Solid Earth Discuss.,
https://doi.org/10.5194/se-2019-11-RC2, 2019

Solid Earth
Discussions
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Interactive comment on "Improving subduction interface implementation in dynamic numerical models" *by* Dan Sandiford and Louis Moresi

Anonymous Referee #2

Received and published: 13 March 2019

This paper explores different parameterizations of a weak layer that is used to model one-sided subduction. It particularly explores the controls on the width of this weak layer and finds that, within the context of the models presented, there is a preferential width. In general I think this is a nice, albeit technical, contribution to the literature describing fully dynamical modeling of subduction zones. I have a few somewhat broader comments and a fair bit of more detailed comments.

Section 2 contains a fair bit of information that was already mentioned in the introduction or other superfluous. A bit of careful editing can shorten this section and make it clearer.

The citations in the text don't seem to follow any chronological or alphabetical order (see example in P4.l9-l11).

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Discussion paper

The weak fault seems rather wide (10 km as mentioned on page 7). If you have a 2 km grid resolution then that it is probably a good idea to smear it out over such a distance but what are your thoughts about FEM grid refinement around this fault to be able to bring it to more realistic thicknesses?

I wonder if the improvements you find when choosing the initial and maximum width of the weak zone to be 20 km is just a matter of the numerical resolution (mesh and #particles) that you use. Maybe you need at least 10 elements in this zone for things to stabilize. You mention that a lot of small wavelength variations disappear compared to using 10 km. This might be a symptom of discretization issues. It would be very helpful if you could repeat your exercise with higher resolution. I suspect your maximum width will go down with increasing resolution. In 5.3 you do a divergence test but I am not sure that this is very meaningful given that you show that coarser resolution meshes lead to worse results. It is far more exciting to see what happens when you start converging.

Figure 11. I am not certain it is useful to show underresolved results.

More detailed remarks (I wish SE would use continuous line numbering instead of restarting it every page. . ..).

P1 footnote

1. why footnote?

2. might be good to add a few original references as to why the slab-mantle wedge coupling appears to start at 80 km (that seems to be the case in most SZs; please just clarify why we think this is the case)

P2.l5. typo

P2.l25. typo

P2.l25-27. Full sentence here. You can probably rephrase this a bit better as in that sediments may be important amidst various other issues controlling plate velocities.

P2.l33. 10’s -> tens

P3.l12-14. I am confused about this full sentence here. The seismogenic zone is generally not characterized by ending in the mantle (maybe between slab crust and mantle, but not slab mantle and mantle).

P3.l14. Average stresses: where?

P3. line starting at l22. This seems to take a single point of an antigorite-out boundary as some extreme. It’s a bit more variable/complex than that. You can probably delete this sentence.

P4. Figure 1. last line “representative” of what?

P4.l14 missing article

P4.l5 missing plural

P4.l9 typo

P5.l11 typos

P5.l25. What is ‘over-resolving’Âă?

P5.l30 just benchmarking

P5.l31. “1 km, &20K” Not sure what this means. The benchmark study referenced here showed that finite element models agreed on temperature predictions along the slab surface to within about 1K for 1 km resolution. There were some finite difference models that had larger differences. And here and below. It is just ‘20K’ not ‘20\degreeK’.

P7 three sentences starting at l20. Don’t you say essentially the same thing here? You might be able to condense this into a single sentence.

P8.l1 I hope a cosine taper is easy to implement in many subduction models. Is it not?

P9.l12ff. Maybe use subscript ‘conv’?

âĂÍP9.bottom. MDD reference is repetitive

P10.l6 You are citing Figure 8 way out of order

P10.l21 typo

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