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Two component parametrization of variations in solar UV-vis-SWIR radiation

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In the form of electromagnetic radiation, energy output from the Sun plays an important role in determining the thermal structure, and radiation budget of the Earth's atmosphere and, therefore, has an influence on the atmospheric composition, and the global circulation as well the constituent transport. The variation in the solar radiation as well as its impact on the Earth's environment is strongly wavelength dependent. The solar variability in the UV spectral region has been well established, however, very little is known about the smaller variations in the visible and near IR, that nevertheless contribute to about 70 percent to the total solar irradiance (TSI) 11-year-solar-cycle variation of about 0.1 percent.

With recent advances in concurrent global observations of atmospheric composition and solar output from different satellite platforms, solar irradiance variability are beginning to be reliably quantified across the entire spectrum and over a wide range of solar activity conditions. The GOME (Global Ozone Monitoring Experiment) and SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric Chartography) satellites instruments, that have been launched in 1995 and 2002, respectively, are the first satellite spectrometers that provided daily solar irradiance measurements at moderately high spectral resolution covering the visible and near IR (or Short-wave Infrared (SWIR) to be exact, for SCIAMACHY only) range.

At short term time scales, changes of spectral irradiance can be attributed to the Sun's 27-day solar rotation. Significant changes happen, for instance, when a sunspot with accompanying bright faculae transits across the Sun's surface. By selecting time intervals when the instruments are stable, we parametrize changes in spectral irradiances from UV to SWIR in terms of two components namely, (1) faculae brightening (Mg

index) and (2) excess sunspot darkening, where the part of the sunspot darkening that perfectly anti-correlates with the Mg II index has been subtracted. This simple parametrization can be used to estimate longer term variations on decadal time scales and for simulating irradiance variations in climate models.