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New hybrid method to simulate discharges on ungauged catchments by combination of hydrological and hydraulic models

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The estimation of discharges on ungauged basins is a central issue in hydrology and resulted in various modelling developments during the PUB decade. In this field, the potential of distributed and semi-distributed models is high considering their capacity to extract results on interior points of a catchment based on the calibration on downstream discharges. Unfortunately, recent attempts [Smith, 2004, Reed et al., 2004] proved disappointing when such models are compared to lumped ones on objective basis, revealing a paradoxical picture: spatial complexity integrated in distributed models may increase errors that lumped models can limit thanks to a compact structure.

As a continuation of the work of Boyle et al. [2001] and Ajami et al [2004], we propose here to explore the question of interior simulations in a particular context: in many basins, a gauging station can be found upstream of the interior location reducing the problem of ungauged basin to ungauged river reach. Interior discharges are then a combination of propagated upstream discharges and intermediate lateral inflows. This question is of particular importance for river hydraulic modellers that frequently struggle to determine lateral inflows [Vidal et al., 2007] to their model.

Our study applies a semi-distributed model (SD) using GR4J [Perrin et al, 2003] as a rainfall-runoff module and a linearised diffusing wave routing scheme [Moussa, 1996] on 49 French river reaches at the hourly time step. Lump models and pure propagation models are also applied as benchmarks. The improvements of interior simulations from benchmarks to SD models are then related to physical characteristics and recommendations are given to estimate a priori interest for complex semi-distributed schemes.

REFERENCES


