

Interactive comment on “A computational method for determining XBT depths” by J. Stark et al.

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This article presents a novel method to improve the accuracy of depth calculations for XBT devices. The method differs from the traditional approach of correlating depth with time through a fall rate equation (FRE) and it has a unique advantage because the new method allows depth to be determined for ocean conditions that differ from those of the FRE. The authors compare their model with a T5 drop and they show that the results are in very good agreement. The authors use a newly developed transitional model to account for the transition between laminar and turbulent flow in the boundary layer. I expect that with this new information, the authors will be able to investigate the XBT archive and possibly improve ocean heat content measurements for past measurements. Such an improvement would be of great benefit to the oceanographic community.

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There are no major deficiencies in the paper however the following comments are made to deal with minor corrections or request for clarifications.

Comment 1: On Page 2, line 13, replace “fluid patterns”, with “fluid flow patterns”
Comment 2: On page 4, line 7, insert “estimation” right after the phrase “on ocean heat content” to read as “on ocean heat content estimation”.
Comment 3: In equation 1, there is a “t” missing in the momentum derivative. . .the denominator should read as dt and not d.
Comment 4: Just following Equation 1, the authors should state that, “The buoyant force is equal to the difference BETWEEN the probe weight. . .”
Comment 5: Remove “Reold” from equation 7 for clarity purposes replace with: $C_d = \text{function}(\text{Re}) = \text{function}(T, V, \mu)$, computed at the previous time step value.
Comment 6: The Transitional model equation is right. However, on page 9, Line item 17, the authors may need to add reference material to the term “turbulent adjunct function”
Comment 7: On Page 10, line item 11, remove the “a” before “constant”.
Comment 8: On Page 10, line item 12, insert “(Table 3)” as a reference, right after 0.342 m.
Comment 9: On page 12, line item 3, remove “using” and replace with “used”.
Comment 10: Page 21, Fig. 2. Title Needs to read as follows: “Fig. 2. Velocity Contours (a) at the leading edge and (b) in the aft region of the probe.”
Comment 11: On page 22 Fig. 3. Remove “image from title”; Title needs to read as follows: “Fig. 3. Velocity streamlines (a) near probe inlet and (b) in the probe interior.”
Comment 13: On Page 23, replace “coefficients” with “coefficient results”
Comment 14: Fig. 6. X coordinate Label should be Depth (m) instead of Time (s).
Comment 15: On page 25, the figure title should read as: “Fig. 6. Percent deviation of present results from the manufacturer supplied FRE predictions.”
Comment 16: on page 26, the title for Fig. 7 should read as: “Fig. 7. Comparison of present depth-temperature results with current manufacturer FRE.”
Comment 17: The authors acknowledge that in reality, these devices rotate during descent. How would the rotation affect the drag coefficient with Reynolds number? It is likely to make the dependency slightly smaller. Perhaps this should be mentioned.
Comment 18: The authors mention that their solution was independent of mesh size but they do not quantify their mesh-independency study. How many elements were used in the

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coarsening? What criterion was used to determine independency? What variation of this quantity was observed? Comment 19: Was the full XBT probe modeled or was any symmetry used? If so how many degrees? Comment 20: Literature summary was very good. Comment 21: On page 12, lines 25-26, the authors reiterate that the experiment was from a single T5 drop in the Mediterranean. This same information was given at the top of page 12. This level of redundancy is not needed and the second reference should be omitted.

Comment 22: The authors used an explicit time-stepping scheme in Eq. (6). They should make a comment about stability and whether a time-step independency of the results was established. Time step used?

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