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Selection of meteorological conditions to apply in an Ecotron facility

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This presentation aims to propose a generic method to produce meteorological input data that is useful for climate research infrastructures such as an Ecotron, where researchers will face the need to generate representative actual or future climatic conditions. Depending on the experimental objectives and the research purposes, typical conditions or more extreme values such as dry or wet climatic scenarios might be requested. Four variables were considered here, the near-surface air temperature, the near-surface relative humidity, the cloud cover and precipitation.
The meteorological datasets, among which a specific meteorological year can be picked up, are produced by the ALARO-0 model from the RMIB (Royal Meteorological Institute of Belgium). Two future climate scenarios (RCP 4.5 and 8.5) and two time periods (2041-2070 and 2071-2100) were used as well as a historical run of the model (1981-2010) which is used as a reference.
When the data from a historical run were compared to the observed historical data, biases were noticed. A linear correction was proposed for all the variables except for precipitation, for which a non-linear correction (using a power function) was chosen to maintain a zero-precipitation occurrences. These transformations were able to remove most of the differences between the observed and historical run of the model for the means and for the standard deviations. For the relative humidity, because of non-linearities, only one half of the average bias was corrected and a different path might have to be chosen.
For the selection of a meteorological year, a position and a dispersion parameter have been proposed to characterise each meteorological year for each variable. For precipitation, a third parameter quantifying the importance of dry and wet periods has been defined. In order to select a specific climate, for each of these nine parameters the experimenter should provide a percentile and a weight to prioritize the importance of each variable in the process of a global climate selection.
The proposed algorithm computed the weighted distance for each year between the parameters and the point representing the position of the percentile in the nine-dimensional space. The five closest values were then selected and represented in different graphs.
The proposed method is able to provide a decision aid in the selection of the meteorological conditions to be generated within an Ecotron. However, with a limited number of years available in each case (thirty years for each RCP and each time period), there is no perfect match and the ultimate trade-off will be the responsibility of the researcher. For typical years, close to the median, the relative frequency is higher and the trade-off is more easy than for more extreme years where the relative frequency is low.