

Spatio-Temporal Discretization Uncertainty of Distributed Hydrological Models

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Abstract

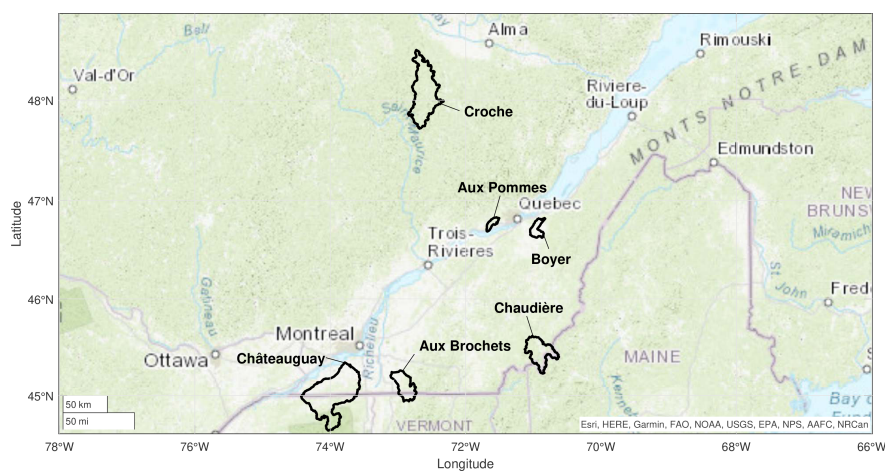
Quantifying the uncertainty linked to the degree to which the spatio-temporal variability of the catchment descriptors (CDs), and consequently calibration parameters (CPs), represented in the distributed hydrology models and its impacts on the simulation of flooding events is the main objective of this paper. Here, we introduce a methodology based on ensemble approach principles to characterize the uncertainties of spatio-temporal variations. We use two distributed hydrological models (WaSiM and Hydrotel) and six catchments with different sizes and characteristics, located in southern Quebec, to address this objective. We calibrate the models across four spatial (100, 250, 500, 1000 km^2) and two temporal (3 hours and 24 hours) resolutions. Afterwards, all combinations of CDs-CPs pairs are fed to the hydrological models to create an ensemble of simulations for characterizing the uncertainty related to the spatial resolution of the modeling, for each catchment. The catchments are further grouped into large ($>1000 \text{ km}^2$), medium (between 500 and 1000 km^2) and small ($<500 \text{ km}^2$) to examine multiple hypotheses. The ensemble approach shows a significant degree of uncertainty (over 100% error for estimation of extreme streamflow) linked to the spatial discretization of the modeling. Regarding the role of catchment descriptors, results show that first, there is no meaningful link between the uncertainty of the spatial discretization and catchment size, as spatio-temporal discretization uncertainty can be seen across different catchment sizes. Second, the temporal scale plays only a minor role in determining the uncertainty related to spatial discretization. Third, the more physically representative a model is, the more sensitive it is to changes in spatial resolution. Finally, the uncertainty related to model parameters is dominant larger than that of catchment descriptors for most of the catchments. Yet, there are exceptions for which a change in spatio-temporal resolution can alter the distribution of state and flux variables, change the hydrologic response of the catchments, and cause large uncertainties.

