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Selecting downscaled climate projections for water resource impacts and adaptation

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Increasingly large ensembles of global and regional climate projections are being produced and delivered to the climate impact community. However, such an enormous amount of information can hardly been dealt with by some impact models due to computational constraints. Strategies for transparently selecting climate projections are therefore urgently needed for informing small-scale impact and adaptation studies and preventing potential pitfalls in interpreting ensemble results from impact models.

This work proposes results from a selection approach implemented for an integrated water resource impact and adaptation study in the Durance river basin (Southern French Alps). A large ensemble of 3000 daily transient gridded climate projections was made available for this study. It was built from different runs of 4 ENSEMBLES Stream2 GCMs, statistically downscaled by 3 probabilistic methods based on the K-nearest neighbours resampling approach (Lafaysse *et al.*, 2014).

The selection approach considered here exemplifies one of the multiple possible approaches described in a framework for identifying tailored subsets of climate projections for impact and adaptation studies proposed by Vidal & Hingray (2014). It was chosen based on the specificities of both the study objectives and the characteristics of the projection dataset. This selection approach aims at propagating as far as possible the relative contributions of the four different sources of uncertainties considered, namely GCM structure, large-scale natural variability, structure of the downscaling method, and catchment-scale natural variability. Moreover, it took the form of a hierarchical structure to deal with the specific constraints of several types of impact models (hydrological models, irrigation demand models and reservoir management models). The implemented 3-layer selection approach is therefore mainly based on conditioned Latin Hypercube sampling (Christierson *et al.*, 2012). The choice of conditioning variables – climate change signal in temporally and spatially integrated variables – has been carefully made with respect their relevance for water resource management.

This work proposes a twofold assessment of this selection approach. First, a climate validation allows checking the selection response of more extreme climate variables critical for hydrological impacts as well as spatially distributed ones. Second, a hydrological validation allows checking the selection response of streamflow variables relevant for water resource management. Findings highlight that such validations may critically help preventing misinterpretations and misuses of impact model ensemble outputs for integrated adaptation purposes.

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[2] www.complex.ac.uk