

Interactive comment on “Ice nucleation abilities of soot particles determined with the Horizontal Ice Nucleation Chamber” by Fabian Mahrt et al.

Anonymous Referee #3

Received and published: 7 August 2018

In this paper, authors measure the ice nucleation properties of various soot samples and further interpret these measurements by characterizing the particle properties and conclude that PCF kind of mechanism can explain the diverse INP properties observed for soot particles. My major concern is properties of realistic (emitted directly into the atmosphere through natural and anthropogenic processes) soot aerosol could be different than soot generated in the lab through dry-dispersion method, and this could affect the conclusions. Lab generated particles may not be atmospherically relevant particles. It is necessary to discuss how this connection can be made. An attempt is made in section 4, but not enough. The surface properties of soot samples from both sources are very different. Detailed discussion including these limitations needs to be explained and acknowledged. In addition, I have few following minor comments that I

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suggest to address before publication.

Page 2-3: Not all historical studies are discussed. It sounds like this is the first paper to study a majority of the soot samples (section 2.1 or Table 1). It may be best to discuss these studies briefly.

Section 2.2: What is the size distribution of soot samples? What size was selected (page 6, line 9)? How was multiple charge correction applied?

Page 8: For ice crystal detection 1 μm threshold was used. How it is ensured that soot particles are not larger than 1 μm . Figure 5 shows the images of these soot samples, and it looks particles are greater than 1 μm . Therefore, ice particles will grow larger than 1 μm . Please clarify. The implications are briefly explained on page 9 (line 5), but details regarding how 'aerosol-correct' is needed.

Page 22, line 31-: If the soot properties of combustion aerosols are different than lab-generated, how it is possible that ice nucleation properties of 100 nm will be similar? The sentence saying '...it is unlikely that such small soot particles ...' is not true.

Section 4: Discussions such as comparison of residence time (timescales) within HINC and aircraft plume is irrelevant. Soot properties in both cases are not similar. Also, the assumption regarding cloud formation cycles is not supported.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-557>, 2018.

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