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Ensemble predictions of runoff using hydrograph transpositions to ungauged basins

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Regionalisation is one common approach for modelling streamflow in ungauged basins. It is sometimes performed on the basis of ensemble modelling and model averaging through the play of parameters of rainfall-runoff models. We propose an original approach for ensemble modelling by transposing physically based time series rather than model's parameters. We applied the approach on 6 sub-basins of the Blavet river in Brittany (France) with area varying from 5 km^2 to 316 km^2. Inside this sample of gauged basins, the water provided by hillslopes to the network at a basin scale, called the net rainfall, is assessed by inverting their simple geomorphology based network transfer function. Those net rainfall time series, estimated at an hourly time step on each gauged basin separately, summarise the hydrological behaviour of their hillslopes without the need of any complex modelling. Moreover, it has the advantage of being relatively scale independent which enables its transposition among basins. Once this net rainfall is transposed to an ungauged basin, it is reconvoluted using its own transfer function in order to estimate the hydrograph therein. We propose to combine several gauged basins to perform ensemble modelling prediction. This ensemble modelling provides an indication of uncertainty. Although it is not a robust estimate of the possible flow range, it informs about the variability of basins behaviour inside the studied region and, as a consequence, the relative confidence in those transpositions of hydrograph. By selecting donor basins according to their similarity to the ungauged one, we aim to improve prediction accuracy, reduce uncertainty and check the best way to define hydrological similarity for the choice of the donor basin. It is demonstrated that spatial proximity provides a relatively robust estimate of the best donor basin, and giving more importance to similar basins does not necessarily lead to higher accuracy in simulations compared to a simple net rainfall average.