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EGU2020-18694
https://doi.org/10.5194/egusphere-egu2020-18694
EGU General Assembly 2020

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Skillful streamflow forecasts provide a key support to several water-related applications. Ensemble forecasting systems are gaining a widespread interest, since they allow accounting for different sources of uncertainty. Because of the critical impact of the initial conditions (ICs) on the forecast accuracy, it is essential to improve their estimates via data assimilation (DA). This study aims at assessing the sensitivity of the DA-based estimation of forecast ICs to several sources of uncertainty and to the update of different model states and parameters of a conceptual rainfall-runoff model. The performance of two sequential ensemble-based techniques are compared, namely Ensemble Kalman filter and Particle filter, in terms of both efficiency and temporal persistence of the updating effect through the assimilation of observed discharges at the forecast time. Several experiments specifically address the impact of the meteorological, model state and parameter uncertainties over 232 catchments in France. Results show that the benefit of the DA-based estimation of ICs for forecasting is the largest when focusing on the level of the model routing store, which is the internal state the most correlated to streamflow. While the EnKF-based forecasts outperform the PF-based ones when accounting for the meteorological uncertainty, the representation of the model state uncertainty allows greatly improving the accuracy of the PF-based predictions, with a longer-lasting updating effect (up to 10 days). Conversely, the forecasting skill is undermined when accounting for the parameter uncertainty, due to the change in the hydrological responsiveness through the update of both the production and routing store levels. A further effort is focused on assessing the impact of the spatial resolution of the hydrological model on the predictive accuracy of DA-based streamflow forecasts.