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Atmospheric Chemistry and Physics Discussions

Interactive comment on "BVOC-aerosol-climate feedbacks investigated using NorESM" *by* Moa K. Sporre et al.

Anonymous Referee #2

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The authors use the NorESM model to investigate the effects of two different aerosol-based feedback paths on a changing climate. The paper is clear and interesting, falls within the remit of ACP, and should be published after the following minor revisions and clarifications have been addressed:

1 General Comments

- Make it clearer that this scenario is an absolute upper limit of response rather than a prediction. While the statement is made, it should be stronger and clearer.
- Make sure all acronyms are defined clearly at their first use.

- Whenever locations of largest absolute/relative changes are mentioned, try to add a line on the expected behaviour resulting from the feedback.
- How were CCN calculated at 0.2 and 1%? Was it based solely on size or was hygroscopicity also included?
- The suggestions for further research in the limitations and uncertainties section was clear and helpful, and provided good guidance for future work.

2 Specific Points

P3, L24: How significant is the correlation? Can you perhaps quote a p-value?

P3, L27: "contribute with a global BVOC emissions gain by 1.07" This statement is unclear.

P4, L30-32: In the limitations and uncertainties section, you mention that the findings are sensitive to the choice of nucleation scheme; why was this scheme chosen? Are there are specific issues that may result from the choice?

P7, L27: Is reduction in hygroscopicity included in the model even if it is not shown?

P8, L19: Amount should be number (grammar issue, relating to countability of nouns)

P8, L23: Are activated cloud droplets stored in the model output? Is it possible to compare CCN and activated cloud droplets together?

P8, L29: Are the vertically averaged CDNC weighted somehow?

P9, L2: Is there any albedo calculation to go with the effective radius and cloud water path?

P9, L21: 11 W m^{-2} seems quite high at first glance - can you offer a little context for the

magnitude of this effect and what other effects might cancel it out to reach a sensible climate perturbation?

P9, L24: ΔNCF_s might be a clearer notation than NCFS.

P10, L1: Do we believe this feedback is already present in the real Arctic atmosphere? Perhaps include a line or two on the potential implications.

P10, L14-19: r = 0.53 is *higher* than 0.08 but it's still not very high...

P10, L24-25: Does total radiation decrease much? Can we maybe see a map of independent behaviour of total and diffuse radiation as well as R?

P11, L9: There is no Figure 11 (c).

P14, L11-12: A 20% reduction in forcing for lower anthropogenic aerosols makes me wonder if you have accounted for the difference between aerosol effects (change in aerosol behaviour at the same time) and aerosol forcings (change compared to pre-industrial effects). Since you do include PI simulations, it's possible that you *do* mean forcings, but I would like to have it be a little clearer.

3 Figures

Please explicitly define the red and blue lines in Figures 1 and 12 as increase or decrease in quantity that arrow points at in flow chart.

For Figure 10, it would help to explicitly state the following:

Based on the model output, AOD does not drive diffuse radiation fraction, but cloud fraction does; and diffuse radiation does not drive gross primary product, but temperature does.

Please also include a few lines on whether you expect these relations are because the

model is missing a connecting process and therefore misrepresenting reality, and if so what process might account for the unexpected outcome.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-930, 2018.