Project Details

ROSES ID: NNH05ZDA001N
Selection Year: 2006
Program Element: Independent Investigation

Topic: Shock acceleration of solar energetic particles by interplanetary CMEs

Project Title:
Implications of Energetic Particle Precipitation for the Stratosphere

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Summary:
We propose to combine satellite data analysis and global modeling to investigate the effects of solar cycle variations in energetic particle precipitation (EPP) on the stratosphere. Precipitating particles continually penetrate the earth's upper atmosphere, producing odd nitrogen. During the polar night, if dynamical conditions are appropriate, the odd nitrogen so produced can descend to the stratosphere where it participates in the catalytic cycles responsible for controlling ozone distributions. While this has been known for decades, the implications for stratospheric ozone have never been quantified, and these effects are routinely neglected in three-dimensional global models. Nevertheless, observational evidence suggests that even under moderate levels of solar activity, EPP affects stratospheric ozone. The goal of this proposal is to investigate the effects of EPP on stratospheric ozone distributions, variability, and trends, and the resulting implications for studies of long-term change in the upper troposphere and stratosphere. To accomplish this, the proposed work has two main objectives: (1) Analyze the historical and continuing data base of stratospheric ozone and NOy satellite measurements to correlate variability in these constituents with solar cycle variations in EPP; and (2) Incorporate EPP into a global chemistry climate model to quantify EPP effects on stratospheric NOy and ozone distributions, and to investigate corollary effects on atmospheric composition and dynamics. Through the combined use of satellite data and modeling, the proposed work is directly responsive to the current NASA ROSES Research Announcement and Living With a Star (LWS) program objectives. It targets the NASA exploration objective "To understand and protect our home planet" by addressing "the role of solar variability in climate and stratospheric chemistry", one of the primary focus topics designated by the LWS Targeted Research and Technology Science Definition Team.

Publication References:

Summary: no summary

Reference: Randall, C. E.; Harvey, V. L.; Singleton, C. S.; Bernath, P. F.; Boone, C. D.; Kozyra, J. U.; (2006), Enhanced NOx in 2006 linked to strong upper stratospheric Arctic vortex, Geophysical Research Letters, Volume 33, Issue 18, CiteID L18811, doi: 10.1029/2006GL027160

Summary: no summary

Reference: Randall, C. E.; Harvey, V. L.; Siskind, D. E.; France, J.; Bernath, P. F.; Boone, C. D.; Walker, K. A.; (2009), NOx descent in the Arctic middle atmosphere in early 2009, Geophysical Research Letters, Volume 36, Issue 18, CiteID L18811, doi: 10.1029/2009GL039706