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Regionalization of a Distributed Hydrology Model Using Random Forest

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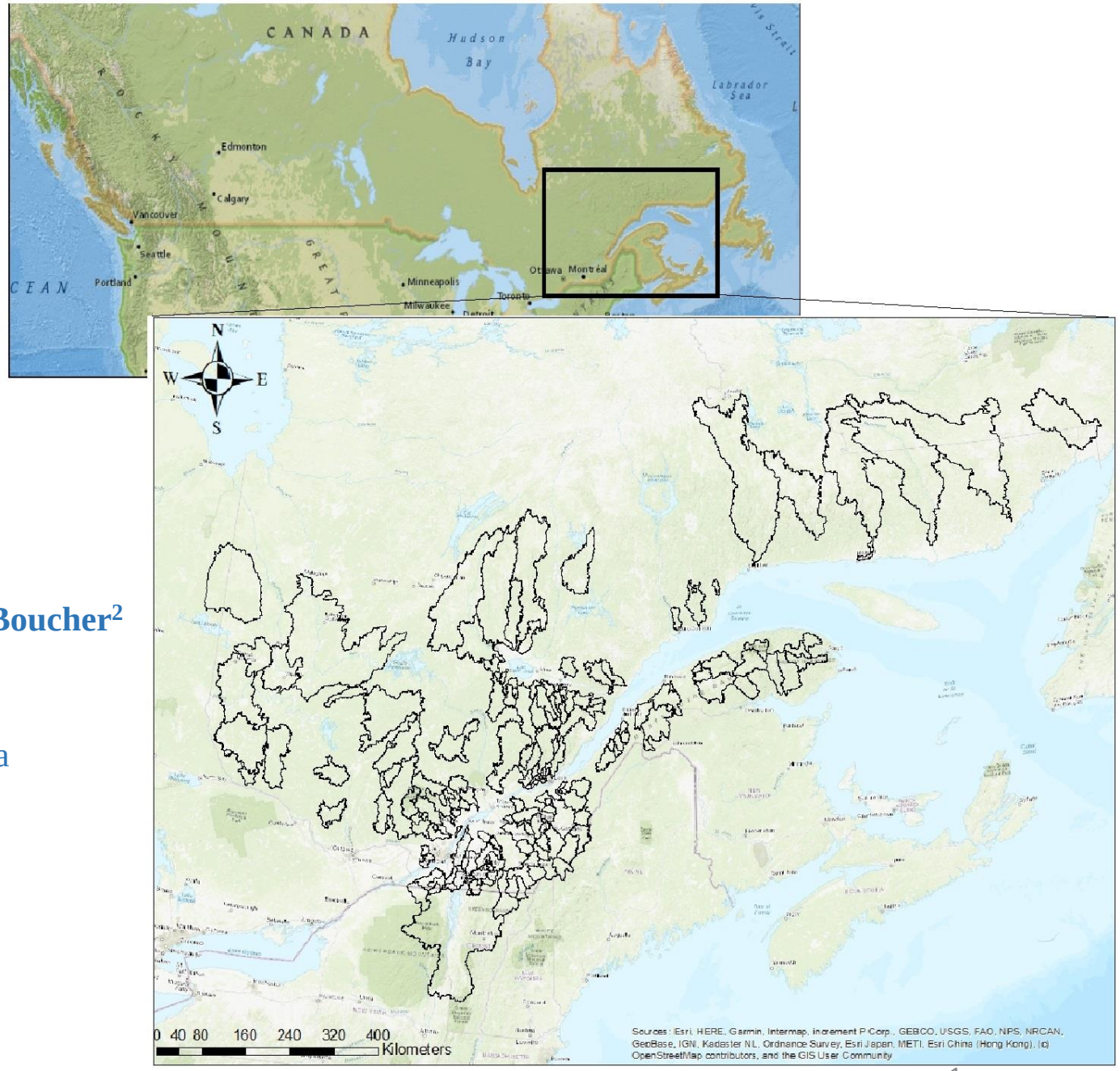
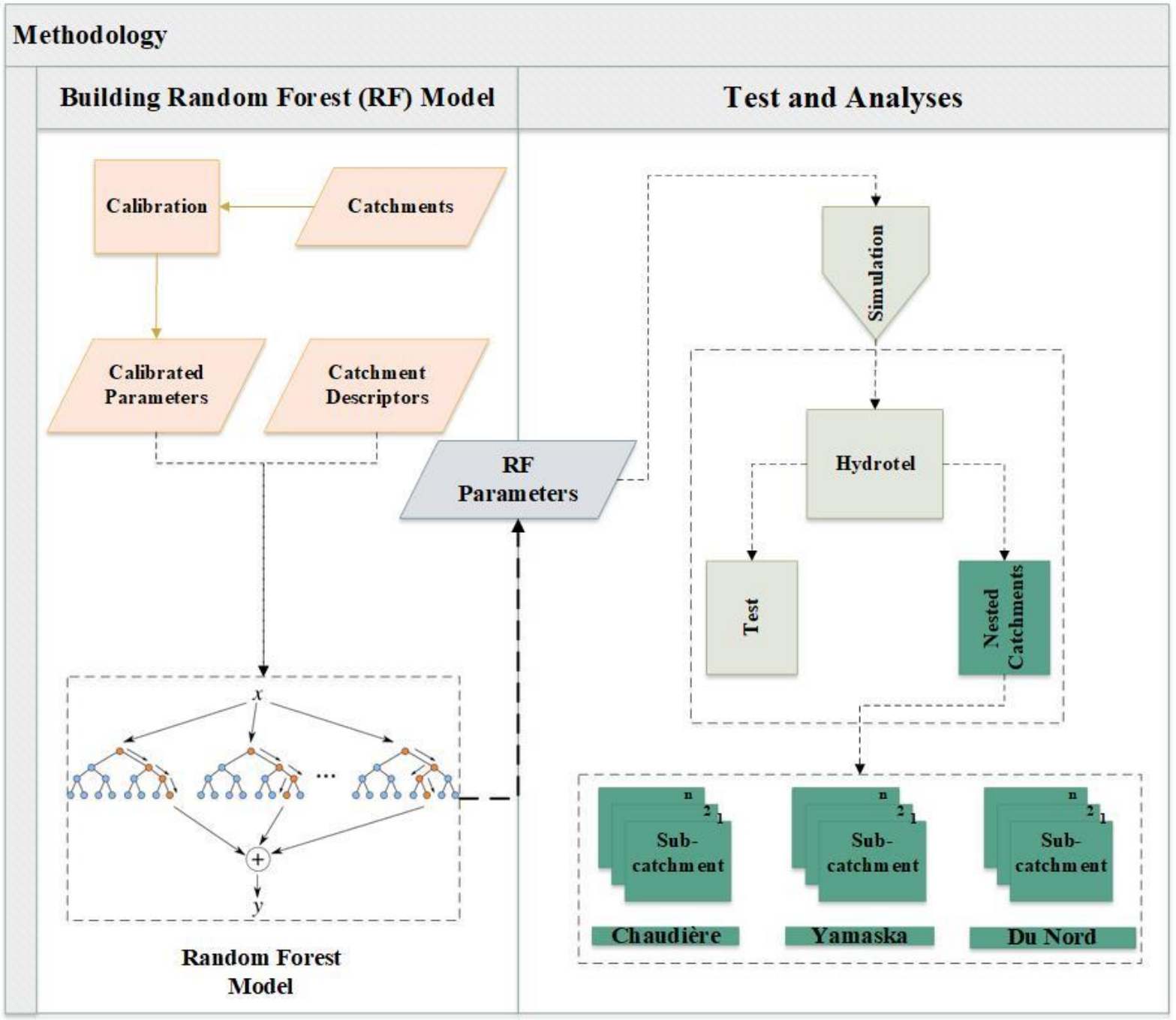


