

REFEREE 1

- L. 21: Hydrometeor larger than 10 mm can be found near the coast, mostly as aggregates (some can be found in the dataset: <https://doi.org/10.1038/s41597-022-01269-7>)

Added

- L. 45: another examples for the usage of disdrometers is <https://doi.org/10.1016/j.atmosres.2017.06.001>

Added

- L. 162: how often this is done? please clarify already here in the text.

done

- L. 214: if there is wind-drifted snow (and so strong enough wind), how can the author be sure of what is stated in L. 120 ? "precipitation falling on a horizontal glass surface accumulates with time until it sublimates, leaving plenty of time for scanning...")

I changed the sentence

- Fig. 8: should this figure also illustrate some temperature profiles? Additionally, please explain in the figure or in the caption, not only in the text, all the short variable names used.

done

- Fig 22, 23, 24: relevant figures. As there are many other figures, maybe they could be combined in a multi-panel image (same for otehher figures before). Additionally, maybe some information is missing to better interpret the meaning of such figures: for eyample the total number of scans of each histogram and the underlying distribution of relative humidity, wind, temperature. The goal would be to see if the distribution appearing in these histograms are due to characteristics of the instrument at various environmental conditions or are just the representation of the distribution of the environmental conditions themselves.

I tried to bind together many figures . I also added the histograms of Temperature, RH, wind speed for the measurement period, as suggested

- About the very large number of figures: please consider multi-panels and also one or more Appendix sections if relevant.

I tried to bind together many figures ..

REFEREE 2

The manuscript has improved significantly with the modifications and additions by the author. Nevertheless, some unclarities remain, which I am pointing out below. In addition, I am listing a few minor things and oversights. With Fig. numbers, Sect.s, and Lines I am referring to amt-2022-62-ATC2.

A) The heating design is still unclear.

1) I appreciate the clarification about the structure of the heated-glass DS. This is what the author seems to call sandwich-like structure. I had confused that with the "double window" consisting of DS and at 13mm distance a second glass sheet with heated air in between, not being aware of that the DS itself has two glass layers with a heating layer in between. The detail that is provided in Fig. 8, could be included as text in Sect 2.5. Fig. 8 is not needed and should be removed.

I tried to better explain the thermal design following the indications of ref.2. Only, I kept Fig.8 , as I personally think it's useful. I added to it a sketch of the temperature profile (as suggested by ref.1)

2) The sentence referring to Fig. 8 in Lines 245/6 is still confusing or misleading due to a seemingly wrong use of "almost". I would suggest to rephrase it to something like:

"The cooling rate is at most only about 50% of the heating rate. The cooling is passive by heat transfer to the surrounding air."

done

3) The new paragraph in L 250-253 is not needed. While it is true, the actual difference between cooling and heating rates depends, in addition to the mentioned heat transfer coefficients, on the heating power of the electrically heated DS glass.

I changed a sentence, but kept the paragraph

4) Heater 1 is a thermostat-controlled heater. I would change, in Fig. 3, "GAS THERMOSTAT" to "THERMOSTAT".

done

5) I am still unsure about Heater 2. Is it the electrically-heated DS glass? Or is it a heater working together with a pump blowing air between the DS glass and the second glass sheet 13mm below the DS. In the previous MS version it said "air is pumped..., filtered, heated and finally blown through the double window space...". Or is it yet another heater? In this respect, the sentence in L 227-229 is unclear. Is it Heater 2 controlling the inside temperature to be above (warmer) than -40degC? What is controlling the DS temperature to not rise above (warmer) than -5degC (cannot be a heater, but the author refers to Heater 2)?

I changed the sentence, I hope it is better written, now

6) L. 235 "...Mylar... prevents overheating of the DS above -5degC". I would change that to be more specific and correct (and connect to the next sentence): "...Mylar... prevents overheating (of the instrument) and allows keeping the DS below -5degC... . Additionally, in warm weather...".

done

B) The resolution of ICE-CAMERA is not given. From the pixel size of 7 um and a 1:1 lens I am assuming that 1 pixel corresponds to 7um (pixel resolution). The author mentions "a fine calibration" without specifying the result of it (confirm 7.0 um/px?). The sentence in L 157 says something vague about the potential resolution of the macro lens, but not of the actual optical resolution of ICE-CAMERA. What are the smallest details/features that can be seen on the images? I doubt that details of 7um size can be seen if one pixel is 7um.

I Added a sentence with the fine calibration details

C) L 274-292 Adhesion of ice on DS: I am a bit confused. It seems you show that particles at normal speeds below their settling speeds would adhere. I.e. if they settle at settling speed they may not adhere.

Is there a limit of wind speed of 5 m/s imposed (mentioned in L 643) that has to do with adhesion?

I didn't change too much this part, because in the text I already explained that small particles can stick for van Der Waals forces alone, while big particles stay attached for electrostatic forces as van der Waals forces are quite weak and not sufficient alone to stick on the DS the 'big' particle in free fall

D) The total number of particles is 81800. Of these only 5500 have been manually classified. All other images have gone through CNN classification followed by manual verification/correction (as explained in L 525-532). That means that many of the around 8000 images (10%) used for testing and compiling the confusion matrices have already been classified by CNN. Does this introduce a bias (improving accuracy in the confusion matrices)?

I Added a discussion

E) L 610 suggests that many particles are rejected for statistical analysis. It would be interesting to know roughly how many and for what reasons. Major reason wind speed threshold? Or too small particles?

I Added a discussion

Other minor things:

L. 54: Consider specifying why "In Antarctica, their (MASCS) practical application is mainly limited to coastal areas."

I added a sentence

The titles of Sect.s 2, 3, 4, and 6 are missing. Additionally, in the numbering Sect 5 is missing completely and Sect.s 6 appear twice.

Done, thank you!

L 158: "A 90 deg bending aluminium mirror..." seems to refer to the "45deg mirror mentioned earlier, I suggest again to use same terminology and names as before: "The 45deg mirror...". Now "DS" is not introduced when this term is first used in Sect 2.1. In addition, in some of the added text there appears "SD" instead of "DS" (L.s 126, 221, 262, 289, 337, 624).

Done

L 211: 3.5 l/m => 3.5 l min⁻¹ or 3.5 l min⁻¹

Done

L 261 galss => glass

Done

L 271: "The non-contact..." => "A non-contact..." (talking about something not mentioned before)

Done

L 297: "The adverse effect is an accelerated..." => "An adverse effect is, however, an accelerated..." (or "A disadvantage...")

Done

In Sect 4.1.4, "1)" is missing in the numbering.

Done

In Sect. 4.1.4 4): Unclear how overlapping particles can be counted twice. Contrarily, two overlapping particles would be counted only as one (cluster). Similarly, merging close-by-particles (point 5) due to region growing results in less counts.

I added a discussion

L 560: remaining 80% of the training => remaining 80% for the training

Done

L 605: 8% regular plates => 9% hex. Plates

Done

L 611: "errors in ... contributed to..." => "problems with ... resulted in..."

Done

Sentence in L 624/5 suggests that (it is clear that) sublimation on DS is less important than natural variation. This is not clear or obvious to me. Perhaps give a hint why or how. Similar in L 632/3.

I tried to better discuss this point, adding (as suggested by ref.1) the histograms of T,RH,Wind speed for the measurement period (2014-2021) for comparison with NpS histograms

L 631 HR => RH

Done