Project Details

ROSES ID: NNH22ZDA001N-LWS
Selection Year: 2022
Program Element: Focused Science Topic

Topic: FST #1: Beyond F10.7: Quantifying Solar EUV Flux and its Impact on the Ionosphere - Thermosphere - Mesosphere System

Project Title:
Investigating the Forecast Capabilities of the Modeling of the Solar Spectral Irradiance from the Solar Surface Magnetic Flux

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Summary:
Science goals and objectives_x000D_
This proposal addresses the Focused Science Topic (FST) #1: Beyond F10.7: Quantifying Solar EUV Flux and its Impact on the Ionosphere Thermosphere Mesosphere System" via the modeling of the Solar Spectral Irradiance (SSI) from the evolution of the surface magnetic flux of the Sun._x000D_
Goals_x000D_
We aim to further develop and test solar spectral models to quantify the solar EUV flux and help evaluate its impact on the Ionosphere, Thermosphere, and Mesosphere (ITM) system. Depending on the direction of the FST team we can also contribute to the development of retrospective analysis of the SSI._x000D_
Objectives_x000D_
We will accomplish our goals by investigating the following scientific questions:_x000D_
What is the contribution of the different magnetic features on the Sun's surface (active regions, ephemeral regions, quiet sun) to the variability of the SSI in different regions of the spectrum?_x000D_
How does the SSI vary at different timescales, i.e. from short (hours, days) to long (solar rotation, solar cycle) periods?_x000D_
Methodology _x000D_
We will use the COronal DEnsity and Temperature (CODET) physics-based model to recover the Solar Spectral Irradiance variability in specific wavelengths in the EUV. The CODET model uses a flux transport model that assimilates line-of-sight magnetic field data from available magnetograms (SOHO/MDI, SDO/HMI, ground-based observations). This project will include the ADAPT (Air Force Data Assimilative Photospheric Flux Transport) model. To model the electron density and temperature in the solar corona, the CODET model uses: i) the potential field source surface (PFSS) extrapolations of the coronal magnetic field; and ii) an emission model based on the CHIANTI atomic database. The modeled irradiance is then compared to the irradiance measurements, from e.g., SOHO/SEM, TIMED/SEE, SDO/EVE, as well as disk integrated intensities from STEREO A and B, AIA/SDO EUV images._x000D_
First, through the comparison of the implementation of different flux-transport models (different approaches and/or input data) we will quantify the effect of observational limitations (duty cycle restrictions, foreshortening, different resolution, center-to-limb variation, reduced sensitivity, and low signal) on the estimation of the SSI ._x000D_
Secondly, we will evaluate the forecast capabilities of the SSI model. To take into account the magnetic flux emerging on the far-side of the Sun we will use different approaches such as incorporating helioseismology-based far-side imaging or EUV observations from the STEREO spacecraft. _x000D_
Proposed Contributions to the FST Team Effort_x000D_
Relevance: The proposal addresses three of the FST science objectives: (1) identifying new and/or improved EUV indices for driving model predictions of ITM structure; 2) improved understanding of how particular portions of the EUV spectrum influence specific aspects of ITM structure; and 3) exploring new EUV observations characterizing the interactions between the ionosphere and thermosphere". Furthermore, our study is relevant to the LWS program goal #1 Understand how the Sun varies and what drives solar variability" and one of four main goals of the LWS Targeted Research and Analysis program (TR&T), now known as LWS Science: Deliver the understanding of how variations in solar radiation, particles and magnetic fields contribute to global and regional climate change" as stated in the LWS 10-Year Vision Beyond 2015 Report._x000D_
Contributions to the Team: We will provide time series of SSI in specific wavelengths and/or spectral bands, and for specific time intervals as discussed with the team: i) to be used as input in ITM models, ii) to be compared with other solar indices and/or proxies from other teams, iii) to be tested in the specification and prediction of ITM parameters.

Publication References:

Summary: test

Reference: test

- **Investigation Type:** Data Analysis
- **Data Sources:** SDO:HMI