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Interactive comment on "Lagrangian simulation of ice particles and resulting dehydration in the polar winter stratosphere" *by* Ines Tritscher et al.

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We would like to thank the anonymous reviewer for reading this manuscript and offering suggestions for improvements. In the following, we respond to his/her comments.

Minor comments

Abstract: Page 1 Sentence starting on Line 13: *This is a slightly confusing sentence, I think you wish to identify that you compare the CLaMS simulations with water vapor data from the MLS observations. But, this sentence is currently in need of revision.*

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We revised the sentence and parts of the Abstract as a consequence of the major concern (3) from Anonymous Referee #2.

Page 2 Line 6: *Replace "precise and realistic" with "precisely and realistically"*

Done.

Page 2 Line 34: *Replace "mid of January" with "mid January"*

Done.

Page 4: Sentence starting on Line 9: *Replace "This step enables now the simulation of water redistribution" with "This step enables the simulation of the water redistribution"*

Done.

Page 4: Sentence starting on Line 30: *Replace "The idea behind is that particles" with "The idea behind this is that particles"*

Done.

First Sentence on Page 6: *Maybe mention at this point that the sources of these small scale temperature fluctuations in the atmosphere are often related to gravity waves. I know this is done almost immediately after this point, but it feels like this information needs to be mentioned earlier.*

Done.

Sentence starting at Line 29 on Page 26: *Maybe should add that at least one paper has done statistical/climatological analysis in both hemispheres. See Alexander, S. P., et al. (2013). "Quantifying the role of orographic gravity waves on polar stratospheric cloud occurrence in the Antarctic and the Arctic." Journal of Geophysical Research - Atmospheres 118(20): 15.*

We added this citation.

Page 11 Sentence starting on Line 13: *Is this the signal around 12 km? which is poorly represented in the CLaMS ice area? Is this related to the MIPAS PSC classification problem identified later in this section or an unrelated issue?*

To reply to this comment, mentioned in all three reviews, we further improved Figs. 2 and 6 of the manuscript. The ACPD version shows solely PSC clouds detected by CALIOP and simulated by CLaMS. However, the MIPAS data include cirrus clouds as well, even though they are often misclassified as NAT. Therefore, we now include cirrus data from the CALIOP data set. By doing this, it becomes evident that CALIOP observes cirrus clouds throughout the entire 2009/2010 season at altitudes below 15 km. CALIOP also observes some NAT mixtures at lower altitudes, but these are likely cirrus that have been misclassified. In reference to the comment on volcanic aerosol, MIPAS is highly sensitive to volcanic aerosol whereas CALIOP will consider volcanic aerosol as part of the “background”. If the aerosol is widespread, it will not be included in the CALIOP PSC product since it just identifies outliers. Only if it is a localized plume, then it would be identified as PSC. In CLaMS, we do not simulate clouds other than PSCs.

We explained this now in more detail in the paper as well.

Page 11 Line 22: *Replace “been in the focus of” with “been the focus of”*

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Done.

Figure 4 text: *The text on Page 12 related to Figure 4 mainly focuses on the potential for misclassification of NAT and STS in MIPAS. However, there is also clearly a relatively large discrepancy for ice. Is this also likely related to limitations of the MIPAS retrieval or other factors?*

Taking into account that the measured volume of MIPAS and the sampled volume of the model does not perfectly match and that small temperature deviations in the model compared to reality matter a lot if one looks at ice formation, we still think that the comparison of ice PSC occurrence between MIPAS and CLaMS agrees well. The spatial pattern of ice occurrence has been reproduced by CLaMS as well as the majority of single ice observations. However, we changed the text in the manuscript slightly. "Even though ice formation is highly temperature depended, the spatial pattern of ice PSC occurrence between MIPAS and CLaMS agrees well (Fig. 4)."

Page 12 Line 23: *Replace "patter" with "pattern"*

Done.

Figure 6 text starting on Page 13: *Could you explain the origin of the large PSC area at low altitudes (around 12 km) seen in CLAMS PSC area panel relative to the CALIOP and MIPAS areas?*

This point has been mentioned in all three reviews, too. The origin of the large PSC area at low altitudes seen in the CLaMS PSC area panel can be explained by the altitude independent fixed detection threshold of 3.3 $\mu m^2\,cm^{-3}$ for STS droplets. At altitude levels around 12 km, the Junge layer becomes visible as well. To reduce the large "PSC area" in CLaMS at low altitudes, we introduced now a temperature threshold to this plot. Only data points with temperatures less than 200 K are considered. This temperature threshold reduces the maximum values slightly.

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