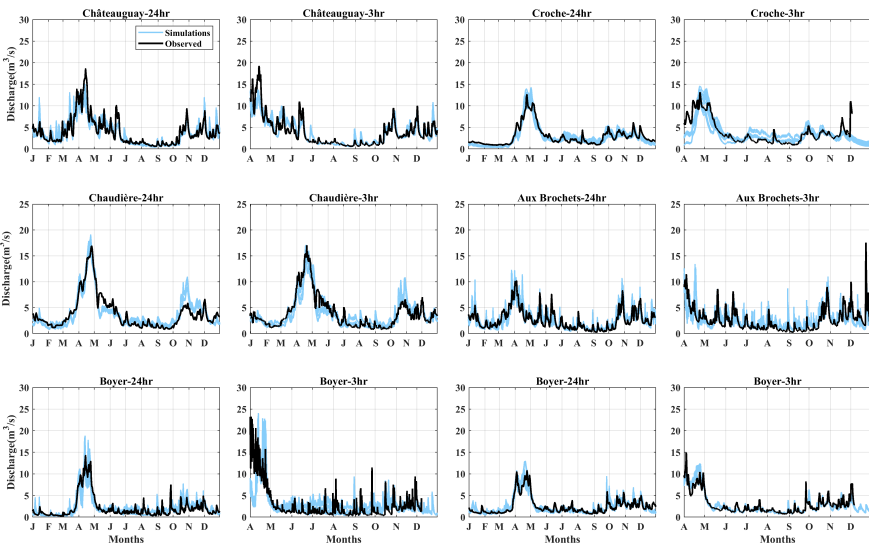
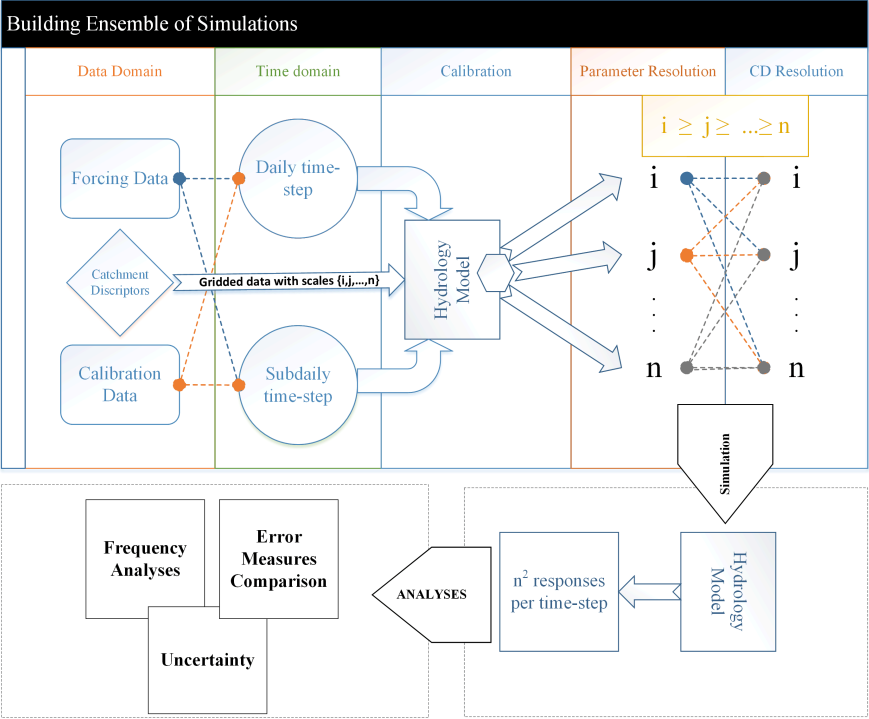
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