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Measurements of Strato-mesospheric Carbon Monoxide by Ground-based FTIR

V. Velazco(1) , S. Wood(2), J. Notholt(1), M. Sinnhuber(1), T. Warneke(1)

(1)Institute of Environmental Physics, University of Bremen, Germany

(voltaire@iup.physik.uni-bremen.de / phone: ++49 421 218 8617)

(2)National Institute of Water and Atmospheric Research Ltd., Lauder New Zealand

(s.wood@niwa.co.nz / Phone: ++64-3-4400426)

At high altitudes, CO can be used as a tracer to study the meridional circulation and the seasonal pole-to-pole gradient. In this work, we present long-term time-series of strato-mesospheric CO vertical columns measured from stations located in Antarctica, mid-latitudes and the Arctic. The instrument and the measurement technique allows the separation of tropospheric and strato-mesospheric contributions to the CO column, therefore providing information on the chemistry and dynamics both at low and high altitudes. Data sets from the polar stations show a similar annual variability of strato-mesospheric CO with a strong maximum in late winter and spring and a minimum in summer. The mid-latitude stations show no significant annual variability, except for values during two anomalous winters in Bremen. Measurements were compared with a two-dimensional chemistry-transport model of the middle atmosphere; the annual and latitudinal variations of CO are reproduced very well by a model run including thermospheric CO. Comparisons with different model scenarios show that the polar winter maximum is due solely to downward transport of thermospheric CO, while enhanced values in summer are due to CHOx chemistry in the stratosphere. Although the annual variability in the northern and southern polar regions are similar, the measurements show that there is more strato-mesospheric CO above 18 km in the Arctic than in the Antarctic, in agreement with the stronger subsidence in the Arctic.