

## Forecasting Equatorial Spread- $F$ Using a Global Assimilative Ionospheric Model

Xiaoqing Pi<sup>1,2</sup>, Chunming Wang<sup>2</sup>, George A. Hajj<sup>1,2</sup>, Gary Rosen<sup>2</sup>, Brian D. Wilson<sup>1</sup>, Yogeshwar Sahai<sup>3</sup>, Eurico R. de Paula<sup>4</sup>, and Mangalathayil A. Abdu<sup>4</sup>

<sup>1</sup>Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, U.S.A.

<sup>2</sup>University of Southern California, Los Angeles, CA, U.S.A.

<sup>3</sup>Universidade do Vale do Paraíba (UNIVAP), São José dos Campos, SP, Brazil

<sup>4</sup>Instituto Nacional de Pesquisas Espaciais (INPE), São José dos Campos, SP, Brazil

A global assimilative ionospheric model (GAIM) has been developed by the consortium of University of Southern California and Jet Propulsion Laboratory. The model is capable of assimilating various types of ionospheric measurements, such as line-of-sight total electron content (TEC) and satellite limb scans of ultraviolet airglow emission, to optimize the modeling of ionospheric volume densities. Among the assimilation techniques developed with GAIM, a 4-dimensional variational (4DVAR) approach allows the estimation of model drivers that satisfies the requirements of minimizing the difference between observations and model predictions on regional and global scales. In this study, GAIM and the 4DVAR technique are applied to low latitudes to solve simultaneously for zonal electric field and thermospheric meridional wind that play key roles in the evolution of equatorial spread- $F$  irregularities. Results of observation system simulation experiments (OSSE) will be presented that are conducted using GAIM with the global positioning system (GPS) and the IGS global ground-based network. Validation of the assimilative modeling techniques is also conducted in the South America region with multi-diagnostic observation techniques, including ionosonde and TOPEX altimeter measurements. Under this study, a framework based on GAIM and the existing GPS observation system is established to predict the weather behavior of spread- $F$  and ionospheric scintillation at low latitudes.