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Solid Earth
Discussions

Interactive comment on "Dynamics of interplate domain in subduction zones: influence of rheological parameters and subducting plate age" *by* D. Arcay

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I thank Referee 1 for his constructive reading and comment of the manuscript. The quoted typos are corrected in the revised manuscript.
Regarding the main comment, Referee 1 suggests to develop the comparison between modelling results and observations, presented in the discussion, by possibly running a few supplementary simulations to better reproduce the range of natural subductions. Initially, the work presented in this paper aimed at testing the influence of geodynamical parameters, such as convergence rate, subducting plate age, upper plate velocities, etc, on the interplate dynamics and geometry, in order to, first, derive empirical

relationships between subduction parameters and interplate characteristics (mainly brittle-ductile transition depth, z_{BDT}, and interplate decoupling depth, z_{dec}), and second, test the modelled relationships against statistical observations. The preliminary results have however revealed that the rheological variables imposed in the simulation had themselves a strong influence on the modelled z_{BDT} and z_{dec} values, and that this effect had to be evaluated and quantified. Based on the presented study, I am now able to perform new sets of experiments to investigate the role of geodynamical parameters, but, to my mind, these results should rather be presented in a separated study, as, once again, the interplay between parameters significantly complicate the subduction interplate behavior. I thus prefered not to run extra simulations for the presented. However, I thank the Reviewer for his helping suggestion, which I have followed to highlight the main modelling results and to illustrate the comparison to observations. Indeed I add a final and supplementary figure ()where the modelled z_{dec} and z_{BDT} depths are depicted as a function of the subduction thermal parameter, ϕ. The constrains quoted in the discussion section (maximum interplate seismogenic depth, velocity contrast in seismic wave propagation tomography, location of maximum heat flow at the forearc surface) are also displayed. I thank once again Referee 1 because this figure not only helps significantly the discussion reading, but it also helped me in placing boundaries on the investigated rheological parameters to fit the observations.

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Fig. 1. Brittle-ductile transition depth (panel a) and interplate decoupling depth (panel b) modelled in this study (crosses) as a function of the subduction thermal parameter, ϕ. (a) The range of maximum depth of seismogenic rupture along subduction interplate encountered in world-wide subduction zones and compiled by Pacheco et al., 1993, and Heuret et al., 2011, is depicted by the blue box. Specific subduction zones where recent mega-earthquakes help to define the deep extent of seismogenic behavior along the subduction plane (Lay et al., 2012) are highlighted by red dots. The green box represents the location of slow slip events encountered at low thermal parameters, compiled by Beroza and Ide (2011), possibly located in the vicinity of z_{BDT}. (b) Blue dots: Interplate decoupling depth inferred from seismic tomography (depth of vertical contrast in seismic wave propagation velocity and/or in attenuation in the subduction wedge tip, see the text for details). Green diamonds: z_{dec} estimates from heat flow profiles from trench to backarc. For Cascadia, NE Japan and N Chile, the uncertainty mainly relies on the inaccurate subduction geometry in the vicinity of the interplate downdip extent. For all subduction zones, the thermal parameters, ϕ, is computed using the Submap database, (Heuret and Lallemand, 2005; Heuret et al., 2011), compiling, notably, world-wide subduction rates and subducting plates.

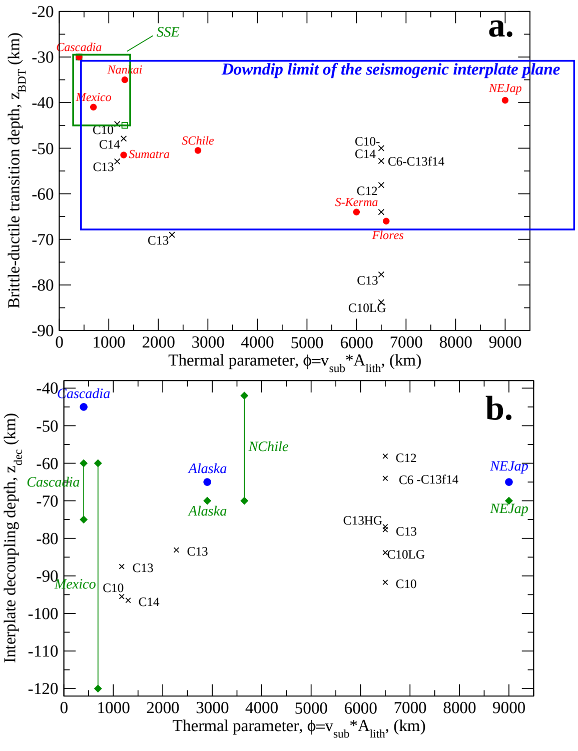

Fig. 2.