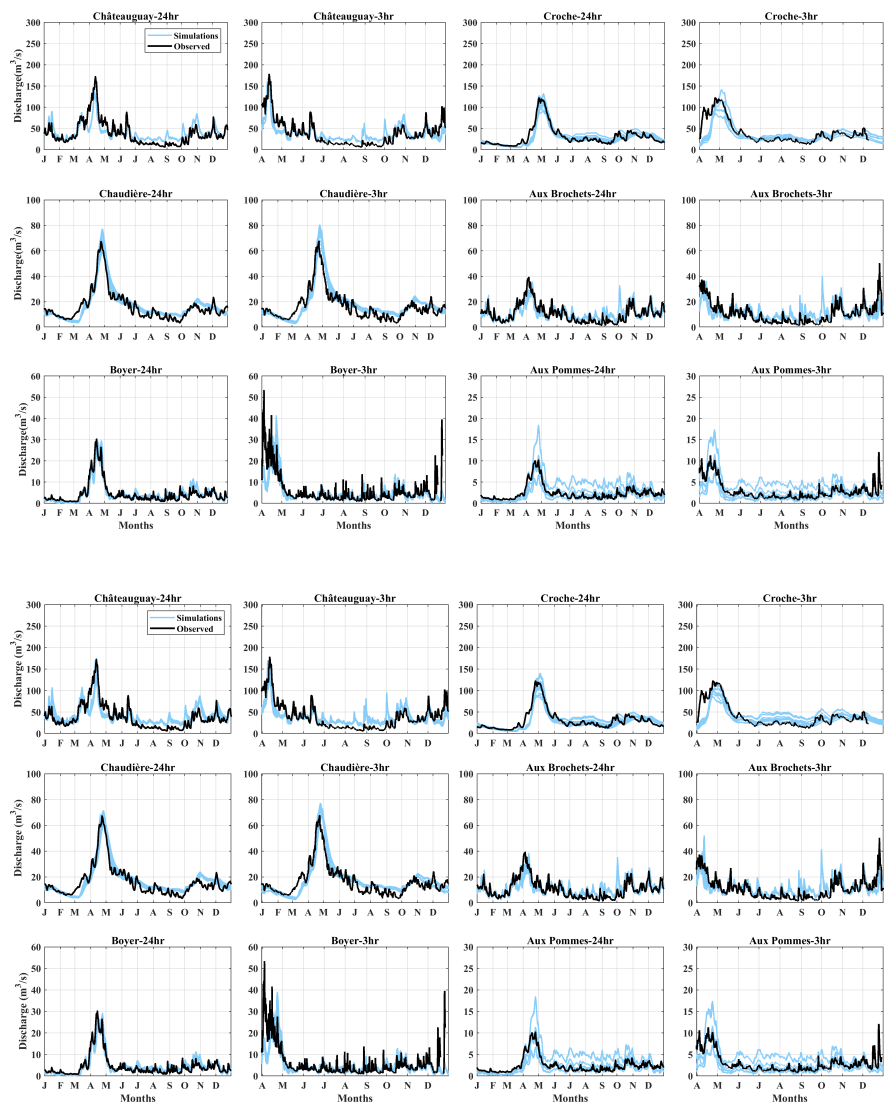
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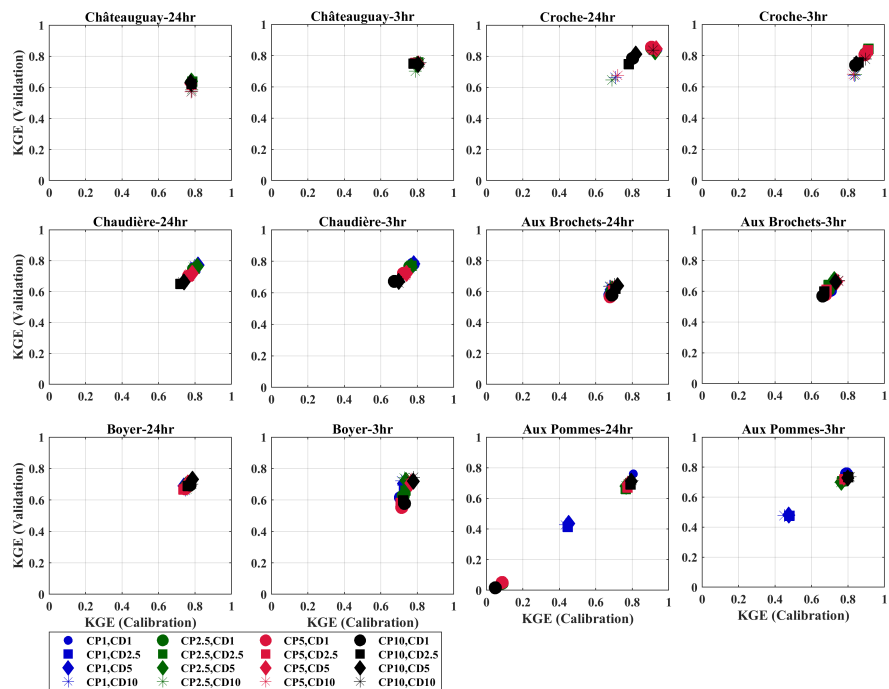
