

Article title: The importance of sound velocity determination for bathymetric survey

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Dear Editor,

I would like to submit the revised version of the manuscript entitled "***The importance of sound velocity determination for bathymetric survey***" by Pier Paolo Amoroso and Claudio Parente. All the differences between the first uploaded version of the paper and this version are shown, highlighting them in yellow.

The article has been revised according to the indications provided by the reviewers. Particularly, we report below our responses point to point to reviewers.

Reviewer E:

The paper presents a study upon the influence of several parameters such as: temperature, pressure, salinity and water depth on the speed of sound in water, a quantity based on which the depth of water is determined using sonar. I would like to make the following remarks:

- The analysis was made only on the basis of statistical parameters of speeds calculated indirectly on the basis of 3 established formulas.

However, the calculations did not take into account the errors of the instrument with which the parameters P, T, S and D were measured, but only some systematic errors were simulated. These errors of the measuring instrument could decisively influence the values of the statistical parameters. I would suggest to specify in the paper the metrological performances of the measuring instrument and to make an analysis of their influence on the results.

Thanks for your precious suggestions. We have introduced the metrological performance of the measuring instruments in the subchapter 3.1, distinguishing between direct and indirect measurement. The accuracy values are deducted from the technical specification document of the probe. Comparison between the instrument declared performances and adopted systematic errors for Pressure, Temperature and Salinity are reported in subchapter 3.2. Particularly, errors are worse than the accuracy values of the probe, so to simulate a combination of unfavorable environmental situations and poorly accurate measurement operations.

- The work should be completed with a practical conclusion, namely to specify which method would be more efficient to apply and under what conditions to obtain optimal results for calculating the speed of sound in water.

Thank for your consideration that has permitted as to introduces different phrases in the last part of conclusion so to better explain our purposes. In fact, our experiments do not permit to evaluate the best method for indirect measurement of sound velocity in water: the paper aims to highlight the impact of

inaccurate determination of Pressure, Temperature and Salinity. For consequence we have remarked that extremely precise probes for direct measurement now available are to prefer to improve the depth determination: removing measurement of P, T and S three possible sources of errors are cut out. However direct measurement of velocity is also affected by errors but their values are less than those derived by indirect measurement.

- Use the same unit for pressure throughout the paper.

Done. Bar is preferred as the same unit for pressure throughout the paper.

- A tolerable unit of pressure is kilogram-force / cm² (kgf / cm²) and not kg / cm². However, using SI units is indicated.

Done. Bar is used in every case, so kg / cm² is now not present in the paper.

- In table 3, the values of the depths at which the determinations were made should be added on a column.

Done. The column has been added to the table 3.

Reviewer F:

The article is interesting and in general well structured, just a few considerations:

1) In the abstract what exactly did you mean when you said: "The injection of errors"? It is not clear, maybe you could rephrase it.

Done. Injection of errors can be inappropriate or not clear, so we have substituted it with "introduction of errors".

2) At the bottom of page 1, when you say: "For a correct functioning of the echo sounder, it is very important to accurately determine the sound velocity in water [7]. I would add a mention of the importance of determining the position and attitude of the vessel in real time.

Thanks for this consideration. We have mentioned also the accurate position and attitude determination as requirements to reach adequate quality standards in bathymetric survey (pagg.1-2).

3) Maybe what I'm about to say is redundant, but when you say: "Once it reaches the bottom, the signal goes back to the transducer. "I would specify that it is the bottom of the sea: at first reading it is not very clear.

Done. We have specified "sea bottom".

4) Is there a specific reason why temperature, pressure and salinity are often written with a capital letter?

We prefer to indicate them with capital letter to remark the role of chemical - physical parameters of sea water, according with usual practice in literature.

5) are you sure that "impeccably" is the right adjective here?

Thanks for your remark. The adverb is inappropriate, so we have substituted it with accurately.

6) when you write "depth" did you mean depht?

It is a typing error; we have corrected it using "depth".

7) on page 4 and following I wonder if it makes sense to report velocities estimated with millimetre accuracy?

Velocities estimated with millimetre accuracy are necessary to remark the differences between the results obtained from the used formulas.

We want to thank the editor and the reviewers for their useful suggestions and constructive comments for improving the quality of this article.

Best Regards,

Claudio Parente and Pier Paolo Amoroso