SIMPLE METHODS TO GENERATE TIME SERIES WITH SCALING BEHAVIOUR

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The scaling behaviour has been detected in a large number of hydroclimatic series on annual and multiyear scales. This behaviour is equivalent to the Hurst phenomenon and, although it affects seriously planning and design of hydrosystems, is often ignored, mostly because it is regarded as difficult to handle. It is shown, however, that it can be reproduced easily in the synthesis of time series. In this respect, four simple methods, utilising and simultaneously highlighting different aspects of simple scaling processes, are discussed. The first method is deterministic and emphasises the fact that simple nonlinear dynamics may produce time series with erratic yet simple scaling behaviour. The second method, based on the weighted sum of three Markovian processes, underlines the multiple time-scale fluctuation origin of the Hurst phenomenon. The third method is based on the invariant properties of a scaling process through different time scales and uses disaggregation to progressively move from coarser to finer time scales. The fourth method utilises the power law form of the power spectrum of a simple scaling process and produces a scaling time series by filtering white noise through a symmetric moving average filter. In addition, it is shown that the last method is general enough to generate any kind of multiple cross-correlated stochastic processes with any autocorrelation structure or power spectrum, and can be extended to sub-annual time scales also reproducing seasonal characteristics of time series.