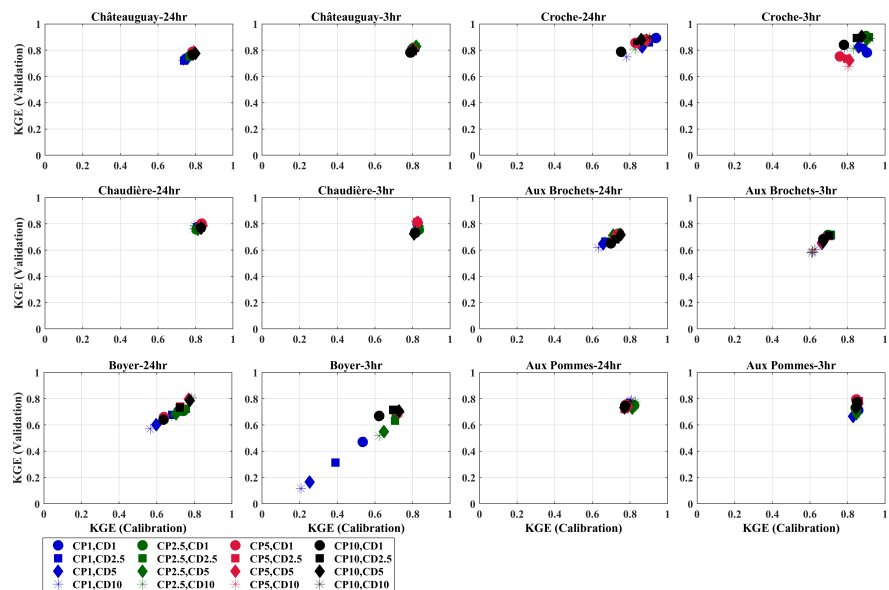
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