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Skill of probabilistic decadal forecasts regarding the frequencies of Northern Hemisphere extra-tropical cyclones

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Mid-latitude cyclones exert a large influence on primary meteorological parameters such as surface temperature, wind speed or precipitation. The variability in their frequency of occurrence is thus important for climate variability in the extra-tropics and consequently a crucial parameter for skillful predictions on interannual to multi-decadal time scales.

This work investigates the skill of a prediction system which is being developed to make climate forecasts for time scales of up to 10 years. Within *MiKlip* – the German initiative for decadal prediction – five different hindcast sets for the period 1961-2010 were set up, all produced by the same model system (MPI-ESM-LR), but following different strategies for initialization (anomaly-initialization and full-field-initialization from different reanalysis data sets as well as initialization from an assimilation experiment). Based on 41 annual initializations for each of the strategies, it is analyzed whether these forecast systems can provide skillful (compared to climatological forecasts and uninitialized climate projections) probabilistic three-category forecasts (enhanced, normal or decreased) of Northern Hemisphere extra-tropical winter (ONDJFM) cyclone frequencies with different lead times.

It is shown, that they exhibit significant skill for the North Atlantic and Pacific storm track, mainly for lead times of 2-5 years. Prediction skill for the subset of intense (strongest 25% according to laplacian of sea-level pressure) cyclones is generally higher than for the full set of all detected systems. A comparison of the different initialization strategies indicates systematic differences for some lead times and regions.

First exploratory analyses regarding potential sources of found predictive skill indicate local oceanic forcing of lower troposphere baroclinicity but also remote influences – especially of tropical origin – modulating large scale circulation patterns.