

Interactive comment on “Atmospheric tracers during the 2003–2004 stratospheric warming event and impact of ozone intrusions in the troposphere” by Y. Liu et al.

Anonymous Referee #2

Received and published: 9 August 2008

This article presents a study on the influence of the stratospheric sudden warming (SSW) that occurred in January 2004 on transport processes in the stratosphere and downward ozone flux towards the troposphere. This event and its consequences are compared with a SSW event that occurred in the previous winter. The study uses atmospheric tracers (N₂O and ozone) from both satellite measurements and model simulation. The article is well written with a rather precise documentation of the scientific context. It provides a detailed description of the SSW events and the behaviour of N₂O and ozone in the middle stratosphere and UT/LS that could be of interest for the documentation of the influence of such events on atmospheric composition in these regions. Since the 2003/04 SSW has already been described in the literature, the

S5756

[Full Screen / Esc](#)

[Printer-friendly Version](#)

[Interactive Discussion](#)

[Discussion Paper](#)



main interest of the paper is the evaluation of the downward ozone flux especially over East Asia. However the part of the manuscript is somewhat weak so I suggest major revisions, according to the following comments.

Main comments

1. In section 5, the paper shows the increase of the downward ozone flux at 100 hPa and the increase of ozone column between 100 and 300 hPa. Since this region includes part of the overworld (above 380 K, which corresponds to the stratosphere), the lowermost stratosphere and the uppermost troposphere, it fails to evaluate the ozone flux that will mix irreversibly in the troposphere, impacting thus directly the tropospheric ozone budget. A much more convincing diagnostic of the stratosphere-troposphere exchange should be given here.

2. In the same section, only one paragraph is dedicated to the increase of ozone in the upper troposphere. It is not demonstrated that this increase is only due to the SSW events and more detailed explanation should be given. Furthermore, in order to be able to provide general conclusions of the impact of such event on the tropospheric ozone budget, which would largely enhance the interest of this study, a comparison with downward ozone flux in normal winter conditions should be given.

3. The authors should quantitatively explain why they compute the heat flux over East Asia and relate the increase of the heat flux in this region with the increase of the downward ozone flux over this region.

4. Section 2.1, MOZART model: This paragraph should include an evaluation or references to validation studies of the model. A paragraph should be devoted to the validity of the MOZART model for the simulation of ozone in the 100-300 hPa region.

5. Section 2.2, MIPAS observations: A summary of the results of the validation studies (particularly for the species and altitude region of interest to this article should be provided.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

6. Section 4 on the impact of SSW events on stratospheric N₂O and O₃ is much more detailed and documented than section 5. Since the interest of this paper relates mainly to the latter section, a better balance between both sections should be found. In particular, I don't see the interest of section 4.2, which repeats results that were already found in previous studies. Can general conclusions be drawn from results presented in section 4?

7. Section 4.1: Figures 3 and 4 show clearly that N₂O from MOZART simulations is overestimated as compared to MIPAS measurements. In the same way, some features are not reproduced, such as the positive N₂O meridional gradient above 30 km. The authors should provide more comments on the various discrepancies between MOZART and satellite data.

8. It is not clear why figures 3 and 5 show N₂O and ozone on January 10 2004, while the strength of the 2004 SSW event reached its maximum on January 7 as mentioned in the text. Furthermore the MPV distribution is different between the N₂O and ozone figures on that day. Both figures should thus be revised.

9. The feature described page 13642 lines 3-5 is not clear from the figure. Another layout could be given, in order to explain this feature.

10. The effect of the EPP event in 2003 on ozone should be quantified.

Additional comments

Page 13642, lines 8-10: This sentence is not clear and should be rewritten

Use hPa units for pressure throughout the text and figure legends.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 13633, 2008.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)