

Interactive comment on “The effect of phase partitioning of semivolatile compounds on the measured CCN activity of aerosol particles” by S. Romakkaniemi et al.

Anonymous Referee #1

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This paper presents analysis of a potentially very important process in improving our ability to resolve cloud activation potential. It is becoming increasingly apparent that evaporative loss or increased condensation of semi-volatile compounds not only effects measured behaviour using current instrumentation, but also creates a disconnect between measured behaviour and processes occurring in the atmosphere. This concise paper goes some way to addressing questions that allude to these effects and should be published for wider consumption. Before publication, I would like some comments to be addressed.

Introduction:

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General comments:

I would request the use of the Henrys law coefficient definition is consistent throughout the paper. There is use of 'effective Henrys law' and standard Henrys law. I would have to agree with the discussion phase of the paper by Compernelle et al 2014 regarding this issue as there are multiple definitions :<http://www.atmos-chem-phys-discuss.net/13/25125/2013/acpd-13-25125-2013-discussion.html>.

'2 Methods' line 3 - Following on from the above, is it not effective Henrys law coefficient? Doesnt a Henrys law coefficient restrict its use to infinite dilution? In my mind this doesnt necessarily catch the trajectory of condensation as a function of increasing water vapour saturation.

'2.1 Experiments' 'For moderate semivolatile gas concentrations, the water flow rate...is large enough to absorb all the gas' Are you referring specifically to nitric acid here. For organics, for example, over which volatility range would you expect this to hold true? Also, what is a 'moderate' semivolatile gas concentration?

'3 results' Please state the source for HNO₃ diffusion coefficient. When modelling loss to the wetted walls, are you using a fixed Henrys law coefficient?

'The 100ppt is a reasonable concentration for background air, but the effect on evaporation rates is small because this concentration is well below the equilibrium value.' - If the concentration (of a vapour) is well below the equilibrium value then wouldnt this encourage evaporation? Or am I missing something here?

page 8422 line 20 'Aerosol acidity and hygroscopicity are more important than the mass fraction of soluble compounds.' Isn't this a circular argument? If the mass fraction of soluble compounds is large (presumably referencing water solubility) then this increases hygroscopicity and thus nitric acid uptake. Why are you decoupling the two, is this related to effects on thermodynamics?

Page 8424 'The effect seen on particles' CCN activity is naturally dependent on the

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compounds, and, especially, the Henry's law coefficient.. It would be great if this analysis could be extended to other semi-volatiles. I fully appreciate the difficulty in this but the reader might not. There is a continual reference to the importance of Henry's law coefficients (standard and effective). Is the model reliant on this value or could the use of saturation vapour pressures and activity coefficients in dilute solutions be used, or would you recommend otherwise. Presumably, for organic compounds, this would be a huge source of error?

Also, could the authors please note whether the analysis could be extended to multi-component evaporation/condensation?

Minor comments:

Abstract: line 10: How big 'a' fraction line 14 - please specify whether this is in the instrument

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 8413, 2013.

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