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Interactive Comment

Interactive comment on "Extreme value statistics of scalable data exemplified by neutron porosities in deep boreholes" *by* A. Guadagnini et al.

Anonymous Referee #2

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GENERAL COMMENTS

The paper presents a scaling analysis aimed at investigating the behavior of extensive sets of neutron porosity data collected in the field. Section 2 describes the dataset, consisting of data collected at six different wells located within three different geological environments, and presents their frequency distribution. Section 3 analyzes the frequency distribution of data increments as a function of lag distance; these are seen to follow Levy stable or normal-lognormal distributions at smaller lags, while becoming Gaussian at larger lags. Section 4 discusses the scaling behavior of sample structure functions of generalized order, showing a dual behavior of the scaling exponent, that is distinctly larger for smaller lags than for larger lags. Corresponding Hurst coefficients, estimated via the method of moments, are of order 0.7 and 0.1 respectively, show-

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Interactive Discussion

Discussion Paper

ing persistence is associated with intra-layer variability, anti-persistence with inter-layer variability. The relationship between structure functions of different order satisfies Extended Self Similarity (ESS) and provides support to the unified theoretical framework, proposed by the authors in previous papers, which views data to be consistent with sub-Gaussian random fields subordinated to tfBm/tfGn (truncated fractional Brownian motion/ truncated fractional Gaussian noise). Section 5 presents the general scaling theory and the derivation of variogram parameters for the specific data set. Further elements of the theoretical framework are reported in Appendices A and B. Sections 6 and 7 of the paper deal with statistics of peaks over threshold (POTs), defined as such when exceeding the 95% quantile. Their frequency distribution follow a generalized Pareto distribution. The structure functions of their increments exhibit behavior similar to unfiltered field. The paper is fully within the scope of HESS, and of interest to its readership. My concern is that the title reflects only partially the contents of the paper. In fact, the application of the methodology to a large dataset constitutes an important contribution in itself. The extension to extreme values is an entirely new topic, yet it covers only two sections out of seven. I suggest to rephrase the title to include all material covered in the manuscript. The paper structure, subdivision into sections, and language are sound; the paper cannot be shortened significantly. The reference section is broad.

The following specific comments/suggestions are aimed at improving the quality of the paper.

SPECIFIC COMMENTS/SUGGESTIONS

1. The tendency of increments to follow a Levy stable or NLN distributions at smaller lags, while becoming Gaussian at larger lags, is common to other applications: could they be compared ? 2. Well 6 exhibits much larger variability than other wells (figure 1); correspondingly, its statistics are different . Is there a geological explanation ? 3. Lambda_u (correlation length associated with support scale) is taken to be zero in section 5. Comparison of support scale with other lengthscales would corroborate this

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assumption. 4. The structure functions associated with POTs behave similarly to the unfiltered field. An interesting exception are the (extremely low, almost zero) values of the Hurst coefficient associated with (large lag) intra-layer variability. Could the authors provide a physical interpretation of this effect ? 5. Generalized Pareto distributions seem to describe the behavior of POTs. A short appendix describing their behavior and associated parameters would help in following the last section of the paper about POTs. 6. I suggest to review the presentation of the background material (underlying theoretical framework), that is now split between Section 5 and Appendices A and B.

TECHNICAL CORRECTIONS

Check caption of figure 14 . . .(d)-(d).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 11637, 2014.

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