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Discussions

Interactive comment on "A wavefront orientation method for precise numerical determination of tsunami travel time" *by* I. V. Fine and R. E. Thomson

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General comments

This paper describes a method to improve the accuracy and efficiency on computing the Tsunami Travel Time of oceanic wide tsunamis. The comparison of the new method's results is done both against a synthetic case of an ocean with 4000 m constant depth and the outputs of a known code in the field, the TTT SDK by GEOWARE. Although the maximum differences in travel time between the two methods range from < 0.5 % to ~ 1 %, the proposed method has the merits of both efficiency and another

one in terms of accuracy that is not explored in the text (see 'Final comment').

Specific comments

1. At the introduction, line 5 page 898, it is made a reference to the "pattern of neighbouring points" but the explanation what this concept of 'pattern' has not been introduced yet and the reader gets lost. The concept must be explained before its usage.

2. First paragraph of section 2.1 (pages 898-899), describes the so called "conventional method" with the help a figure (Figure 1) and say that "the program computes the travel time for points 1 to 3, and points 20 to 32". I don't understand this statement. As I understand the TTT functioning, all travel paths displayed by node connected lines in Figure 1 are computed. One other important point that lacks in the explanation is how the travel times are actually computed. It is necessary to explain how the velocity varies along the path. The TTT algorithm interpolates the velocity linearly between its end values. Furthermore, it also takes into account the variation of the gravity acceleration (g) in function of latitude.

3. Lines 5-7, page 899, discuss the errors in the conventional method due to the fact that not all propagation paths are considered. A pictorial example of such cases would help the reader a lot. I can only imagine that those are points beyond those of the N = 32 pattern displayed in Fig 1, since the other non-visited points will be when the current source node moves into another position. In this regard, I do not understand the statement (lines 9-10, page 899) of the big gaps being along the grid axes. That is true when the source node is at O, but the next to right B1 will be visited when the source node is at that position.

4. Lines 15 herein until the end of 2.1 section discuss how directional errors can be estimated analytically. Again, if I did not know what is being discussed I think I would have difficulties in understanding the point. All would be much clearer with and helping little figure.

Final comment

As I mentioned in the introductory note, the proposed method has a good pro point that has not been explored by the authors and which is related to the approximation that the TTT type codes do regarding the velocity variation along the travel path. As referred, TTT does linear interpolation between the velocities and the end nodes. But this does not take into account how velocity actually varies along the path. Longer the path (higher N's pattern, ironically where method's geometrical accuracy is better), cruder the approximation. The authors could not 'capture' this effect because their analytical solution used a very simplified constant depth ocean and therefore of constant velocity. By not extending more than one grid node distance for each propagation time step, the problem of the true velocity variation does not come into play. This, I believe, probably worth's more than the efficiency gain and the small gain of 2.4 min shown for the comparison P64-F8 case in Table 4.

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