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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comment on evidence for surface-initiated homogenous nucleation" *by* J. E. Kay et al.

Anonymous Referee #1

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The comment by Kay et al. addresses important issues regarding a recently proposed hypothesis, namely that ice nucleation in atmospheric water droplets occurs at the droplets' surface rather than within their interior. I believe the authors bring forward some very interesting arguments that are a valuable addition to the discussion on that topic. I recommend publication in ACP after the following remarks have been taking into account in the manuscript.

Scientific Points:

P3364, L3-4: Do I understand it correctly that because of a Rc/Rd ratio of 10ˆ-3 the attack frequency differs by 10ˆ-9? If yes, please add another sentence to make this statement. Furthermore, aren't the same arguments true for real 2D nucleation? What would be the difference in attack frequency for such a scenario?

P3365, L5-7: I must say I do not understand how this sentence (i.e. the prediction by Elbaum and Schick) can be used as an argument against using Elbaum's experiments as an indication for partial wetting. Please explain the thought in an additional sentence or two.

P3365, L12-18: As far as I know most surface energies at -40 oC have been deduced from ice nucleation rate measurements by fitting the data to classical volume nucleation theory in order to extract the surface energy as one of the unknown parameters. Doesn't this automatically imply, that such estimates are flawed when used as an argument for or against surface nucleation, since volume nucleation was inherently used in deriving the values? Please discuss.

Fig.1: In the calculations shown in the figure two different nucleation rate coefficient parameterizations have been used to construct the two lines for Jv and Js. These symbols refer to nucleation rate coefficients with units cmˆ-3sˆ-1 and cmˆ-2sˆ-1, respectively, i.e. are material constants if you want. However the estimated freezing temperature is based on a nucleation rate (in units sˆ-1), which depends on sample volume or surface, i.e. Jv*V and Js*S. Hence, I suggest to use a different symbol for this freezing rate (i.e. omega or something similar). The same inconsistency, i.e. calling Jv and Js nucleation rates rather than, correctly, nucleation rate coefficients occurs in many articles on that topic (including the one by Tabazadeh, PNAS, 2002, equation 1). I believe this formality requires a little more attention.

Technical Points:

Homogeneous is misspelled homogenous in several places including the title.

P3363, L10: remove hyphen in super-cooled

P3364, L12-14: There is a minor inconsistency in the subscripts of the surface energies; i,w,v refer to ice, water, and vapor, while in the text you use solid, and liquid vapor.

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Interactive comment on Atmos. Chem. Phys. Discuss., 3, 3361, 2003.

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Interactive Comment