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Probabilistic Gaussian copula regression model: application to multisite and multivariable downscaling

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Atmosphere–ocean general circulation models (AOGCMs) are useful to simulate largescale climate evolutions. However, AOGCM data resolution is too coarse for regional and local climate studies. Downscaling techniques have been developed to refine AOGCM data and provide information at more relevant scales especially for hydrological applications. Among a wide range of available approaches, regression-based methods are commonly used for this purpose. When several variables are considered at one or multiple sites, regression models are employed to reproduce the observed climate characteristics at small scale, such as the variability and the relationship between sites and variables. The objective of the present talk is to introduce a probabilistic Gaussian copula regression (PGCR) model for simultaneously downscaling multiple variables at several sites. The proposed PGCR model relies on a probabilistic framework to specify the marginal distribution for each downscaled variable at a given day through AOGCM predictors, and handles multivariate dependence between sites and variables using a Gaussian copula. The proposed model is applied for the downscaling of AOGCM data to daily precipitation and minimum and maximum temperatures in the southern part of Québec, Canada. In addition, to assess the potential of the proposed method, reanalysis products are used in this study. Results of the study indicate the superiority of the proposed model over classical regression-based methods.

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