Ocean Sci. Discuss., 8, C668–C671, 2011
www.ocean-sci-discuss.net/8/C668/2011/
© Author(s) 2011. This work is distributed under
the Creative Commons Attribute 3.0 License.

Ocean Science Discussions



# *Interactive comment on* "A computational method for determining XBT depths" *by* J. Stark et al.

**J. Stark et al.**

jpabraham@stthomas.edu

Received and published: 23 September 2011

Response to Review 2

We are grateful for the detailed responses from referee # 2. We believe that we can adequately respond to all of items in the critique and we are hopeful that the revised manuscript will be improved. We begin by making the point that we believe this method is unique; to our best knowledge, no one has used CFD to calculate drag coefficients with high precision. Furthermore, no one has used local temperature information to re-create fall information as we have done in this paper. We believe that this introduction of the method is significant for the field of oceanographic measuring. There certainly is more to do in the future and we are working on expanding our technique to other probes and to begin the process of re-evaluating historical archives.

1. The referee makes the point that while this is a new method and the analysis is



Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

sound, it remains to be seen how this information is useful since the results are similar to manufacturer FREs. There are a number of reasons why this information is useful. First, the model presented here allows a user to input various operating parameters such as launch height, initial probe weight, etc. In addition, out method allows a calculation of the probe depth independent of local water temperatures. For instance, if a FRE has been obtained in tropical-water experiments, it is not certain that the FRE will be valid in cooler waters, where the viscosity differs. Similarly, if other conditions such as drop height change in an experiment, the FRE may no longer be valid.

This new method allows the initial conditions to be input into the computer program by the user. This feature, in itself, is an advancement over the current state-of-the art. In addition, our method uses the temperatures gathered by the probe as it falls through the water to calculate the local viscosity. Therefore, our method would be very useful for XBT experiments in cooler waters.

2. The Mediterranean experiments were used to test the model to show that we can predict depths that are in close agreement with the FRE. Our method is capable of recalculating depth from any past XBT experiment and this experiment was chosen for convenience. It is possible to compare our method to a simultaneous CTD experiment. Such comparisons are done in a revised version of the manuscript and new figures will be added that show the comparisons. These figures show independent XBT-CTD comparisons and reinforce the quality of the temperature results which are obtained using our method. These comparisons also demonstrate that our method can be used to re-evaluate XBT results from past experiments.

3. T5 devices were initially chosen for convenience because devices were available to construct them from physical measurements. Since this paper's primary purpose was to show the general technique, the T5 device was considered sufficient for that purpose. We recognize that the majority of XBT devices are in the T4 /T7/DB family and we are working to reproduce this work for those devices. The end goal of the project is to develop this method for all XBT classes.



OSD

8, C668–C671, 2011



CC BY

4. The model can account for probe properties such as shape of the device and fins, number of fins, mass of the probe, mass of the wire, linear mass density of the wire, wire diameter, drop height, water temperatures. One useful outcome of the model is that the sensitivity of the fall rate from these parameters can be determined.

5. It is true that other factors such as height, angle, local water conditions, initial probe weight, changes in shape, etc. can impact the fall rate. Our method, as outlined in the dynamic model can account for some of these parameters such as: initial probe mass, mass per unit length of the wire, drop height, and local water temperature. It is not possible to account for angle with our method. We have added a statement in the paper regarding the ability of the model to account for some operating parameters (listed here). In fact, the method allows a user to perform a sensitivity study to evaluate the impact of these parameters on the probe depth.

6. Our method is not meant to account for a bias in the thermistor, which is an uncertainty that differs from depth uncertainties. Such biases may be based on the initial temperature of the thermistor, the recording systems, or other factors. Our method is also not able to deal with biases in the recording system. However, our method is able to account for drop height, initial mass, local water temperature, and linear mass-density of the wire.

7. A new figure is added which shows the differences between the FRE and our new results in meters (in addition to a percentage deviation). This new figure is Fig. 7 in the revised manuscript.

8. It is premature to use this method to recalculate ocean heat content. The purpose of the study is to improve the accuracy of XBT data so that in the future, a better understanding of ocean heating will be possible. In particular, this method potentially allows improvements in our estimate of fall rates in geographical regions where no XBT/CTD experiments have been performed.

9. The wire is unspooled as the device falls through the ocean and it is believed that



OSD

8, C668–C671, 2011





the wire does not pull on the device.

10. This is a good suggested, the Introduction has been changed accordingly.

11. The referee is correct that XBT are not the oldest devices. However, the sentence stated that “Among these devices. . .” What we intended to say was that among the devices listed in the prior sentence, XBTs were the oldest. We can see how this might be misinterpreted and we’ve reworded the offending sentence.

12. Sea density was not treated as a constant. We accounted for changes in the water density with temperature. To clarify this, we have added a sentence in the revised manuscript.

13. One of the advantages of the method is that it can be run with a simple spreadsheet program. We certainly will make it available to any interested parties. It can easily be sent by email. The only thing that a researcher has to enter is the time/temperature information from an XBT experiment and the initial conditions of the test.

---

Interactive comment on Ocean Sci. Discuss., 8, 1777, 2011.