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Evaluating probabilistic decadal forecasts of Northern Hemisphere extra-tropical cyclone frequencies

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Mid-latitudinal cyclones are a key factor for understanding regional anomalies of primary meteorological parameters, such as temperature, surface wind speed or precipitation. Extreme cyclones potentially cause tremendous impacts on society and economy, e.g. by enormous wind-storm induced damages.

Based on an ensemble prediction experiment with 41 annually initialised (1961-2001) hindcasts, as part of the German *MiKlip*-initiative for decadal prediction, this study evaluates a single-model decadal forecast system (MPI-ESM-LR). It analyses, whether the forecast system can provide skillful probabilistic three-category forecasts (enhanced, normal or decreased) of extra-tropical winter (ONDJFM) cyclone frequencies over the northern hemisphere with lead times from one year up to a decade. Thus, it will be analysed whether the *MiKlip*-system is of additional value compared to climatological forecasts and uninitialised climate projections.

It is shown, that these predictions exhibit significant skill, mainly over the North Atlantic and Pacific for lead times of 2-5 years. Skill for the subset of intense (strongest 25% according to laplacian of SLP) cyclones is generally higher than for the full set of all detected systems.A comparison of decadal predictions from different initialisation strategies indicates systematic differences for some lead times and regions. Additional parameters (e.g. air temperature, SST, and geopotential height) and indices of large-scale variability modes (e.g. NAO and PNA) are analysed for a better understanding of the underlying mechanisms of cyclone frequency modification and thus potential sources of skill.