MODELING THE IMPACT OF THE STORM TIME ELECTRIC FIELDS ON THE REDISTRIBUTION OF THE LOW LATITUDE IONOSPHERE

NAOMI MARUYAMA[1], T. Fuller-Rowell[2], M. Codrescu[3], D. Anderson[4], A. Richmond[5], A. Maute[6], S. Sazykin[7], F. Toffoletto[8], R. Spiro[9], R. Wolf[10], and G. Millward[11]

1: University of Colorado, CIRES, and NOAA, SWPC, Colorado, USA, e-mail: naomi.maruyama@noaa.gov
2: University of Colorado, CIRES, and NOAA, SWPC, Colorado, USA, e-mail: tim.fuller-Rowell@noaa.gov
3: NOAA, SWPC, Colorado, USA, e-mail: mihail.codrescu@noaa.gov
4: University of Colorado, CIRES, and NOAA, SWPC, Colorado, USA, e-mail: David.Anderson@noaa.gov
5: National Center for Atmospheric Research, High Altitude Observatory, Colorado, USA, e-mail: richmond@hao.ucar.edu
6: National Center for Atmospheric Research, High Altitude Observatory, Colorado, USA, e-mail: maute@hao.ucar.edu
7: Rice University, Physics and Astronomy Department, Texas, USA, e-mail: sazykin@rice.edu
8: Rice University, Physics and Astronomy Department, Texas, USA, e-mail: toffo@rice.edu
9: Rice University, Physics and Astronomy Department, Texas, USA, e-mail: spiro@rice.edu
10: Rice University, Physics and Astronomy Department, Texas, USA, e-mail: rawolf@rice.edu
11: University of Colorado, LASP, Colorado, USA, e-mail: george.millward@noaa.gov

The electric field is a major driver of low latitude ionospheric dynamics. Quantifying the impact of the storm time electric fields on redistributing the low latitude ionospheric plasma has been challenging, mostly because of the degree of variability in the storm time electric fields, which tends to make it difficult to interpret the individual observations. Two sources of the storm time electric fields have been understood, prompt penetration and disturbance dynamo. However, their roles and relative contribution in the low latitude ionosphere throughout different phases of magnetically disturbed periods are yet to be separated. We have developed a self-consistent first-principles model that accounts for the two sources of the storm time electric fields. Modeling of the storm time electric fields requires, as a first ingredient, the field-aligned currents that connect the magnetosphere and ionosphere and that are responsible for the penetration and shielding processes. The second set of ingredients is the global ionospheric conductivity and neutral winds that are responsible for the disturbance dynamo. By including both processes of prompt penetration and disturbance dynamo into the model, the storm time electric fields are reproduced in reasonable agreement with observations.
In this paper, we will demonstrate that our model can help us identify the two sources of the storm time electric fields when interpreting the observations. Furthermore, we will attempt to quantify the impact of the storm time electric fields on restructuring the low latitude ionosphere and thermosphere, by taking into consideration the time scales, magnitudes and the relative importance of prompt penetration and disturbance dynamo.

modeling, magnetosphere-ionosphere coupling, electric field

Naomi Maruyama, University of Colorado, CIRES, and NOAA, SWPC, 325 Broadway, Boulder, Colorado, 80305, USA, tel: +1-303-497-4857, fax: +1-303-497-3645, e-mail: naomi.maruyama@noaa.gov