

Project Details

ROSES ID: NRA-00-OSS-01

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Program Element: Independent Investigation: LWS

Project Title:

Solar Influence on Energetic Particles Impacting the Earth's Atmosphere

PI Name: Gerald H. Share

PI Email: atn@g.ucla.edu

Affiliation: Naval Research Laboratory

Summary:

We propose to use gamma radiation to study the impact of energetic particles on the earth's atmosphere and to monitor the geomagnetic cutoffs for solar energetic particles. The gamma radiation is composed of bremsstrahlung, annihilation radiation, and nuclear lines from interactions of cosmic rays and solar energetic particles (SEP) with the atmosphere. The atmospheric gamma-ray emission varies with geomagnetic latitude, the solar-modulated cosmic ray flux, and the intensity of solar energetic particles. Atmospheric emission increased by over three orders of magnitude during the intense solar particle event of 1989 October 20. We propose to use archival gamma-ray data from the Solar Maximum Mission (SMM) and new data from the High Energy Spectroscopic Imager (HESSI) in this study. We specifically propose to: 1) determine the spectrum of protons impacting the atmosphere during the October 20 event and compare it with the spectrum measured by GOES (this provides information on particle transport in the magnetosphere); 2) study gamma-ray emission from weaker SEP events and determine the geomagnetic cutoffs; 3) study the relationship between solar activity and electron precipitation >15 keV; 4) study solar cycle variations of atmospheric gamma-rays and thermal neutrons; 5) study geomagnetic latitude variations of atmospheric gamma-rays and thermal neutrons; and 6) determine the origin of the highly variable ⁷Be concentration in the upper atmosphere. These studies have the goal of providing the foundation for a remote system that will monitor the energetic particle environment in the upper atmosphere and the geomagnetic cutoffs for solar energetic particles. Such a system can provide real time warning for astronauts and for passengers on commercial and military flights at high latitudes.

Publication References:

Summary: no summary

Reference: Share, Gerald H.; Murphy, Ronald J.; (2001), Atmospheric gamma rays from solar energetic particles and cosmic rays penetrating the magnetosphere, Journal of Geophysical Research, Volume 106, Issue A1, p. 77-92, doi: 10.1029/2000JA002012