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Towards the probabilistic climate change scenarios for impact studies: linking the weather generator with the GCM-based climate change scenario

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In assessing impacts of the future climate change, the climate change scenarios related to a specific time horizon and emission scenario are required. These scenarios typically consist of changes in monthly means. Having the scenario, the time series (commonly with daily step) required as an input to the impact models may be produced either by modifying the observed weather series according to the climate change scenario, or with the weather generator whose parameters were modified according to the climate change scenario. The climate change scenario is often based on a transient GCM simulation run at a given emission scenario. To determine the climate change scenario for an emission scenario for which the GCM simulation is not available, the pattern scaling technique may be used. In this technique, the climate change scenario is obtained as a product of the standardised climate change scenario and the change of the global mean temperature. The change of the global mean temperature for a given emission scenario and climate sensitivity may be calculated by a simple climatic model, e.g. MAGICC. The standardised scenario, which defines responses of individual climatic characteristics to 1K rise in global mean temperature, may be derived from a longer portion (e.g., 100 years long) of the transient GCM simulation by a linear regression, in which the independent variable is the change in global mean temperature, and the dependent variable is the change of a given variable in a given month (Dubrovsky, 2005). The standardised scenario is loaded by uncertainty, which relates to the error in the regression coefficients. The question may stand, how to account for this uncertainty in climate change impact studies. This presentation assumes that the uncertainty in the standardised scenario is due to natural climatic variability and may be modelled by stochastic weather generator. Specifically, it is proposed that the weather series

representing the changed climate are produced by the daily weather generator, which is linked to the monthly generator, whose parameters may also be modified according to the GCM-based climate change scenario to account for possible changes in low-frequency climatic variability. An approach used in Met&Roll generator will be used to link the daily and monthly weather generators (Dubrovsky et al., 2004).

The present experiments will: (i) examine uncertainty involved in standardised climate change scenarios (addressing the surface climatic characteristics) derived from the recent GCM simulations (made for the 4th IPCC Assessment Report), (ii) compare intermonthly variability in GCM-simulated monthly series vs. surface observations (using observational data from a set of European stations), and (iii) test ability of the monthly generator based on the first-order autoregressive model to capture this low-frequency variability.

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