

Interactive comment on “Mechanisms of clay smear formation in unconsolidated sediments – insights from 3D observations of excavated normal faults” by Michael Kettermann et al.

Anonymous Referee #1

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The manuscript investigates the mechanisms of clay smear using an exceptional outcrop exposure created by the Authors by excavating around a normal fault in a lignite mine in Germany. The Authors integrate the detailed field observations with: a) a 3D model created by photogrammetry that is used to map the 3D clay smear thickness and b) a model to characterize the effect of clay fragment size and rate of mixing on the evolution of sand-clay gouge.

I think that the manuscript presents a very detailed work, based on a unique 3D fault exposure, with fundamental observations for the understanding of the 3D evolution of clay smear. Therefore I strongly support the publication of this manuscript in Solid Earth.

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In reading the manuscript, with its length, the 24 figures, the Appendix, the 3D model to be viewed with Matlab, the Matlab code in supplement material to evaluate the evolution of clay-sand gouge, I was wondering if it would be better to split this huge work in at least two manuscripts: a) one dealing with geometrical characterization of fault and clay smears; b) the other dealing with 3D models, detailed analytical outcomes (for example at lines 289-290 the sentence “The measured thickness data show a log-normal distribution” and the associated figure seems to be not well explained), and the modeling part.

In same parts of the manuscript I have not been able to see in the figures, what it is mentioned in the text or the figures deserve a better labeling. For example, lines 195-195 mentioning Figure 5: I am not able to see both hanging-wall and footwall cut off (labeling the cut-off would help the reader). The text at lines 229-231 is not clear or in other words the figures are not clearly explained by the text. It would be helpful to label R R1 and D-shears in figure 7 since it is the first time this terminology, together with a fault image for it, is introduced in the manuscript. Can you label D-shear in figure 13: it took me a lot of time to pick-up the D-shear position.

Paragraph 5.1 on the origin of stair-stepping geometries. Some jumps forward back forward (Figure 13-14-15) in mentioning figures and model have created a bit of confusion during my reading. I suggest first describing the observations and then presenting the model.

Lines 482-483. In the model there is the assumption of circular clay fragments. Since clay minerals are platy minerals I suggest to better justify this assumption.

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