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Fractal Metrology: A toolbox for qualitative and quantitative data analyses in Earth Science

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If you can not measure it you can not manage it (Cox, 2002).If you can not measure it with known precision and exactness you can not make unbiased conclusions. A diversified quatifying Fractal Geometry´s toolbox (Mandelbrot, 2002) enables the Earth Science with precise measures of scale invariance, universality, non linearity, complexity, criticality etc. However, the absence of the reference techniques for measurement of complex system basic attributes, as well as the lack of standards and quality assurance for analysis of sometimes extensive data surveys, makes difficult (why not impossible!) any comparison between conclusions derived, either from empirical observations or theoretical analyses. We use the basic principles of Metrology concerned with measurement, uncertainty and bias analysis (International Vocabularity of Basic and general terms in Metrology, 2004) in order to design the basic concepts of *Fractal Metrology*, devoted to the standard measurement of basic attributes of rough nonlinear sets and processes. The uncertainty, as well as volatility of main fractal parameters and their relation with the system's origin is exemplified in the present research with some point studies accomplished by authors during the last ten years of research in multifaceted fields of statistics and geostatistics of natural systems (Oleschko et al., 2002; Oleschko et al, 2003).

The multiscale data compression using the probability density function (PDF) is presented and its roughness is assessed in terms of Hurst exponent extracted from the spline wavelet and rescaled-range function fitted to each studied distribution. The

standard deviation is used to test the performance of the proposed approach, while the volatility (Stanley,) is proposed as the measure of data oscillation.

Reference

1. Cox, S., 2002. The generalized weighted mean of correlated quantities. Computers and Electronics in Agriculture, 36: 93-111.

2. Mandelbrot, B., 2002. Gaussian Self-Affinity and fractals, Springer-Verlag, new York.

3. Oleschko, K., et al., 2002. fractal scattering from soils. Physical letters, 89, 18:188501-4.

4. Oleschko et al., 2003. Fractal radar scattering from soil. Physical review E, 67, 041404-1: 041403-13.

5. Stanley, H.E.; 2005. Correlated randomness: some examples of exotic statistical physics, PRAMANA J. of Physics, Indian Academy of Sciences, 64, 5:645-660.