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Probabilistic forecasts of extreme local precipitation using HARMONIE predictors and comparing 3 different post-processing methods

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Statistical post-processing of deterministic weather forecasts allows production of the full forecast distribution, and thus probabilistic forecasts, to be derived from that deterministic model output. We focus on local extreme precipitation amounts, as these are one predictand used in the KNMI weather warning system. As such, the predictand is based on the maximum hourly calibrated radar precipitation in a 3x3 km^2 area within 12 large regions covering The Netherlands in a 6-hour afternoon period in summer (12-18 UTC).
We compare three statistical methods when post-processing output from the operational high-resolution forecast model at KNMI, HARMONIE. These methods are 1) extended logistic regression (ELR), 2) an ensemble model output statistics approach where the parameters of a zero-adjusted gamma (ZAGA) distribution depends on a set of covariates and 3) quantile random forests (QRF). The set of predictors used as covariates includes model precipitation and indices capturing a variety of processes associated with deep convection. We use stepwise selection to select predictors for ELR and ZAGA based on the AIC. Predictors and coefficients are selected in a cross-validation framework based one two-years of training data and the skill of the forecasts are assessed on one-year of test data. The inclusion of additional predictors results in more skilfull forecasts, as expected, particularly for higher precipitation thresholds and for forecasts using the QRF method. We also assess the value of using a time-lagged ensemble. Forecasts derived from ZAGA and QRF are generally more skilfull, as defined by the Brier Skill Score, than ELR and lower precipitation amounts are skillfully predicted.