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Solid Earth Discussions

Interactive comment on "Extension and Inversion of Salt-Bearing Rift Systems" *by* Tim P. Dooley and Michael R. Hudec

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Oriol,

Many thanks for your thorough and positive review of our inversion paper. I will reply to your comments below, pasting in your text in order to answer specific comments if needed.

General comments:

1. Agree, will add more specific information on sedimentation rates etc. in the modeling methodology section. In general the height-change maps generated from the DIC system guided me here during all stages of the model runtimes. Base-level was raised just enough to clear any rising diapirs resulting in sequences that markedly thinned

across the rift flanks.

2. This would be more difficult to do for a 3D system that is being modeled here. I think the figures as they stand give the readers a walk through of the model evolution and final geometries.

3. Ah! Yes. These experiments were not run in the order they are presented in! Models 2 and 3 were run before Model 1, and it became obvious that the thin basal decollement (3-4 mm of silicone polymer) needed to cover the entire base of the rig to facilitate inversion of the entire subsalt and supra salt sequence. The only difference this made to the pre-inversion geometries was pushing the marginal graben systems further towards the periphery of the model. These marginal graben are quite minor and the main focus is aimed at the main segmented rift system.

4. Yes, the "harpoon" reference is poor and will be removed. "Inverted subsalt graben" will be used or something to that effect.

5. Marginal graben – see point 3 above. It's minor and not our focus.

6. This is a very interesting and modeling-focused point. In general the infiltration "depth" I believe is governed by the grain size of the sediments, and thus by the mixture of sands/censopheres used in these strata. You have likely seen the same phenomena, and I keep some of this material in my labs to show visitors that sand can fold if it has been "infiltrated" by polymer, but still fail in a brittle fashionunder higher strain rates! I really can't answer all your questions in this section. I'm sure you have seen that welds between sub- and suprasalt sand layers appear to be very clean, unlike may between sand and a rigid, non-porous baseboard. But you commonly see a slight change in color of the strata just above and below the weld for about 2-3 mm, again depending on grain size. I will try to add in a sentence or two to clarify this, but for now it's a known unknown, but the best explanation I have for efficient reactivation of these subsalt graben.

7. This is a great observation and something I will discuss. If you compare Model 1 (Figures 9 and 15b) with Model 2 (Figure 10) the primary welds are in different locations - much more toward the minibasin centers in inverted models, but at the flanks of the minibasins in non-inverted models. Yes, these have likely been "sheared off" during inversion as the entire minibasin is pushed upwards above the rising hanging walls of the segmented graben systems. And the length or extent of the welds becomes greater – e.g. see Section 33 in Figure 9. I'll add in Roma et al. *2018b) and discuss in the relevant section. Thanks.

8. Yes, additional references will be added as per your suggestion. Makes it more complete.

Specific comments:

Will fix those and add reference to volumetric percentages of sand and ceonspheres where appropriate.

Figure 2 – the stretching rubber sheet is black and is visible through the basal thin polymer layer. But I have it as green in Figure 2a. I'll adjust this and fix the caption to clarify.

Figure 4 – I though I did mention it. I'll check. This is to track where our model salt in the central graben flows to during extension and loading.

I will standardize on "Stage" to make it consistent.

Thanks for catching the references.

Again, many thanks for the comments and suggestions/discussions.

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