Responses from authors to Reviewer 1's comments

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Title: Development of an in situ Acoustic Anemometer to Measure Wind in the Stratosphere for SENSOR

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Reviewer 1's comments:

This manuscript focuses on the description of the development of a sonic anemometer designed to perform measurements in the stratosphere (with a sampling rate of 10Hz) on board of high altitude research balloons. A claim is made in the abstract that "Developing this anemometer was necessary, as there is no existing commercial off-the-shelf product, to the authors' knowledge, capable of obtaining in situ wind measurements on a high-altitude balloon or other similar floating platform in the stratosphere". Clearly, the latter statement appears to be not accurate, as later on in the text the authors cite an article by Maruca et al. (appeared in AMT in 2017 : https://amt.copernicus.org/articles/10/1595/2017/) describing an experiment in which an off-the-shelf anemometer with minimal modifications was employed to perform three-dimensional velocity measurements of the wind in the stratosphere, with a sampling rate of 200Hz. The run performed by Maruca et al. produced data used to conduct a spectral analysis of the stratospheric wind, presented in the same AMT article. Previously, Banfield et al. developed and tested a homemade acoustic anemometer which operated up to an altitude of 33km, returning as well high resolution wind velocity measurements. In my opinion, the outcome of these 2016 and 2017 articles allows to say that operating a sonic anemometer in the stratosphere is by itself no news, which is the major problem I have with the present manuscript.

Indeed, main conclusions here are that the acoustic anemometer developed by the authors "obtained continuous wind velocity data at the floating altitudes of 24-25km" and "...preliminary spectral analysis demonstrate that the acoustic anemometer employed in this study can sense rapid changes in wind and is useful for researching small-scale wind fluctuations in the stratosphere", indeed similarly to what was done by Maruca et al. in 2017.

I consider very valuable the efforts made by the authors to develop a new acoustic instrument able to perform velocity wind measurements in the stratosphere, I really think this is needed and I strongly encourage them to pursue with further developments of their instrument. However, in order for a probe to be worthy of becoming the subject of a scientific article, such instrument should either make it possible sets of observations which were not possible in before, or the measurements collected in runs of the newly developed probe must be used to produce original analyses and results. The latter should address one or more science cases that need do be described and thoroughly discussed in the draft proposed for publication. For these reasons, I cannot suggest the present manuscript for the publication in AMT.

Answers to the Reviewer1's comments:

Thank you very much for your time and efforts reviewing this study. The answers that we have made based on the reviewer's comments are discussed below (the comments are shown in italics and blue while responses in non-italics and red).

This manuscript focuses on the description of the development of a sonic anemometer designed to perform measurements in the stratosphere (with a sampling rate of 10Hz) on board of high altitude research balloons. A claim is made in the abstract that "Developing this anemometer was necessary, as there is no existing commercial off-the-shelf product, to the authors' knowledge, capable of obtaining in situ wind measurements on a high-altitude balloon or other similar floating platform in the stratosphere". Clearly, the latter statement appears to be not accurate, as later on in the text the authors cite an article by Maruca et al. (appeared in AMT in 2017 : https://amt.copernicus.org/articles/10/1595/2017/) describing an experiment in which an off-the-shelf anemometer with minimal modifications was employed to perform three-dimensional velocity

measurements of the wind in the stratosphere, with a sampling rate of 200Hz. The run performed by Maruca et al. produced data used to conduct a spectral analysis of the stratospheric wind, presented in the same AMT article. Previously, Banfield et al. developed and tested a homemade acoustic anemometer which operated up to an altitude of 33km, returning as well high resolution wind velocity measurements. In my opinion, the outcome of these 2016 and 2017 articles allows to say that operating a sonic anemometer in the stratosphere is by itself no news, which is the major problem I have with the present manuscript.

Response-1:

Thank you very much for your suggestions. The claim here is indeed inappropriate. What we want to clarify is that no off-the-shelf equipment can be used directly on our balloon, which is flying at an altitude of about 25km. We will modify the claim according to your suggestions as follows.

"Developing this anemometer was necessary, as there is no existing commercial off-the-shelf product, to the authors' knowledge, capable of obtaining in situ wind measurements on a high-altitude balloon we used in SENSOR campaign, which is floating at an altitude of about 25km".

Indeed, main conclusions here are that the acoustic anemometer developed by the authors "obtained continuous wind velocity data at the floating altitudes of 24-25km" and "...preliminary spectral analysis demonstrate that the acoustic anemometer employed in this study can sense rapid changes in wind and is useful for researching small-scale wind fluctuations in the stratosphere", indeed similarly to what was done by Maruca et al. in 2017.

Response-2:

Thank you for your comment. To ensure that the anemometer can function properly at the floating altitude (~25km) of our balloon, we had taken further improvements based on drawing experiences from their work. Different from theirs, we choosed transducers at lower resonant frequency according to the analysis of acoustic signal propagation attenuation in the atmosphere, and designed an Automatic Gain Control (AGC) circuit to adjust received signal gain levels with altitude range. As a result of these efforts, we obtained measurements during float flight. For data analysis, Maruca et al. (2017) presented spectra of data during ascent, which were in the Euler frame of reference. And what we had done was to evaluate the Lagrangian spectrum slope with frequency in the inertial subrange using measurements during float flight of a high-alitude balloon. These aspects are different from what was done by Maruca et al. in 2017, and are also the major contributions of our work.

I consider very valuable the efforts made by the authors to develop a new acoustic instrument able to perform velocity wind measurements in the stratosphere, I really think this is needed and I strongly encourage them to pursue with further developments of their instrument. However, in order for a probe to be worthy of becoming the subject of a scientific article, such instrument should either make it possible sets of observations which were not possible in before, or the measurements collected in runs of the newly developed probe must be used to produce original analyses and results. The latter should address one or more science cases that need do be described and thoroughly discussed in the draft proposed for publication. For these reasons, I cannot suggest the present manuscript for the publication in AMT.

Response-3:

Thank you very much for your appreciation and encouragement of our work. Our article mainly focused on the development of an acoustic anemometer for the SENSOR campaign and the demonstration of measurements obtained from the flight experiment. As discussed in Response-2, to our knowledge, the efforts we had taken to accommodate our acoustic anemometer to the high-altitude atmosphere and the analysis of the Lagrangian spectra in the inertial subrange using measurements during float flight of a high-alitude balloon have not been reported before.

We have expanded and re-combed the part of spectral analysis in the revised manuscript. We appreciate your suggestions to show more science cases in the manuscript. These work are indeed in process and will be presented in another article because they are considered to deviate from the topic of this paper.