

Interactive comment on “Bimodal or quadrimodal? Statistical tests for the shape of fault patterns” by David Healy and Peter Jupp

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We thank the reviewer for their concise and constructive comments on our manuscript. We address the issues raised in sequence in the text below, complete with any explicit changes we have made to our manuscript.

1. Geological context and processes of bimodal and quadrimodal fault patterns should be explained in the introductory sections and then reconsidered in the discussion and conclusion.

Reply: we disagree. Full reference is made to relevant papers that discuss the key differences between bimodal/conjugate and quadrimodal/polymodal fault patterns. Our manuscript describes a new method to distinguish between these distinct patterns, and

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we think a full repetition of the issues is not warranted. We do highlight the key issues in the Introduction (section 1), and address the issues raised by our statistical analysis in the Discussion (section 5).

2. Once these contexts/ processes are explained, natural fault patterns to be statistically tested should be taken from these explicit cases or, for comparison/contrast, from different cases.

Reply: this is exactly what we do; in addition to the synthetic datasets built from Watson distributions, we use published datasets of natural normal fault orientations previously ascribed to either bimodal/conjugate origin (e.g. Peacock & Sanderson, 1992) or to quadrimodal (Krantz, 1989) patterns.

3. In the case of quadrimodal/polymodal fault patterns, I do not see many alternative cases (I might be wrong) to polygonal faults that are polymodal (normal) faults developed in one single event. I know that many of these faults are known only from offshore areas thanks to seismic images. I wonder whether it would be possible a statistical test using only the fault strikes (instead of fault attitude) that are documented in many papers on polygonal faults based on seismic data. It is also true, however, that polygonal faults start to be known and measured also in many inland cases. For references on papers on offshore and onshore polygonal normal faults I refer the authors to the following paper (Wrona et al., 2017).

Reply: polygonal faults remain enigmatic, and in comparison to bimodal or quadrimodal fault patterns they are statistically insignificant. A quantification of fault strikes from polygonal arrays has already been performed e.g. in the cited paper by Wrona et al., 2017. Our method to distinguish between bimodal and quadrimodal fault patterns fundamentally depends on the input of fully 3D orientation data – i.e. the poles to the fault planes – and not just the fault strikes.