Modification of OVATION Prime model using PC-index as input parameter: model validation and nowcasting

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The development of an Auroral Ionospheric Model (AIM), which is aimed to provide information about spatiotemporal density distribution of different particle species in E and F-layer, requires estimation of background and sporadic electron fluxes, that are actively interact high-latitudes under quiet and disturbed magnetospheric conditions. Precipitating magnetospheric electrons with initial energies of 1-30 keV significantly change ionization rate at altitude range from 90 to 150 km and actively participate in chemical reactions between recombination and solar radiation ionization processes. To account for the effects of the precipitation ionization source we use OVATION-Prime as the most advanced model which is based on spectral measurements of different auroral particle species onboard DMSP spacecraft [Newell et al., 2009, 2010]. The undisputed advantages of this model is that it (1) separately categorizes both the discrete and diffuse aurora, (2) estimates local and global quantitative characteristics of particles precipitation (auroral power, electron/ion number flux, energy flux, average energy) in both hemispheres and (3) is parameterized by Newell's coupling function [*Newell et al.*, 2007] which best predicts auroral power and makes it possible to forecast aurora. However, the solar wind detected far ahead of dayside magnetopause at the location of the ACE spacecraft (Lagrange point, L1), in some cases does not reach the magnetosphere and the aurora predicted by the OVATION Prime model does not agree with reality. We apply PC-index as the input parameter of the OVATION Prime model (named OVATION-PC after model's modification) since it measures the energy of the solar wind that directly penetrates the magnetosphere and quantitatively characterizes the level of the substorm activity improving the synchronization in the substorm cycle and reducing the model inconsistency caused by errors in solar wind parameters conversion from L1 to the magnetopause. In this work we show how we did parameterize and test the OVATION Prime using PC-index and present online source which provides historical and real-time OVATION-PC output.

References

Newell, P. T., T. Sotirelis, K. Liou, C.-I. Meng, and F. J. Rich (2007), A nearly universal solar wind-magnetosphere coupling function inferred from 10 magnetospheric state variables, J. Geophys. Res., 112, A01206, doi:10.1029/2006JA012015.

Newell, P. T., T. Sotirelis, and S. Wing (2009), Diffuse, monoenergetic, and broadband aurora: The global precipitation budget, J. Geophys. Res., 114, A09207, doi:10.1029/2009JA014326.

Newell, P. T., T. Sotirelis, and S. Wing (2010), Seasonal variations in diffuse, monoenergetic, and broadband aurora, J. Geophys. Res., 114, A03216, doi:10.1029/2009JA014805.