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Session 9B Paper 1

Fuller-Rowell, Tim: University of Colorado, CIRES
Maruyama, Naomi: University of Colorado, CIRES
Akmaev, Rashid: Space Weather Prediction Center, NOAA
Viereck, Rodney; Fang, Tzu-Wei; Fedrizzi, Mariangel; Codrescu, Mihail; Yudin, Valery; Li, Zhuxiao; Richards, Phil

Transitioning a Coupled Whole Atmosphere Model (WAM) and Ionosphere-Plasmasphere-Electrodynamics (IPE)Model into Operations at NOAA

In an effort to model the space weather system from the Sun to Earth, NOAA is transitioning three separate physical model components. These include the WSA-ENLIL solar wind propagation model, the Michigan Geospace model of the magnetosphere, and a coupled model of the whole atmosphere and the ionosphere-plasmasphere-electrodynamics (WAM-IPE).

The first two of these components have already been transitioned to operations at NOAA, and the third component is due to be tested in an operational real-time setting in September 2017. WAM is a whole atmosphere extension of the National Weather Service (NWS) Global Forecast System (GFS) operational weather model, extending the top boundary from 60 km in GFS to ~600 km in WAM. WAM can also be run with the NWS Gridpoint Statistical Interpolation (GSI) data assimilation scheme in order for WAM to follow real changes in tropospheric weather.

The WAM model is coupled to a new Ionosphere-Plasmasphere-Electrodynamics (IPE) model, using the Earth System Modeling Framework (ESMF) and the National Unified Operational Prediction Capability (NUOPC) layer, under the NOAA Environmental Modeling System (NEMS).IPE is a time dependent, three-dimensional model of the ionosphere and plasmasphere developed through a collaboration between University of Colorado, George Mason University, NOAA Space Weather Prediction Center (SWPC), NOAA Global Systems Division (GSD), NCAR HAO, and NESII.

WAM provides the thermospheric properties of wind, composition, and temperature to the IPE, and can respond to changes in terrestrial weather propagating upward and influencing the thermosphere. IPE in turn provides time dependent, global, three-dimensional plasma densities for nine ion species, electron and ion temperatures, and both parallel and perpendicular velocities of the ionosphere and plasmasphere.

IPE reproduces not only the climatology of global TEC observations, but the model also responds to changes in solar wind conditions during geomagnetic storms, and to terrestrial lower atmosphere changes, such as during sudden stratospheric warmings (SSW). The model follows the storm time redistribution of plasma in the ionosphere and plasmasphere during an SSW, and the evolution of storm enhanced densities (SEDs) during a geomagnetic storm.

In this presentation, an overview of the WAM and IPE model development and current status is presented. Furthermore, the configuration expected to be transitioned in September will be described. It is important to establish this baseline configuration, which will gradually be improved over the coming years. In the future, the WDAS data assimilation in the lower atmosphere will be extended into the thermosphere and ionosphere to better address operational needs and to capitalize on COSMIC-II and GOLD data sources.