# Simple Inner Magnetosphere Model


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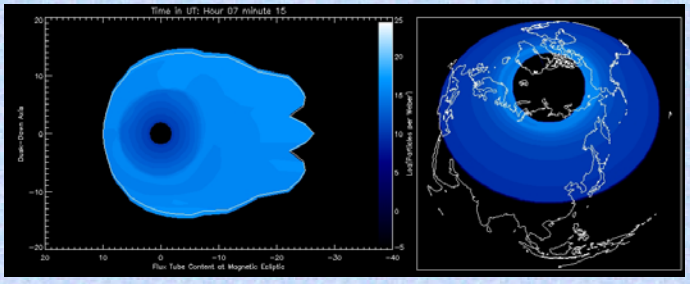
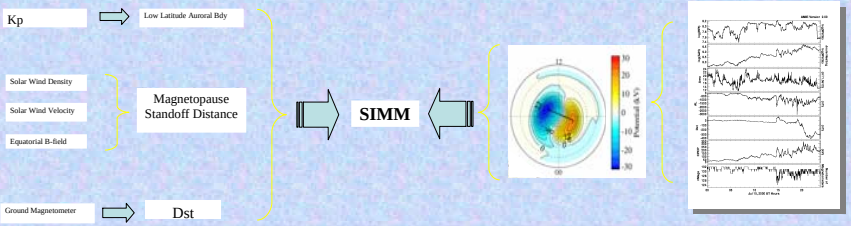
**Abstract**

The Simple Inner Magnetosphere Model (SIMM) is a particle trace model designed to specify Magnetopsheric particle fluxes for particles up to 100 Kev at geosynchronous orbit. Based on the Magnetospheric Specification Model (MSM), SIMM is designed to take advantage of the improvements in empirical and data assimilative modelling since initial development of the MSM. In particular, SIMM uses electric potential patterns created by the Assimilative Mapping of Ionospheric Electrodynamics (AMIE) technique as the electric field driver for the semi-empirical plasma sheet model. The SIMM model output provides a valuable tool for evaluation of spacecraft exposures, calibration of particle measurement instrumentation, biological effects on organisms' on-board spacecraft and provides an advances tool for space weather modelling. The model output is being archived at the National Geophysical Data Center and is available for viewing through the Space Physics Interactive Data Resource (SPIDR). This Preliminary analysis looks at the 5 day period beginning Sep. 25, 1996 ending Sep. 30, 1999, chosen due a range of low to moderate geomagnetic activity. SIMM output is compared to direct spacecraft measurement and Kp based average climatology provided by M. Thomson of Los Alamos National Laboratory.


**Input Models**

**B-Field**

Hilmer – Voigt Magnetic Field Model

W. Hilmer, and H. Voigt - *J. Geophys. Res., 100*, 5613-5626, 1995

**E-Field and Precipitating Particles**

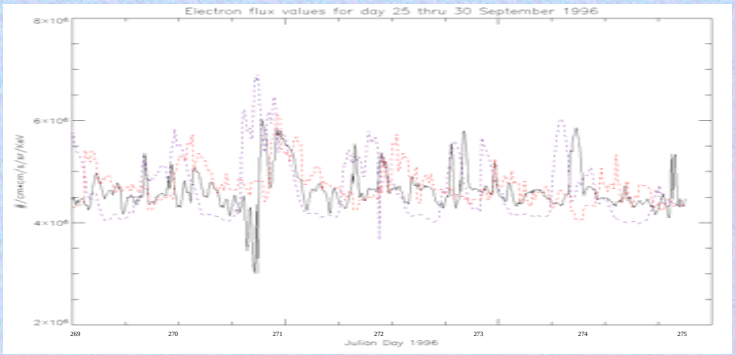
Assimilative Mapping of Ionospheric Electrodynamics

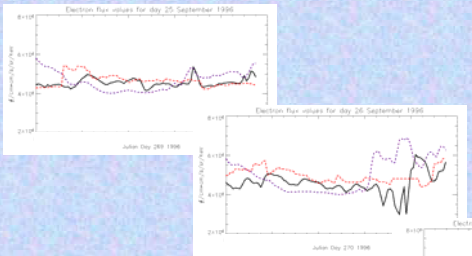
Richmond, A. D., and Y. Kamide - *J. Geophys. Res., 93*, 5741, 1988

**Initialization**

*Garner et al.* Statistical Plasma Sheet Model

Garner, T. W., R. A. Wolf, R. W. Spiro, M. F. Thomsen, and H. Korth, *J. Geophys. Res., 108*(A8), 1331, doi:10.1029/2003JA009877, 2003



Plot shows flux values for the 41 KeV energy channel from the LANL Energetic Particle Detector (black), SIMM (purple), and Kp based climatology (red). Values given by SIMM yield a skill score of 0.045 against climatology values compared to the direct measurement of the particle detectors. Any improvement over the predictive capability of climatology is significant because SIMM provides global coverage from ~4-9 Earth radius whereas the climatology estimates are restricted to the geosynchronous altitudes where the spacecraft reside.

