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Estimating predictive hydrological uncertainty by dressing deterministic and ensemble forecasts; a comparison, with application to Meuse and Rhine

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Hydrological forecasts are characterised by uncertainties originating in the meteorological forecasts as well as in the modeling of streamflow generation and routing processes. Estimates of predictive hydrological uncertainty therefore have to be inclusive of both meteorological and hydrological uncertainties. Generally speaking, there are two approaches to estimating this 'holistic' predictive uncertainty: a source-specific approach where uncertainties from each source are estimated separately and subsequently integrated, and a lumped approach where all uncertainties are estimated using a single technique.

The present paper explores an 'in between' approach, often referred to as 'ensemble dressing'. Uncertainties in the predicted meteorological forcings are estimated using an ensemble approach, the remaining uncertainties are lumped using a statistical post-processor and the two estimates are combined to arrive at an estimate of total uncertainty.

Skill and quality of forecasts in four scenarios are inter-compared: 'bare' deterministic and ensemble streamflow forecasts and their 'dressed' equivalents. This evaluation shows that, generally, (i) bare ensemble forecasts have higher skill than bare deterministic forecasts; (ii) dressed forecasts have higher skill than their bare equivalents; (iii) the skill of dressed ensemble forecasts is roughly equal to that of dressed deterministic forecasts. These conclusions are discussed with respect to what constitutes a possible 'best' approach for estimating predictive hydrological uncertainty.