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Modeling the Solar Spectral Irradiance from the Solar Magnetic Flux: status and future work

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Abstract

The radiative flux of the Sun in the extreme ultraviolet (EUV) range of the spectrum can drive several effects in the Ionosphere-Thermosphere-Mesosphere (ITM) system. For this reason, it is of utmost importance to properly understand its variations at all timescales. Direct measurements of the EUV irradiance can only be obtained from space. The availability of long-term records of such data is affected by diverse factors such as the degradation of the radiometers, the difficulties in cross-calibrating data from different instruments, and the lack of continuity of measurements at specific wavelengths or with similar technical specifications. As an alternative to quantify the EUV radiative flux, different proxies, such as the F10.7 and the MgII index, have been derived but they usually represent a single spectral band or define a specific solar feature. The most commonly used solar proxy is the F10.7 index (i.e. the solar flux at 10.7 cm) but unfortunately, it is now recognized that this index does not correctly describe the EUV flux at wavelengths below 102.5 nm.

To investigate a viable alternative to the F10.7 cm, our work focuses on the modeling of Solar Spectral Irradiance (SSI) variations from the photospheric magnetic flux in the region of the spectrum below 102.5 nm. Our approach leverages observations from magnetograms that are assimilated into models to provide the full surface photospheric magnetic maps and the extrapolated coronal magnetic field, and ultimately retrieves the SSI at different EUV wavelengths. Furthermore, it uses additional EUV data sets from the twin spacecraft STEREO, particularly necessary for locations at which SSI measurements are not available. Here, we discuss the status and our plans to advance in the improvement of the capabilities to forecast the SSI variations.

This work is part of the NASA Living With a Star (LWS) Program, Focused Science Topic: “Beyond F10.7: Quantifying Solar EUV Flux and its Impact on the Ionosphere - Thermosphere - Mesosphere System”.