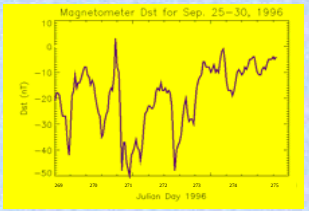
***Conclusions***

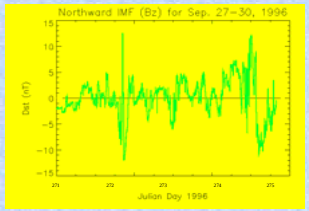
These preliminary results show that SIMM can be used as an effective model for evaluating Inner Magnetosphere particle fluxes. Although our results show only a slight improvement over Kp based climatology, the fact that SIMM is a global model and because the preliminary results lack a number of fixes that is expected to improve results, there is promise for a wide range of applications. There are several areas that are thought to improve the SIMM predictive capability. SIMM is run with 1-minute between iterations, which may not be physically valid because of the characteristic time periods on which the magnetosphere responds to changes in the solar wind - The MSM model from which SIMM is based runs on a 15 time interval. Successive evaluations will require us to run SIMM on longer time intervals and re-evaluate the models effectiveness. Other areas that show promise to improve SIMM's predictive capabilities include a more effective method of determining standoff distance, better correlation between magnetic field lines and ionospheric currents, and application of AMIE runs that extend below 40 degrees latitude during periods of high geomagnetic activity.

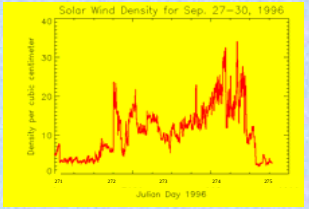
Kp based climatology is based on:

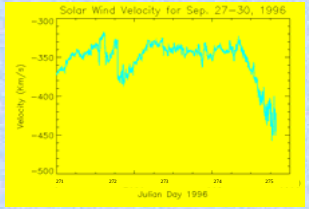
Korth,Thomson,Borovsky and Comas, Plasma sheet access to geosynchronous orbit, JGR 104, 25047-25061, 1999

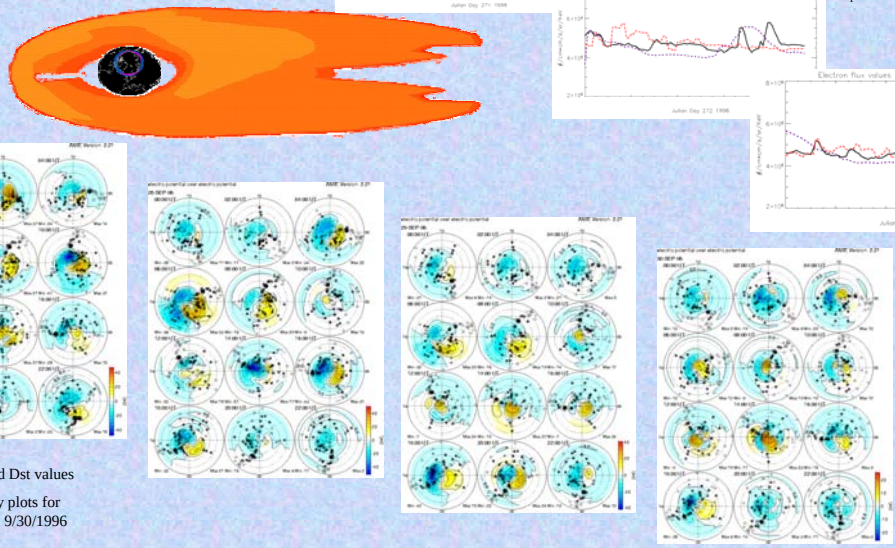
The climatology is based on a running average of geosynchronous spacecraft flux over a solar cycle and distributed based on Kp.



Left: Solar Wind and Dst values

Top: AMIE summary plots for 9/27/1996 thru 9/30/1996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