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Post-processing of hourly rainfall for hydrological and weather warning-oriented applications

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In France, the SCHAPI (Central Hydrometeorology and Flood Forecasting Support Service), and the 22 SPCs (Flood Forecasting Services) spread over the territory, produce vigilance maps twice a day for forecasting floods. To do this, they use numerical forecasts. These three types of forecasts are currently deterministic.They take into account the rainfall forecasts. For hydrological models, they estimate flows upstream watersheds from measured or forecast rainfall. For hydraulic models,they transfer upstream flows downstream of rivers.
Given the amount of uncertainty on the three models involved (meteorological, hydrological and hydraulic), a chained deterministic prediction of the three models is unreliable and must be given up in favour of a ensemble-theoretic approach. The establishment of an ensemble forecast chain will allow the forecaster to predict either a water level, but ranges of expected heights, with associated uncertainties. This approach is entirely compatible with the estimate of the risk of exceeding the threshold (yellow, orange or red), as currently used in the national raw warning system.

In this context, Météo-France chose to post-process its high-resolution limited area ensemble forecast PEAROME for hourly rainfall but doing an upscaling on watersheds' scale, avoiding the double penalty issues. A study was made on three French watersheds comparing several post-processing techniques such as EMOS or Quantile regression Forests (QRF) and their derivations. Using calibrated radar precipitation as observations, we show that QRF has the best performance. Techniques of Ensemble Copula Coupling has also been applied in order to restore the spatio-temporal consistencies between the different meteorological scenarios.