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Temporal merging of decadal predictions and climate projections to obtain seamless information: challenges and potential solutions

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There is an increasing demand from society and policy makers for reliable, robust and actionable climate information for the upcoming 40 years. However, providing such seamless information poses a challenge to the scientific community. Traditionally, the scientific community developed targeted forecasts for specific time scales, e.g. short-term, seasonal or decadal predictions. These model integrations have thus a limited forecast period and do not provide seamless information on time scales up to 40 years.

This work discusses two alternative approaches to combine information from initialized decadal predictions (providing information up to ten years) with uninitialized climate projections (available until 2100 and beyond).

The first is a novel framework, which is designed to implicitly make use of the (added) values from initialization by constraining uninitialized climate projections using decadal predictions. This approach is applied to near-surface temperatures over the North Atlantic Subpolar gyre region from CMIP5 models. Results suggest that such a constraining approach is able to provide more skillful, seamless climate information beyond decadal time-scales compared to using unconstrained climate projections.

The second approach is based on the simple temporal concatenation of decadal predictions and climate projections. It is shown that this can introduce inconsistencies, which may impact the usability for potential end users. Two different methods to overcome these issues are discussed: the application of a simple calibration method and a weighting scheme based on model performance. Results for the calibration method are in general promising, whereas the impact of the model weighting scheme is smaller. The latter is mainly associated with the small size of the decadal prediction ensemble, which hinders the usual application of the weighting scheme as done in previous studies based on much larger ensembles.