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Atmospheric Measurement Techniques Discussions

Interactive comment on "Atmospheric ice nucleators active $\geq -12\,^{\circ}$C may be quantified on PM_{10} filters" *by* F. Conen et al.

Anonymous Referee #1

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In this paper the authors describe a method to measure ice nuclei concentrations in the atmosphere using PM10 quartz filters. Small areas are cut from the filters and then used in freezing measurements. The authors show that unexposed filters give only a small background signal, and that field samples show ice nuclei concentrations well above the background level.

The technique is a simple, yet potentially important, variation on other filter techniques to measure ice nuclei in the atmosphere. One of the benefits of the technique is that the required infrastructure has been deployed world-wide. In addition the technique doesn't require constant supervision by an expert. This latter benefit opens up the possibility of long term continuous measurements at remote locations. I recommend

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Interactive Discussion
Discussion Paper

this paper for publication after the authors have addressed adequately the comments below.

1. The authors emphasize that one of the benefits of the technique is the ability to measure small number concentrations of ice nucleators at warm temperatures. When ice nucleator concentrations are small, will these ice nucleators have any impact on clouds or precipitation? Some discussion on the concentrations of ice nucleators required to influence clouds and precipitation should be added to the manuscript.

2. Page 6848, line 16-19 and page 6852, line 14-19. "Conen et al. (2011) suggested that larger numbers of IN per unit mass of soil dust may be found in colder, compared to warmer regions. Our filter selection served to test whether – in principle – such differences may be detectable through the analysis of PM10 filters." Also "these results lend support to the proposition by Conen et al. (2011) that larger numbers of IN per unit mass of soil dust may be found in cooler regions and where soils have larger concentrations of organic matter, compared to warmer regions or where soils have lower organic matter concentrations, such as desert soils". I don't think the results from this study provide a good test of the suggestions by Conen et al. (2011). To test the suggestions by Conen, one would need to show that the ice nuclei are associated with soil dust. I would suggest not using Conen et al. as a justification of the filter selection, rather just state that the different filters were selected to provide a variety of air masses for analysis.

3. In Figure 1 the authors show surface source sensitivities (i.e. footprints), but I don't think they have mentioned how these source sensitivities were calculated. Also I don't think there are references for these calculations (unless I missed it). Some additional details and references would be useful for the uninformed reader. Also the font size in the legend for Figure 1 should be increased.

4. Table 1. It may be useful to add CO concentrations to this table.

5. Page 6853, line 17-20. "Since the median number of IN is very similar to that

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observed by Bowers et al. (2009), who stored their filters at −20 C and analysed them within the first two weeks following the collection campaign (Robert M. Bowers, personal communication), we believe that our filters have not markedly suffered from storage." I don't think the similarity between the current results and the results from Bowers et al. (2009) is strong evidence that the filters have not markedly suffered from storage. The measurements by Bowers et al. may have been under completely different conditions. Similar median numbers of IN between the two studies may have been a coincidence.

6. Table 1. The authors do not quote an uncertainty in their reported IN concentrations. Since this is an instrumental paper, it would be appropriate in the current manuscript to discuss uncertainties. The technique involves measuring freezing in a finite number of samples. I believe an uncertainty due to the finite number of measurements can be calculated from Poisson statistics. See Koop et al. Journal of Physical Chemistry, 1997, 101, 1117-1133 and Garwood, Biometrika, 1936, 28, 437-442.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 6845, 2011.