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Stratospheric ozone profiles from the GROMOS microwave radiometer at Bern: intercomparison, trends and their uncertainties

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Stratospheric ozone depletion has been a focus of attention for the last few decades. After a continuous ozone decline, first signs of an ozone recovery in the stratosphere were observed starting in 1997. Recent studies have confirmed that ozone is increasing in the upper stratosphere at mid- and low-latitudes, but different trend profiles are not always consistent. To improve trend estimations of stratospheric ozone profiles, continuous and stable time series are crucial and trend uncertainties need to be addressed.

This study helps to explain inconsistencies in recent trend profiles of stratospheric ozone at northern mid-latitudes by comparing ground-based ozone time-series and assessing their trends and uncertainties. We present an updated and improved 22-years time series of stratospheric ozone from the GROMOS (GROund-based Millimeter-wave Ozone Spectrometer) microwave radiometer located at Bern, Switzerland. We compared the GROMOS data with data from other ground-based instruments in central Europe from the Network for the Detection of Atmospheric Composition Change (NDACC), namely lidars, ozonesondes and microwave radiometers. We found a good agreement in the middle and upper stratosphere with relative differences of 3 to 10% and identified some biased periods possibly due to instrumental issues.

Stratospheric ozone trends based on the different instruments were estimated with a multilinear trend model, which can handle uncertainties in a flexible way. We assessed how instrumental uncertainties contribute to the trend estimates by adapting uncertainties of the underlying ozone time series in the trend model. Furthermore, we show how different sampling rates and period lengths influence the resulting trends. The GROMOS data are well suited to investigate such factors thanks to the long and complete time series and the high temporal resolution.