

Project Details

ROSES ID: NNH08ZDA001N

Selection Year: 2009

Program Element: Focused Science Topic

Topic: Determine the possible role of galactic cosmic ray particles as a source for cloud condensation nuclei in the troposphere and lower stratosphere.

Project Title:

Determination Of The Causes Of Observed Neutral Density Enhancements In The Auroral Cusp

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Summary:

The purpose of this proposed research is to determine the causes of thermosphere neutral density enhancements that have been observed in the auroral cusp region of the Earth's ionosphere on most orbits by the CHAMP satellite. The enhancements are typically a factor of 2 in density and have an average horizontal width of a few hundred kilometers. It has been hypothesized that thermospheric heating due to intense field aligned currents causes the density enhancements, but previous modeling studies do not support this explanation. In this proposal, we investigate an alternative explanation that the enhancements are caused by heating due to soft electron precipitation and magnetospheric heat flows that are ubiquitous in the cusp region. The investigation will be carried out with a reevaluation of the thermospheric heating rate, electron precipitation, and with the aid of a state-of-the-art general circulation model.

The proposed work is important because it will greatly enhance our understanding of the causes of thermosphere variability by quantifying the influence of auroral electron precipitation and magnetospheric heat fluxes on the thermospheric neutral density. In achieving the main goal of determining the cause of the cusp density enhancements, this research will produce two useful products, 1) a better quantification of the auroral electron heating efficiency, and 2) a much improved model of electron precipitation. This proposal addresses some of the fundamental coupling processes and exchanges of plasma between the ionosphere and magnetosphere with far reaching consequences for our understanding of the ionosphere-thermosphere-magnetosphere system

This proposal is aimed at TR&T focused science topic e) Determine and quantify the responses of atmospheric/ionospheric composition and temperature to solar XUV spectral variability and energetic particles.. This work is particularly relevant to NASA's Strategic Goal 3: Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of the human space flight program to focus on exploration: In particular, Strategic Sub-goal 3B which is to understand the Sun and its effects on Earth and the solar system.

Publication References:

no references