

Interactive comment on “Rapid meridional transport of tropical airmasses to the Arctic during the major stratospheric warming in January 2003” by A. Kleinböhl et al.

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1. General comments

This is a study of an interesting stratospheric warming event that occurred in winter 2003. The measurement data presented are very interesting and unique, but the data interpretation does not reach the same standard. Therefore, in my opinion, the following points must be addressed before the paper is acceptable for ACP.

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2. Major points

The authors show calculations of idealized (i.e., linearized) chemical changes along idealized (i.e., not actually calculated or otherwise estimated) trajectories. As the results are quite sensitive to the time scales of the transport, it is speculated what the transport times were. To me, this is too much of an idealization and, as it stands, adds little to the study because qualitatively it is already clear what happened (transport from low latitudes), and quantitatively the calculations don't really help.

Furthermore, this study is all about a transport event, but the transport itself is not explained sufficiently well. The PV maps for three days of a 1-week period shown in Fig. 1 are too far apart from each other to be connected in terms of the underlying meteorology and the wave breaking event. Also, other supporting information, e.g., trajectories or maps of a calculated tracer, are missing.

To overcome the above difficulties, I suggest it would be easiest to calculate a few trajectories based on the meteorological analyses for the period under consideration. That way, both the transport time could be estimated (very likely you could significantly narrow down the current range of 3-10 days) and the transport itself could be understood more fully.

The authors switch back and forth between different altitude coordinates (pressure, potential temperature, altitude are all used). This makes it very difficult for the reader to compare the different values. E.g., on page 7124, line 20, the criterion for a stratospheric warming is given in hPa, whereas on line 22, the PV maps referred to are on potential temperature surfaces. Similarly, Fig. 1, 3, 4 and 5 use potential temperature, whereas Fig. 2 uses altitude as the vertical coordinate. This must be made coherent.

The individual maps in Fig. 1 and 5 are the size of stamps, i.e., by far too small. I still enjoy relatively good eyesight, but even for me they are difficult to read on a normal printout.

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3. Minor points

Page 7127, line 1: Why isentropic transport? Isentropic transport is an idealization that does not occur in reality. Strictly, it is certain that this transport (like any other in the atmosphere) was NOT isentropic.

In section 2, the (approximate?) horizontal and vertical resolution of the measurements should be indicated.

On page 7124, line 22, MPV is introduced without an explanation. The concept of MPV should be briefly explained.

Page 7128, lines 4-6: north, south, north should not start with capital letters.

Page 7130, lines 20-23: What do you mean with that the air masses must be confined at polar latitudes in order to form low ozone pockets? Do you expect that the high-ozone pockets would eventually end up as low-ozone (i.e., lower than normally inside the vortex) pockets? Could you explain the underlying chemistry?

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 7121, 2004.

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