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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.

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Thank you for your comments. They made us think again about some of the issues in our manuscript. We address the remarks as numbered in the review.

1. Ice particles formed at warm temperatures (-3 to -8 oC) can multiply in number by rime splintering (Hallett and Mossop, 1974) and at colder temperatures (peak at -15 oC) through ice-ice collisions (Yano and Phillips, 2011). This suggests that precipitation in clouds is not strictly limited by the number concentrations of IN at these temperatures thereby implying that the small number concentrations of IN active at these temperatures can initiate the formation of enough cloud ice to affect precipitation. For example, precipitation rates observed during a 29 day period over the Southern Great

Plains have been explained with 10 IN m-3 active at -10 oC (Zeng et al., 2009), which is within the range of our observations (2.0 to 15.5 IN m-3 active at -10 oC).

2. Indeed, the present study is not a perfect test of suggested regional differences in numbers of IN associated with soil dust. Nevertheless, the suggested regional differences were in all honesty our motivation for the present study. But, as you mention, a better test would include additional analyses that could show whether detected IN are actually associated with soil particles. At the same sampling site (Jungfraujoch), Kamphus et al. (2010) previously analysed single cloud ice residues by time-of-flight-mass-spectrometry. Mineral dust was the dominant ice residue in the mixed phase clouds they had sampled. However, this does not proove that IN on our filters sampled at another time were also associated mainly with soil dust. It just shows that this may be possible.

3. In section 2.3 the method/model to derive source sensitivities was described. Since, this is a standard method in atmospheric transport analysis we did not give extensive details. In the revised manuscript we will add an additional reference (Seibert and Frank, 2004) and a sentence clarifying that the source sensitivities were derived by summation of the residence time of all model particles in a certain grid cell. The figure will appear larger in the final AMT print and text should be easier to read in the final version.

4. Thank you for the suggestion to add CO values to Table 1. We will do this in the revised version.

5. This is correct, the similar median values may be a coincidence. At least, we could say the similarity in median values between observations made by Bowers et al. (2009) and by us is not contradicting the assumption that our filters have not markedly suffered from storage. Of course, this is not the same as claiming the similarity is evidence for our filters not to have suffered from storage.

6. Thank you for the suggestion and the references. Interception of IN by the small

areas that we later cut out of the filter for analysis is a stochastic process. Numbers of IN detected per m3 are small (Table 1). Each number was obtained from the analysis of 108 filter bits, each of which had collected aerosol particles from 0.12 m3. Hence, a value of 10 IN m-3 is based on a total of 130 IN detected in 13 m3 of air. The total number of IN detected has a standard deviation of 11.40 (square root of 130) and the number of IN m-3 has a standard deviation of 0.88 (11.4/13). Consequently, the 95 % confidence interval for a value of 10 IN m-3 ranges from 8.24 to 11.76.

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