

Interactive comment on “Contribution of feldspar and marine organic aerosols to global ice nucleating particle concentrations” by Jesús Vergara Temprado et al.

Anonymous Referee #1

Received and published: 19 October 2016

This paper is a study of using ice nucleation parameterizations accounting for differences in particles ability to nucleate ice. Here they used K-feldspar and marine organic aerosols as ice nucleation particles (INP). They developed a global model of INP concentrations relevant for the mixed-phase clouds based on laboratory and field measurements. They show that simulated INP concentrations compare better with observations when using the two-species parameterization compared to other parameterizations that only consider dust, or temperature. The paper is clear and mostly well written and I think it should be published after addressing a few minor comments.

Minor comments:

-Page 2, lines14-19: I think there are some contradictions in these sentences: The

authors mention the parameterization by DeMott (2010), which is dependent on the INP concentration (greater than a certain size). Then shortly after it is stated that, “However, studies have shown that cloud are sensitive to INP concentrations. “ This is already included in the DeMott (2010) parameterization. What DeMott (2010) does not take into account is the variation in nucleation properties (as stated to be an important factor in the previous sentence). I think the sentences on these lines need to be rephrased.

Further, the sentence on line 29-30 is almost identical to the sentence on line 17-18.

-Page 3, line 12. I suggest including references to Marcolli et al. (2007) and Eidhammer et al. (2009), who also included distributions of contact angles in their studies.

Marcolli, C., S. Gedamke, T. Peter, and B. Zobrist (2007), Efficiency of immersion mode ice nucleation on surrogates of mineral dust, *Atmos. Chem. Phys.*, 7(19), 5081–5091

Eidhammer, T., P. J. DeMott, and S. M. Kreidenweis (2009), A comparison of heterogeneous ice nucleation parameterizations using a parcel model framework, *J. Geophys. Res.*, 114, D06202, doi:10.1029/2008JD011095.

-Page 3, line 15-16 and many other places: There are many citations where the parentheses are misplaced, such as for the Vali et al. (2015) citation. Here it should be “. . . .approximation (Vali et al. 2015) in which the time” Other places, such as page 5, line 6, it should be “. . . .model described in Mann et al. (2010). “ Please go through the manuscript and fix all misplaced parentheses.

-Page 3, line 33. I suggest including reference to Koehler et al. (2010), which also conducted studies of the ice nucleation ability of dust.

Koehler, K. A., Kreidenweis, S. M., DeMott, P. J., Petters, M. D., Prenni, A. J., and Möhler, O.: Laboratory investigations of the impact of mineral dust aerosol on cold cloud formation, *Atmos. Chem. Phys.*, 10, 11955-11968, doi:10.5194/acp-10-11955-2010, 2010.

-Page 3, line 32: I am confused by this sentence: Atkinson et al. (2013) found that a

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mineral component of desert dust, is responsible for most of ice nucleating activity of mineral dust aerosols.

Should it be “. . . .activity of desert dust aerosols”?

-Page 4, line 1: What does “this type of mineral” exactly refer to?

-Page 5, line 13-14: By Nucleation scavenging is suppressed for ice clouds, is it meant that it is not included, meaning that the ice nucleation parameterization is only based on temperature and not INP concentration. This should be explicitly stated. Also, by stating assumed to glaciate at -15C, is it implied that below -15C, the clouds comprise only of solid hydrometeors, and not mixed?

-Page 5, line 21: using “accurately” by stating that the model has been shown to reproduce dust concentration accurately is a strong statement. I suggest rephrasing/rewording.

-Page 9, line 18. Figure 3 has not been mentioned yet. Therefore Figure 4 should be labeled Figure 3 instead. Further, I suggest moving the reference to Fig 3. (which now should be Fig. 4) to a separate sentence, instead of in the parenthesis.. For example: “Figure 3 shows an illustration of the different ways of displaying INP. “

-Page 14, line 1: Are Figure 6 zonal averages?

-Page 14: line 12: Please give a range for the mixed-phased range.

-Page 22, EqA1. I suggest moving Eq.A1 up to line 1, page 22, where the equation is first mentioned.

Technical comments

Page 1 line 2: Replace “of their properties” to “of the cloud properties”

Page 1, line 15: replace “. . .Southern Ocean at some time of the year” with “. . .Southern Ocean at some part of the year”

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Page 2, line 10: remove “other”

Page 2, line 27: “In future” should be “In the future”

Page 4, line 6: Replace “;” with “and”

Page 5, line 7: Suggest replacing “resolution“ with “gridspacing”

Page 6, line 3: Southern Ocean is “a” . Remove “a”

Page 6, line 34: Include: “. . . .based parameterizations such as in Rinaldi et al. (2013) and Gnatt et al. (2011) but scaled . . .”

Page 8, line 12: I suggest replacing potassium feldspar with K-feldspar for consistency.

Page 12, line 6: 5a should be in parenthesis.

Page 14, line 22: Fig. 6 should be in parenthesis.

Page 22, line 11 and 12. Missing parentheses before Fig.11a and Fig.11 b

Page 25, line 6: Replace Where with Here.

Page 25, line 13: switch : “be therefore” with “therefore be”

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-822, 2016.

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