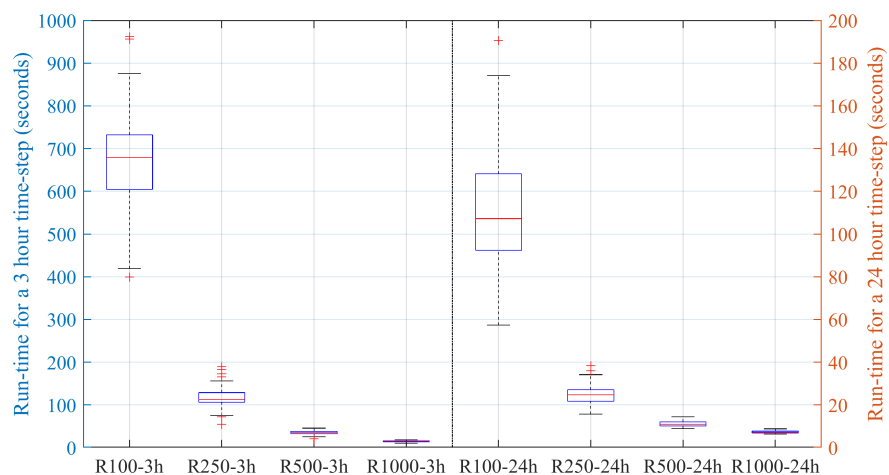
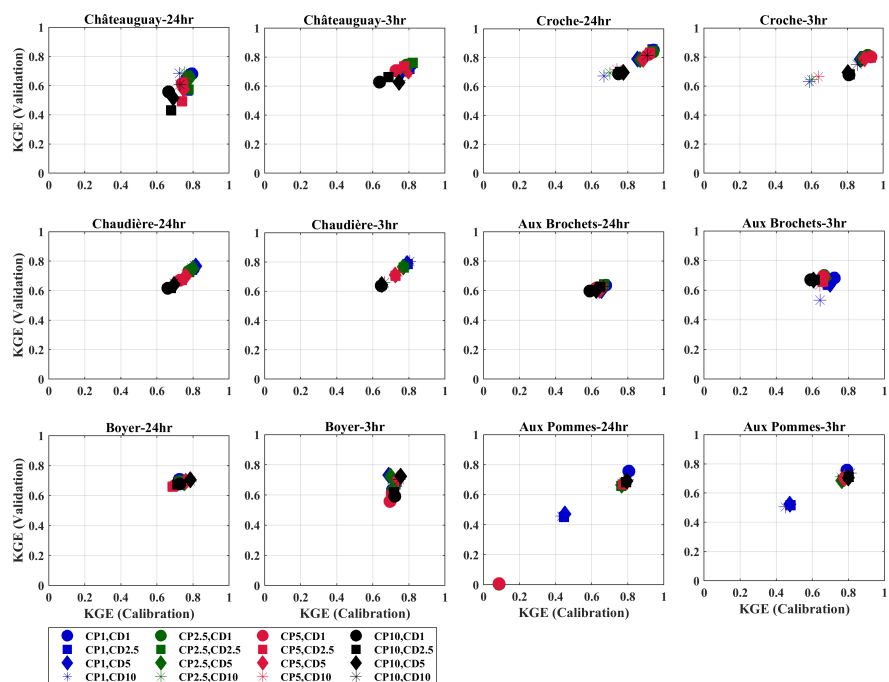
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