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Stochastic analysis and simulation of large dimensional intermittent fields with the help of a Lévy-Clifford algebra of multifractal cascade generators.

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Multifractal fields have opened a new approach in geophysics to explore “spatial chaos”, i.e. processes that are not only complex in time but also in space, because their definition is rather independent of their domain dimension. However multifractals have been for too long restricted to be scalar valued, i.e. to have one-dimensional codomains. This has prevented to deal with the key question of complex component interactions of vector fields and their non trivial symmetries.

On the theoretical level, this is resolved by considering the Lie algebra of stochastic generators of cascade processes with arbitrarily large codomains, e.g. flows of vector fields over large dimensional manifolds. We recently investigated the neat example of stable Levy generators on Clifford algebra that provide both universal statistical and robust algebraic properties to the basic symmetries of the corresponding fields (Schertzer and Tchiguirinskaia, 2015).

This presentation will focus on the concrete analysis of observation data and their simulation in the Levy-Clifford algebra framework. This correspond to a wide and innovative generalisation of classical multifractal methodologies.

Schertzer, D. & Tchiguirinskaia, I., 2015. Multifractal vector fields and stochastic Clifford algebra. Chaos: An Interdisciplinary Journal of Nonlinear Science, 25(12), p.123127.