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On the use of a Nash cascade to improve the lag parameter transposability at different time-steps in hydrological modelling

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Flow observation data are mostly available at the daily time-step, especially over long periods of time. However, in the context of flood events, the daily time-step can be too coarse. Because climate data could be more easily available than flow data at short time-steps, rainfall-runoff simulation is a solution to produce flow at subdaily time-steps. However, the determination of the hydrological model parameters can represent an issue as often the parameters are time dependent.

To solve this problem, it could be interesting to transpose at hourly time-step the parameters obtained by calibration at daily time-step. Some studies found relations between the parameters obtained by calibration at different time-steps but, due to its time discretization, the parameters of lag components of bucket-type models, such as unit hydrographs, are often difficult to transpose.

This study introduces a method to obtain lag parameters that are transposable accorss time-steps by replacing a unit hydrgraph by a so called “Nash cascade” (Nash, 1957). By fixing an adequate number of stores in the cascade, this transformation does not modify substancially the water time distribution (Santos et al., 2017).

This study is based on an example with the lumped model GR4 model (Perrin et al., 2003). The obtained model has the same parameter values when it is calibrated at daily and hourly time-steps. This allow to calibrate the model at the daily time-step and use it at the hourly time-step. Results were analysed using criteria on flood events.

References

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