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Annual and seasonal variations of the diurnal cycle of stratospheric ozone measured by microwave radiometer

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The microwave radiometer SOMORA is a total power microwave radiometer measuring the thermal emission line of ozone at 142.175 GHz. Operated continuously since 2000 in the framework of the NDACC, SOMORA is measuring ozone profiles from the stratosphere up to the lower mesosphere with a temporal resolution of 30 min. This dataset suits to the investigation of the annual, seasonal and diurnal fluctuations of the stratospheric ozone profiles.

At northern hemispheric mid-latitudes, the diurnal cycle of ozone content varies with altitude from +4% at 25 km to -25% at 60 km, and is attributed to dynamical or chemical causes depending on the altitude. In the frame of this study, the long-term variations of the ozone diurnal cycle are investigated.

Assessing diurnal cycle changes in time requires the measurements to be fully characterized in terms of uncertainties and measurement vs a priori contribution. As the ozone volume mixing ratio profiles are retrieved by optimal estimation (ARTS/Qpack), a complete error characterization can be obtained in the frame of the retrieval.

A clear sensitivity of the diurnal cycle intensity to the measurement contribution has been put into evidence. The ozone profile dataset used in this study has been harmonized ensuring a stable measurement contribution to the retrieved ozone profiles.

An investigation of the 2000-2015 annual and seasonal variations of the diurnal cycle has been performed. Trends of the stratospheric ozone diurnal cycle have been calculated using a multiple linear regression model on monthly means of day and night profiles. Proxys representing processes known to impact ozone have been used (zonal winds, solar radio flux, Eliassen-Palm flux and East Atlantic/West Russian pattern). Yearly trends of day and night profiles show differences in function of altitude, and variations in the significance of the proxys will be shown. The difference between day and night trends seems to show a seasonal dependence and will be discussed.