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HOWGH: an hourly weather generator for pests modeling in present and future climates

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Agriculture is assumed to be largely affected by indirect effects of climate change, such as changes in pest populations. In the warmer climate, agricultural pests are generally expected to occur more frequently and possibly extend to previously unaffected regions. To quantify impact of the projected climate change on a specific pest in a specific site, we may use a calibrated pest model and compare the outputs obtained with site specific weather data representing present vs. future climates. This contribution focuses on the HOWGH weather generator, which produces synthetic hourly weather data required by a dynamic pest model SOPRA simulating the development of codling moth.

Part 1 - model of the generator: HOWGH is based on a combination of parametric and non parametric statistical methods and allows to generate optional number of weather variables. Here we use it to generate hourly series of three weather variables required by SOPRA: solar radiation, temperature and precipitation. The underlying algorithm consists of three steps: (i) Generating daily values by M&Rfi weather generator, which is based mostly on parametric modelling. (ii) For each single day generated by M&Rfi, the hourly values are sampled from the observational hourly database. (iii) Adjusting the sampled hourly values so that they exactly fit the daily values generated by M&Rfi.

Part 2 - validation of the generator: To finetune the 3 step algorithm, the synthetic series generated by HOWGH with various settings are validated in terms of (i) climatic characteristics (derived both from daily and hourly series) and (ii) characteristics derived from the output of SOPRA model fed by the synthetic series (e.g. flight start of the codling moth in spring).

Part 3 - use of HOWGH in climate change impact study: To generate synthetic weather series representing the future climate, the WG parameters are modified according to the climate change scenario. In case of our experiments, the scenarios are based on multi-model projections (RCMs) and include changes in the precipitation and temperature means, changes in precipitation frequency, intensity and the dry to wet day transition probability. The methodology of generating the future-climate weather series is described here, the results of codling moth simulations for future climate are presented separately.

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