Geophysical Research Abstracts
Vol. 16, EGU2014-8903, 2014
EGU General Assembly 2014

Simulations of the effects of vertical transport on the thermosphere and ionosphere using two coupled models

Douglas Drob, David Siskind, Kenneth Dymond, and John McCormack

US Naval Research Laboratory, Space Science Division, Washington, United States (douglas.drob@nrl.navy.mil, 202-404-8090)

We have explored the sensitivity of the thermosphere and ionosphere to dynamical forcing from altitudes near the mesopause ($\sim$ 95 km) as recently described by Siskind et al., (2014). We show results from five simulations, all for the year 2009, with the NCAR/Thermosphere Ionosphere Electrodynamics General Circulation Model (TIEGCM). Two simulations were driven with the NCAR Global Scale Wind Model (GSWM) and three used output from the Advanced Level Physics High Altitude (ALPHA) version of the Navy's Operational Global Atmospheric Prediction System (NOGAPS). Use of NOGAPS-ALPHA allows for realistic meteorological variability from the lower atmosphere to propogate up into the TIEGCM, including a rich spectrum of non-migrating tides. We find that the additional vertical transport from these tides causes a significant reduction in the calculated peak electron density of the ionospheric F2 layer (NmF2). The mechanism for this effect is the enhanced downward transport of atomic oxygen to the base of the thermosphere. In turn, this yields a greater relative abundance of N2 and hence, enhanced recombination of ions and electrons. To get improved agreement with observed electron densities, we must reduce (Kzz) by a factor of 5. However, even with lower Kzz, our calculation still underestimates the NmF2 compared with radio occultation observations by the Constellation Observing System for Meterology, Ionosphere and Climate (COSMIC) satellite system. This underestimate of NmF2 may be linked to an overestimate of the non-migrating tides in the coupled TIEGCM-NOGAPS calculations or to uncertainties in the bottom boundary for atomic oxygen in the TIEGCM. We are currently exploring the second hypothesis by actively constraining the bottom boundary of the TIEGCM to observed atomic oxygen values from the NASA TIMED/SABER instrument.

Siskind et al., (2014) Simulations of the effects of vertical transport on the thermosphere and ionosphere using two coupled models, J. Geophys. Res., DOI:10.1002/2013JA019116.

This work sponsored by the Office of Naval Research.