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What can we expect by accounting for the spatial variability of rainfall in lumped rainfall-runoff models?

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Rainfall is often considered as a major source of spatial variability in streamflow simulation at the outlet of catchments. Often mean areal precipitation is the only available information to lumped rainfall-runoff models as input for simulation.
This average precipitation is most likely a source of uncertainty in parameter estimation as well as a source of errors in runoff simulation. Probably it is because this average conceals some available information like rainfall variance. Nevertheless, the relations between rainfall spatial variability and errors in runoff simulation are considered as a conundrum by most hydrologists (Smith et al, 2004).

The key issue of this study is to better take into consideration precipitation heterogeneity in a lumped model. An alternative of lumped model could be strategies of semi-distribution of rainfall. But, is the information of rainfall spatial variability useful for lumped rainfall-runoff models? How can it be taken account in these models? How can the model benefit from this information? Can impacts of such an approach vary according to time step, catchment area, catchment's hydroclimatic condition?

In order to address these issues, we use a multi-model approach where n models are run in parallel (we feed each model with data from a specific raingauge, a combination of rain gauges or a synthetic rainfall derived from the variance of the mean areal

rainfall). At the end the streamflow simulations are combined.

We test and compare these methods based on a sample of 200 French catchments.

We discuss the results and their implications for reducing the uncertainties in streamflow simulations as well as in model parameter estimation.

References:

Smith, M. B., Koren, V. I., Zhang, Z., Reed, S. M., Pan, J.J. and Moreda, F., (2004) Runoff response to spatial variability in precipitation: an analysis of observed data,

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