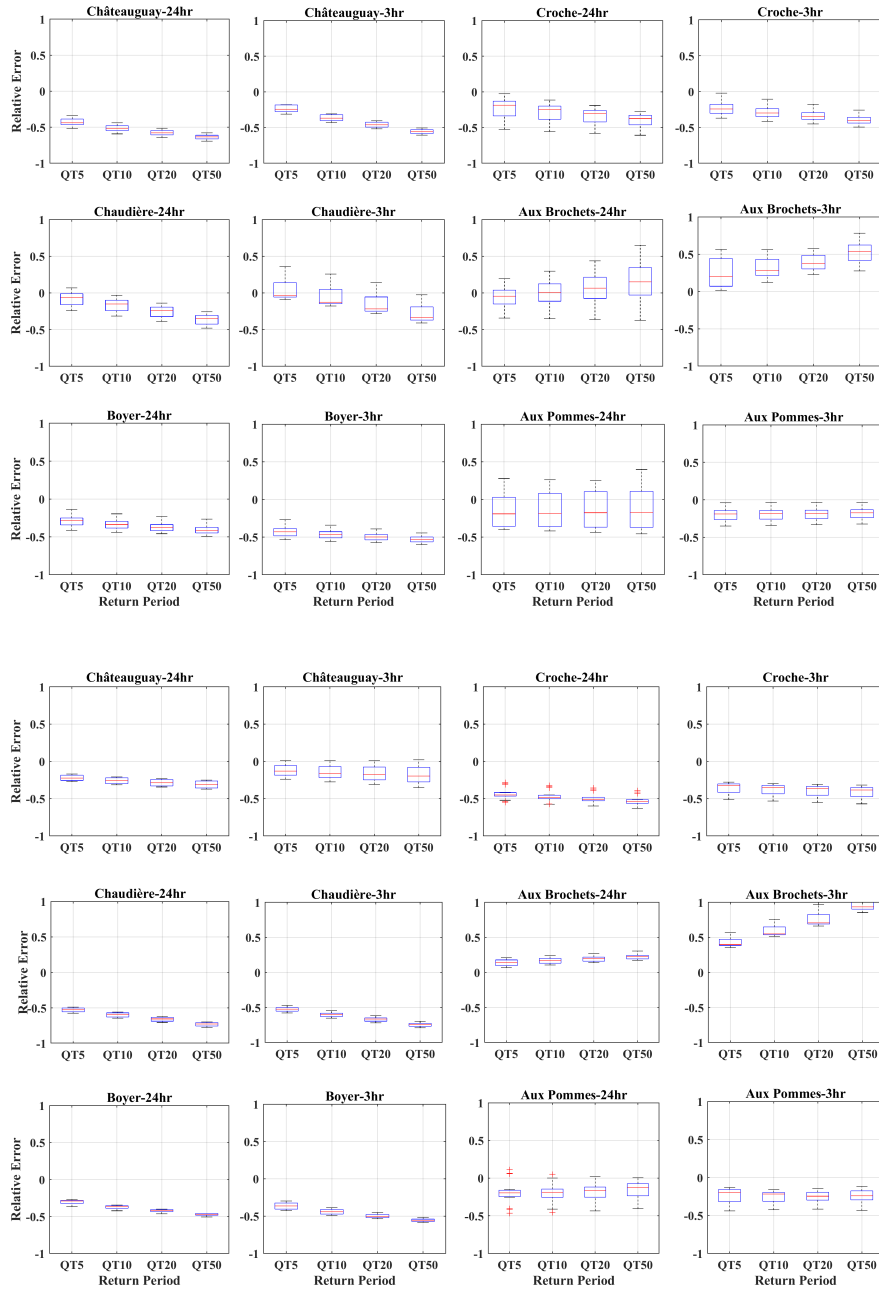


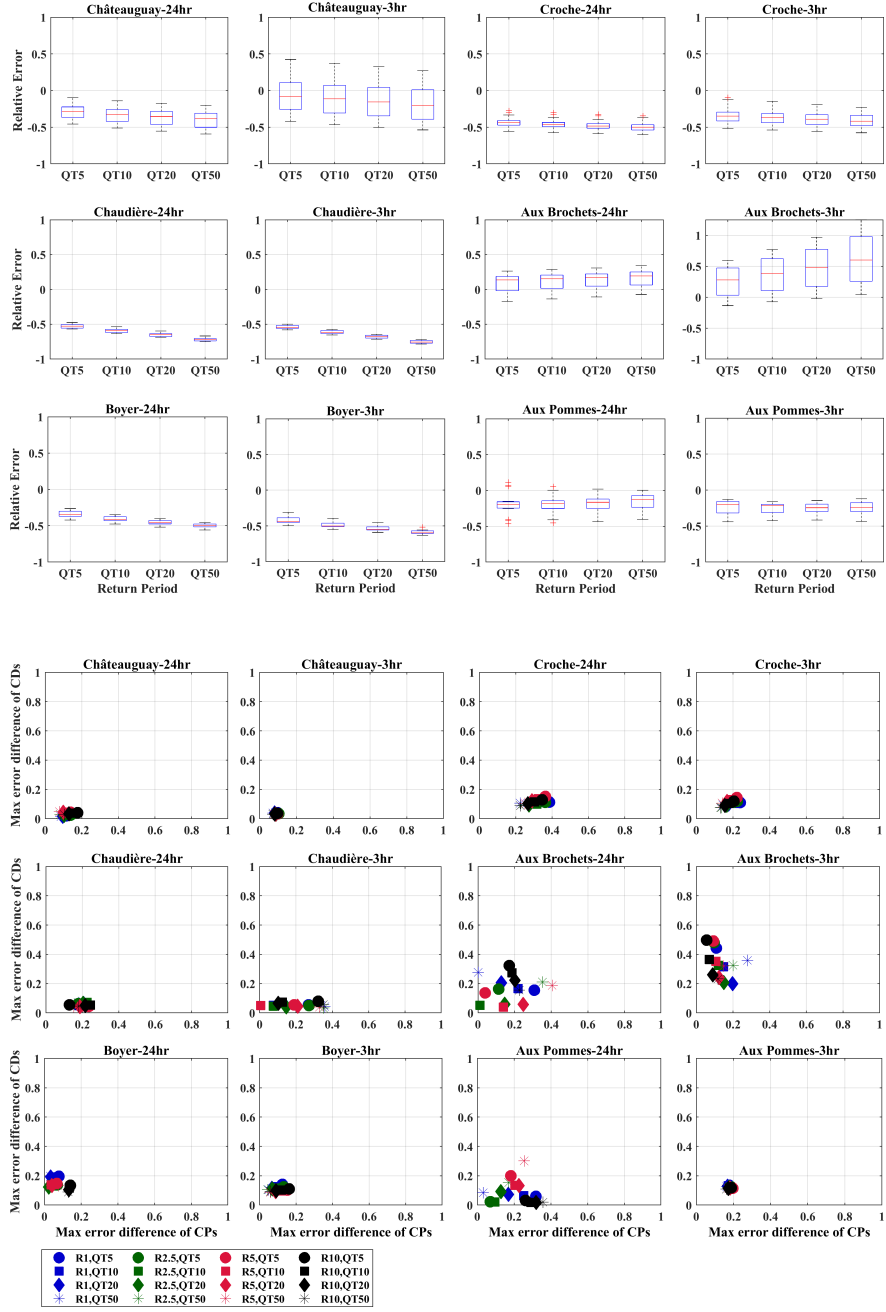


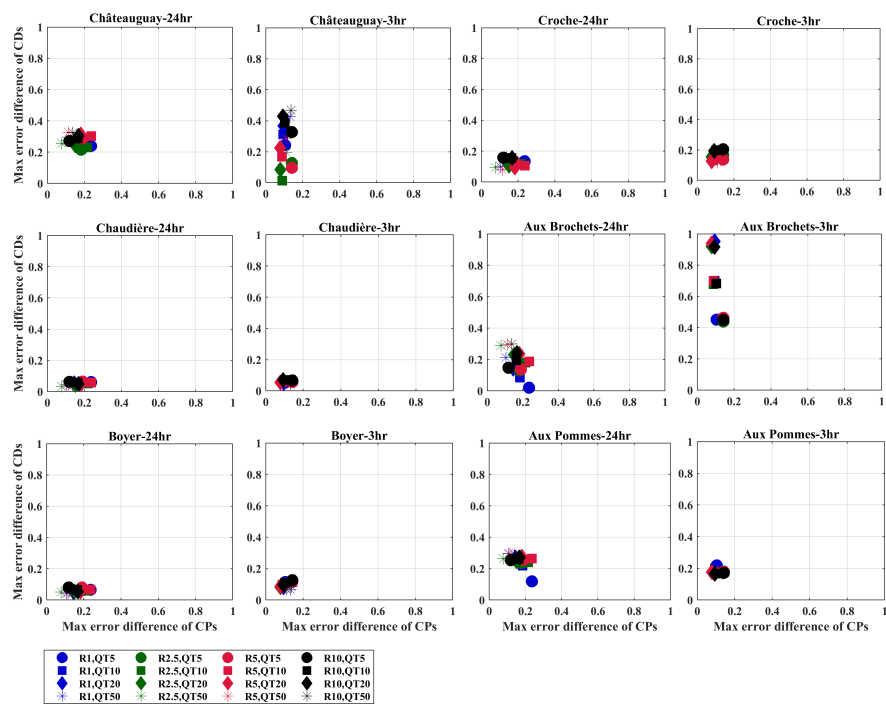
