

VALIDATION OF THE USU GAIM DATA ASSIMILATION  
MODEL OF THE IONOSPHERE FOR OPERATIONAL USE

Scherliess, L., Schunk, R. W., Sojka, J. J.  
, Thompson, D. C., Zhu, L.

Utah State University, Center for Atmospheric and Space Sciences,  
Logan, UT 84322-4405

Physics-based data assimilation models of the ionosphere were developed at Utah State University as the central part of a DoD MURI funded program called GAIM (Global Assimilation of Ionospheric Measurements). Recently, the Air Force Weather Agency (AFWA) has selected one of the USU GAIM models for its operational use and the same model will also be implemented at the Community Coordinated Modeling Center (CCMC) for scientific studies. The selected model is based on a physics-based model of the ionosphere and a Gauss-Markov Kalman Filter (GMKF) as a basis for assimilating a diverse set of real-time (or near real-time) observations. The physics-based model is the Ionospheric Forecast Model (IFM), which accounts of five ion species and covers the E-region, F-region and the topside from 90 to 1400 km altitude. Within the GMKF, the IFM derived ionospheric densities constitute a background density field on which perturbations are superimposed based on the available data and their errors. In the current configuration the GMKF assimilates slant TEC from a variable number of ground GPS sites, bottom-side  $N_e$  profiles from a variable number of ionosondes, in situ  $N_e$  from four DMSP satellites, and nighttime line-of-sight UV radiances measured by satellites. To test the GMKF for real-time operations and to validate its ionospheric density specifications, we have tested the model performance for a variety of different geophysical conditions. During these model runs various combination of data types and data quantities were assimilated. To simulate real-time operations the model ran continuously and automatically, and produced 3-dimensional global electron density distributions in 15 minute increments. In this paper, we will report on the status of the model development and present the results of our validation study, with an emphasis on a comparison with independent observations.

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1. (a) Ludger Scherliess  
Utah State University  
Center for Atmospheric and Space  
4405 Old Main Hill  
Logan, UT  
84322-4405 USA  
ludger@gaim.cass.usu.edu
- (b) 435-797-7189
- (c) 435-797-2992
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