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Hydro-Meteorological Variability and Future Climate: Model Formulation and Numerical Implementation

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The increase of global atmospheric temperature caused by anthropogenic activity together with natural climate variability, influences the changing statistics of local meteorological variability. More severe and frequent weather extremes, as well as changes in weather patterns affect local and regional economic activity. However, it is changes in regional- and planetary-scale variability that drive the non-stationarity of local meteorological variability. This manuscript proposes a methodology aimed at analysing changes in local meteorological variability, as caused by changes in large-scale climate.

First, we select a weather index capturing a specific meteorological hazard of interest for each small-scale pixel of a regular grid by using random forests. Next, we select heuristically the climate driver that is likely to most strongly affect the small-scale weather indices defined in the previous step. Finally, we select the climate model that best simulates the evolution in time of the primary driver. This three-step procedure is illustrated by applying it to projections of drought and extreme heat during spring and summer in Western Europe. Physical explanations of the variation in projections of drought and heat waves statistics to climate model is provided.