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Interactive comment on "The Geodynamic World Builder: a solution for complex initial conditions in numerical modelling" *by* Menno Fraters et al.

Fabio A. Capitanio (Referee)

fabio.capitanio@monash.edu

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This paper introduces an interesting tool to support the modelling of complex geometries, temperature distributions and, more in general, initial conditions to numerical models. The paper explains the approach to the problem and the algorithm choice and the coding strategy, then proceed to illustrates some workflows to embed the tool in existing geodynamics computational frames. I find this tool very helpful and timely and I am confident our community could benefit from using it. I have recommendations the Authors could consider, listed below. The paper reads well and I will not comment on the form, yet I would suggest some more explanation in the content: while i understand that the ropes are likely explained in the documentation, a minimum amount of information should be provided here to warrant a separated scientific paper, unless this is

intended as a technical report.

More information is needed on the thermal structure of the slabs. I understand this is derived from McKenzie, 1970, yet I'd recommend the equation solved is presented - briefly - in the paper. This would help the reader understand some critical aspects, such as the velocity assumed to advect the temperature field, if any, whether this solution allows for diffusion or not. This is not clear from figure 1, which seems a bit odd. In principle, this is not a problem, since energy equations routinely solve for both advection and diffusion, in the simplest formulation, yet, strong temperature (and, hence, viscosity) gradients affect the performance of some solvers (mg, for instance) as well as some mesh topologies (e.g., mesh refinements). Some information might help the seamless integration of this tool in the numerical codes. Additionally, this comment applies to the offset ridge in figure 3, where strong horizontal temperature gradient result along the offset zones. More in general, the way lateral variations are handled remains a bit unclear. In principle, one could use blocks where the properties are piecewise constant, yet, this is hardly a natural case and might prompt unwanted inaccuracy in the numerical solution. Perhaps a simple "smoothing" parameter could be considered, as opposed to a proper solution of the (temperature/concentration/material) diffusion equation, which can be done numerically by the preferred code.

I find the treatment of the tectonic provinces appealing, although I'd recommend some more focus on the subduction zone. From my experience, in both the mechanical and thermo-mechanical approaches, a control on the interface is critical. While non-linearities in the upper plate do reduce the coupling along this interface, this might not happen at the inception of subduction, where the available pull forces are low, whence the use of "weak zones" to ease subduction. Indeed, this might not be the case of the model in fig.5, yet in three-dimension, where computational cost is at a premium, allowing alternative strategies is important. Likely a back arc zone can be imposed with a thinned area with a piecewise constant thickness, although a more flexible strategy is in order, here.

Last, but not least. I find that this tool's great potential likely resides in the embedding of realistic datasets. Perhaps the Authors have some example or some idea on workflows using datasets, such as slab 2.0, populating the thermal field in a slab defined by the Benioff zone, or perhaps embedding oceanic lithosphere age dataset into the ridge model, for instance.

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