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Probabilistic empirical prediction of seasonal climate: evaluation and potential applications

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Preparing for episodes with risks of anomalous weather a month to a year ahead is an important challenge for governments, non-governmental organisations, and private companies and is dependent on the availability of reliable forecasts. The majority of operational seasonal forecasts are made using process-based dynamical models, which are complex, computationally challenging and prone to biases. Empirical forecast approaches built on statistical models to represent physical processes offer an alternative to dynamical systems and can provide either a benchmark for comparison or independent supplementary forecasts.

Here, we present a new evaluation of an established empirical system used to predict seasonal climate across the globe. Forecasts for surface air temperature, precipitation and sea level pressure are produced by the KNMI Probabilistic Empirical Prediction (K-PREP) system every month and disseminated via the KNMI Climate Explorer (climexp.knmi.nl). K-PREP is based on multiple linear regression and built on physical principles to the fullest extent with predictive information taken from the global CO_2-equivalent concentration, large-scale modes of variability in the climate system and regional-scale information.

K-PREP seasonal forecasts for the period 1981-2016 will be compared with corresponding dynamically generated forecasts produced by operational forecast systems. While there are many regions of the world where empirical forecast skill is extremely limited, several areas are identified where K-PREP offers comparable skill to dynamical systems. We discuss two key points in the future development and application of the K-PREP system: (a) the potential for K-PREP to provide a more useful basis for reference forecasts than those based on persistence or climatology, and (b) the added value of including K-PREP forecast information in multi-model forecast products, at least for known regions of good skill. We also discuss the potential development of stakeholder-driven applications of the K-PREP system, including empirical forecasts for circumboreal fire activity.