

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-200

Anonymous Referee #2

Referee comment on "Secondary aerosol formation in marine Arctic environments: a model measurement comparison at Ny-Ålesund" by Carlton Xavier et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-200-RC2>, 2022

The manuscript describes a modelling study using the ADCHEM model updated with a complex MSA-halogen mechanism in simulating new particle formation in the Arctic, and the comparison using observation from Arctic sites and campaigns. The manuscript is very-well written and easy to follow, and the results nicely support the conclusions. I find the manuscript suitable for publication in ACP, after addressing the comments and corrections I have listed below.

Introduction

What is the aim of the study and the hypothesis? A paragraph at the end of the introduction section on this could be useful.

Line 57: Recent studies (e.g. Lenssen et al., 2019) suggest the warming rate is up to a factor of three).

Lenssen, N. J. L., Schmidt, G. A., Hansen, J. E., Menne, M. J., Persin, A., Ruedy, R., and Zyss, D.: Improvements in the GIS-TEMP Uncertainty Model, J. Geophys. Res.-Atmos., 124, 6307–6326 <https://doi.org/10.1029/2018jd029522>, 2019.

Line 72: Correct as Arrigo and van Dijken (2015), and throughout the manuscript.

Methods

Line 148: Why is this period chosen? Is it a period of observed NPF or is it the ALANDIA campaign? How does the model behave in non-NPF periods?

Line 159: Are there also PM2.5 chemical composition measurements available?

Are biomass burning emissions not taken into account?

Results

Figures 1 and 2. Is it possible to show a third panel where obs-model is shown? It would be useful for the reader to compare visually what is written in the text.

Line 369: Is it Figure 1a or Figure 2a?

Line 449: Does the model take into account the sulfate production via in-cloud oxidation of SO₂? The model discrepancy highlighted in 466-471 can be a result of this process not taken into account.

Figure 4 could be considered to be removed as the text does not provide any discussion on the temporal variation or magnitude compared to earlier measurements. I would rather provide a figure (a bar blot or box whisker) comparing the simulations with the measurements.

Figure 5b and Table 2 shows the same information in different ways, which is well described in the text. I would move one of them to the supplement.

Line 573: Correct the sentence.

Line 575: Are the NMB values representing under 200 m asl or the whole vertical extent?

Can the good agreement in the 200-600 m compared to the first 200 meter imply that the model is doing poorly close the local sources, which can be attributed to the uncertainty in the emissions, while 200-600 meters represent more transported particles and the model captures this transport?