

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

### **Anonymous Referee #3**

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This paper examines an extension to the CLaMS simulations based on a new Lagrangian scheme adding ice PSC particle nucleation, growth, sedimentation, and evaporation. These CLaMS simulations forced with ERA-Interim data are compared with CALIOP, MIPAS and MLS observations for the 2009/2010 Arctic and 2011 Antarctic winters. As identified in the paper the agreement between the CLaMS simulations and the CALIOP, MIPAS, and MLS observations is in general very good over a wide range of temporal and spatial scales and these results suggest this extension of previous work provides improved results and physical insight. This work is clearly of high quality and in my opinion requires only very minor revision before being worthy of being published in ACP. However, I would say that the way that this work has been formed relies less on mathematical rigour than comparison of patterns by eye. Some statistics

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identifying the strength of the pattern correlations (that are quite clearly high, but are not quantified) might add some quantification of the quality of the CLaMS output that might aid in future studies to determine whether the model skill has been improved relative to the current study.

In addition, a number of small points that the authors might wish to consider are identified below. However, I should note that many are effectively grammatical.

Minor points:

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.

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

Page 2 Line 34: Replace 'mid of January' with 'mid January'

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'

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

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.

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.

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Page 11 Sentence starting on Line 13: is this the signal around 12km? 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?

Page 11 Line 22: Replace 'been in the focus of' with 'been the focus of'

Figure4 text : The text on Page 12 related to Figure 4 mainly focusses 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?

Page 12 Line 23: Replace 'patter' with 'pattern'

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

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