An innovative stochastic process and simulation algorithm for approximating any dependence structure and marginal distribution

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We present an innovative stochastic framework for the approximation of any dependence structure and marginal distribution. This framework is based on the concepts of ergodicity, stationarity and homogenization and can adequately simulate (through implicit and explicit methods) the correlation structure (from small to large scales), marginal distribution (with focus on the extreme left and right tails), internal periodicities (such as diurnal and seasonal) as well as certain aspects of the intermittent behaviour. We further introduce a flexible stochastic process and we apply it (following the suggested framework) to an abundant number of geophysical processes (such as temperature, dew-point, relative humidity, wind, streamflow, precipitation, atmospheric pressure and several turbulent microscale processes) and we seek for stochastic similarities in between them. Interestingly, all the examined processes exhibit fractal behaviour (at the small scales) and Hurst-Kolmogorov behaviour (at the large scales).