Observational Constraints on Irradiance Models in the UltraViolet

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Understanding solar irradiance variations, in particular in the ultraviolet wavelength range, is essential for climate modeling and for space weather. Solar irradiance models are precious for reconstructing the solar spectral irradiance in the absence of observations or when the latter lack stability. However, they come with their assumptions. Here we aim at constraining these in the UV by characterizing the contrast of solar magnetic features at different wavelengths. We consider solar images taken by the Solar Dynamics Observatory between 2010 and 2016. From these we extract the contrast, which we study as a function of position, magnetic field strength and time. We find that photometric thresholds are necessary to properly segment solar structures, mainly in the UV, because of the coexistence of both dark and bright structures for the same value of the magnetic field. Some pixels that are classified as quiet-Sun by the SATIRE-S model actually belong to faculae, but they are too few to have a significant impact on irradiance reconstructions. Our results highlight the importance of having multi-wavelength observations for better constraining the identification of structures. The distinction between network and faculae is essential for such reconstructions, and using a network with magnetically variable contrast and other structures with constant contrast is a valid simplification to reconstruct the solar irradiance. Finally, we find no evidence for solar cycle variations in the contrast.