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Interactive comment on “The dynamics of laterally variable subductions: laboratory models applied to the Hellenides” by B. Guillaume et al.

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This paper provides a rigorous study of lateral variation of the nature of subducting plate on the overall tectonic style. These three-dimensional variations in subduction style are common on Earth but yet poorly understood, they therefore deserve full attention. This study addresses this issue by presenting laboratory models of subduction that include lateral buoyancy contrast within subducting slabs. The study benefits from an in-depth analysis of the model outputs including advanced post-processing (PIV-scanning) and visualization (maybe few photos of the actual models would be appreciable). A detailed comparison of the model’s general results with the tectonics of the Hellenic-Aegean domain is provided and completes this study. The paper reads very well and I could not find any mistakes nor typos (I am not a native english speaker).

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It is very appreciable that, despite the simplicity of the models (rheology, setup), the models manage to reproduce first order features of the natural prototype of interest. I think this work deserves publication with minor revisions. You will find below a list of points that mostly concern the first sections of the paper.

Thibault Duretz

p. 316 l. 7 - In the abstract you mention "two units", at this stage it is not clear what these two units are.

p. 317 l.19 - Why would the subduction of continental material trigger transient effects ? Consequence of such process might be as dramatic as slab detachment and/or delamination. In the same sentence you seem to wanna confront perturbation of mantle flow to actual observations (upper plate strain, trench deformation). I would here use the term topography (instead of dynamic topography) since topography is an actual direct observation of surface deformation (i.e. not a model).

p. 318. l. 8 - You mention 'at least during the earlier stages', it is not clear which stages you refer to (oceanic, continental subduction, something else ?). I would also add a reference concerning the process of slab distortion during subduction.

p. 318 l. 21 - As a matter of clarification, I would clarify what the term "dynamically self-consistent" means. Do you mean that the flow is gravitationally driven ? Does it mean something in terms of boundary conditions ?

p. 320 l. 9 - A continental crustal thickness of 16km seems rather thin. Is it specific to the natural prototype of interest ?

p. 320 l. 24 - I am unsure that the term "thin viscous sheet approximation" is suitable, this is usually employed to describe the vertical integration of the 3D momentum equations. However, the laboratory models are fully 3D and do include vertical viscosity layering (at the LAB for example). I would rather tell that the lithosphere is modeled

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using one unstratified mechanical layer. Also, concerning the absence of "spontaneous" localization of tear faults, I'd rather think that this effect is related to the nature of the model's lithospheric layer (e.g. Newtonian viscous). Although, I am not sure that employing a (perfectly) stratified lithosphere would help triggering tearing (without introducing the geometry of a TOC).

p. 321 l. 9 - Adding a layer of vaseline probably leads to a huge viscosity contrast within the model's lithosphere (what is the viscosity of the employed vaseline ?). How does the introduction of this new parameter affects the scaling of the experiments ? Isn't it possible to employ the same material as you use to decouple the subduction interface ?

p. 321 l. 26 - For consistency and in relation to the above statement ("In the following, we directly express the quantities with their corresponding scaled values. . .") , you may want to scale this value.

p. 322 l. 11 - Concerning the slight influence of the tracers on the fluid properties, adding a reference could help justifying this statement.

Interactive comment on Solid Earth Discuss., 5, 315, 2013.

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