

Interactive comment on “Interaction of chemical and transport processes during the formation of the Arctic stratospheric polar vortex” by D. Blessmann et al.

Anonymous Referee #2

Received and published: 31 January 2012

This study investigates the persistence of ozone anomalies in the polar stratospheric vortex during winter using a state of the art Lagrangian photochemical model. The method and analysis appears to be sound and the manuscript is generally well written. However, I have some comments that I recommend to be considered before publication in ACP.

General comments

The question, how much of an initial ozone perturbation during the vortex formation phase in autumn can survive throughout the winter appears to be the central point this work tries to address.

C14906

a) The introduction refers to Kawa et al. who found a correlation between ozone in autumn and (total) ozone in March. Why does the present analysis by Blessmann et al. then stop in January, rather than March? In particular as the model runs were performed until end of March (p.32287, l.19)? Why do all figures stop in January? On p.32290, l.20 it is stated that after mid-winter "the remaining signal is preserved". This should be shown explicitly, if possible.

b) The study is based on only a single winter season (1999/2000). Will inter-annual differences in vortex dynamics affect the results? Ideally one should repeat these model experiments for other winters to test the sensitivity of the results to inter-annual changes in dynamics. If this is not feasible for technical reasons, at least some caveat should be included in the discussion.

c) I don't really see how this study addresses the "interaction of chemical and transport processes" as stated in the title. The possible feedback of chemistry (ozone changes) on dynamics and transport cannot be addressed within the present modeling framework. Some caveat should be included in the introduction and/or discussion.

d) In fact, I don't think the title correctly reflects the content of this manuscript. This paper is not really on the "interaction of chemical and transport processes" and it does not discuss the role of these processes "during the formation of the Arctic stratospheric polar vortex"!

e) In the introduction, the processes during vortex formation are briefly discussed (p.32286, first paragraph). It would be good to include relevant references, or to show this in more detail in the present manuscript.

Specific comments

p.32284: The first paragraph of the introduction is not needed and can be removed.

p.32285, l.9: You may want to include a reference to Kiesewetter et al. (2010) for the development and persistence of ozone anomalies during polar winter.

C14907

p.32285, l.28: it sounds a bit odd to say the strong westerlies "surround" the polar vortex; I would argue that they form the polar vortex.

p.32286, l.12: "Only this fraction can contribute...": Unless there is some feedback on dynamics and transport.

Technical corrections

p.32285, l.14: if -> in

p.32285, l.29: But -> However

p.32286, l.8: remove brackets

References:

Kiesewetter, G. et al., A long-term stratospheric ozone data set from assimilation of satellite observations: High-latitude ozone anomalies, *J. Geophys. Res.*, 115, D10307, doi:10.1029/2009JD013362, 2010.

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