Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., author comment AC2
https://doi.org/10.5194/gmd-2021-112-AC2, 2021

Response to reviewers

Lachlan Grose et al.

Author comment on "Modelling of faults in LoopStructural 1.0" by Lachlan Grose et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-112-AC2, 2021

Dear reviewers and editor,

Thank you very much for your constructive and helpful comments. Below are responses to both reviewer's major comments. Figure enhancement suggestions, text and grammar will all be included in the revised manuscript.

Patrice Rey comment 1:

Given the difficulties inherent to the subject, the text must be as accurate as possible, and as easy to read as possible.

We agree with this comment and with the suggested grammatical corrections you have proposed. We will thoroughly check the revised manuscript to ensure the text is as accurate as possible.

Patrice Rey comment 2:

This first part of the paper is certainly interesting and interesting, but the absence of illustration means that readers have only textual information to develop an understanding of the 3D geometrical meaning of each approach. Adding some figures would definitively help readers who not familiar with this topic.

We will add an additional figure in the beginning of the manuscript to summarise the background work to show a visual comparison between the different approaches for incorporating faults.

Patrice Rey comment 3:

General comment regarding figure captions and labelling

We will review all of the figure captions and labels to make sure the capitalisation is consistent and also ensure the subfigure labels are consistent with the journal style.

Italo Goncalves comment 1:

Section 3 explains the methodology's core, so I believe it is important to include a figure showing exatcly how f0, f1, and f2 are measured and how the field data is encoded in order to constrain their values (as scalars, displacement vectors, etc.).

We will include a figure that shows how the fault frame can be defined from the field observations of the fault. This figure will also show the application of the displacement curves to the coordinates of the fault frame.

Italo Goncalves comment 2:

When applying the displacement field, is there any risk of generating ''knots'', i.e. of a point landing on top of another or past it? In other words, is the relative ordering of the points always maintained?

Knots could occur if the displacement field generated from the fault frame and the fault displacement functions is not continuous, or if the step size used to apply the rotation is too large. Knots would be an indication that the fault is poorly constrained either the geometry is to complex or the data are inconsistent. We will discuss this in section 4.2.

Italo Goncalves comment 3:

It seems it is necessary to label the faults according to their relative age. What if this information is not available?

When modelling faults that do not cover the whole model domain (finite faults), it is only necessary to know the relative timing of faults that are close enough to interact. In general, this should be captured on the geological map in the input data (see Jessell et al., (2021, GMD) for an example of how to extract this from a map). In the cases where the map patterns do not intersect but the faults do at depth then it would be necessary to label the faults. We will add this point into section 3.3.

Italo Goncalves comment 4:

Section 4.1: if the coordinates are interpolated sequentially, wouldn't it be possbible to

obtain coordinate 2 directly from the cross-product □f0 x □f1?

It is possible to obtain the direction of coordinate 2 but this does not provide the scalar field that measures the distance in that direction from the fault centre. The scalar field is required for defining the fault displacement magnitude. The addition of a figure showing the fault frame construction and fault displacements will demonstrate this point.

Italo Goncalves comment 5:

In Figure 8B the fault displacement vectors appear only on one side of the fault, while in 6A they appear in both sides. Is this correct?

This is intentional, the fault in 8B has a constant displacement on the hanging wall and 0 on the footwall. The fault in 6 has a relative displacement that is -ve on the footwall and positive on the hanging wall to define a “finite fault”. We will update the captions to clarify this.