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Long term annual variations of the daily cycle of stratospheric ozone.

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The microwave radiometer (MWR) SOMORA, operated continuously since 2000 in the framework of the NDACC, is measuring ozone profiles from the stratosphere up to the lower mesosphere with a temporal resolution of 30 min to 1h, providing a dataset which suits to the investigation of the annual and seasonal fluctuations as well as of the diurnal variations of the stratospheric ozone profiles. The ozone volume mixing ratio profiles are retrieved by optimal estimation and a complete error characterization can be obtained on a profile per profile basis in the frame of the retrieval.

SOCOL is a chemistry-climate model based on the middle atmosphere model MA-ECHAM5 version 5.4.00 and a modified version of the MEZON chemistry model. MEZON and MA-ECHAM5 are coupled by the 3-D temperature field and the radiative effect of the different greenhouse gases. The transport of the chemical species is calculated by the advection scheme of MA-ECHAM5 (details in Stenke et al, GMD, 2013). The model allows to cover the atmosphere from the surface to the mesosphere. Data used in this study are processed by the IAC Zurich for the grid cell covering Payerne, with a time resolution of 1h in the time range of 2000 to 2015.

Multi-instrument comparison analyses are essential to assess the long-term stability of data records by estimating the drift and the bias of instruments. The SOMORA ozone profile dataset has been compared to the profiles measured by the GROMOS MWR in Bern, and by satellites (MLS, MIPAS, HALOE, SCHIAMACHY, GOMOS). The long-term stability of the timeserie and the mean biases in function of time have been estimated.

The ozone daily variation coupled to the satellite orbit drift and to the sampling of the dataset are impacting trend values. Impact of the daily cycle of ozone on trends has been quantified by deriving annual trends of MWR hourly ozone profiles by MLR. In the upper stratosphere/lower mesosphere, diurnal ozone trends and nocturnal ozone trends of MWR datasets show a significant difference while in the middle stratosphere, smaller differences between morning and afternoon trends are noticed.

In the upper stratosphere, the MWR annual nocturnal ozone trend is significantly positive while the annual diurnal ozone trend is significantly negative. Attempt of correlation to trends of OH as simulated by SOCOL will be presented. In the middle stratosphere, MWR ozone trends will be related to trends of T and NO_x as simulated by SOCOL.