

Interactive comment on “Abutting faults: a case study of the evolution of strain at Courthouse branch point, Moab Fault, Utah” by Heijn van Gent and Janos L. Urai

Fabrizio Balsamo (Referee)

fabrizio.balsamo@unipr.it

Received and published: 28 October 2019

Dear Editor,

this is my review of the paper SE-2019-137 “Abutting faults: a case study of the evolution of strain at Courthouse branch point, Moab Fault, Utah”, by van Gent & Urai, submitted in Solid Earth. The paper is a net study performed in a famous locality in Utah (USA) known as Courthouse branch point, a sector where two normal fault segments of the regional-scale Moab Fault are in contact, and one abut the other. According to this and previous papers, this sector is characterized by outstanding outcrop exposures, which allowed a full structural analysis and fracture mapping at very detailed

C1

scale. Several structural-oriented studies focussed in the past on these spectacular outcrops along the Moab Fault. Such studies are extensively cited by the authors.

The present contribution provides a new structural dataset (n=207) on secondary fault attitude and kinematics that, in combination with cross-cutting relationships and previously published datasets, are analysed and used to constrain the stress/strain evolution in the Courthouse branch point. In particular, seven different fault sets are analysed using numerical dynamic analyses (stress/strain inversions) to obtain the paleo-extension directions through time. The paper is short and well written, and the quality of data is good. Conclusions are sound and supported by the evidences.

There are, however, three weak points that could be strengthened before publication, which mostly concern, in order of importance, the following aspects: (i) amount of structural data presented, (ii) figure quality, (ii) typing errors in the text. Apart from point (i), the two other items can be improved easily. Therefore, I recommend this paper with moderate to major revision.

To facilitate the revision, I list below the major points which should be addressed before publication. Further, I provide in attach a scanned copy with my own modifications and comments on the manuscript.

Kind regards Fabrizio Balsamo

Major points to be addressed (Specific comments) 1) Number of structural data presented In line 165, it is stated that a total of 207 separate fault orientation/slip direction measurements were acquired. So, the stress/strain inversions are based on such data, and the evolutionary model (paleo-extension orientation during faults interaction) is based on this dataset - plus previously published observations by Johannsen et al., 2015. Despite the model in Fig. 8 is supported by the data presented and analysed, I have some general concerns on a structural evolutionary model of a regional fault based on 207 data. Further, in the Methods is explained that, to avoid outliers and measurement errors, each fault surface/slickensline was measured 3 times along their

C2

strike, which makes the fault dataset smaller. If this is the case, it should be stated in the manuscript that this is the only available fault dataset, and that all available faults in the Courthouse branch point were measured and mapped. Moreover, to overcome this issue, a good strategy would be the completion of the structural map in Fig. 3a with the real fault strands (not only straight isolated lines) and the arrows indicating fault kinematics. As it is now, the map in Fig. 3a (Courthouse Junction) contains lines with no kinematic indicators. Finally, I think that some more clear evidence (photos) of cross cutting relationships between the different fault sets should be provided (at least for the 3 groups which constrain the evolutionary model in 3 steps). With the map completed, and more clear evidence of cross cuttings between fault sets, the evolutionary model in Fig. 8 would be better supported.

2) Figure quality Many figures contain letters and symbols which are practically invisible. In particular: Figure 1 – all invisible, either (a) and (b). Please keep in vertical the two maps. Consider that font < 6-7 are invisible in an A4 page. Figure 2 – In Figure 2c the slickenlines are not clearly visible (at least in my printed pdf). Figure 3 – Please in all stereographic projections add the number of data. Also add (a), (b) and (c) for the sub-images. Figure 4 – Increase font size in (b) Figure 5 – Add n data in the stereonet Figure 6 – Add n data in the stereonet (n=XX) and increase significantly the font size in X-Y diagrams. Figure 7 – same as figure 6. Figure 8 – Add (a), (b) and (c) for the three evolutionary steps. Also, indicate segment A and segment B in the first image (isolated faults).

3) Typos and text modifications See the attached PDF with my own corrections.

Please also note the supplement to this comment:

<https://www.solid-earth-discuss.net/se-2019-137/se-2019-137-RC2-supplement.pdf>

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2019-137>, 2019.