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The response of the MLS mesospheric daytime hydroxyl to the short-term solar irradiance variability

Anna Shapiro (1,2), Eugene Rozanov (1,2), Alexander Shapiro (1), Tatiana Egorova (1), Werner Schmutz (1), and Thomas Peter (2)

(1) Physikalisch-Meteorologishes Observatorium Davos, World Radiation Center, 7260 Davos Dorf, Switzerland, (2) Institute for Atmospheric and Climate Science ETH, Zurich, Switzerland

Hydroxyl is the most important natural oxidizing fast-reacting and short-lived free radical in Earth's atmosphere. We analyze the response of the Aura Microwave Limb Sounder (MLS) hydroxyl daytime data to the short-term solar irradiance variability measured by the SOLSTICE instrument onboard SORCE satellite. Presently the coverage of the MLS data is less than one 11-year solar activity cycle and therefore statistically robust analysis can be applied only to the rotational 27-day solar cycle.

The short wave solar radiation is highly variable during the solar rotation cycle, especially at the Lyman-alpha line (121.6 nm). The photolysis of the water vapor by the short wave solar radiation is an important source of the hydroxyl in the mesosphere. Tight positive correlation of the OH and solar irradiance variability was reveled by model simulations but was not confirmed by observational data analysis. We have analyzed the MLS hydroxyl data from August 2004 till December 2005 to estimate the response of the mesospheric hydroxyl to the 27-day variability of the Spectral Solar Irradiance (SSI). We have found that in the mesosphere the hydroxyl mixing ratio observed during the sunlit hours positively correlate with the solar irradiance at nearly zero time lag. The obtained correlation is however much smaller than obtained by the models. The derived hydroxyl sensitivity to the SSI variability during the solar rotation cycle is estimated as high as 0.6% relative to 1% change of the irradiance in Lyman-alpha line.