Statistical-dynamical downscaling of the Seine basin climate for hydrometeorological studies

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A multivariate statistical downscaling methodology is implemented in order to study the impacts of climate change on the hydrological cycle of the Seine basin in France. The statistical downscaling algorithm is based on weather typing. It starts from regional climate properties in order to establish discriminative weather types for the chosen local variable, precipitation in this case. Intra-type variations of the relevant forcing parameter are then taken into account by multivariate regression using the distances between the different weather types and a given day as predictors. The final step consists in conditional resampling. The impact of the model's resolution on the results of statistical downscaling is tested. Two versions of the same general circulation model are used. The first version has a regular grid with a resolution of about 2.8x2.8 degree whereas the second version has a variable resolution wich allows to obtain an high resolution on the domain of interest (about 0.5 degree). The results obtained with the variable resolution model are far better. It highlights the interest of an hybrid approach in downscaling studies, for which the large scale circulation obtained with dynamical downscaling is then used as a predictor in a statistical downscaling scheme. Regional climate variables directly obtained from dynamical downscaling and obtained with the hybrid approach are also compared. In our case, dynamical downscaling only does not apppear sufficient to obtain a realistic representation of regional climate. Finally, hydrological simulations using downscaled climate variables as forcing are realized and compared to observations in order to globally evaluate the methodology.