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Variability of solar irradiance from the UV to the NIR from GOME and SCIAMACHY for use in atmospheric models

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The Sun is the primary energy source that drives the Earth's climate system. Its radiative output is known to vary in time, for instance, with the 11-year solar cycle and 27-day solar rotation period. Variations in the solar spectral irradiance (SSI) affect the thermal structure and chemical composition of the Earth's atmosphere. Although the largest solar variations are observed in the UV spectral region, a large fraction of the total solar irradiance (TSI, solar constant) variation over a solar cycle comes from the visible and near IR spectral range. In order to understand how SSI variations cause a detectable change in climate, we need to quantify UV, visible, and near IR variation in the solar spectral irradiance to a high level of certainty both over the short-term solar rotation 27-day period and 11-year solar cycle. Using daily solar irradiance observations from SUSIM (1992-2005), GOME (1995-present), and SCIAMACHY (2002-present), we study solar variations over 27-day solar rotations from 120 nm to 1600 nm. The variability is modelled by parameterizing SSI in terms of faculae brightening (using the Mg II core-to-wing ratio proxy) and sunspot darkening (using the photospheric sunspot index). Since the variations in the visible and NIR are well below 1% and the instrument stability over an extended period is only on the order of a few percent, the 11-year solar cycle variations have to be estimated using the SSI model adjusted to the 27-day period observations. We compare our results with the semi-empirical model SATIRE. In terms of radiation bands that are relevant for appli-

cations in GCMs, we present 11-year solar cycle amplitudes in the Herzberg, Hartley, Huggins, and Chappuis ozone bands.