

Interactive comment on “Changes in chemical composition of the middle atmosphere caused by sudden stratospheric warmings as seen by GOMOS/Envisat” by V. F. Sofieva et al.

Anonymous Referee #3

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The paper analyse the evolution of O₃, NO₂, and NO₃ in the aftermath of the SSW events of 2002/2003, 2003/2004, 2005/2006, and 2007/2008. The study is based on GOMOS observations, together with MLS and ECMWF data, and the Fin-ROSE and SIC models. The analysis is quite detailed, the methodology well described, and the results are clearly discussed. The study of the chemical stratospheric/mesospheric composition "response" to warming events is quite an interesting topic, particularly in relation to the different roles played by dynamical and chemical processes. This study furnishes a valuable contribution to this issue (for example it analyses the NO₃ component which is a peculiarity of the GOMOS measurements). I suggest the publication of the manuscript after consideration of the minor suggestions reported below.

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Specific comments

- 1) I suggest to clearly indicate in the title the chemical species considered for the analysis;
- 2) Introduction: pg, 23319, lines 5-8 I suggest to refer to Schoeberl et al., [1978] when you introduce SSWs
Schoeberl, M., Stratospheric warmings: observations and theory, Reviews of Geophysics and Space Physics, 16,521-538, 1978.
- 3) pg. 23319, line 12: I suggest to replace "this" with "the"
- 4) pg 23319, lines 23-25: also several studies based on satellite and ground-based observations have documented the changes in chemical composition related to the changes in the dynamical situation during SSW events, especially in the lower and middle stratosphere (see for example: Kleinbohl et al., ACP, 2005; Di Biagio et al., JGR, 2010)
- 5) pg. 23327, lines 17-18: you state that the ozone mixing ratio is lower in the whole stratosphere compared to mid-latitudes; this is not completely true in the lower stratosphere (see for example the MLS ozone maps at the potential temperature level of 490 K, available at <http://mls.jpl.nasa.gov/data/gallery.php>).
- 6) Section 3.1 does not present results, so it should be moved to the introductory part, I suppose;
- 7) One point that it is probably missing in the paper is the relation of the observed chemical changes with the whole dynamic evolution; for example, when the vortex breaks down and when it recovers during the considered events? How these changes in the dynamical situation influence the observed chemical species (and this aspect is probably important during winters when you have more than one SSW event; in fact, the chemical composition of the vortex after a SSW may be quite different from its pre-warming composition, and this should be taken into account when considering a

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second warming in the same winter). Please, give some comments on this aspect.

8) I suggest to enlarge the figure labels.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 23317, 2011.

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