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Atmospheric Measurement Techniques Discussions

Interactive comment on "On-line determination of ammonia at low pptv mixing ratios in the CLOUD chamber" *by* F. Bianchi et al.

Anonymous Referee #1

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Overall, this is a clear, well-written paper describing the methodology for measuring gas phase ammonia in the CERN CLOUD chamber. While the specifics of the technical implementation (e.g. lack of discrimination against particles) mean that the approach is not universally applicable, the details are important to describe for interpretation of experiments regarding the ammonia dependence of nucleation rates. Given that there is strong motivation to reduce the detection limit below 35 ppt, I wonder if the authors considered using an acid to reduce the pH of the scrubbing solution? This may allow for the efficient capture of NH3 at a lower liquid flow rate, potentially improving the sensitivity.

I recommend the manuscript be published in AMT after addressing the following points:
Abstract and later - The detection limit is reported for what measurement interval?

P 2113, L 1-10 The authors are providing background literature on the NH3 concentration dependence of nucleation rates, however they do not explain at what NH3 levels the Benson et al. experiments were carried out. Also, might it not be expected that the ratio of NH3/SO4 rather than the absolute value of NH3, would be important in determining the dependence of nucleation rates on NH3?

P 2114, L 3-7 I think the high detection limit with many techniques, including the CIMS instruments described in this section, can be attributed to variability in background levels, rather than simply high backgrounds.

P 2114, L 9-18 This paragraph reads a little awkwardly. Initially two reasons are mentioned (particles and hydrophilicity), then a third (diffusion coefficient). In the last sentence, it's not clear which 'two properties' are being referred to.

P 2114, L 18 In the text, the publication year of Bae et al. is 2009, but in the references it is listed as 2007

P 2116, L 23 Which flow has a rate of 10 L/min? This doesn't seem to match anything mentioned later in the text.

P 2117, L 1 Which dimension is 34 mm?

P 2117, L 16 Data are provided every 2 seconds, but considering the residence time and volume in the coil, there is a lot of opportunity for mixing, which would smooth out the instrument response. Have any tests been done to assess the true time response of the system?

Equation 1 – The authors should clarify if the fit is forced through the origin.

P 2119, L 4-8, I find the terminology 'stripping efficiency' a little unclear in this context. Presumably, by efficiency, the authors mean the fraction of gas phase ammonia collected per unit air sampled. However because there is also a liquid flow, one could interpret the meaning as the efficiency per unit liquid flow. This would obviously have a very different relationship than the data presented in Figure 4. I recommend clar-

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ifying the mean of ‘efficiency’. More broadly, does the plateau at 0.3 mL/min hold over a large range of gas phase concentrations? Since ammonia is a weak base, it will become more difficult to collect the same fraction into solution at higher levels of NH4+(aq). This should be considered by the authors.

P 2119, L 7, add a comma: ‘...further, indicating...’

Figure 5 – it would be interesting to know what the theoretical ammonia mixing ratio in the chamber is (based on the rate at which air is exchanged) in addition to the MFC setting. How far off are the measured values from what would be theoretically calculated, even after significant time for equilibration?

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 2111, 2012.