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Trend analysis of the 20-year time series of stratospheric ozone profiles observed by the GROMOS microwave radiometer at Bern

L. Moreira (1), K. Hocke (1), E. Eckert (2), T. von Clarmann (2), and N. Kämpfer (1)

(1) University of Bern, Institute of Applied Physics, Microwave Physics, Bern, Switzerland, (2) Karlsruhe Institute of Technology, Institute for Meteorology and Climate Research, Karlsruhe, Germany

The ozone radiometer GROMOS (GROund-based Millimeter-wave Ozone Spectrometer) has been performing continuous observations of stratospheric ozone profiles since 1994 above Bern, Switzerland (46.95°N, 7.44°E, 577 m). GROMOS is part of the Network for the Detection of Atmospheric Composition Change (NDACC). From November 1994 to October 2011, the ozone line spectra were measured by a filter bench (FB). In July 2009, a fast Fourier transform spectrometer (FFTS) was added as a back end to GROMOS. The new FFTS and the original FB measured in parallel for over 2 years. The ozone profiles retrieved separately from the ozone line spectra of FB and FFTS agree within 5% at pressure levels from 30 to 0.5 hPa, from October 2009 to August 2011. A careful harmonisation of both time series has been carried out by taking the FFTS as the reference instrument for the FB. This enables us to assess the long-term trend derived from stratospheric ozone observations at Bern. The trend analysis was performed by using a robust multilinear parametric trend model which includes a linear term, the solar variability, the El Niño–Southern Oscillation (ENSO) index, the quasi-biennial oscillation (QBO), the annual and semi-annual oscillation and several harmonics with period lengths between 3 and 24 months. Over the last years, some experimental and modelling trend studies have shown that the stratospheric ozone trend is levelling off or even turning positive. With our observed ozone profiles, we are able to support this statement by reporting a statistically significant trend of +3.14 % decade⁻¹ at 4.36 hPa (37.76 km), covering the period from January 1997 to January 2015, above Bern. Additionally, we have estimated a negative trend over this period of -3.94 % decade⁻¹ at 0.2 hPa (59 km).