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Interactive comment on "On condensational growth of clusters and nanoparticles in sub-10 nm size range" *by* T. Nieminen et al.

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The key point of the paper is interesting and publishable, but the paper should not be more than a short note. It should be shortened significantly. Also, there are some misleading statements that need to be corrected.

What I found most interesting about this paper is that the effect of neglecting the size of the condensing molecule is larger and extends to larger sizes than I expected. I would think that this point should be emphasized in both the abstract and conclusions. I suspect that underestimating the errors due to the usual approximation is a factor in its continued use. The title should be reconsidered with this in mind. The present title is uninformative and a bit redundant.

The abstract and the heading for section 2.1 refer to an “exact” solution. But equation (1) is not exact. It is based on the assumption of hard, unpolarizable spheres. When dispersion forces are taken into account, there is a more complex dependence on both particle size and collision energy. Also, the use of condensed phase density to estimate the size of a single molecule is not exact and most molecules are not spheres. I am not asking that these factors be included, only that it be acknowledged that the equations used are still not exact.

There is no need for equation (10). Equation (11) can be obtained much more directly from equation (9). In proceeding from equation (9) to the usual simplified expression, two approximations are made: replacing the collision diameter with the particle diameter and replacing the reduced mass with the vapor molecule mass. If only the second approximation is made, one immediately obtains equation (11) from equation (9). The approximation to the reduced mass made in obtaining equation (10) results in a cubic term that is dropped in passing to equation (11).

The justification for not using reduced mass is simple. For the conditions referred to in the text preceding equation (11) (equal densities, dv = 0.2*dp and dv = 0.5*dp), the errors in neglecting 1/mp in equation (9) are, respectively, 0.4% and 6.1%. The errors given in the text, 0.6% and 9.4%, seem to be overstated as a result of comparing one approximation to another (it looks like the errors in the two approximations are in opposite directions).

The claim is made, both in the abstract and at the end of section 2, that the equation used here accounts for particle motion. As explained above, it does not. It only accounts for the effect of the size of the condensing molecule. This claim must be corrected.

Equation (9) includes a Fuch-Sutugin correction factor, gamma, and this is retained in equation (12), creating the false impression that equation (12) is not restricted to the kinetic limit. But gamma is treated as a constant in doing the integration; this is only

ACPD
10, C46–C48, 2010

true in the kinetic limit. So gamma in equation (12) should be replaced with the mass accommodation coefficient. Doing so does not reduce the utility of the result, since the effect would seem to be of interest only of concern in the kinetic limit. Equations (2) through (8) should be deleted since they ultimately serve no purpose in this paper.

I don't see the point of including equation (13). It adds no insight and it does not seem to be used.

Figures 4 through 7 don't add anything important and get in the way of the main point. The conclusion from Figure (4) that "The highest growth rate is obtained when the condensing vapor has a large molecule mass and a small liquid phase density" is obvious from inspection of either equation (9) or the standard formulation. Figure 5(a) would be interesting if the maximum is real and if an explanation were provided for it. But I think it must be an error. If the core is unchanged, only its size should matter, not its mass (since particle motion has been neglected). Figures (6) and (7) add little, as indicated by the perfunctory discussion of them.

In summary, this paper would be much better if it were cut down to a well focused note.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 1693, 2010.