Answer to Anonymous Referee #3 (https://doi.org/10.5194/egusphere-2022-708-RC3):

Thank you for accepting to be a referee, and the time spent to review this manuscript. We appreciate the comments. We have updated our manuscript accordingly and hope to answer the questions satisfactory, in the following. Where we references to manuscript lines, these are the lines in the new, revised manuscript.

Larger Issues, Point 1: Handling of errors.
Handling of errors of the clustering have been discussed in the previous answer to referee #2.

As I understand, this issue concerns the errors of the models themselves. The electrical resistivity and density model errors are difficult to derive due to the ambiguity of geophysical inversion. Therefore, it's not a common practice to specify model errors. Usually model anomalies are tested for their necessity, which we performed in the previous publication (Franz et al., 2021). Here, the analysis of models is focused on comparing differences in the models' parameters along the passive margin. The clustering algorithm is used to identify zones of common parameter relationships and distinguishing from zones with different parameter relationships. This zoning is then linked to geological processes to enhance passive margin interpretation.

Larger Issues, Point 2: Purpose of manuscript.
Our referenced previous publication is a discussion of different approaches for the joint inversion data and model integration. We thoroughly describe models and data, joint inversion technical aspects, and discuss model resolution and uncertainties. It includes a short discussion about the geological interpretation of the results, which is only based on the physical models and comparison to previous research.

This manuscript presents user-unbiased approach to model interpretation, and a more thorough geological discussion based on the Namibian margin's history. Clustering of the model parameters is a significant improvement to model interpretation, because it offers independent assignment of different model areas. These model areas are then linked to lithological units and validate the previous subjective interpretations.

We have added short explanations of the benefits of the clustering concept to the introduction (l. 67 f.) and conclusion (l. 679 f.).

Larger Issues, Point 3: Hypothesis of different magma sources south of – and below Walvis Ridge
In our manuscript we state the hypothesis, that the crustal structure south of Walvis Ridge and along the ridge differ as a result of the direct plume impact at Walvis Ridge latitudes. We note, that the involvement of the Tristan plume is a topic to debate (l. 99 f.). This comment helped us to realize inconsistencies in our hypothesis. What we actually wanted to state, is a difference in the crust and

upper mantle related to the degree of mantle and melt depletion. And to link the higher depletion below Walvis Ridge to the impingement of the Tristan hot spot and the corresponding extraction of volatiles. The residual upper mantle would then be more depleted compared to the hypothesized “rift related” crust south of Walvis Ridge. We have rephrased the parts of the discussion and conclusion to clearly describe this hypothesis (l. 509ff. and 665 ff.).

We are not specialists in isotope geochemistry, but have evaluated the proposed papers. We believe that their conclusions do not contradict our statements. We state that the earliest phase of continent break-up is associated with rifting and that that early magmatics are mainly of upper mantle composition (in l. 100 f.). Gibson et al. (2006) also link this earliest stage of the CFB emplacement (~145 Ma) to melts at the mechanical boundary layer (MBL) at ~150 km depth and not a deep plume source. We do not rule out involvement of plume material in the Etendeka CFB in the subsequent stages. In fact we point out the interaction of the Tristan plume and the lithosphere and heterogeneous composition (l. 131 ff.) of intrusive magmatics, which we link to the ascend of magma which forms dykes and eventually the CFB (l. 136, 142).

Concerning the comment about the model depth and depth of depleted mantle: Thank you for describing this problem of a mismatch of mantle convection and our statements about a different mantle structure south of-, and along Walvis Ridge. We understand that there needs to be clarification, because we haven’t clearly stated that interpretations should be confined to the upper/lithospheric mantle only. We added appropriate statements: We point out, that the resolution capabilities of the electrical resistivity model decrease with depth, and the statements therefore become more vague with depth (l. 635 f.). Additionally, we clearly phrased that interpretations of the mantle domain should not extent below the LAB in l. 389 ff. In our discussion of the mantle clusters, we also added the explicit statements, that our interpretations concern the shallow, lithospheric mantle (l. 513 f. and 562 f.).

Larger Issues, Point 4: Salt north of Walvis Ridge

Salt deposits north of Walvis Ridge have been mapped offshore Angola in the Kwanza basin north of ~15°S (e.g. Blaich et al., 2011; Moulin et al., 2010; Strozyk et al., 2017, Torsvik et al., 2009). The salt directly adjacent to the FFZ may have been sheared off to the South American margin during the Albian ridge jump. The latitudes north of 15°S are not included in our model area. Therefore, we do not discuss any inclusion of salt horizons in our model region.

