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Rapid meridional transport of tropical airmasses to the Arctic during the major stratospheric warming in January 2003

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Abstract. We present observations of unusually high values of ozone and N₂O in the middle stratosphere that were observed by the airborne submillimeter radiometer ASUR in the Arctic. The observations took place in the meteorological situation of a major stratospheric warming that occurred in mid-January 2003 and was dominated by a wave 2 event. On 23 January 2003 the observed N₂O and O₃ mixing ratios around 69° N in the middle stratosphere reached maximum values of ~190 ppb and ~10 ppm, respectively. The similarities of these N₂O profiles in a potential temperature range between 800 and 1200 K with N₂O observations around 20° N on 1 March 2003 by the same instrument suggest that the observed Arctic airmasses were transported from the tropics quasi-isentropically. This is confirmed by 5-day back trajectory calculations which indicate that the airmasses between about 800 and 1000 K had been located around 20° N 3–5 days prior to the measurement in the Arctic. Calculations with a linearized ozone chemistry model along calculated as well as idealized trajectories, initialized with the low-latitude ASUR ozone measurements, give reasonable agreement with the Arctic ozone measurement by ASUR. PV distributions suggest that these airmasses did not stay confined in the Arctic region which makes it unlikely that this dynamical situation lead to the formation of dynamically caused pockets of low ozone.

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