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3
4 *[A0]* For clarity and visual distinction, the referee comments or questions are listed
5 here in black and are preceded by bracketed, italicized numbers (e.g. *[I]*). Authors'
6 responses are offset in blue below each referee statement with matching numbers
7 (e.g. *[A1]*). Page and line numbers refer to online AMTD version.
8

9 The manuscript of Mason et al. deals with optimization and validation of a combined
10 aerosol particle collection and freezing technique to determine atmospheric ice nucleating
11 particles (INP), which is relatively new in its current state (2013). As actual INP
12 measurement decades still differ by an order of magnitude in their concentration readings,
13 such work is crucial for the progress of INP research. The authors come up at the end of
14 their experiments with correction parameters for the MOUDI-DFT technique, which are
15 in the range of 0.7 to 2.0, in average correcting for an underprediction of INP by this
16 technique. Given the comparatively large differences between MOUDI-DFT and their
17 reference technique CFDC (factors of 1.1 and 3.8), however, obviously there are more
18 biases to be regarded in future (not necessarily in the MOUDI-DFT technique only). The
19 paper is concisely written and the results are adequately presented. Appropriate reference
20 to previous work is given. Therefore, I recommend publication after some minor
21 corrections.
22

23 We thank the referee for his helpful comments!
24

25 *[I]* General remarks 2233/13-16: 3 or 4 samples were used for calculation the correction
26 parameters. It didn't become clear to me from the manuscript, however, whether the
27 aerosol density data and the confidence intervals were calculated from all samples as a
28 single dataset or for each sampled glass slip separately. Basic question: is there a
29 difference from sample to sample in the corrections derived from the data displayed in
30 Figs. 4 to 6 and the resulting functions shown in Fig. 9, or are they identical or at least
31 very similar for each sample? I would suggest demonstrating this at least in one graph.
32

33 *[A1]* The normalized particle concentration as a function of distance from the deposit
34 center was calculated for each cover slip individually. What is reported in Figs. 4–6
35 is the average of all cover slips with uncertainty as the 95 % confidence interval,
36 which is related to the sample-to-sample variation. In the revised manuscript, instead
37 of 95 % confidence intervals we report the standard deviation as this better illustrates
38 sample-to-sample variability. For clarity the sentences of 2235/10-16 have been
39 revised to the following:
40

41 “The normalized particle concentration, which is the quotient of the particle
42 concentration of a given step divided by the maximum particle concentration, was
43 calculated as a function of distance from the center of the MOUDI aerosol deposit
44 for each hydrophobic glass cover slip at spatial resolutions of 1 and 0.25 mm. Visual
45 inspection of aerosol deposits showed that there was spatial variability of the particle
46 concentrations at a spatial resolution as low as 0.10 mm for MOUDI stages 6-8, so

47 these stages were also analyzed at this spatial resolution. A total of three
48 hydrophobic glass cover slips were analyzed for stages 2 and 8 and four hydrophobic
49 glass cover slips for stages 3–7.”

50
51 The statement at the beginning of Sect. 3.1 (2238/3-6) has also been revised for
52 improved clarity:

53
54 “Shown in Figs. 4, 5, and 6 are the normalized concentrations of aerosol particles as
55 a function of distance from the center of the MOUDI aerosol deposit at spatial
56 resolutions of 1, 0.25, and 0.10 mm, respectively, when averaged over all analyzed
57 samples. The uncertainty in Figs. 4–6 is the standard deviation of these samples.”

58
59 **[2]** There are some forward references (‘see below’, etc.), which make the manuscript at
60 some points not so easy to read. Please give this a critical read and revise, if possible.

61
62 **[A2]** References to “see below” or similar directions have either been removed or
63 revised to direct the reader to specific sections.

64
65 **[3]** Minor remarks/corrections: 2227/14-15 and 2228/1: Why were these previous
66 methods limited to $> -25^{\circ}\text{C}$ and the current one not?

67
68 **[A3]** Previous methods were likely limited to ice nucleation temperatures of
69 approximately -25°C or greater due to significant interference from background
70 freezing events at lower temperatures. In the current technique, background freezing
71 events didn’t occur until close to homogenous freezing temperatures, approximately -
72 37°C . Background freezing events at temperatures of -25 to -37°C were prevented
73 by using small droplets and hydrophobic glass cover slips, which do not provide
74 efficient heterogeneous nucleation sites. The sentence at 2227/14-15 has been revised
75 to the following:

76
77 “These methods have all been limited to freezing temperatures of approximately -25
78 $^{\circ}\text{C}$ or greater, likely due to significant background counts at lower temperatures.”

