The stratospheric ozone response to a discrepancy of the SSI data.

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Abstract.

The solar radiation, which is the main energy source in the Earth atmosphere, is highly variable especially at the ultraviolet region of the solar spectrum. The UV radiation penetrates down to the stratosphere and the variability in the irradiance can lead to the substantial response of the atmosphere in this region. In particular, the Herzberg continuum (200-242 nm) and Hartley band (200-300 nm) irradiance variability strongly influences the ozone concentration.

The recent SIM and SOLSTICE measurements onboard SORCE satellite show absolutely unexpected behavior of solar irradiance variability. The 11-year activity trends of the solar irradiance have different signs in the visible and UV regions. Besides the variability in UV is several times higher than all recent estimates (e.g., Lean et. al., 2005). Moreover the irradiance variability measured by SIM is different from measured by SOLSTICE in their common spectral part.

To investigate an influence of these discrepancies to the ozone response we run 3D climate-chemistry model SOCOL forced by the different SSI datasets. The SSI input for the SOCOL model is the spectral solar irradiance from 121 to 750 nm. We used three different datasets reconstructed by Lean 2005 and two composites of measurements. First one is based on SOLSTICE measurements up to 210 nm and SIM outwards (SIM dominated dataset) and the second one is based on SOLSTICE measurements up to 290 nm and SIM outwards (SOLSTICE dominated dataset).

We have simulated atmospheric response for period from May 2004 to February 2009. We have analyzed the ozone response using multiple regression analysis and found that the response strongly depends on the applied SSI dataset. The data should be analyzed with a special care as both solar irradiance and chlorine family concentration have downtrend during the period of simulation. Both these factors strongly influence the ozone concentration so two these effects have to be separated. To investigate ozone response to the chlorine changes we have made additional model simulation where we removed the trend due to the solar activity cycle from all datasets. Based on the obtained in this run sensitivity of the ozone to the chlorine we can determine the sensitivity of the ozone changes to the SSI variability.