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## ***Interactive comment on “Direct quantification of total and biological ice nuclei in cloud water” by M. Joly et al.***

**M. Joly et al.**

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The study under review quantified the amount of biological particles or better bacterial cells /INA proteins in cloud water samples. As there is still a controversial discussion about the importance of biological particles for atmospheric processes, this study provides important information about the possible number of bacteria in clouds. The freezing method used in the study is comparably insensitive, due to the use of large droplets containing a lot of material, but it is still a powerful method to investigate whether a sample freezes or not and how a sample changes if it is treated for example by heat, as it was done here. The authors focused on the determination of heat sensitive INA proteins in the samples which are the most active biological particles known

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so far. It would have been interesting to see if the samples changed further when they were treated with other procedures, which can also destroy heat insensitive biological IN. So, as already stated in the paper, this study gives only the lowest possible value for concentrations of biological IN, which nevertheless still is important information. However, the title of the study promises that information about biological particles in general would be given. As this is not done, the authors should change their title as to not give promises that cannot be fulfilled.

We do not agree on the fact that the title promises such result. Yet, we modify it by “Quantification of ice nuclei active at near 0°C temperatures in low altitude clouds at the puy de Dôme atmospheric station (1465 m a.s.l.)” for giving more precise information about the content of the manuscript.

1) In the presentation of the procedure and the data I found some missing and contradictory information. p3712, 11: Some samples already froze during the sampling procedure. Is it possible that this makes any differences?

See answer 2) to referee 1.

2) p3714, 6: Why do you use sometimes 32 and sometimes 160 droplets? The information how many droplets were used for each experiment could be added to table 2. What is the uncertainty for the two types of experiments? Is it possible to get some error bars to figure 3 and 5?

We actually replicated 5 times assays of 32 droplets in some samples. Since the standard error was very low at all temperatures ( $< 4$  IN mL<sup>-1</sup>) and that these replicates in reality corresponded to a larger amount of droplets, basically, we decided to present it as 160 droplets rather than replicates of 32 ( $5 \cdot 32 = 160$ ). We have included the number of droplets used for each sample in Table 2. The number of droplet assayed had no influence on the data ( $p > 0.05$ ; Spearman's correlation test).

3) - p3714, 16: It would be interesting to know the value of the dilution factor Df and

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how it is determined.

In our case, the dilution factor is 1: we used cloud water directly without any dilution.

4) - p3716, 7: I think it is better to say: "none of the samples remained completely supercooled at temperatures below  $-11^{\circ}\text{C}$ ", because if I understand it correctly, you want to say that at  $-11^{\circ}\text{C}$  every sample showed at least one frozen droplet. In your statement it sounds that all droplets of all samples were frozen at  $-11^{\circ}\text{C}$ .

We agree that these sentences were confusing, so we rephrased it as for example "In 11 of the 12 cloud samples (92%), the onset temperature of freezing (i.e. temperature at which the first droplet froze) was  $-8^{\circ}\text{C}$  or warmer. Only sample #87 started to freeze at colder temperature ( $-11^{\circ}\text{C}$ )." (Line 228).

5) - p3716, 7: a reference would be nice at that point (e.g. Pummer et al., 2013)

We added the following reference: Pummer, B. G., Bauer, H., Bernardi, J., Bleicher, S. and Grothe, H.: Suspendable macromolecules are responsible for ice nucleation activity of birch and conifer pollen, *Atmos. Chem. Phys.*, 12(5), 2541–2550, doi:10.5194/acp-12-2541-2012, 2012.

6) - p3717, 10: Why at  $-9^{\circ}\text{C}$ ?

We reanalyzed data, and stats have been redone. It appears that a mistake was done, and the concentration of bacteria is actually not correlated with IN data. This is now indicated in the text and shown in Table S2.

7) - Fig1: This is potentially a very interesting sketch, but the font is quite small. If you want that your readers can get anything from this plot, you either have to make sure that it will cover one complete page in a possible final publication, or better still increase the size of the font!

We were not able to increase the size of the font without altering the figure. So this will be presented as a complete page if possible in the manuscript.

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Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/14/C2585/2014/acpd-14-C2585-2014-supplement.pdf>

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 3707, 2014.

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