Results from the daily solar segmentation (SOLARSEG) of EUV images over a 5-years period: correlation and periodicity of the EUV irradiance.

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Understanding the variability of the EUV and UV irradiance on time scales from hours to months is of critical importance in the context of the Sun-Earth connection. A promising method to study the impact of the different coronal features, such as active regions and coronal holes, is by using segmentation algorithm on full-disc EUV images. In this respect, we created the Solar Segmentation (SOLARSEG) pipeline, based on the Spatial Possibilistic Clustering Algorithm (SPoCA) segmentation algorithm, which has been continuously producing daily maps (4h cadence) of the active regions (ARs) and coronal holes (CHs) using EUV images from the Atmospheric Imaging Assembly (SDO/AIA) starting from January 2011. The segmented maps were used to extract the EUV irradiance from these regions of interest using the different wavelengths provided by the AIA instrument. Initial comparison with the full-disk EUV irradiance recorded by the Large Yield Radiometer (PROBA2/LYRA) indicated a strong correlation with the irradiance extracted from EUV images, proving the usefulness of image segmentation to estimate the EUV irradiance from the different features. Maps were also be applied to other imaging instrument, namely the Sun Watcher with Active Pixel System detector and Image Processing (PROBA2/SWAP) and the Helioseismic and Magnetic Imager (HMI), to respectively compare the recorded irradiance around 17.1 nm and discuss the underlying magnetic field.

Although the end-goal of the project is to discuss the variability of the EUV irradiance over a full solar cycle period, current results for a 5-years period already contain interesting results. For example, a strong correlation was found between the coronal irradiance and the photospheric magnetic field. This correlation was expected for active regions, but was also found in the quiet sun region (i.e. region not included in either the ARs maps or the CHs maps). Such result, combined with one of our previous results estimating the contribution of the quiet sun region to more than 60% of the total EUV irradiance, suggests that the photospheric magnetic field has a more global impact on the EUV irradiance than expected, indicating its importance in understanding and predicting the EUV irradiance variability.

The present poster discusses in more details the correlation and periodicity found between the irradiance from the different atmospheric layers observed by the AIA EUV bands and the underlying magnetic field over a 5-years period, from 2011 to 2016.

Keywords: Solar physics, EUV irradiance variability