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Calibration of decadal ensemble predictions

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Climate predictions for decade(s) are of great socio-economic value, because typical planning horizons of political and economic decision makers coincide with that time scale.

Due to the uncertainties in initial conditions of weather and climate, forecasts should be and are increasingly issued in a probabilistic way. One problem frequently observed for probabilistic ensemble forecasts is that they tend to be not reliable, i.e. the ensemble spread does not represent the forecast uncertainty. They thus need to be re-calibrated for further use in impact and attribution studies. Moreover, decadal prediction systems typically exhibit systematic errors like lead-time dependent uncondtional and conditional biases.

We propose a decadal forecast recalibration strategy (DeFoReSt) which simultaneously adjusts unconditional and conditional bias, as well as the ensemble spread while considering the typical setting of decadal predictions, i.e. model drift and a climate trend. The resulting parametric correction terms for bias, conditional bias and ensemble spread are functions of time and lead time and can be used to localize causes of non-calibrated forecasts. Applying DeFoReSt to the MiKlip system (Germany's initiative for decadal prediction) reveals that the forecast system's ensemble spread needs only minor adjustment if bias and conditional bias are properly adjusted.