

Interactive comment on “Impact of the 2009 major stratospheric sudden warming on the composition of the stratosphere” by M. Tao et al.

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I have read with interest your analysis of the 2009 major warming and I would suggest comparing your data and results also with the paper:

Di Biagio, C., G. Muscari, A. di Sarra, R. L. de Zafra, P. Eriksen, G. Fiocco, I. Fiorucci, and D. Fuà, Evolution of temperature, O₃, CO, and N₂O profiles during the exceptional 2009 Arctic major stratospheric warming as observed by lidar and millimeter-wave spectroscopy at Thule (76.5°N, 68.8°W), Greenland, *J. Geophys. Res.*, 115, D24315, doi:10.1029/2010JD014070, 2010.

In the paper by Di Biagio et al. (2010) we provided an analysis of the winter 2009 thermal and chemical (N₂O, O₃, CO) structure of the stratosphere based on lidar
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and GBMS (Ground Based Millimeter-wave Spectrometer) measurements obtained at Thule (Greenland), i.e. in the region where the maximum of the 2009 warming was observed (Labitzke and Kunze, 2009). At first, these data can be useful to you to test the performances of the CLaMS model and its capability of resolving high-resolution spatial features.

Also, the measurements we performed at Thule have permitted to evidence the impact of mixing and the role of air mass transport over the Arctic in the aftermath of the warming event. This was done by combining the N₂O, O₃, and CO measurements at the site with isentropic stratospheric back-trajectories. I think the information we retrieved at Thule can integrate and complete your picture of the stratospheric dynamical evolution during the winter 2009.

Additionally, in our study we used CO data to measure the vertical descent within the re-formed vortex and we estimated that the rate of descent after the warming was about 0.2–0.3 km/day at 60 km. It could be interesting to compare these values with the results of your analysis. Moreover, I think you should add in the discussion the comparison with the paper by Orsolini et al. (2010), which already pointed out the anomaly of the mesospheric descent into the upper stratosphere in winter 2009.

References

Labitzke, K., and M. Kunze (2009), On the remarkable Arctic winter 2008/2009, *J. Geophys. Res.*, 114, D00102, doi:10.1029/2009JD012273.

Orsolini, Y. J., J. Urban, D. Murtagh, S. Lossow, and V. Lympasuvan (2010), Descent from the polar mesosphere and anomalously high stratopause observed in 8 years of water vapor and temperature satellite observations by the Odin submillimeter radiometer, *J. Geophys. Res.*, 115, D12305, doi:10.1029/2009JD013501.

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