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On the importance of methods in hydrological modelling. Perspectives from a case study

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The hydrological community generally appreciates that developing any non-trivial hydrological model requires a multitude of modelling choices. These choices may range from a (seemingly) straightforward application of mass conservation, to the (often) guesswork-like selection of constitutive functions, parameter values, etc. The application of a model itself requires a myriad of methodological choices – the selection of numerical solvers, objective functions for model calibration, validation approaches, performance metrics, etc.

Not unreasonably, hydrologists embarking on ever ambitious projects prioritize hydrological insight over the morass of methodological choices. Perhaps to emphasize "ideas" over "methods", some journals have even reduced the fontsize of the methodology sections of its articles. However, the very nature of modelling is that seemingly routine methodological choices can significantly affect the conclusions of case studies and investigations – making it dangerous to skimp over methodological details in an enthusiastic rush towards the next great hydrological idea.

This talk shares modelling insights from a hydrological study of a 300 km2 catchment in Luxembourg, where the diversity of hydrograph dynamics observed at 10 locations begs the question of whether external forcings or internal catchment properties act as dominant controls on streamflow generation.

The hydrological insights are fascinating (at least to us), but in this talk we emphasize the impact of modelling methodology on case study conclusions and recommendations. How did we construct our prior set of hydrological model hypotheses? What numerical solver was implemented and why was an objective function based on Bayesian theory deployed? And what would have happened had we omitted model cross-validation, or not used a systematic hypothesis testing approach?