Solid Earth Discussions

Solid Earth Discuss., referee comment RC1
https://doi.org/10.5194/se-2020-214-RC1, 2021

Comment on se-2020-214

Anonymous Referee #1

Referee comment on "Complex rift patterns, a result of interacting crustal and mantle weaknesses, or multiphase rifting? Insights from analogue models" by Frank Zwaan et al., Solid Earth Discuss., https://doi.org/10.5194/se-2020-214-RC1, 2021

Review of "Complex rift patterns, a result of interacting crustal and mantle weaknesses, or multiphase rifting? Insights from analogue models"

Summary:

This manuscript addresses the problem of understanding the effects of inherited weaknesses on rift evolution. The authors produce 3D analogue models to test the interaction between differently oriented in the crust and upper mantle. The main result is that crustal and mantle weaknesses can simultaneously localize rift structures leading to intricate fault patterns that could be interpreted as a result of multiphase extension. The authors conclude that multiphase extension is not required to explain different structural orientations in rift basins, and suggest that the tectonic history of natural examples should be reevaluated.

General Comments:

This is an interesting manuscript that aims to solve an important problem in the evolution of rift basins. I think that the manuscript is well-written, explains clearly the methods used, and arrives at reasonable conclusions. The implications are well-received and useful for interpreting deformation patterns in rift basins.

One component that I think is missing is the comparison and contrast of the resulting

models with natural rift patterns. For example, the comparison with the Malawi Rift would be interesting because it is a young rift with low extension (just as the set-up of the models) and inherited crustal weaknesses with varying orientations. The trend of the Malawi Rift is perpendicular to the extension direction but it meets the Shire Rift to the South with an oblique orientation. Do the rift structures show a pattern recognizable in the analogue models in this manuscript? The addition of this component would increase the impact of the manuscript.

Grammatical and orthographical errors on lines.

- Paragraph 500: Fix “)parallel”