

Interactive comment on “Lagrangian analysis of microphysical and chemical processes in the Antarctic stratosphere: a case study” by L. Di Liberto et al.

Anonymous Referee #1

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The authors present a comprehensive analysis of a PSC observation based on in-situ balloon and lidar measurements. The microphysical and chemical evolution of the observed PSC was documented by satellite observation and air-mass trajectories. Finally the observations were compared to chemical and microphysical box model simulations.

The paper is of interest to the scientific community due to the comparison of observational data with model simulations. The results are valuable in the ongoing discussion regarding whether cold liquid aerosol (background) can explain most of the chlorine activation.

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The authors should emphasize the advances in PSC box modeling with respect to previous studies. This is the first time that I see all PSC components represented in model simulations with prescribed particle size distributions. I suggest to add an outlook on the potential of the box model with respect to the comparison to ground-based and spaceborne lidar measurements as well as regarding the understanding of PSC evolution in the polar vortex.

I only have some minor points that need to be addressed for clarification in the revised version of the paper.

- Satellite instruments: Can you please add the horizontal resolution of the MLS and MIPAS observations.

- Trajectories: Trajectories are shown between 350 and 460 K. However, the PSC was observed between 330 and 420K. Why the difference?

- Microphysical and optical model: page 32637, line 19-20: Can you please add studies that have used the model under those conditions.

- Microphysical studies:

1. The modeled PSC (Figure 5) only reflects the second observed layer from the lidar measurements (14 to 17km). What is the reason for that?

2. Further, the backscatter ratio and the aerosol depolarization ratio are higher in the model compared to the lidar observations. What could be the reason for that?

3. The bimodal lognormal distribution is only fitted to the PSC observation between 14.5 and 16 km. Why not over the entire altitude region of the observed second PSC layer between 14 and 17 km?

- Chemical simulations: results are only shown for 400 K. However, the double overpass of the air-mass was between 380 and 420 K. Are the simulations robust for the entire altitude region?

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Other minor comments: Figure 5, upper panel: altitude axis is partially covered.

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