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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The accommodation coefficient of water molecules on ice-cirrus cloud studies at the AIDA simulation chamber" *by* J. Skrotzki* et al.

Anonymous Referee #1

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Review of Skrotzki et al.

The accommodation coefficient of water molecules on ice-cirrus cloud studies at the AIDA simulation chamber.

This is an excellent summary of experiments to determine, as the title indicates, the accommodation coefficient of water. The experiments are unique, the analysis seems correct, and it is well written. The results are important for understanding cirrus clouds. I have some general comments:

- There is a paper (not mine) just out in the last few days about accommodation on liquid water (Miles et al, J Phys Chem A 10.1021/jp3083858) and one of the points it

makes is that for consistent results between different research groups attention must be paid to using consistent values for thermodynamic quantities such as the diffusion coefficient. The authors should put their values in the context of this new work.

- The abstract is somewhat overstated compared to the rest of the paper. In particular, I am not sure that the lack of dependence on the supersaturation is an especially strong result – it is weaker than the overall result that the accommodation coefficient is large.

- I believe that the statement that "An alpha-ice value close to unity also suggests that an enhanced growth at few specific ice particle facets does not play a significant role for the ice particle growth. . ." is too strong. There is an alternative that facets do play a role but that migration of water molecules along the ice surface is sufficiently fast that water molecules that do not directly impinge on a growing facet still contribute to growth by sticking and then moving to the growing spot. This gets into issues about a quasi-liquid layer that are under debate and beyond the scope of this manuscript, but some mention could be given.

- The manuscript should note that the cloud chamber growth studies will select for particles that grow rapidly. That is, if some particles have higher accommodation coefficients than others, the ice growth and vapor depletion will be a function of the fast particles rather than the ones that don't grow. This isn't bad – the atmosphere works this way – but it should be noted.

- I found the discussion of the two models (SIGMA and ACPIM) more difficult to follow than it needs to be. Although everything is there somewhere in the manuscript, it is somewhat scattered. For example, I didn't immediately realize that the two models were about different aspects of what was happening in the chamber rather than two independent models of the same phenomena. In fact the two models use the same growth equation, something that isn't clear until the model details are given on page 13. I think that using the acronyms less and saying rather "ice water content model" and "bin microphysics model" or something like that would be helpful. Looking back,

both the abstract and conclusions mention two independent models with the acronyms but in neither place does it describe in general terms what the models are about. So a reader who only looks at the abstract and conclusions would have no idea what was done with the models. Also, the abstract and conclusions using the word "independent" for the models (line 13 in abstract) is somewhat misleading given that that both models make the same approximations in the mass/thermal transport equation – both use equation (6).

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 24351, 2012.