Nat. Hazards Earth Syst. Sci. Discuss., 3, C445–C447, 2015
www.nat-hazards-earth-syst-sci-discuss.net/3/C445/2015/

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Source of the 6 February 2013 M_w 8.0 Santa Cruz Islands Tsunami" *by* F. Romano et al.

Anonymous Referee #1

Received and published: 14 April 2015

Manuscript of Romano et al. addresses the source model of the Santa Cruz island M80 earthquake as revealed by inversion of 5 DART and 3 local tide gauge sea-level records. The manuscript has a very clear structure: Authors start by presenting observation data; continue by describing their rupture- and tsunami- forward modeling approaches; then – inversion scheme; checkerboard resolution test; resulting slip distribution with some rupture kinematics; and, finally, discussion regarding complex oblique tectonic regime as well as differences to the previous source models.

The Manuscript is written in a very professional way – clear, concise, well illustrated. A good example of scientific paper writing.

I have only few suggestions to the text and illustrations:

- Page 1952, Line 4-5: try to re-write this sentence, because it is not clear what means "... events ... not dislocated ...". 'Dislocated' relative to what? I assume Authors mean aftershocks taking place exactly at the subduction plate interface, not deeper and not shallower. Along the plate interface, aftershocks can be of course 'dislocated' relative to the main shock or to each other.

-Page 1956, last sentence: please re-write this sentence, now it reads just like a real mess.

-Figure 6: I suggest to place graph labels (a)-(e) out of each panel or, at least, make them more visible (increase font size, use bold). It is hard to find them on the Figure.

- Same Figure: 'black star' mentioned in figure caption is missing on panel (d).

At the same time, I have two major comments/suggestions which may require moderate revision of the Manuscript.

(1) Authors apply the linear concept of Green's functions to model (and to invert) tsunami waveforms at 3 tide gauges located at a very shallow depth. Strictly speaking, linear long-wave approximation is not valid any more in the vicinity of tide gauges, together with the whole Green's functions concept. In their previous publication, Piatanesi and Lorito (2007) suggested considering Green's functions as an attempt to linearise the non-linear problem around some most representative slip value at the patches. Anyway, applicability of the Green's functions concept is to be proved numerically. Such a test is, to my understanding, not less important than the checkerboard resolution test. To do that, I suggest Authors to compare synthetic waveforms for the two 'predicted' models: (i) model which is a superposition of the pre-computed Green's functions (I assume that is exactly the model which they call 'Predicted' on Figure 5), against (ii) model computed 'from-the-scratch' using their best-fit source, without any Green's functions, just in one single Neowave run. Differences between waveforms at tide gauges should then prove (or disprove) applicability of the Green's functions concept for source inversion at coastal tide gauges. I think this is a very important point

and I suggest Authors to make this numerical exercise.

(2) How important is rupture kinematics for the final model? Authors employ radial rupture propagation with 1.5 km/s and note that the main seismic moment in their model was released between 15 and 45 seconds origin time. This 'less-than-one-minute' timing is, for sure, important for teleseismic inversions, but does it has any sense for tsunami generation and propagation? Would the predicted waveforms at buyos and tide gauges be changed if we assume an instant sea-floor deformation? If not, maybe we should try to keep the model as simple as possible?

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 1949, 2015.