

Interactive comment on “Contribution of pollen to atmospheric ice nuclei concentrations” by J. D. Hader et al.

Anonymous Referee #3

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This study addresses the hypothesis that macromolecules may become dispersed by rupturing of pollen sacs during wetting and drying cycles in the atmosphere and that this could be a significant source of ice nuclei in the atmosphere in the pollen season.

The manuscript present results from a field study carried out in Raleigh, North Carolina USA in 2013. Seven samples collected using a Swirling Aerosol Collector were analyzed for IN activity on a drop freezing assay. In addition rain water samples were analysed similarly. The hypothesis above was tested by comparing ice nuclei spectra with pollen concentrations.

The topic is and timely, the authors present an interesting data set. Sampling and analysis seem to be carefully done. I have some comments and suggestions for im-

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provement as outlined below and I agree with the comments/concerns already provided by two reviewers and others. I can recommend publication after these have been addressed.

General comments

The authors attempt to extrapolate to make conclusions about pollen in general, the global scale and feed-back cycles in the Amazon. These brought conclusions do not seem justified based on the available dataset, and are not needed to merit publication of the data. I suggest the authors to shorten and tighten the discussion and conclusion sections.

The methods section could be organized better. It is unclear to the reader what the 15ul aliquot of water sample is and how it is sampled until having read quite a bit of the text. It would seem more natural to me to start with (2.1) the sampling procedure (p. 31679) and explain about the ice nuclei spectra afterwards in a new subsection (2.2). When explaining the nomenclature about the droplets (pico, nano) it would be helpful to mention what droplet diameters that correspond to right from the beginning.

Pollen particles, pollen grain, granules particles per pollen grain, macromolecules, cellular debris – it seems that some of these words are used for the same thing - the notation should carefully explained and be consistent throughout.

Figures: Figures 5, 7 and 8 are too small. It should be checked that all symbols, lines etc. are explained in the figure captions – e.g red lines are not explained in caption for Fig 8.

Specific comments

Page 31680: In the introduction it is stated that pollen can be transported more than 3000 km from their emission source, but it is assumed that the pollen samples studied are only from local sources? Could the samples not be influenced by pollen from other than local sources?

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Page 31676: “rainwater samples were collected during rain events at the peak of the pollen season” ... it was only collected during some rain events. Why were these selected?

Page 31679: Why was the rain water filtered and resuspended?

Page 31680: It is not clear how the reported recovered percentages (20% for rainwater, 100 % for ATD) were obtained.

It should be explained how the representative pollen sample was used. What are the 4 samples? As I understand only one pollen sampled was collected?

Page 31685: the text says that Figure 3 shows that 10% of the particles froze heterogeneously and this corresponds to certain limits of detection – this should be explained.

Page 31688: “The main conclusion from fig 6 is that as a first order approximation a generic pollen grain is expected to induce ice formation at $T=-20\text{C}$ - this should be explained.

Page 31689-31690: Comparison with Fletcher model:– “Data are in reasonable agreement”, most of the spectrum are in “excellent agreement” nonetheless the shape does not always follow. . . These are quite quantitative statements. The model results should be shown in the figure together with the data.

Page 31692: “Composition of rainwater solutions could lead to freezing point depression within cloud drops” This statement should be explained – what compounds in the rain water are the authors thinking about?

Minor comments:

Page 31675: at temperatures as low as -9 – should be “as high as” ?.

Page 31677, line 28: Exact droplet volumes are estimated . . . It does not sound right to estimate something exact. I suggest to delete exact and just write: Droplet volumes are estimated from . . .

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 31673, 2013.

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