A model-data comparative study of large-scale ionospheric disturbances during the 17 March 2015 storm

*Gang Lu[1], Irina Zakharenkova[2], Iurii Cherniak[2], Tong Dang[3]

1. National Center for Atmospheric Research, 2. COSMIC Program Office, University Corporation for Atmospheric Research, 3. University of Science and Technology of China

This paper presents a detailed model-data comparative study of the 17 March 2015 geomagnetic storm using the high-resolution version of the Thermosphere-Ionosphere-Electrodynamic General Circulation Model (TIEGCM) and the total electron content (TEC) observations from a dense GNSS network. Driven by time-dependent high-latitude ionospheric convection and auroral precipitation inputs, together with an empirically defined subauroral plasma stream (SAPS) field, our simulation reproduce many observed storm-related ionospheric phenomena, including large-scale traveling ionospheric disturbances (TIDs) over Europe, the effects of prompt penetration electric field (PPEF) over South and Central America, and the formation of a storm enhanced density (SED) plume across the continental United States. Our simulation results reaffirm a number of important characteristics concerning the SED plume: (1) enhanced background ionospheric density is a necessary but not sufficient condition, and enhanced ion drift is required to form the SED plume; (2) the SAPS flow channel does not directly transport the plasma from midnight to postnoon via dusk to form the SED plume; instead, the SED plume is formed at the equatorward and westward edge of the SAPS channel; and (3) the SED plume appears to subcorotate with respect to the Earth.

Keywords: Traveling Ionospheric Disturbances, Storm Enhanced Density (SED), SED Plume, prompt penetration electric field (PPEF)

