

Interactive comment on “The CopterSonde: An Insight into the Development of a Smart UAS for Atmospheric Boundary Layer Research” by Antonio R. Segales et al.

Anonymous Referee #1

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General comments:

The manuscript describes the development and application of the CopterSonde as a novel and cost-efficient unmanned system for atmospheric boundary layer research. It is in general well written and provides thorough overview on the technical solution, as well as glimpse on the potential of the system by shortly presenting two case studies. The topic and the overall presentation are well suited for AMT, I have, however identified a few shortcomings that have to be addressed before publishing.

The first paragraph of the introduction is in my opinion rather thin and should be deepened and extended, last but not least, also with a few references. As it stands now

C1

it provides a bit of everything but appears as rather unstructured and low in content. Here the meteorology guys in the group should be able to give some more substantial input. Also the terminology used is in some occasions rather unspecific/unusual (e.g. “numerical modeling simulations”)

From a language/grammar point of view, I suggest a thorough overhaul with respect to the use (or mostly non-use) of commas. I feel that there are a lot missing, but I am for sure not the right person to put them all in correctly! But it will improve the readability of numerous passages with rather lengthy sentences considerably.

My main point to address is a certain inconsistency in the description and use of the apparently two different wind speed determination modes, either using the wind vane mode, or not. The description of the wind vane mode and the estimation of the horizontal wind are at the moment not well linked in the manuscript. The wind estimation should be in general much better when performed using the wind vane mode. From the description given, it is not clear if you normally support your wind estimation by the wind vane mode. The description of the wind vane mode in lines 119-123 gives the impression that the wind vane mode is only motivated by the goal of optimizing the flow onto the thermodynamic sensors. But in line 138-139 you outline the motivation for the wind estimation, this should also be mentioned before.

The description of the wind vane mode algorithm in section 2.3 becomes very technical. In my eyes it could in addition also be illustrated/described in a more descriptive way as: the magnitude of the roll angle of the CopterSonde is minimized or kept around zero by changing the yaw angle of the vehicle. To assure head wind the yaw is changed in the direction that the pitch is minimized (negative pitch, nose downward).

In summary I highly suggest the manuscript for publication in AMT, after the authors have incorporated my comments.

Specific comments:

C2

Abstract line 13: I suggest to replace “to have” by “to offer” or “to provide”

Line 27: I suggest not to introduce another abbreviation in the UAS/UAV/RPAS/drone world; let's keep it “unmanned aerial system”

Figure 1: I suggest to split this figure into two; The Coptersonde deserves one solo picture here in the beginning, maybe something also visually indicating its size; the picture in flight side by side with the mast would fit perfectly where you describe your comparison/calibration procedures.

Line 43: replace “in the flight site” by “at the flight site”

Figure 2: should appear bigger in the final manuscript

Line 128: typo in “achieve”

Line 139: add “an” before “additional”

Table 2: the footnotes indicate that the accuracy depends on temperature, but not the response time; I am rather sure that, in particular the response time of the humidity sensor is strongly dependent on temperature!

Figure 5: should appear bigger in the final manuscript

Line 217: replace “sun radiation” by “solar radiation”

Figure 8: hard to read; use the whole page width!

Line 240: “horizontal wind field” should be replaced by “horizontal wind vector”. A field consists of several vectors at different locations observed at the same time. The CopterSonde observes a 2D wind vector along a trajectory, one point at a time.

Line 245(Equation 3): Equation 3 can be simplified when applying the wind vane mode and assuming $\phi=0$.

Line 254 (Equation 5): The equation is becoming problematic for asymmetric airframes. A_{proj} and c_d are very likely to be different for head wind and cross wind. This is

C3

where the wind vane mode becomes important, since the cross wind direction can be neglected and the calibration effort becomes much smaller. This also links to my general comments.

Line 266: “several different days” is a bit confusing; either “several” or “different” alone should be enough; if you use different, you might indicate how many

Line 290: a bit philosophical question, but it is “automatic” or “autonomous” landing? In my opinion it is the first!

Line 290/291: you state you need good GPS for a precise landing; what about the lidar range finder and the IR precision landing camera you have introduced in the beginning?

Line 321: remove “the” after “To date, “

Line 321: replace “have been deployed” by “has been deployed”

Figure 9: should appear bigger in the final manuscript; in particular the labels have to be increased

Figure 10: the units in the caption are not necessary but changing C to degC ($^{\circ}\text{C}$) in c) and f) would look better.

Line 362: has KAEFS been introduced/defined before?

Line 376: replace “during which it time it has” by “during which time it has”

References:

Partially incomplete, in particular volume, issue, page numbering (e.g. Bonin et al. 2015)

Journal names abbreviated (e.g. Brock et al., 1995; McPherson et al. 2005/non-abbreviated