

Automatic and global optimization of the Analogue Method for statistical downscaling of precipitation - Which parameters can be determined by Genetic Algorithms?

Pascal Horton (1), Rolf Weingartner (1), Charles Obled (2), and Michel Jaboyedoff (3)

(1) Oeschger Centre of Climate Change Research, Hydrology Group, Institute of Geography, University of Bern, Bern, Switzerland, (2) Université de Grenoble-Alpes, LTHE, Grenoble, France, (3) University of Lausanne, Lausanne, Switzerland

The Analogue Method (AM) aims at forecasting a local meteorological variable of interest (the predictand), often the daily precipitation total, on the basis of a statistical relationship with synoptic predictor variables. A certain number of similar situations are sampled in order to establish the empirical conditional distribution which is considered as the prediction for a given date. The method is used in operational medium-range forecasting in several hydropower companies or flood forecasting services, as well as in climate impact studies.

The statistical relationship is usually established by means of a semi-automatic sequential procedure that has strong limitations: it is made of successive steps and thus cannot handle parameters dependencies, and it cannot automatically optimize certain parameters, such as the selection of the pressure levels and the temporal windows on which the predictors are compared. A global optimization technique based on Genetic Algorithms was introduced in order to surpass these limitations and to provide a fully automatic and objective determination of the AM parameters.

The parameters that were previously assessed manually, such as the selection of the pressure levels and the temporal windows, on which the predictors are compared, are now automatically determined. The next question is: Are Genetic Algorithms able to select the meteorological variable, in a reanalysis dataset, that is the best predictor for the considered predictand, along with the analogy criteria itself? Even though we may not find better predictors for precipitation prediction than the ones often used in Europe, due to numerous other studies which consisted in systematic assessments, the ability of an automatic selection offers new perspectives in order to adapt the AM for new predictands or new regions under different meteorological influences.