<u>Direct comments:</u>
Line 35: mantle
Corrected.

Line 62: check ages of rifting
we rephrased the sentence slightly and included short time spans to indicate the uncertainty of different plate reconstructions stating different times (l. 82 f.)

Line 71: basement
Changed “background” to basement (l. 92).

Line 79: technically this is volcanic. There are no constraints as to whether plutonic rocks were generated initially. The timing of magmatisim and rifting is of considerable controversy - please examine the following papers and incorporate their insights. As you will see from the papers, the correlation between magmatism and rifting is not quite as portrayed.
We added the explanation of the alternative hypothesis of an early plume impact and major influence in rift initiation (l. 106 ff.).
Generally, this phase summarized the very early rift phase and we only discuss the potential triggers for this rifting. We have now included both hypotheses: “plume inducing”, and “plume induced”. We describe the arrival of magmatism in the second phase, where the intrusive and extrusive magamtics are described in more detail. To avoid confusion, we completely removed the mentioning of CFB in this paragraph.

Line 81: This statement is open to misinterpretation and does not reflect the totality of how these rocks were generated. These rocks are generated by a plume but the melt mechanism is debated. See comments in major points above
See answers to previous comment and response to major point #3. Alternative models are now included in l. 106 ff.

Figure 1 - spelling of Kaoko belt is different in the figure.
Corrected.

Line 138: this line is unhelpful as it presumes a vector of continuing increasing melt. There is no evidence that underplates form before flows. Indeed, volcanism is contemporaneous with rifting and break up. Underplates may form in response to fractional crystalization at the crust mantle boundary by progressive accumulation of these phases. Delete this line.
Sentence rephrased.

Line 141: a typical feature associated with these flows cannot be SDRs as these are seismic features to which the flows themselves belong. Rephrase.
Sentence rephrased

Line 146: volcanic not magmatic.
Corrected.

Line 148/9: what evidence exists for chemical heterogeneity. No citation is provided and I'm not aware of one in this locale.
The main factor to distinguish SDR flows from CFB is surely the different prepositional environment. The possible chemical heterogeneity would be reasoned by the different melt source related to a later stage of rifting, compared to the initial CFB signature. We slightly rephrased the sentence to make it clearer, and added a reference, which characterizes SDR's and describes how they may be built by different lava types (l. 174 ff.).

Line 151: rapidly
Corrected.

Line 155: there is evidence of volcanic activity to the north, just much less. The transition isn't as abrupt as noted here. For example, the Namibe basin just north the FFZ has thick SDRs in the south and not much salt. Please examine the existing literature describing the marginal basins to the north of the FFZ.
The central southern Atlantic section is generally referred to as a magma-poor or non-volcanic passive margin (e.g. Blaich et al., 2011; Contrucci et al., 2004; Mohriak et al., 1990). Of course this does not completely rule out any volcanic activity, which is why we phrased "little to no" magmatic signature. For our models, the strongest reference is the seismic profile corresponding to our marine MT stations presented in Planert et al. (2017). They have interpreted the northern crust as oceanic crust. We follow their interpretation.

Line 159: citation required for this assertion.
References added (l. 186 f.).

Line 162: pronounced
Corrected.

Line 163: see paper by Morgan et al 2020 on plume flow in PNAS
Incorporated the paper (l. 190 ff.)

Line 395: data do not disclose, rephrase
Rephrased (l. 459)

Line 399: comma required
Comma inserted.

Line 406: delete further
Deleted.

Line 445: Speculation. There is no evidence of particularly wet melts along this margin. Delete.
We have completely rephrased this hypothesis. It now states that the difference in mantle resistivity could be related to a difference in depletion due to the volatile extraction caused by the hot spot impingement. We removed the references to melt source (l. 509 ff.).

Line 447/8: it is entirely unclear to the reader how this follows. From my reading of this section, the paper suggests that the speculation of a wetter and drier mantle is associated with more or less plume activity. This is used to suggest the plume is dominant to the north along the WR and that the southern area is 'rift driven breakup'. This is totally unclear as it does not explain the source of magmatisim. Much more discussion is needed and actual evidence from the magmatic system.
See answer to previous comment.

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