Project Details

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

Topic: Atmosphere-Ionosphere Coupling During Stratospheric Sudden Warmings

Project Title:
Characterization of the stratospheric, lower thermospheric, and ionospheric variability related to the sudden stratospheric warmings

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Summary:
We propose a research program that will analyze a variety of data with the goal of providing insight into possible causal mechanisms of stratosphere-ionosphere coupling during sudden stratospheric warming (SSW) events. The proposed study will focus on three key altitude regions at low and middle latitudes: 1) the stratosphere, where semidiurnal tides are generated through the absorption of solar UV by ozone molecules; 2) the lower thermosphere, where tides reach their largest amplitudes and drive the E-region dynamo; and 3) the ionosphere, where sudden stratospheric warming effects are the strongest at low and middle latitudes. Science focus questions on which we will reach closure are quantitative identification of key SSW temporal and spatial effects in 1) stratospheric planetary wave, wind, temperature, and ozone mass mixing ratio perturbations; 2) lower thermosphere tide and E region ionospheric modifications; and 3) ionospheric F region and TEC responses. We will use ECMWF (European Center for Medium Range Weather Forecast) and NASA MERRA (The Modern Era Retrospective-analysis for Research and Applications) reanalysis data to characterize variations in stratospheric parameters, including temperature, planetary wave activity, zonal and meridional wind, and ozone mass mixing ratio. Lower thermospheric data from incoherent scatter radars will be used to examine variations in tidal modes around stratospheric warming events, with the focus on inferring the temporal development of tidal components. GPS total electron content (TEC) measurements and incoherent scatter radar data will be used to identify and examine the ionospheric response to stratospheric warmings using observations of the ionospheric vertical drift, the density and height of the F2 region peak (NmF2 and hmF2), and the TEC. The results of this research will provide a unique and valuable set of observational truth and observational constraints for the team modeling effort.

Publication References:

no references