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Evaluating decadal predictions – some considerations on bias correction and cross-validation

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Currently substantial efforts are undertaken to improve the prediction capability on the time-scale of a few years to a decade. In seasonal forecasting validation techniques based on past model performance are well-established tools. So far there is no consensus on the degree to which these are also applicable to decadal predictions. We contribute to this discussion by assessing the effects of drift-correction and cross-validation on the skill estimates. The study employs decadal hindcasts of 2m temperature from the EU FP6 ENSEMBLES project and a synthetic toy model.

Decadal predictions can be subject to substantial lead-time dependent model drifts. The conventional drift-correction method has a considerable sampling uncertainty taking up to 40% of the potentially predictable signal. Introducing a smooth drift curve allows to reduce this uncertainty by about 30% for annual values. The typical leave-one-out cross-validation, as recommended for seasonal forecasting, may lead to biased skill estimates for decadal prediction due to the small number of hindcasts available. We identify this effect and show that "Jackknifing" represents a suitable technique to estimate potential skill without bias and to estimate sampling uncertainty. Results indicate significant correlation skill on the order of 0.7-0.9 for predicting global annual mean temperature on all lead-times.

The strong sampling uncertainty due to the lack of independent and representative decadal hindcasts remains the key problem for the evaluation. It prohibits drawing a final conclusion, by means of verification, on whether or not decadal predictions have skill in predicting climate variability beyond a simpler trend estimate.