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From research to applications – Examples of operational ensemble post-processing in France using machine learning

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Statistical post-processing of ensemble forecasts, from simple linear regressions to more sophisticated techniques, is now a well-known procedure in order to correct biased and misdispersed ensemble weather predictions. However, practical applications in National Weather Services is still in its infancy compared to deterministic post-processing. This paper presents two different applications of ensemble post-processing using machine learning at an industrial scale. The first is a station-based post-processing of surface temperature in a medium resolution ensemble system. The second is a gridded post-processing of hourly rainfall amounts in a high resolution ensemble prediction system. The techniques used rely on quantile regression forests (QRF) and ensemble copula coupling (ECC), chosen for their robustness and simplicity of training whatever the variable subject to calibration.

Moreover, some variants of classical techniques used such as QRF or ECC have been developed in order to adjust to operational constraints. A forecast anomaly-based QRF is used for temperature for a better prediction of cold and heat waves. A variant of ECC for hourly rainfall is built, accounting for more realistic longer rainfall accumulations. It is shown that forecast quality as well as forecast value is improved compared to the raw ensemble. At last, comments about model size and computation time are made.