Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "An adsorption theory of heterogeneous nucleation of water vapour on nanoparticles" by A. Laaksonen and J. Malila

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We thank Referee 1 for the comments. There seems to be a slight misunderstanding: the adsorption-nucleation model corresponds more closely to the Volmer-Weber growth mode (i.e. growth of isolated islands on a bare surface) rather than Stranski-Krastanov (whereby the islands grow on a monolayer film). We assume that clusters grow on the bare surface until the surface is completely filled. At that point, they all coalesce to form a uniform film, which continues to grow as a smooth liquid layer.

1. The model is of course an approximate one, and does not explicitly account for the complex microscopic dynamics that must be going on even in an equilibrium situation, e.g. diffusion and coalescence of clusters, that will lead to a size distribution. However,

when the surface coverage is sub-monolayer, there must be a well-defined average cluster size that does not evolve with time when temperature and saturation ratio are fixed. Similarly, if a snapshot of the situation is taken, there must be an average spacing between clusters which also is a constant. Whether this constant remains fixed when the saturation ratio is changed can of course be questioned. In any case, the theory can be fitted quite nicely to sub-monolayer adsorption data in many systems using the assumption of constant spacing (see Figs. 2 and 3 in the present manuscript, and the figures in Laaksonen, J. Phys. Chem. A, 119, 3736-3745, 2015). (As shown by Laaksonen, 2015, the adsorption fits can in some cases be improved by allowing for some variation to the active site distance and contact angle. However, this would add another degree of freedom to the model, which is not desirable – as Einstein is rumored to have said, "everything should be made as simple as possible, but not simpler".)

2. Thank you for the suggestion. There is a figure in Laaksonen, 2015, showing nucleation data and theories as a function of contact angle in the case of flat surfaces. We will consider making something similar for the final version.

3. Will be fixed.

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