Atmos. Chem. Phys. Discuss., 11, C12429–C12431, 2011
www.atmos-chem-phys-discuss.net/11/C12429/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Birch and conifer pollen are efficient atmospheric ice nuclei" *by* B. G. Pummer et al.

D. O'Sullivan

d.osullivan@leeds.ac.uk

Received and published: 28 November 2011

Comments by Ben Murray and Daniel O'Sullivan:

The observations reported in this paper, that suspendable macromolecules adhered to the surface of pollens can themselves act as ice nuclei, is a very exciting discovery and will certainly challenge researchers in the field to reconsider the efficacy of pollens as atmospheric ice nuclei.

There are a few issues which we think the authors should consider.

1) Similar to comment 4 suggested by Dr. C. Morris, we would like to draw the authors' attention to their discussion of the 'efficiency' with which the pollens nucleate ice. In particular, we highlight the authors' comparison of their measured rate coefficients to

those of mineral dusts determined by Eastwood et al. (J. Geophys. Res. 2008, 113, D22203). On the basis of this comparison, which is graphically depicted in Fig. 5, the authors conclude that "many pollen species produce far more efficient ice nuclei than all studied mineral dusts" (p. 27288, lines 7-9), which is a striking claim. However, the rate coefficient measurements conducted by Eastwood et al. were for ice nucleation in the deposition mode and cannot be directly compared with measurements in the immersion mode. They cannot be compared in this way because they are determined for explicit RH values and J will vary strongly with RH at constant temperature. Eastwood's measurements also have different units. We suggest that the authors compare their rate coefficients to those of mineral dusts which have been measured in the immersion mode, such as performed by Murray et al. (Atmos. Chem. Phys. 2011, 11, 4191-4207). Murray et al. report J values in units of cm-2 s-1 but a comparison could be made if this were converted to cm-3 s-1 (units used by Pummer et al). This could be done for droplets of a particular size with a particular mineral concentration. It should be borne in mind that kaolinite is just one mineral type relevant to the atmosphere and other data suggest there are more 'efficient' minerals, although the results do not lend themselves to easy comparison with the format chosen by Pummer et al.

Units should be mentioned in caption of figure 5.

2) Fig. 5. Rather than using the natural logarithm as is stated on the vertical axis, the authors appear to have taken the base 10 logarithm of the rate coefficients from Eastwood et al. Is this also the case for the rate coefficients reported for the birch pollen? A table reporting the actual values might be useful.

3) P27221. ln 7-8. The Pratt result of 33% was for one out of a number of flights. Insert words 'up to'.

4) P 27223 ln 24. Why can droplet collisions 'ease nucleation events'?

5) Section 4. It would be helpful to include the isothermal data in the form a plot of fraction frozen (or unfrozen) verses time. Murray et al. (Atmos. Chem. Phys. 2011,

11, 4191-4207) showed plots such as this for kaolinite and Broadley et al. (Atmos. Chem. Phys. Discuss., 11, 22801–22856, 2011) showed results for NX – illite. The close to exponential decays in Murray et al. suggested the probability of all droplets freezing in a given time was approximately equal and that this was consistent with the single component stochastic model. Broadly et al found that for NX illite, a mixture of minerals thought to be representative of natural dust, the decay of liquid droplets is not exponential and indicated some droplets contained better ice nuclei than others. In which category does pollen fall? This is important because the expression used here (Eq 1) is a single component stochastic equation.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 27219, 2011.