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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Generalisation of Levine's prediction for the distribution of freezing temperatures of droplets: a general singular model for ice nucleation" *by* R. P. Sear

Anonymous Referee #2

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I support publication of the paper.

The first part of the paper (sections 2 and 2) is rather tutorial in nature, which is appropriate in this instance since Levine's paper is not readily accessible. Re-stating his assumptions and results in the context of extreme value statistics in this venue provides much needed background for the discussion of the nature of heterogeneous nucleation, which Dr. Sear references in the first paragraph on page 10501.

The paper is not, however, simply a regurgitation of Levine's work. There are some important points in Section 4, which is why I am supportive of publication. That said,

there are a couple of places where I think the author could elaborate a bit.

Given a fit to the Generalized Extreme Value Distribution, the parameter ξ governs the class, or underlying probability distribution. For $\xi < 0$, it is a Weibull distribution, which implies the existence of an upper cutoff, T_u. Does that imply that there's an upper limit to the nucleation temperature, no matter what the surface area is? (The discussion just below Equation 17 on pg. 10511 seems to imply that.) I think a brief discussion of this would help, especially in the context of the more traditional view of classical nucleation theory. For higher temperatures, the heterogeneous nucleation rate isn't usually considered to be zero, just very low. With units of cm^{-2} sec^{-1}, the implication is that if you added enough material to increase the surface area enough, you could get a nucleation temperature as close to the melting point as you liked. Existence of T_u seems to contradict that. Am I interpreting this correctly?

The bottom of pg. 10508 is a discussion of fitting nucleation data to the GEV, whch can then reveal whether the data is Gumbel, Weibull, or Fréchet. Nucleation data is notoriously prone to scatter. A brief discussion of some of the difficulties that might be faced in getting reliable parameters for the GEV when faced with real data would be appropriate here.

Grammar, minor points, etc...

pg. 10504, line 18. "affect" should be "effect"

pg. 10508, line 26. "It is stronger..." This is an incomplete sentence.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 10499, 2013.