Project Details

ROSES ID: NNH07ZDA001N
Selection Year: 2008
Program Element: Focused Science Topic

Topic: Focused science topics for Strategic Goal 4 (Ionosphere-Thermosphere): Determine the sources of daily variability in the thermosphere and ionosphere

Project Title:
Thermospheric Variability in Aurora

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Summary:
Observations from the ground, sounding rockets, and satellites demonstrate that the thermospheric composition and the neutral wind are influenced by auroral activity on local and regional scales. For example, the intensity ratios of auroral emissions are interpreted as relative depletion of atomic oxygen at F-region heights. Satellite measurements indicate an irregular density distribution in auroral regions. Simulation studies and rocket experiments provide additional evidence that processes other than thermal expansion play a considerable role in the vertical dynamics and composition of the thermosphere.

The proposed research will examine neutral density and composition changes in response to the inputs of Joule heating and auroral precipitation for typical day and night time conditions. The study will use a local three-dimensional fluid model in combination with an auroral transport model. The physics includes all relevant transport terms, i.e., ionization and recombination, friction between the various plasma and neutral constituents, and collisional energy exchange. To address composition changes the single neutral species will be replaced by separate neutral constituents in the simulation. The auroral electron transport model provides transport coefficients and self-consistent auroral emissions. The study will clarify the role of ion-neutral drag versus neutral expansion due to heating in combination with diurnal changes of photo-dissociation rates for the neutral density and composition.

Specific output will be the height distribution of atomic oxygen and the brightness ratios expected from the modeled profiles. Results will be compared to ground and satellite observations. The study will provide a clarification of the physical mechanisms for neutral density and composition changes, and it will identify optical diagnostic tools (emission line ratios) that are suitable to measure thermospheric composition.

Publication References:

no references