A Long-Term Dissipation of the EUV He II (30.4 nm) Segmentation in the Full-Disk Solar Images

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Power spectra of segmentation-cell length (a dominant length scale of EUV emission in the transition region) from full-disk He II images observed during days of quiet-Sun conditions by the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory (SDO) were analyzed. Our previous analyses of the spatial spectral ratios (spectral densities over some time interval) reported in Didkovsky and Gurman, Solar Phys., 289, 153, (2014) and in Didkovsky et al., Solar Phys., 292, 32, (2017) were based on the results from the images taken by the Extreme ultraviolet Imaging Telescope (EIT) onboard the Solar and Heliospheric Observatory (SOHO) and from the AIA images. The results presented in this investigation show a continuation of the increase of these ratios for a number of quiet-Sun days during the AIA operation (2010 -- 2017). We represent the changes of these spatial spectral ratios during a 22-year (1996 to 2017) period as a network transformation that is interpreted as a dissipation of mid-size EUV network structures to smaller-size structures in the transition region. In contrast to expected cycling of the segmentation-cell dimension structures and associated spatial power in the spectra with the Solar Cycle, the spectra demonstrate a significant and steady change of the EUV small-dimension network from the 22/23 Solar Cycle minimum (1996) through the 23/24 minimum (2008) to the post-minimum quiet-Sun dates for up to 8 November 2017. Each of the latest changes calculated for a number of short-term intervals has been converted to a monthly mean change. The monthly mean ratio values demonstrate variable-sign and magnitudes, thus confirming the solar nature of the dissipation. The dissipation does not follow the long-term activity profile from the soft X-ray and He II (30.4 nm) irradiance measured by the Extreme ultraviolet Spectrophotometer (ESP), a channel of the Extreme ultraviolet Variability Experiment (EVE) onboard the SDO.