Project Details

ROSES ID: NNH11ZDA001N
Selection Year: 2012
Program Element: Focused Science Topic

Topic: Atmosphere-Ionosphere Coupling During Stratospheric Sudden Warmings

Project Title:
Mechanistic Studies of Stratosphere-Ionosphere Coupling during SSW Events

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Summary:
A number of recent studies indicate possible connections between midlatitude sudden stratospheric warming (SSW) events, and the F-region ionosphere. Nonlinear interactions between tides and the strong-amplitude planetary waves preceding SSWs have been proposed as a mechanism to facilitate their coupling. However, this hypothesis has remained unvalidated, in part because the evolution of tides during SSW events between the stratosphere and the F-region cannot be observed with the existing global satellite and radar networks. One way to circumvent this limitation is to use output from an assimilative model that includes the relevant physics that produces tides.

We propose to analyze a newly available hourly product of the NOGAPS-ALPHA forecast-assimilation system. This product will enable, for the first time, the identification of the tidal components in the middle and upper atmosphere that evolve concurrently with SSW events. The tidal components will be used as a bottom boundary condition for the NCAR TIEGCM, in order to track their effects on key thermospheric and ionospheric state variables, including tropical induced electric fields that are believed to be an important link in coupling the neutral thermosphere to the ionosphere. We will close the loop by comparing TIEGCM output with ionospheric radar data such as that from Jicamarca, and with several satellites datasets including TIMED, C/NOFS and CHAMP.

This proposal describes an end-to-end study spanning the middle atmosphere, thermosphere and ionosphere, that addresses Focused Science Topic (c): Atmosphere-Ionosphere Coupling During Stratospheric Sudden Warmings. This topic was formulated in support of Strategic Goal 4 articulated in NASA LWS TR \& T SC Report, 2010-2011: "Deliver understanding and predictive models of upper atmospheric and ionospheric responses to changes in solar electromagnetic radiation, and to coupling above and below".

Publication References:

Summary: no summary

Reference: Iimura, H.; Fritts, D. C.; Lieberman, R. S.; Wu, Q.; Skinner, W. R.; (2014), Interannual variability of the nonmigrating semidiurnal tide at high latitudes and stationary planetary wave in the opposite hemispheres, Journal of Atmospheric and Solar-Terrestrial Physics, Volume 110, p. 37-49, doi: 10.1016/j.jastp.2014.01.003