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Effect of extreme precipitation event properties on the forecast skill

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Precipitation extremes naturally belong to the most studied meteorological and climatological hazards because of their high impacts on the human society. The skill of the quantitative precipitation forecast is often insufficient to predict accurately and consistently their location, amount, type, and timing. The fact that assessing the forecast uncertainty may significantly improve the predictability of such events motivates our research. We show the first results for the territory of the Czech Republic (CR) by presenting representative, mostly recent case studies where we analyze the dependence between the forecast skill and the extremeness characteristics of the events including accompanying circulation conditions.

Extreme precipitation events (EPEs) is selected by the Weather Extremity Index (WEI), an advanced tool which combines the rarity of totals, extent and duration. The WEI is calculated from 1-day totals within the CR and separately within 11 catchments each covering the area of approximately 7000 km2. Selected EPEs are re-forecasted with the horizontal resolution of 2.8 km by the NWP model COSMO, the non-hydrostatic, compressible model which is able to resolve and explicitly simulate larger elements of organized convection. In order to evaluate the forecast skill, various spatial verification methods are used. Verification data comprise daily totals from rain gauge measurements from approximately 700 stations, precipitation intensities from a couple of pluviographs (since 1960) and radar measurements (since 2002).

Next, accompanying circulation conditions are investigated by the method of anomalies, according to our experiences an appropriate approach using the NCEP/NCAR Reanalysis dataset. Frequency analysis of various thermodynamic variables is carried out in each grid box. An anomaly in a variable is determined as a contiguous space where probabilities of exceeding are nearing 0 or 1. The anomalies are characterized by their magnitude, extent, and duration. We assume that the conditional extremity of the circulation pattern will be the main explanatory variable of the forecast uncertainty.