BOSTON UNIVERSITY

Boston University College of Arts & Sciences Center for Space Physics

2019—2020 SPACE PHYSICS SEMINAR SERIES

Unraveling the physical processes in the thermosphere and ionosphere during geomagnetic storms when super-impoised on quiet-time variability

Operational tropospheric weather forecasting has used physics-based numerical simulations combined with data assimilation techniques for decades. Modeling the coupled atmosphere-ionosphere system has arguably reached a level of accuracy and sophistication that it too may now be useful to operational users of high-frequency (HF) communication, satellite navigation and drag, and for situational awareness. Stand-alone coupled thermosphere-ionosphere models can respond to variations in solar and magnetosphere drivers, but the response to a geomagnetic storm is superimposed on a relatively smooth unchanging background atmosphere, that we know is not very realistic real. Ionospheric observation in January 2009 clearly showed that on some days the ionosphere can change by as much as 50%, apparently unrelated to solar or geomagnetic activity, and day-to-day variability is typically 20% in many of the state thermosphere and ionosphere (T-I) variables. This knowledge has prompted the extension of weather models to the top of the atmosphere, to not only capture the potential impacts of this day-to-day variability, but also to provide a realistic background upon which geomagnetic storms are launched. When geomagnetic storms are severe, they tend to dominate the physical processes in the thermosphere and ionosphere, and fidelity of the modeled response indicates we understand many of the physical processes that ensue. However, variable background condition may well modulated response to weaker storms. We are hopefully on a path where these atmosphere-ionosphere models, when run at high resolution much like the weather models, can potentially predict impact on HF from undulations in the bottom-side ionosphere, predict where and when an electrified MSTID might appear, and providing realistic triggers of ionospheric irregularities to predict their apparent random day-to-day occurrence.

Thursday, November 21st

4:00-5:00 p.m.

725 Commonwealth Ave | Room 502

Tim Fuller-Rowell

NOAA