



Multiple levels of validation for downscaled ensemble results

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We present a multi-level validation strategy for downscaled climate projections. A first step is to assess the GCMs using common EOFs to compare their spatio-temporal structure of variability with reanalyses. The next level involves a validation of the downscaling method through standard protocols such as cross-validation. A third aspect, which applies to large ensembles of GCM runs and/or large number of stations, is to compare observations to the statistical population of sampled model results. This level includes an evaluation of simulated trends against corresponding observed trends and a count of points outside the 90% confidence limit. A Wilcoxon test can also be used to test how the observations rank with the ensemble members. A fourth aspect of validation can include a set of sensitivity tests that bring in additional information about how robust various climatic parameters are to long-term historic warming, seasonal variations, and changes in geographical conditions. We show how the validation scheme can be applied to multi-site projections for temperature, precipitation and downscaled storm tracks. We also present some ideas to estimate and validate probabilities of occurrences and projected number of extremes per year, based on empirical-statistical downscaling applied to GMC ensembles.