Reviews of Manuscript No.: nhess-2013-193

Title: Modelling of tsunami wave run-up, breaking and impact on vertical wall by SPH method

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Responses to reviewer comments of nhessd-1-C736-2013-supplement

Dear reviewer,

Thank you very much for commenting on our work. We would like to discuss on the issues raised by the reviewer in the paragraphs right below each question. Suitable changes will be incorporated to the revised manuscript and are indicated in the answers.

Minor Points:

1. In the abstract the Authors write “the enhanced Smoothed Particle Hydrodynamics...”. Since the term “enhanced” is a bit too generic at this stage, I think it is preferable to write “an enhanced Smoothed Particle Hydrodynamics...” or to add a citation (or a brief description) of such an enhanced SPH solver.

   Answer: As the details of enhancement development were published in other publications of ours, we put reference links to them instead of including in the manuscript. We will put references in the abstract.

2. Introduction, page 3. The Authors state “The original SPH methods, although satisfying the mass conservation, still have zero order in the kernel approximation which sometimes leads to significant dissipation of momentum”. I do not agree with this statement. In absence of solid walls, the standard SPH scheme (without any artificial viscosity) conserves both mass and linear/angular momenta exactly. The zero-consistency of the kernel approximation does not affect these conservation properties. Then, the spurious dissipation in momenta described by the Authors can be only caused by the presence of solid walls and by the way in which the solid wall conditions are enforced. I would like a comment on this topic in the manuscript.

   Answer: We observed significant reduction in wave height as wave propagates. With correction of kernel, the result is much improved. We will look into this issue. As for the manuscript, a statement "...which sometimes leads to significant reduction of wave height" would be more appropriate.

3. Introduction, page 3. The enhanced SPH scheme used by the Authors implements specific corrections to improve the accuracy of the SPH differential operators. Similar kind of corrections are also used in other SPH schemes but they generally lead to the loss of the conservation properties I listed in the previous point. Could the Authors clarify this point? Does the enhanced SPH method preserve mass and linear/angular momenta exactly, like the standard SPH scheme?

   Answer: With corrections, the original conservation of momentum of standard SPH will be lost. In most of practical SPH simulations, either corrections or some dissipation terms are introduced. These will lead to loss of momentum conservation but improve the final results.

4. Section 2.2. Since the manuscript focuses on the SPH method, the Authors should provide details of the enhanced SPH scheme they adopt (or, at least, a brief description). Indeed, the presentation given in Section 2.2 just describes the standard SPH scheme.

   Answer: In the manuscript, we have references to the original publications where the enhancements were presented. We can also bring them into the revised manuscripts. However, the focus of this manuscript is the comparison between methods and experiments thus we prefer not to include the enhancement details.

5. Section 2.2, formula (6). May be I am wrong, but the kernel provided in this formula is known in the SPH community as Wendland kernel rather than Quintic kernel.

Answer: Wendland kernel is a quintic kernel. It is also referred to as "Wendland Quintic kernel".

6. Section 2.2. In this section the Authors should provide some details on the adopted numerical sound speed, on the integration time stepping, on the method used for the modeling of the solid walls and on the algorithm used to implement the solid boundary conditions.

   Answer: We will provide them in the revised manuscript or provide reference to our original papers. The same will be done for Tunami-N2 model.

7. Section 3.1. The Authors should specify the positions of the gages (these are not so clear in figure 1).

   Answer: We will provide these information in the text in the revised manuscript.

8. Figures 8 and 10 show the occurrence of large fragmentation of the free surface after the breaking events. Since the standard SPH is generally not affected by this issue, such a fragmentation is probably due to the use of the corrections for the SPH differential operators. The Authors should clarify and comment of this topic.

   Answer: This fragmentation of free surface after wave breaking appears in standard SPH too. That is mainly due to lake of air resistance in the single-phase simulation and incomplete kernel operation at free surface. Inappropriate treatment of kernel summation at free surface in single-phase simulation would further worsen the fragmentation. We will comment on this observation in the revised manuscript.