

# ***Interactive comment on “Bathymetry observations of inland water bodies using a tethered single-beam sonar controlled by an Unmanned Aerial Vehicle” by Filippo Bandini et al.***

## **Anonymous Referee #2**

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This manuscript presents an innovative approach to the measurement of bathymetry in water bodies using a UAV equipped with a tethered sonar. While the use of ROVs (such as remote control boats) have been used to conduct bathymetry surveys, this is the first time I have seen a UAV used for this approach. This idea to use unmanned vehicles for bathymetry mapping is a simple one, but as shown in this paper, an involved process. The authors describe the method adequately (although sometimes very brief), and use two case studies to showcase the results of their work; the results are very encouraging. The method described here is a valuable contribution to the field, as the accuracy of computer models will certainly benefit from the inclusion of the high-resolution bathymetry data provided by using the UAV. I outline my suggestions to

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the authors for improvement below.

#### General Comments:

1) The paper needs to be proof read thoroughly for English. There are instances of very long sentences (especially in the Methods section), which make it very difficult to grasp exactly what the authors are trying to convey without re-reading them several times. The paper will read a lot better after having been edited for the English.

2) The figures in text are useful, however I find that they are overall too small, and have text in them that is hard to read. I suggest that the authors make some of the figures larger (e.g, Figs 1, 2, 5, 6, 7, 9), and the text labels on axes etc in all the figures should be larger.

3) For Figures 6,7,9: The water depth colour scale is very hard to see, as the dots are very small. Also, the intervals of depth are not consistent intervals. I think that for 6, for example, it would be better to depict this as depth between 0-36 m at consistent intervals of 3m (0-3, 3.01-6, etc). For Figure 7, The difference would also be easier to understand if the intervals were of consistent length.

4) The figure captions are sometimes lacking. I suggest that the authors make sure that everything that is shown in figures, including abbreviations and locations, are adequately described in the captions without the reader having to refer back to the text.

5) Most abbreviations used after the intro are defined the wrong way around. E.g., pg 6, line 10: Wsen and Hsens, should be referred to as: "Sensor width and height, denoted Wsens and Hsens, respectively..." or something similar. Also, object distance (OD) is nowhere defined in text. Please make sure that all abbreviations are spelled out in full and then abbreviated in ().

#### Specific comments:

6) pg 2, line 21: who is the manufacturer of the bathymetric depth finder mentioned?

7) A quick google search tells me that the model of sonar used in this study is the: Deeper Smart Sensor PRO+ (Deeper, UAB, Vilnius, Lithuania). Please make sure that the model numbers/names for all equipment mentioned in the manuscript are correct and that the manufacturer and their location is in text. This is generally quoted in text as I done in the first line of this specific comment.

8) The methods section would read better if it were restructured. Describing the UAV set up first would make more sense, followed by the sonar instrument used. I found myself wanting more details about the sonar unit (like depth it can measure to) in 2.1, to find that it had been put in 2.3 instead. I would suggest putting 2.2 first, and then combining sections 2.1 and 2.3 and have them follow the section on the UAV.

9) General comment: is it a coastline or shore? These are rivers/lakes are they not? To avoid confusion I would refer to it as the shore. Coastline refers to something next to an ocean or sea.

10) Fig 3, there is some overlap between the axis and the label z. OD is over the line, should be to the side.

11) Hsens isn't described in the caption. FOV (degree) label is cut off.

12) pg 6, lines 10-21: Please define the equation elements more clearly, rather than just mentioning what is in the equation. The sentence lines 13-16 is particularly confusing to follow. Perhaps having the equations in line in text after they are first mentioned would be an easier way to understand and explain what is going on, without having to refer to the table.

13) pg 8, line 3: please refer to equations 8 and 9 in text here.

14) how long does it take to do all of the data processing? There are a lot of steps, but an indication of how long it takes to do the data processing would be a useful. Are these scripted codes? Done manually?

15) Fig 8/pg 11, line 12: "underestimation" - are the sonars underestimating or over-

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estimating the depth?? The points sit above the line, so they look to me that they are slightly overestimating not underestimating as you say in text. You mention later in text that the sonar systematically overestimates water depth in the channel (pg 13, line 15).

16) Table 3: I suggest the authors swap the rows and columns around. So that the data for sample size, RMSE, etc, reads down the column rather than across. This will also help with the formatting of the long names of the comparisons shown; wider first column, and narrower columns for statistics.

17) Fig 10 caption: I am assuming that x is the position along the transect, but in which direction with respect to the Lat/Long quoted?

18) Table 4, LIDAR, column 3: "few dm", is this supposed to be cm?

19) What happens if an operator can't wade into a river to get ground truth measurements?

20) Table B1: What currency are the costs quoted in? Also on pg 2, line 37.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2017-625>, 2017.

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