Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-44

Aaron Kennedy (Referee)

Referee comment on "A differential emissivity imaging technique for measuring hydrometeor mass and type" by Dhiraj K. Singh et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-44-RC2, 2021

The authors present a novel new instrument for measuring properties of liquid and ice precipitation. Overall, I think this is a worthwhile contribution to the field, but the paper needs clarifications in a few places. Further, the paper would benefit from comparisons to other instrumentation for field components of the paper. It is unclear whether these observations exist or not.

- Is there an operating range for the instrument? What is energy consumption as a function of ambient temperature? This would shed light on the requirements for deployments in different areas.
- What are the impacts of wind flow around the instrument for snow events? Since this is mentioned as a drawback of other instruments, should address. It seems like provided wind tunnel tests were focused on thermal effects of wind (this is good!). This should be pointed out at L295, otherwise reader could interpret this statement too far. The statement at L350+ about minimal interference with the camera seems like a stretch, but that's coming from someone that lives in a windy environment. I agree that a flat plate implies it is better than other platforms.
- My biggest concern with the paper is the missed opportunity to compare DEID to other common measurements. Take visibility for example… was there a forward scattering sensor on site? Provided that the instrument is sensitive to hydrometeors > 200μm, I presume there could be bias. What about MASC data? Would be great to see PDFs of select variables between the two systems. Statements like Line 310-312 could be backed up with MASC images.
- Can you explain the logic between sampling rates? Why was 12 Hz decided upon for field work? Precipitation rate is mentioned, but is this determined on the fly by input from other instruments? It's unclear how the range of 2-30Hz is related to the rates quoted in Section 2.2 that mentions tests up to 120 fps / 240 Hz.
- What are the computing requirements like? It was unclear whether the imagery is processed in real-time or not, and if so, what type of resources are needed.
- Figure 12: Is there any significance to the width of the heavy/light snow columns? It seems like these could be broadened.

Minor comments:

Line 25: Might be worth highlighting the challenges of other instruments for snow/wind? See associated references that could be added to this section.

Parsivel:

Battaglia, A., Rustemeier, E., Tokay, A., Blahak, U., & Simmer, C. (2010). PARSIVEL Snow Observations: A Critical Assessment. *Journal of Atmospheric and Oceanic Technology*, *27*(2), 333–344. https://doi.org/10.1175/2009JTECHA1332.1

Loeb, N. and A. Kennedy, 2021: Blowing Snow at McMurdo Station, Antarctica During the AWARE Field Campaign: Surface and Ceilometer Observations. *J. Geophys. Res. Atmos*., 126, e2020JD033935.

MASC:

Fitch, K. E., Hang, C., Talaei, A., and Garrett, T. J., 2020: Arctic observations and numerical simulations of surface wind effects on Multi-Angle Snowflake Camera measurements, Atmos. Meas. Tech., 14, 1127–1142.

Figure 4 caption: water droplets or water and ice droplets?

L230: Is there an extra – before Collins?

L235: Please clarify- what is a sample referring to if there were 2000 snowflakes or rain drops contained within? I think this is answered at L358… just make sure this is clarified earlier on.