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Interactive comment

Interactive comment on "Fracture attribute scaling and connectivity in the Devonian Orcadian Basin with implications for geologically equivalent sub-surface fractured reservoirs" *by* Anna M. Dichiarante et al.

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This is a valuable and very interesting contribution. The study looks at outcrop analogues from the Middle Devonian Sandstone - North of Scotland - for analysing fracture attributes and fracture network connectivity. The authors display a multi-scaled fracture dataset (from km-scale high-res bathymetry maps down to the mm-scale thin sections). Fracture attributes (namely, length and aperture) are collected using a linear scanline method, while fracture network data (i.e. connectivity and fractal behaviour) are collected using a mix of circular scanline and box counting methods. Fracture attributes are then statistically analysed to extrapolate the best viable underlying theoretical distribution using the Maximum Likelihood Estimation (MLE), jointly with Kolmogorov-Smirnoff for testing the goodness-of-fitness. Fracture network connectivity are instead analysed following the method od Sanderson and Nixon (2015).

My comments are mostly relevant to the statistical analysis presented in this work.

In the current manuscript it is not very clear how fracture length data have been acquired. I suppose that, for the different scale-sizes, the authors have measured the all visible fracture trace length cross-cut by the scanlines. If this is the case I could not find it explicitly mentioned in the manuscript.

I found that the the 'checkerboard' diagrams (associated to the MLE plots) showing the the variation of the percentage of p-value> 0.05 and percentage of H0 (null hypothesis) with increasing truncated samples are great and practical way of assessing the best upper- and lower-truncation to apply to the sample. Hence, it would be very nice to see these diagram in the main body of the paper rather than in the supplementary materials. In this regards, a possible explanation to the finding that "upper cut has a greater influence over the sample fit". This outcome is a direct result of the current method used in Rizzo et al. (2017a) and Healy et al. (2017) to find the best fitting law (which follows Clauset et al, 2009): this method looks for that minimum value (x-min) for which the theoretical distribution law will hold (either Power-law, Lognormal, or Exponential). Large values therefore, do not influence the fitting. Consequently, the method can effectively account for truncation but not for censoring effects.

I believe that throughout the manuscript you have used erroneously the term 'population'. It is more common that we have access to a subset of the population (i.e., a sample) from which it is then possible to estimate the population parameters using the appropriate sample statistics.

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