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Session 11B Paper 1

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Modeling Weather in the Ionosphere using the Navy's Highly Integrated Thermosphere and Ionosphere Demonstration System (Navy-HITIDES)

The Naval Research Laboratory (NRL) has recently developed a ground-to-space atmosphere-ionosphere prediction capability that allows the investigation of lower atmospheric effects on the lower thermosphere and the ionosphere. The Navy Highly Integrated Thermosphere and Ionosphere Demonstration System (Navy-HITIDES) can be coupled with any neutral atmosphere model, and for the purpose of this work we have coupled Navy-HITIDES with the NCAR Whole Atmosphere Community Climate Model, extended version (WACCM-X). Navy-HITIDES/WACCM-X is the U.S. Navy's first coupled, physics-based, atmosphere-ionosphere model, one in which the atmosphere extends from the ground to the exobase (~500 km altitude) and the ionosphere reaches several tens of thousands of kilometers in altitude. Navy-HITIDES/WACCM-X has been developed by coupling WACCM-X with NRL's physics-based ionospheric model, Sami3 is Another Model of the Ionosphere (SAMI3). Integrated into this model are the effects of drivers from atmospheric weather (day-to-day meteorology), the Sun, and the changing high altitude composition. To simulate specific events, Navy-HITIDES/WACCM-X is constrained by data analysis products or observations.

We have performed simulations of the ionosphere during January - February 2010 in which lower atmospheric weather patterns have been introduced using a new atmospheric forecast model, the High Altitude NAVy Global Environmental Model (HA-NAVGEN). In this paper, we analyze the impact of a sudden stratospheric warming event on the ionosphere and compare our results to observations. We discuss the importance of including lower atmospheric meteorology in ionospheric simulations to capture day-to-day variability as well as large-scale longitudinal structure in the low-latitude ionosphere. In addition, we examine the effect of the variability on HF radio wave propagation by comparing simulated ionograms calculated from the Navy-HITIDES/WACCM-X ionospheric specifications to ionosonde measurements.