



HAL
open science

Seeking best streamflow assimilation scheme in a semi-distributed hydrological model for flood forecasting

Paul Royer-Gaspard, François Bourgin, Alban de Lavenne, Charles Perrin, Guillaume Thirel, Vazken Andréassian

► To cite this version:

Paul Royer-Gaspard, François Bourgin, Alban de Lavenne, Charles Perrin, Guillaume Thirel, et al.. Seeking best streamflow assimilation scheme in a semi-distributed hydrological model for flood forecasting. IAHS-AISH Scientific Assembly 2022, May 2022, Montpellier, France. hal-03695861

HAL Id: hal-03695861

<https://hal.inrae.fr/hal-03695861v1>

Submitted on 15 Jun 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License



PREVIEW

IAHS-AISH Scientific Assembly 2022

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



Seeking best streamflow assimilation scheme in a semi-distributed hydrological model for flood forecasting

Paul Royer-Gaspard, François Bourgin, Alban de Lavenne, Charles Perrin, and Guillaume Thirel
Université Paris-Saclay, INRAE, HYCAR, Antony Cedex, France (paul.royer-gaspard@inrae.fr)

Semi-distributed hydrological models have the potential to improve the efficiency of flood forecasting chains. Such models take into account the spatial distribution of both meteorological forcings and soil moisture states to predict streamflow along the river network and allow the assimilation of streamflow observations on multiple internal flow gauges. How to update the model states on ungauged upstream sub-catchments remains however a challenge. Indeed, the actual relative contribution of each upstream sub-catchment to the observed streamflow at the outlet cannot be observed but simply estimated by the hydrological model from the simulated upstream streamflow and routing-lag. In this work, we test the following hypotheses:

- the simultaneous assimilation of streamflow observations at internal gauges should improve streamflow predictions at the main downstream outlet
- accounting for time lags between flow gauges is needed to efficiently update model states in cases where no streamflow observations are available at internal gauges

The analysis is performed with a semi-distributed version of the hourly GR5H model (de Lavenne et al., 2019; Peredo-Ramirez et al., 2021) on a large dataset of French gauged catchments, each one having at least one internal gauged station. Several experiments were set up in gauged and pseudo-ungauged contexts to test both hypotheses. Two updating schemes were used: a particle filter (Piazzini et al., 2021) and a direct insertion method used in the operational flood forecasting model GRP (Furusho et al., 2016).

References

de Lavenne, A., Andréassian, V., Thirel, G., Ramos, M.-H., & Perrin, C. (2019). A regularization approach to improve the sequential calibration of a semidistributed hydrological model. *Water Resources Research*, 55, 8821–8839, 2018WR024266.

Furusho, C., Perrin, C., Viatgé, J., Lamblin, R., and Andréassian, V. (2016). Collaborative work between operational forecasters and scientists for better flood forecasts, *La Houille Blanche*, 102:4, 5-10.

Peredo-Ramirez, D., Ramos, M.-H., Andréassian, V., and Oudin, L. (2021). Investigating hydrological model versatility to simulate extreme flood events. *Hydrological Sciences Journal*, in review.

Piazzini, G., Thirel, G., Perrin, C., and Delaigue, O. (2021). Sequential data assimilation for streamflow forecasting: assessing the sensitivity to uncertainties and updated variables of a conceptual hydrological model at basin scale. *Water Resources Research*, 57(4), e2020WR028390.

