

Atmos. Meas. Tech. Discuss., referee comment RC1
<https://doi.org/10.5194/amt-2020-476-RC1>, 2021
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Reviewer 1

Anonymous Referee #1

Referee comment on "Application of cloud particle sensor sondes for estimating the number concentration of cloud water droplets and liquid water content: case studies in the Arctic region" by Jun Inoue et al., Atmos. Meas. Tech. Discuss.,
<https://doi.org/10.5194/amt-2020-476-RC1>, 2021

The CPS is a sensor that is clearly needed for making profiles in clouds with upsonds, dropsonds or even teathered balloons. The original description by Fujiwara et al. was a good introduction but left out four very important details that also limit the usefulness of the present paper. 1) What is the intensity profile of the lasr beam across the sample areas of the two detection systems, 2) What is the shape of the elaser beam, 3) What are the actual dimensions of the two parallelograms and 4) For the collection geometry what do the Mie scattering cross sections look like for water droplets.

Lacking this information in the present paper, all of the corrections that are related to the pulse width and the sizing are irrelevant since they all assume a beam shape and laser intensity that is uniform, assumptions that are likely not the case.

I am puzzled that readily available software like Zmax was not employed to model the actual optical system. The figures in 3a and b are speculative, in the words of the author. Speculation has no place in a technical article.

The size calibration is based on water equivalent sizes of crown glass and PSL particles, but these water equivalent sizes have to come from theoretical considerations. Nowhere is this described.

The cloud physics community that uses optical spectrometers are now using precise droplet generators to map the sample areas of spectrometers similar to the CPS. This needs to be done for the CPS if this technology is to be accepted and inversions have to be applied as there is no qualifier in the system to constrain the particles through the sample area. I recommend that the authors read the papers related to the IAGOS Backscatter Cloud Probe.

Finally, trying to model the flow through the CPS with no measurement validation is unconvincing. The much simpler and more convincing approach is to do the measurements in a low speed wind tunnel that are employed around the world to calibrate anemometers.

From a presentation perspective of the material, once the study is repeated more vigorously, this is an AMT paper so most of the introduction is irrelevant except for the last paragraph that describes the objectives. The title is misleading and needs to be more explicit and the photos, while pretty, are also irrelevant to the topic.

Finally, comparisons in the field are irrelevant until the corrections are justified properly and in addition the OPCs against which they are compared have their own uncertainties that have to be explained to put the comparisons into context.