Geoscientific
Model Development
Discussions

Interactive comment on "Geodynamic diagnostics, scientific visualisation and StagLab 3.0" *by* Fabio Crameri

Anonymous Referee #2

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This manuscript addresses 3 different aspects of the post-processing of mantle convection numerical models. The first part could be described as a small review of some useful and robust diagnostics which can be used to describe the lithosphere and mantle behaviour of a complex and dynamic system. The second part points at the (well-known but often neglected!) problem of correctly displaying scientific results. More importantly, the last part presents StagLab 3.0, a code written in Matlab and capable of performing all the diagnostics described in the first two sections.

Scientific significance:

I read this manuscript with interest, since, as mentioned by the author, efficiently post-processing the outputs of mantle convection models is a growing concern in the geodynamics community and is time-consuming. Although this paper does not come with any

substantial new concept, it is an efficient and flexible open-source tool to post-process global and regional mantle convection models which can be useful to a large number of researchers of the mantle geodynamics community. I would therefore recommend its publication in GMD.

Here-below, I indicate potential minor suggestions to improve the clarity and goals of the proposed manuscript.

Scientific quality:

StagLab 3.0 proposes to describe key plate tectonics and mantle processes, which are still investigated amongst the geodynamics community. Therefore, the proposed diagnostics can be potentially used to lead to significant scientific results. It uses model data to robustly analyse a large variety of processes (age, velocities, topography, plate boundaries, active/passive up/downwellings...). It provides at least a first step to more complex potential diagnostics, which will hopefully be developed later, in a global effort of developing open-source post-processing routines.

Scientific reproductibility:

- Although primarily built for StagYY (which is not fully open-source), StagLab 3.0 aims at being potentially applied to post-process the outputs of every mantle convection code. It has already been tested with Fluidity, providing the routine f_readFluidity. The author provides the routine f_readOther to import raw data from other convection codes. However, no details are provided about how to adapt this last routine. Even if it may be hard to quantify precisely, is it possible to give more insight on the nature of the adaptations needed to use StagLab with another convection code? For example, a large number of geodynamicists use CitcomS and Aspect codes. Is a StagLab routine envisioned to be publicly accessible to read outputs from such codes?

- GMD strongly encourages the submission of the code or a user manual in the supplementary material. Although I think that it is not whether a user manual is available.

Presentation quality:

The manuscript is well written, clear and well organised. However, in section 2.1, entitled 'Plate tectonics diagnostics', I would have followed the order of the Fig. 1 flow chart for simplicity and clarity purposes. I would therefore advise to start with the global plate diagnostics (thickness, stagnant lid, boundaries, age, velocities, topography...) and finish with the more regional diagnostics (subduction topography, slab-dynamics and plate bending), which are more specific and less likely to be used for a large number of scientific purposes.

Technical corrections:

- P19, line 18: "StagLab is built" instead of "build" - Table 2 (third column) and first paragraph of section 2 (p19-20): is StagLab applicable to 2D slices of spherical models? It seems that it is the case but it's not clearly written. - Table 3, column 1: a 'e' is missing for Plate-boundary tracking - Figure 3: A stagnant-lid model is shown, therefore, no active subduction detected on Fig. 3b. Nevertheless, since the goal of this figure is to show that active/passive downwellings/upwellings are properly recovered by StagLab, I would have chosen a model displaying both plumes and slabs. - Fig. 6: Timestep 6: a ridge is not detected although the lithosphere is thin. Is it because the velocity threshold used to detect ridges is too high? - Fig. 7: What do the red crosses at the bottom of the slab mean? They are not described in the caption. Fig. 10: For simplicity, I would have just put the two sets of figures next to each other instead of adding perspective and transparency