MESOSPHERIC AIR IN THE STRATOSPHERE: BALLOON-BORNE OBSERVATIONS AND MODELLING

A. Engel (1), H.P. Haase (1), T. Möbius (1), H. Klein (1), U. Schmidt (1), R. Heinz (2), I. Levin (2), K. Grunow (3) and Th. Reddmann (4)

(1) Institute for Meteorology and Geophysics, University of Frankfurt/Main (Germany)

During a balloon flight launched on March 6, 2003 from the ESRANGE Rocket and balloon facility in Kiruna, Sweden (68°N) 13 stratospheric whole air samples were collected at altitudes up to 33 km. The meteorological analysis showed, that based on the Nash criterion 11 of these samples were inside the arctic polar vortex. These samples were analysed for a variety of longer-lived trace gases, including, CH4, H2, CO, N2O, several CFCs and in particular the age tracers SF6 and CO2. Of these gases H2 and CO are expected to show much higher mixing ratios in the mesosphere than in the stratosphere, whereas SF6 is expected to be depleted due to a mesospheric sink. CO2 also has a sink in the mesosphere due to dissociation, but this sink is quite weak up to about 70 km altitudes. Age of air values derived from SF6 should, therefore be larger in comparison to those derived from CO2. The vertical profiles observed on March 6, 2003, indeed show such an effect around 25 km altitude. At the same altitude elevated levels of both CO and H2 are observed. The observations are compared to previous occasions when mesospheric air was observed in the stratosphere.

The KASIMA model operated at the Forschungszentrum Karlsruhe has been used to simulate the northern hemispheric winter in the year 2002/2003. The comparison between model and observation shows that the model can reproduce this effect. The model calculations indicate that the downward transport of mesospheric air deduced from the observations in March occurred mainly in December of 2002. The meteorological processes involved and the extent to which mesospheric air influenced the stratosphere inside the arctic polar vortex in early 2003 is discussed.