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27-day and diurnal variations in SABER ozone data

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The sun influences the thermal structure, dynamics, and chemistry of the Earth's middle atmosphere. If the UV radiation levels alter, it modifies stratospheric and mesospheric ozone and other trace gases formed by photolysis from a direct radiation effect and due to a dynamical response of solar variability (indirect effect). In particular, the UV radiation response to ozone above 60 km is not well established. We perform a Fourier analysis to time series of height resolved SABER (25 -105 km altitude) and SCIAMACHY (35-65 km) limb ozone to detect a solar signal from the 27-day solar rotation period from which the magnitude of ozone sensitivity to UV radiation is estimated. As a proxy for UV irradiance variability we use the SCIAMACHY Mg II index. SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric Cartography) aboard ENVISAT and SABER (Sounding of the Atmosphere using Broadband Emission Radiometry) aboard the TIMED satellite, have been launched in 2002 and 2001, respectively. Besides the 27-day solar signal it is also possible to find the diurnal solar signal in the SABER ozone data. As the TIMED satellite is in a non-sun synchronous orbit it passes by at any given latitude at different local times within a period of about 60 days. The local time or solar zenith angle (SZA) dependence of mesospheric ozone is a factor of up to 50 larger than on a 27-day scale. Diurnal and 27-day solar variations and their impact on ozone are also studied with a simple 2D climate-chemistry-model (CCM) and compared with satellite observations. The results from this study will be discussed with respect to findings from earlier studies.