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Solid Earth Discussions
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Interactive comment on "Rift zone-parallel extension during segmented fault growth: application to the evolution of the NE Atlantic" *by* Alodie Bubeck et al.

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I'd like to thank the editor for the invitation to review this manuscript. This is the first time I participate in an open-discussion review, and I very much look forward to the improvements arising from it at different stages.

This manuscript discusses formation, development, interaction and strain implications of extensional fault systems within relay zones. Findings obtained from the analysis of newly-acquired data are put in context by the authors by establishing links to global examples. I believe the topic is within the scope of Solid Earth and the manuscript would be of interest to both structural geologists and researchers in tectonics. However,

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Discussion paper

I see two areas for improvement before publication.

First, large sections of the manuscript would benefit from being re-written in a more concise way. The overuse of “technical” terms makes it hard to follow at times, due to the abundance of very long and wordy sentences. There are also several instances in which you use terminology that, to me at least, is not clearly defined (or has been defined in different ways by the geoscience community). This makes the text confusing.

Second, but not less important, I would suggest to re-think your organization of the manuscript. At the moment, certain types of content seem to be spread across sections, and this makes the manuscript hard to follow. You should also draw clear links between your aims, your method, your discussion and your conclusions. Make it easy for the reader to see how one section flows into the next!

In the following I give examples of these two points as well as some other minor corrections, by manuscript section.

1. Introduction

Page 1 L24-25: About growth mechanisms for normal faults: not always through stages. In analogue experiments we often see cases of vertical and lateral growth and linkage but we also see faults develop their full length early on and maintain it. See for example the very recent Jackson et al. (2017) doi: 10.1144/SP439.22

Page 1 L34: I wasn’t entirely sure about what you meant when you say “coherent” normal faults.

In the introduction you give me a little bit of background, you tell me what you will address in this paper but you don’t tell me why. I think there needs to be a clear connection here between what you do, how you do it and why you do it. On the “how”. . .why don’t you give any details about your data collection? From the abstract I get that you went to the field , tell me about it! What did you measure, how did you measure it? This is important later on, because in your results section you give a lot of measurements but

I'm not sure how you got them.

2. Background

The structure of this section is very similar to that of the introduction. You start by giving the reader background and then you move on to focusing on what you will be presenting in this paper. Why go back and forwards twice? I would suggest merging these two sections into one or, at least, if you would like to keep both, differentiate them clearly by their content.

Page 2 L4: "We aim to demonstrate. . ." This is what I need in the introduction! aims!, why throw this into the background section?

Consider writing an introduction with three distinct key elements: - Background/previous work - Summary of your findings and how you've obtained them (or, you could have a separate methods section) - Aims/rationale: why is this important, what is this study's motivation

3. Field study areas

Page 3 L28: "Approximately 2000 measurements. . ." You should have told the reader where does your new data come from before this point. Here you do give some detail, such as the use of GPS but skip some other details such as when did your field campaigns take place and what you did in the field. I'd suggest to focus this section on results, and talk about the methodology earlier.

Page 3 L42 ". . .we infer that.." suggests interpretation. If this is a results section there should be no place for interpretations in it.

Page 4 L16 "A kinematically and geometrically coherent fault array. . ." Wouldn't this be more suited to a discussion? You seem to be making the point that what you see in the field should fit to the Walsh model?

Page 4 L38 ". . . may represent the first and final stage of deformation. . ." This again

seems to be misplaced, it is an interpretation of results.

Sections 3.1 and 3.2 You give lot's of numerical values, measurements. I found it hard to follow, perhaps a table would help the reader get the full picture better? Also, your interpretations should be limited to section 3.3, and clear links should be established between those interpretations and the observations that lead you to them.

Section 3.3

Page 5 L10 "Relay zones, located at the lateral terminations of first-order segments, are characterized by second-order faults and fractures that strike oblique and normal to the bounding rift faults and show a heave displacement deficit in the regional extensional strain" is an extremely long sentence. It illustrates my earlier point that the use of too many technicisms makes the manuscript hard to read. Are what you call "bounding rift faults" the same as "first-order segments"? I'm not sure I follow your point here.

4. Discussion

Personally, I would separate a classic discussion from the evaluation of findings within global settings. Maybe consider having a section where you discuss how your findings can shed light on North Atlantic tectonics? If you do that, you can then keep the discussion lighter and clearer, and use both your findings and the conclusions drawn from applying hypothesis to global examples as topics for discussion.

What motivates me to suggest a change in text structure is that Sections 4.2.1 and 4.2.2 don't read like discussions to me at all, they read like a literature review.

5. Conclusions

I don't doubt the list you provide are conclusions from your work but the link between the two is not clear to me from the manuscript. A shorter and more concise discussion would greatly help the reader see where your conclusions are coming from.

Figures:

For some reason the figures in the .pdf are really small! Had to zoom to 300% to read some of the text. Worth considering how the figures would look once embedded in the text and the journal's format – adjust text sizes accordingly.

My general comment about the figures is that they could use some cosmetic touch ups. The information is there in most cases but by making small changes it would come across much more easily. Having multiple panels in a figure is fine, but having each panel oriented in a different direction (same for text) is confusing and not very helpful for the reader. Also, it should be clear what part of the figures are keys (by simply putting symbols into a box and label the box for example).

Figure 2: Why are the angles of the yellow set with respect to the red set different on the photo and the evolution diagrams?

I would keep the three boxes in section (c) the same size, it would look more tidy.

I struggled to figure out why the symbols over c.i. are there! Maybe that is just me but no harm in making it clear it is a key. (Same for figures 4 and 8)

Figure 3: I don't quite understand why you have used x-y plots in part a instead of a scale bar? Maybe it is just me but it really confused me.

Figure 4: I'd suggest avoiding having multiple-panel figures where some panels are rotated. This same comment applies to other figures. Perhaps your choice is motivated by trying to keep north up? Part c has text going in all possible directions!

Again, the fault sets in the evolution diagrams seem to be at different angles than in the photos?

You have the content for an interesting paper which, if presented in a clear and concise manner will be helpful to many geoscientists. I hope my comments are helpful to you for the revision of the manuscript and please ask for clarification if you need it.

Best of luck, Lucia

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