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Statistical Postprocessing of Long-Range Air Temperature Forecasts in the Czech Republic Using Neural Networks

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Long-range weather forecasts represent an important tool for planning across various sectors, from agriculture to energy. Their use on a global scale continues to grow, supported by the improving quality of numerical models. However, under the conditions of Central Europe—particularly in the Czech Republic—their reliability and applicability face a number of challenges. This contribution focuses on the potential of statistical postprocessing of long-range air temperature forecasts in the Czech Republic.

Dynamical forecasts use full three-dimensional climate models to simulate potential changes in the atmosphere and oceans over the coming months based on current conditions. Ensembles of simulations provide probabilistic weather scenarios that indicate the likelihood of a given period being wetter, drier, warmer, or colder compared to the seasonal average. The added value of various postprocessing approaches for seasonal forecasts remains a topic of ongoing debate.

This work focuses on statistical postprocessing based on empirical relationships derived between a locally observed predictand of interest (in this case, air temperature) and one or more suitable model predictors from global seasonal forecasting systems. The study analyses the seasonal forecast systems available in the Copernicus Climate Change Service (C3S) archive, which provide near-surface air temperature data at 1° × 1° spatial resolution. It examines the statistical postprocessing of air temperature forecasts for the Czech Republic using four weather forecast systems: the European Centre for Medium-Range Weather Forecasts (ECMWF), Météo-France (MF), Deutscher Wetterdienst (DWD), and Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC).

The analysis covers the period 1993–2016, which represents the longest hindcast period common to all systems, and the domain of the Czech Republic in Central Europe (49–51°N, 12–19°E). For statistical postprocessing using a neural network method implemented in STATISTICA software, air temperature and sea level pressure data from global forecast models were used as predictors. The reference data used in this study are gridded station-based observational air temperature datasets. The forecast performance is evaluated across three temperature categories: above normal, normal, and below normal.