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Comment on amt-2021-424

Anonymous Referee #2

Referee comment on "Development of an *in situ* Acoustic Anemometer to Measure Wind in the Stratosphere for SENSOR" by Liang Song et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-424-RC2>, 2022

The authors introduce a self-made ultrasonic anemometer (hereafter called "sonics") for wind velocity measurements based on a drifting stratospheric balloon in an altitude of about 25 km.

It is claimed that these are the first measurements with high resolution at those altitudes because off-the-shelf sonics do not reliably run in those extreme environments due to poor signal-to-noise ratio.

The authors claim that the main motivation for their work is "To the authors' knowledge, there is no existing commercial off-the-shelf product that can obtain *in situ* wind measurements at altitudes exceeding 20 km" which is then also immediately refuted to a large extent in a cited article by Marcua et al. which presents sonic data observed in an altitude of 18 km which is not much less than the mentioned 20 km.

The authors start their sensor evaluation with a ground-based intercomparison with a commercial sonic with much less temporal resolution which has been designed for weather observations and not research. There is no doubt about the question if the new developed sensor works in general and provides reasonable data, however, this simple experiment does not provide high quality data needed for a detailed characterization of the sensor performance. I got no idea about the absolute accuracy or even the sensor resolution of the new sonic based on carefully performed observations.

The technical description of the new sonic is at many places too detailed compared to the real important things. For example, the discussion about the transducer separation L is vague; so why did you choose 20 cm which is longer than for most commercial devices and how do you conclude that this compromise is working? There are many other places which provide information which does not really help to better understand your device.

That a "controller board serves as a brain" does not provide any useful information. Phrases as "extreme environments" do not help; please provide numbers and I suggest avoiding such vague phrases and technical details which are not necessary to understand the real important things. That a circuit is protected by a fuse is standard and not worth to be mentioned here but instead I would like to know in which way you have overcome technical limitations you mentioned at the beginning and why is your system running in 25 km height and others not (if true).

About the data analysis:

You mentioned spikes in the observations as technical problems but no details are given how they have been removed. Also possible reasons for that spikes are only very briefly mentioned but if this a problem for high altitude measurements with sonics than a more detailed discussion would be interesting.

Measuring vertical wind speeds from a moving platform is extremely challenging and strongly depends on the accuracy of the measured pitch angle; however, there is absolutely no discussion about this issue.

The section about the power spectral analysis is very brief and vague but you draw the simple conclusion that the newly developed sonic works well - this is too less for a scientific analysis and does reads more like a short progress report. To be convinced that this sensor provides useful data for scientific analysis - in particular for turbulence analysis - much more work is needed. From my point of view there is no proof that this ultrasonic works better in the stratosphere than other sensors. I had a brief look into the corresponding section of Marcua et al.: their sonic provides two decades higher spectral resolution which is striking. The only differences which might justify a new publication is that Marcua et al provide observations up to "only" 18 km and your data has been observed at 25 km - however, with less resolution.

Although I greatly appreciate the development of the new sonic, the manuscript in its current state does not warrant publication. The progress compared to other similar systems is not convincingly presented and the analysis methods of the acquired data - both on the ground as a comparison and on the balloon - are rather simplistic.