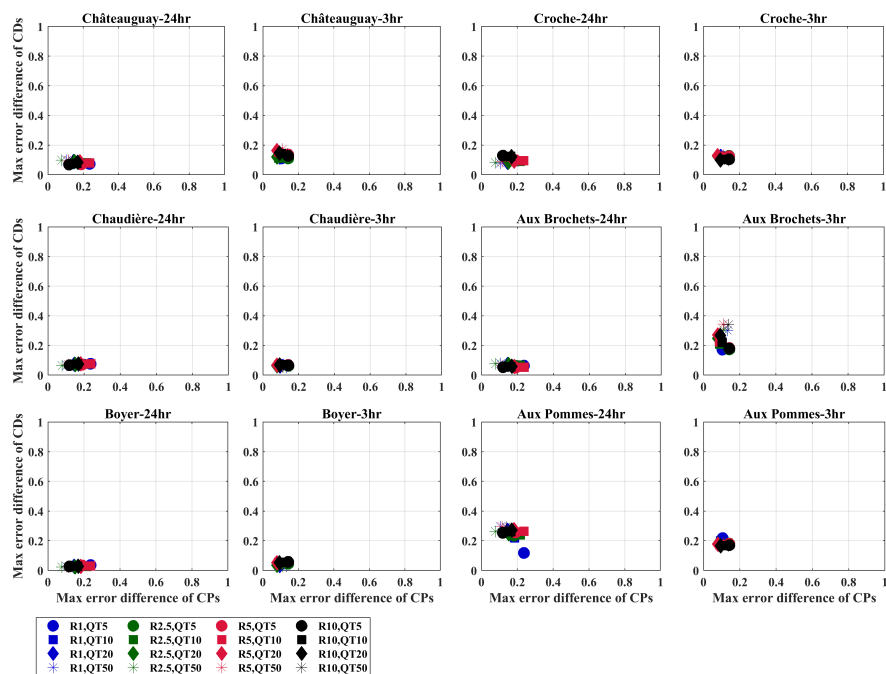


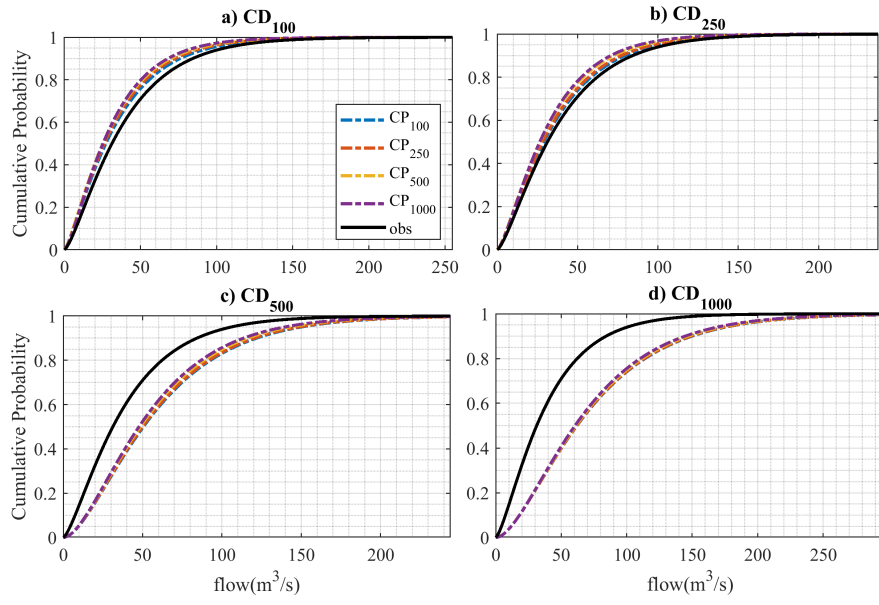












Ground Water Level (3 hours time-step)

