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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Simulating tsunami propagation in fjords with long wave models" *by* F. Løvholt et al.

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The paper by Løvholt et al. faces a very interesting problem in tsunami research, i.e. the simulation of the propagation and impact of subaerial landslide generated tsunami in fjords, which represent very peculiar environments posing relevant challenges to tsunami modellers. The study has the merit of taking experimental data, collected by means of a 1:500 scale model of a portion of Storfjorden in western Norway, as a starting point. The authors clarify that the primary goal of their study is not to use experimental data as benchmark, but rather to use it to build suitable initial conditions for different tsunami simulation codes. The paper aims at studying numerically the effect of non-linearity, dispersion and alongshore inundation on wave propagation and run-up

for the short-frequency and high-amplitude waves produced by subaerial landslides in fjords, as well as to investigate the grid resolution needed to reproduce similar waves. The simulation codes used in the paper are Coulwave, GloBouss and MOST. Coulwave is used mainly in its finite-volume formulation. No turbulence or rotational effects are taken into account. In particular cases, a NLSW version with finite-difference formulation is used. GloBouss is used by itself to study wave propagation and coupled with MOST to study inundation and run-up. The main conclusions of the paper might be summarized as follows: - The leading wave is moderately influenced by non-linearity and dispersion and it is hence well described by the non-linear shallow water model - For the trailing waves, dispersion and dissipation from the alongshore inundation of the travelling waves become more important. - Inundation influences the alongshore propagation, although the effect is not very strong (stronger for the trailing waves than for the leading wave) - Run-up simulations in Hellesylt are in good agreement with measurements - Run-up simulations in Geiranger are less satisfactory and the matching with measurements is worse

The paper is interesting and surely deserves publication. But there are some general points that should be made clearer. The selection of the numerical codes is one of these points. It is straightforward that the choice of GloBouss and Coulwave comes from the contribution of the authors in the development of those codes themselves. But, could it have been possible to take into account other codes implementing the same, or similar, equations/formulations? The reader cannot avoid the question: may the application of other codes allow getting through the limitations shown by GloBouss and Coulwave in their application to the specific environments studied here? The way in which initial conditions are constructed and "feeded" in the different numerical runs is not immediate to understand. I invite the authors to be a little more detailed. Since the core of the paper is the presentation of results obtained by running different codes in different modes with different inputs and with different grid resolutions, at some point in the paper (I suggest at the end of Section 2) a table summarizing and putting into relation all this information would be extremely useful for the reader. The final

feeling is that the authors do not completely tell the lesson learned. We understand that “our present ability to accurately model the wave train from tsunamis propagating in fjords is somewhat limited”. In which directions should we move to overcome these limits? Better experiments? Better equations? Better simulation codes? Moreover, how does these limitations affect our ability to assess the tsunami hazard in peculiar environments like fjords? The authors are invited to spend some words on the above topics at least in the “Conclusions” section. I attach an annotated version of the paper with a number of corrections and suggestions. In particular, regarding figures I strongly recommend that they are made more readable, especially as regards axes labels and legends.

Please also note the supplement to this comment:
http://www.nat-hazards-earth-syst-sci-discuss.net/2/C3205/2015/nhessd-2-C3205-2015-supplement.pdf

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