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An advanced stochastic weather generator for simulating gridded high-resolution climate variables for environmental applications: AWE-GEN-2d

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A new stochastic weather generator, Advanced WEather GENerator for a 2-dimensional grid (AWE-GEN-2d) was recently presented by Peleg et al. (2017). The model combines physical and stochastic elements to simulate key climate variables (e.g. precipitation, cloud cover, near-surface air temperature, solar radiation, vapor pressure, atmospheric pressure and near-surface wind) at high spatial and temporal resolution. The use of a combined stochastic-physically based method makes possible accounting for the dependence between meteorological variables and simulating them at sub-daily temporal scales. This overcomes limitations of empirical-statistical weather generators where statistical correlations at sub-daily scales are complex to reproduce. The resolution of the input data controls the resolution of the weather generator simulated fields, e.g. 2 km by 2 km and 5 min for precipitation when using common weather radar system, and 100 m by 100 m and 1 h for other climate variables when using data from typical ground station networks.
AWE-GEN-2d is parsimonious in terms of computational demand and therefore is particularly suitable for studies where exploring internal climatic variability at multiple spatial and temporal scales is a fundamental goal. The model is suitable for studying the impacts of stochastic climate variability, spatial heterogeneity and temporal and spatial resolutions of climate forcing, as well as for climate downscaling. In this respect, the model can also be used in the context of climate change analyses by modifying the model parameters using information derived from dynamical climate models (e.g. GCMs and RCMs).
Applications of AWE-GEN-2d include generating meteorological forcing for environmental models, where high spatial and temporal resolution is required for the correct simulation of hydrological, ecological, agricultural and geomorphological processes. The weather generator was calibrated and validated for the Engelberg region, an area with complex topography in the Swiss Alps. Model test show that the climate variables are generated with a level of accuracy that is sufficient for many practical applications. Examples of AWE-GEN-2d in reproducing stochastic ensembles of future climate scenarios are also presented.

Peleg et al. (2017), An advanced stochastic weather generator for simulating 2-D high-resolution climate variables, J. Adv. Model. Earth Syst., 9, 1595–1627.