Solid Earth Discuss.,
https://doi.org/10.5194/se-2020-127-AC3, 2020


Solid Earth Discussions

# *Interactive comment on* "Thick- and thin-skinned basin inversion in the Danish Central Graben, North Sea – the role of deep evaporites and basement kinematics" *by* Torsten Hundebøl Hansen et al.

**Torsten Hundebøl Hansen et al.**

torsten.h.hansen@geo.au.dk

Received and published: 21 November 2020

Thank you very much for your comments. I have posted your general comments followed by our replies below, one paragraph at a time:

"1) ABSTRACT: In my opinion the main idea to include in the abstract is that Zechstein salt acted"

Reply: I take it you meant to write something along the lines of "that Zechstein salt acted as a decoupling agent during both extension and inversion". We will emphasize



this as well as act on the other comments to the abstract in your annotated pdf.

"2) INTRODUCTION: The introduction section (chapter 1.1) corresponds to a small review of tectonic inversion. I suggest to specify that it refers to positive inversion (extension followed by contraction). In a similar way, I would like to suggest to introduce Bally (1984) as a reference, who in fact was the first author to propose a classification of the amount of inversion related to the basin bounding fault. Few years later, Cooper and Williams (in Copper et al., 1989) suggested the terms mild, moderate, strong and total inversion to refer at the degree of inversion included in your introduction."

Reply: Good suggestions. We will include these in our revised text.

"On the other hand, as much of the works based on physical models pointed out, this technique is not the best one to study inversion tectonics as granular materials (sand) are used to simulate brittle rocks. This difficult the reactivation of extensional faults during inversion because they are not effective mechanical discontinuities. In fact, the experimental setups of all the references of your introduction constrained the fault geometry with a rigid block allowing its contractional reactivation during inversion. In this sense, I think you should also use the recent work of Dooley & Hudec (2020) as a reference. These authors solved this limitation using a hybrid system allowing a partial inversion of faults developed in the granular material."

Reply: This is a relevant point. We will include this reference and note on the problem with sand.

"3) RESULTS & INTERPRETATIONS: I fully agree with SC1 (Sia Evans) comments regarding the use of local names of the structures. This is an often-repeated issue in regional works difficult to solve. The constant use of names is critical for a reader unfamiliar with the Danish Central Graben. If in addition, these local names are only referred in few figures (e.g. Fig. 1 and some of the maps), the reader can easily become spatially disoriented. Similarly, some of the local names are just pointed in the manuscript but are not located in any figure. I also recommend to review this

point. There also some inconsistencies in the names of the different structures. In some cases they are written in capital letters (e.g. Gorm-Tyra Fault), and in others in lower case (e.g. Gorm-Tyra fault). These small inconsistencies should be reviewed and modified applying the same criteria."

Reply: Yes, these are very valid points. We will include many more figure references to solve the problem of orientation for unfamiliar readers, and review local names that are not illustrated in any figures. Inconsistencies will be corrected.

"Why do you use maps (Figs. 9, 10 and 11) instead geoseismic sections (Figs. 4 to 8) when describing structures? This difficult to follow your descriptions. Please, use further geoseismic sections, they are practically self-explained and will make the story more readily understandable. Observations and interpretations are mixed in chapter 4, giving rise later to repetitions in the discussions chapter."

Reply: We will seriously consider adding additional seismic sections and certainly make more use of the existing ones when describing the structures. I do feel though, that using maps in combination with sections when describing three-dimensional structures has clear advantages. We will make sure to go over the descriptions again and edit where needed. We will carefully assess Chapters 4 and 5 to give the text a clearer structure and remove unnecessary repetitions.

"4) DISCUSSION: As occurs with the results and interpretation chapter, some points developed in the discussion chapter are difficult to follow because they are not referred to your figures or the references used are not enough to suport your sentences. This should be definitely improved. I think this paper need a restorarion illustrating the geometries, thickness patterns, and evolution both during early extension and subsequent shortening. Readers will greatly benefit from a new figure showing the evolution rather than having to rely only on words. I recommend use the lines of Figs. 6 and 8 for the restorations. I am sure they will entail some additional work, but they will greatly improve the paper. In a similar way, I thin this section needs a new figure with the



concept of triangle zone (Stewart, 2014) adapted to the case-study. In fact, this figure will definitely help the reader."

Reply: Again, we will make sure to include many more references to our figures to support our points. We will include additional restorations illustrating early-extension geometries (around Mid Jurassic time) for both the sections in Figs. 6 and 8, and illustrate the whole of the section in Fig. 8 at all steps, rather than only the Kraka Structure. We will also include a new figure to illustrate the triangle-zone concept for unfamiliar readers.

"5) REFERENCES: Review the journal style and order of references. Some of the references are not included in the final list and vice versa. "

Reply: We will check our references carefully to ensure they are all included and referred to in the text, and that they are correct and follow the journal style.

---

We are very grateful for your helpful, thorough and constructive review of our submitted manuscript. Thank you for taking the time!

On behalf of the authors,

Torsten Hundebøl Hansen

---

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2020-127, 2020.