Reproduction of climatic characteristics by interpolated weather generator

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Stochastic weather generators (WGs) are used to produce observed-like synthetic weather series, which may serve as an input to various weather-dependent models (e.g. crop models [1,2,3,4,5] and rainfall-runoff models [3]). Typically, WGs are used in assessing sensitivity of the modelled processes to variability and changes in climatic characteristics.

CaliM&Ro project (www.ufa.cas.cz/dub/calimaro/calimaro.htm) is focused on calibration of a stochastic single-site 4-variate daily weather generator Met&Roll [1,2,3,4,5,6] for sites with non-existing or incomplete historical daily weather series. Met&Roll is a parametric weather generator. It uses Markov chain (order = 1 to 3) to model precipitation occurrence, Gamma distribution to model precipitation amount and first-order autoregressive model to model solar radiation and daily extreme temperatures. Daily generator may be optionally conditioned on the monthly generator [3] based on the 1st order autoregressive model. Parameters of the generator are allowed to exhibit annual cycle.

To calibrate WG for the ungauged location, WG parameters may be interpolated from the surrounding stations. In our previous experiments, we tested three interpolation techniques: kriging or co-kriging run from ArcGIS, neural networks and nearest neighbours. In this contribution, we focus on the nearest neighbours interpolator which defines the interpolated value as a weighted average from the surrounding stations using a bell-shaped distance-based weight. The performance of the interpolation techniques is examined in two ways: (i) accuracy of interpolation of individual WG parameters is assessed in terms of the Root-Mean-Square Error and Reduction-of-Variance of individual WG parameters. (ii) Climatic characteristics derived from the synthetic series produced by the interpolated weather generator are compared with those produced by WG calibrated with the site-specific observed weather data. The climatic characteristics employed in this experiment include annual precipitation and temperature extremes and duration characteristics of wet, dry, hot and cold spells.

To visualise performance of the interpolation techniques, selected WG parameters are interpolated into regular 0.5Ďe0.5ąň grid covering whole Czechia using the global GTOPO30 digital elevation model

[http://edc.usgs.gov/products/elevation/gtopo30/gtopo30.html].

References: [1] Dubrovsky M. et al, 2000, Clim. Change 46, 447-472; [2] Zalud Z. and Dubrovsky M., 2002, Theor. Appl. Climatol., 72, 85-102; [3] Dubrovsky M. et al., 2004, Clim. Change 63, 145-179; [4] Trnka M. et al., 2004, Theor. Appl. Climatol. 77, 229-249; [5] Trnka M. et al., 2004, Clim. Change 64, 227-255; [6] Kysely J. and Dubrovsky M., 2005, Int.J.Climatol. 25, 251-269.

Acknowledgement: The contribution is an outcome of the CaliM&Ro project sponsored by the Grant Agency of the Czech Republic (project 205/05/2265).