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Results from the VALUE perfect predictor experiment: process-based evaluation

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Until recently, the evaluation of downscaled climate model simulations has typically been limited to surface climatologies, including long term means, spatial variability and extremes. But these aspects are often, at least partly, tuned in regional climate models to match observed climate. The tuning issue is of course particularly relevant for bias corrected regional climate models. In general, a good performance of a model for these aspects in present climate does therefore not imply a good performance in simulating climate change. It is now widely accepted that, to increase our condidence in climate change simulations, it is necessary to evaluate how climate models simulate relevant underlying processes. In other words, it is important to assess whether downscaling does the right for the right reason.

Therefore, VALUE has carried out a broad process-based evaluation study based on its perfect predictor experiment simulations: the downscaling methods are driven by ERA-Interim data over the period 1979-2008, reference observations are given by a network of 85 meteorological stations covering all European climates. More than 30 methods participated in the evaluation. In order to compare statistical and dynamical methods, only variables provided by both types of approaches could be considered. This limited the analysis to conditioning local surface variables on variables from driving processes that are simulated by ERA-Interim.

We considered the following types of processes: at the continental scale, we evaluated the performance of downscaling methods for positive and negative North Atlantic Oscillation, Atlantic ridge and blocking situations. At synoptic scales, we considered Lamb weather types for selected European regions such as Scandinavia, the United Kingdom, the Iberian Pensinsula or the Alps. At regional scales we considered phenomena such as the Mistral, the Bora or the Iberian coastal jet. Such process-based evaluation helps to attribute biases in surface variables to underlying processes and ultimately to improve climate models.