Modelling hydrometeorological processes with Laws of Randomness: from Univariate to Space-Time simulations

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Randomness is nature's building block and while laws of physics offer elegant and viable options in modelling hydrometeorological processes, investigating the sort- or long-term variability of natural processes based on laws of randomness is crucial in environmental risk estimation, management, and planning. Many stochastic models exist, developed under different rational, and each targeting to explicitly reproduce different statistical properties. But which properties should a model reproduce to offer competent simulations applicable for different processes and at any temporal or spatial scale? This presentation describes a generic stochastic modelling framework (CoSMoS) starting from univariate cases, expanding to multisite and concluding with advanced space-time modelling. In all cases the aim is to reproduce marginal distributions (including intermittency) of the processes under investigation and their correlation structures in space and time. In its most advanced from CoSMoS allows space-time simulations described by velocity fields with locally varying speed and direction and locally varying anisotropy. The scheme will be demonstrated by univariate and multivariate simulations and well as space-time simulations with complex motions and patterns that mimic storms at fine scales, swirling weather phenomena such as cyclones, colliding air masses and many more.

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