Project Details

ROSES ID: NNH06ZDA001N
Selection Year: 2007
Program Element: Focused Science Topic

Topic: Solar Origins of Irradiance Variations

Project Title:
Magnetic Origins of Solar Irradiance Variations

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Summary:
We propose to explore the magnetic origins of solar spectral and total irradiance variations, through observations, data analysis and modeling approaches to directly address NASA-LWS TR&T Program's Focused Science Topic "d) Solar Origins of Irradiance Variations" as stated in this NRA. Changes in the spectrally integrated total solar irradiance (TSI) affect global climate directly, since TSI is the primary source of radiative energy input to the Earth system. Indirect climate influences include the solar radiative output at different wavelengths (spectral irradiance), which affect specific components of Earth's atmosphere in diverse ways. Exploring the nature and physical basis of this solar radiative forcing is vital towards understanding and predicting its effect on life and society, and for clearly distinguishing the natural and anthropogenic causes of global climate change.

Solar spectral and total irradiance variability is governed by the changing magnetism of the Sun. Specifically, the appearance, evolution and associated dynamics of solar active region magnetic fields and its overlying coronal loops, directly contribute to irradiance variations - the latter is clearly magnetic in origin. In this proposal we plan to explore the magnetic origins of solar irradiance variations by: I) Establishing the relationship between important active region magnetic parameters (such as field strength, flux, loop length, measures of non-potentiality) derived from magnetograms and the observed solar spectral and total irradiance, II) Studying the connection between active region evolution and irradiance variations through the usage of a magnetogram partitioning algorithm that can follow the fragmentation of a decaying active region and the consequent redistribution of flux between the main spot and fragmented regions, III) Modeling the observed dependence through analytic and numerical techniques to develop predictive capabilities for solar irradiance variations. Through specific examples, we demonstrate that the proposed data analysis and modeling are feasible and the probability of success in the proposed research is high. The research experience of the proposal team encompasses solar vector magnetic field analysis, coronal imaging, and data analysis and modeling of spectral irradiance variations.

This proposal is highly relevant for the LWS TR&T program's focused research topic "d) Solar origins of Irradiance variations" as stated in this NRA. Our proposal also addresses the LWS program's general objective to understand the solar origins of Space Weather and Climate and develop predictive capabilities to mitigate their adverse effects on life and society. In the larger context, our proposal supports NASA Science Mission Directorate's strategic sub-goal 3-B - "Understand the Sun and its effects on Earth and the solar system".

Publication References:

Summary: no summary

Reference: Nandy, D. 2008, "Magnetic Helicity, Coronal Heating and Solar Flaring Activity: A Review of the Role of Active Region Twist," ASPC, 383, 201