungary

[4]University of L'Aquila, L'Aquila, Italy

[5]Institute of Geophysics, Polish Academy of Science, Warsaw, Poland

[6]Los Alamos National Laboratory, Los Alamos, NM, USA

[7]Air Force Research Laboratory, Albuquerque, NM, USA

[8]Space Science Institute, Boulder, CO, USA

[9]NASA/GSFC, Greenbelt, MD, USA

[10]UCLA, Los Angeles, CA, USA

The Earth's plasmasphere is a region of dense plasma, originating in the ionosphere, extending nearly to geostationary orbit. The precise extent of the plasmasphere is dynamic, particularly during geomagnetic active conditions. Knowing the exact distribution of plasma in the plasmasphere is important as an input to coupled magnetospheric models. In particular, density gradients inside the plasmasphere and at the plasmapause, are important in controlling waves which are responsible for the growth and decay of the radiation belts. At the most basic level the plasmasphere can be described in terms of plasma exchange with the ionosphere and convection due to an imposed electric field. At that level plasmasphere modeling is relatively simple. However there is currently insufficient knowledge of the drivers, particularly the electric field, to model the plasmasphere boundaries at the most accurate level to provide sufficient quality inputs to wave and radiation belt models.

The solution to this problem is to use a data assimilation approach. Data assimilation wraps a feedback loop around the plasmasphere model in which free, ideally unknown, model parameters are adjusted to maximize the agreement between the model and observations. There are many possible implementations of this feedback loop. We use the Ensemble Kalman Filter in which a statistical ensemble of models tracks the observations through linear transformations. In previous work we have used either ground-based observations from the PLASMON project (funded by the European Seventh Framework Program), or a small number of space-based observations. The next step is to use a larger number of data sources, including a variety of ground-based and space-based observations as well as other knowledge contains in empirical models. In this talk we will discuss our approach to incorporating disparate data sets and demonstrate some assimilation results which combine different data sources.

978-1-4673-5225-3/14/$31.00 ©2014 IEEE