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What is the minimal geomorphology based hydrological model?

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Hydrological modelling is a usefull tool to understand hydrological process. With knowledge increasing, models often become more complex. Drived by each researchers hypothesis, new components are added years after years. However, in many cases, the need of this complexity appears to be unnecessary or, in a context of lack of data, even unsuitable. We propose a modelling framework improvement of geomorphology-based models. By updating step by step models' structure and by checking separatly hypotheses for improving model performance, we aim to improve our understanding of catchment behaviour.

We apply this framework on six catchments in Brittany, France. With catchment's area varying from 5km^2 to 316km^2, we explore heterogeneous situations to enrich the discussion about model's efficiency, robustness and facility of implementation. Simulations are performed from monthly time scale to annual time scale using 5 years of rainfall-runoff data. We compare the improvement bring by changing progressively model's structure. This is done by splitting catchment dynamics through the play of several flow velocities inside one or several width functions. We test separatly different hypothesis of model improvement, like accounting of velocity and rainfall spatio-temporal variability, as well as considering hydrodynamic dispersion. Models are parametrized using a particle swarm optimisation algorithm. With a minimum complexity level, this framework enable to choose wich model suits the objectives and how to take advantage of the available data.