

Numerical space weather prediction: Solar wind-radiation belt model

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Large-scale solar wind structures and the magnetohydrodynamics (MHD) parameters at the Earth's position are essentially important for driving the space weather phenomena such as geomagnetic storms, geomagnetically induced currents, and radiation belt enhancement. We report our recent progress on the space weather modeling of the solar wind and radiation belts. The simulation code couples the global MHD solar wind model and the Fokker-Planck type radiation belt model via the time-varying solar wind MHD parameters at the Earth's position to give a quantitative estimate of the outer belt electron flux for a week. The probability forecast of the flux enhancement alert at geosynchronous orbit (GEO) also works at the same time using the information of stream interfaces and interplanetary shocks. We show the model performance via some examples, including the extreme flux enhancement event at GEO associated with the solar wind rarefaction due to a very fast coronal mass ejection. We also discuss how to handle the turbulent magnetic field of the solar wind, which is an essential cause of a series of auroral substorms and subsequent flux enhancement of the outer belt.