79
80 **[4]** 2228/24-2229/16: This reads rather like a summary of a part of the paper than an
81 introduction. I suggest revising and shortening to a few sentences just outlining the
82 approach.

83
84 **[A4]** This section has been revised to the following:

85
86 “In the following paper we improve on the MOUDI-DFT approach. We first measure
87 the concentration of particles on the MOUDI aerosol deposits as a function of
88 distance from the center of the deposits to determine aerosol deposit non-uniformity.
89 We then use these non-uniformity measurements to build substrate holders for the
90 different MOUDI stages and calculate correction factors to be used when
91 determining INP concentrations using the new substrate holders.”

92

93 [5] 2230/6: Having as first Fig. reference a no. 9 might raise objections from the technical
94 editor.

95

96 [A5] The discussion of the blank freezing experiments has been moved to Sect. 3.5 to
97 avoid Fig. 9 being the first figure referenced in the text.

98

99 [6] 2230/7: Consider a new paragraph before ‘To determine. . .’

100

101 [A6] As suggested, a new paragraph has been inserted before “To determine...” on
102 page 2230.

103

104 [7] 2233/2: It appears to me that Eq. 2 is only valid if the aerosol density on the substrate
105 is low, i.e. no particle is deposited touching another. Could you comment on that, and if
106 the case, include the restriction?

107

108 [A7] We are not sure why Eq. 2 should only be valid if the aerosol density is low on
109 the substrate. In order to comment on this, we will need additional information. Sorry
110 that we don’t understand.

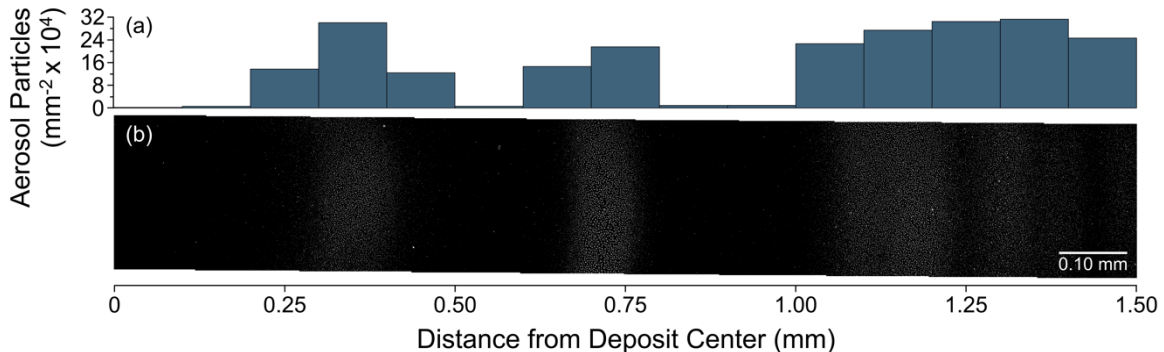
111

112 [8] 2234/27 and Fig. 3: This figure is practically useless in current state due to poor
113 resolution. However, I think it makes sense in the manuscript to present it, so I suggest a)
114 taking care that it comes with sufficient resolution in online / print version (let it span the
115 whole page) and b) additionally somehow illustrating the changes in particle density, e.g.,
116 by drawing a graph showing the particle density per area as function of the distance of the
117 deposit center in parallel above the image.

118

119 [A8] The resolution of Fig. 3 was improved and a panel showing the change in
120 particle concentration has also been included:

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Fig 3. (a) The concentration of aerosol particles on MOUDI stage 8 as a function of distance from the center of the aerosol deposit, measured at a spatial resolution of 0.10 mm. (b) A subsection of the continuous cross-section of the aerosol deposit of MOUDI stage 8. The images have been background corrected by subtracting the sample image from a particle free image. Background correction was done to remove spots on the image from dust on the optics. When overlapping individual images to produce the continuous image, the individual images do not align perfectly in the vertical dimension because moving the hydrophobic glass cover slip in the x

131 direction using the XY translation stage of the microscope causes slight movement in
132 the y direction.

133

134 *[9]* 2243/22: The following section is rather a summary than conclusions.

135

136 *[A9]* To address the referee's comment we have changed the title of this section from
137 "Conclusions" to "Summary".