Hypotheses and Method

I. Finer time-step adds more information to the calibrated parameters and improves the efficiency of the regionalization model.

II. The parameters approximated by RF are spatially consistent and transferrable across the scales.

III. More spatially representative predictors will improve performance of regionalization at the outlet and internal ungauged locations.

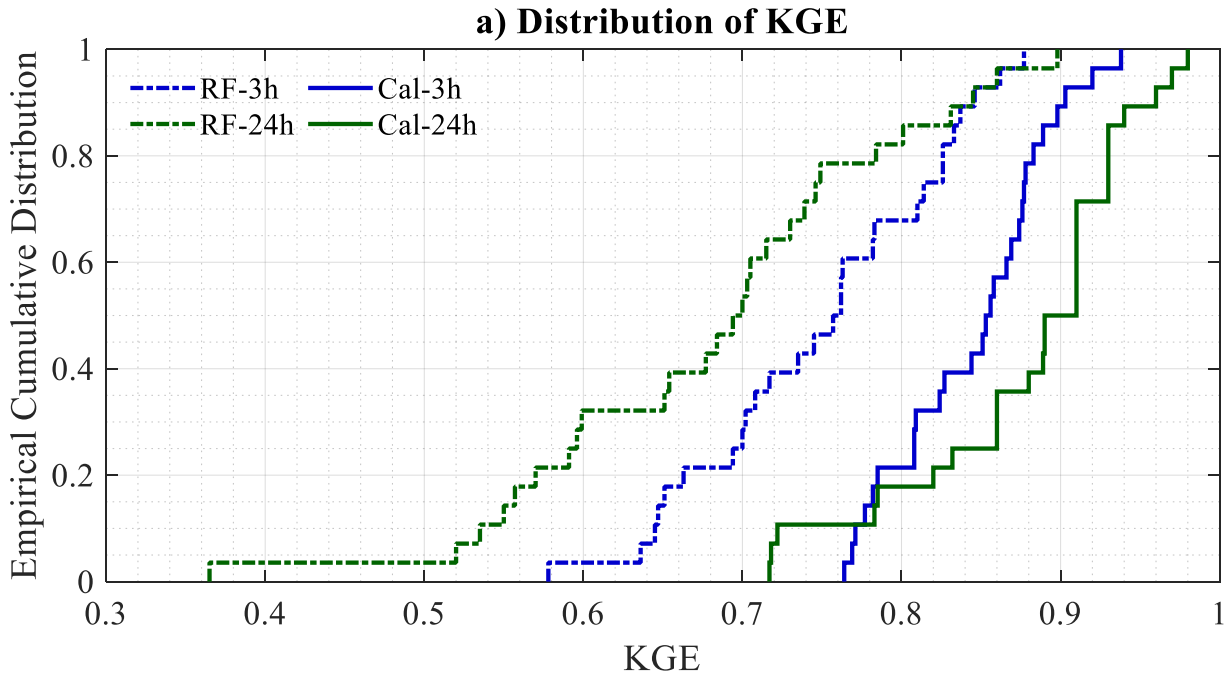


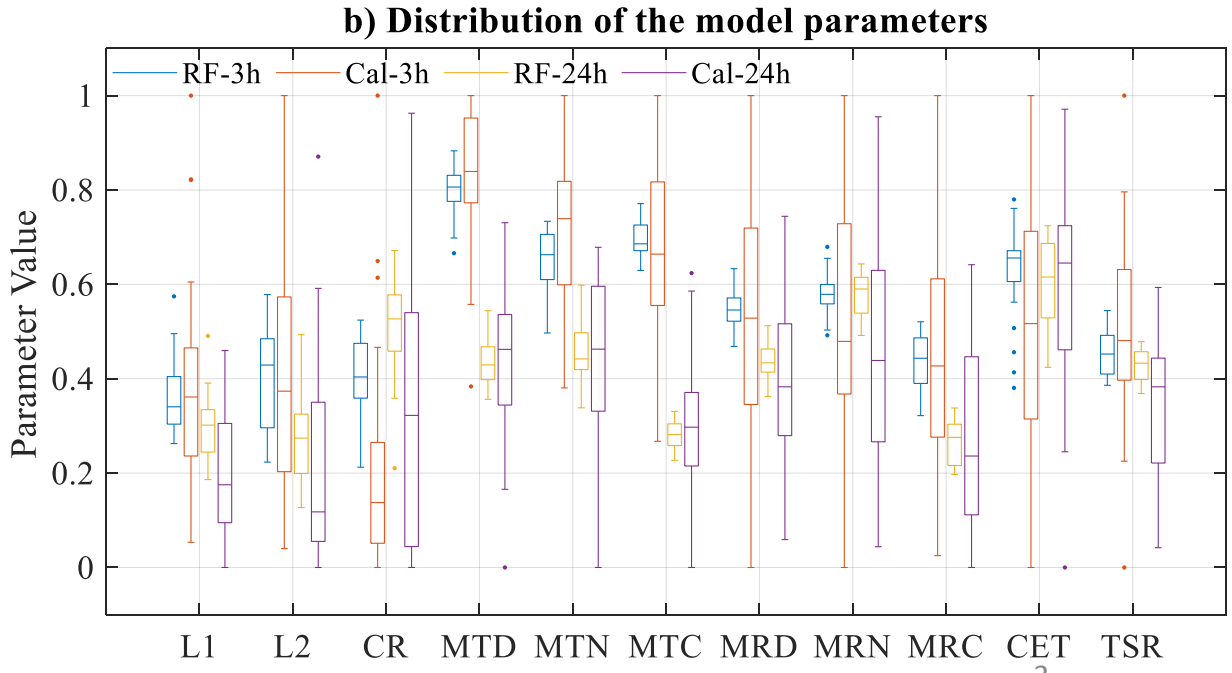
Hypothesis I

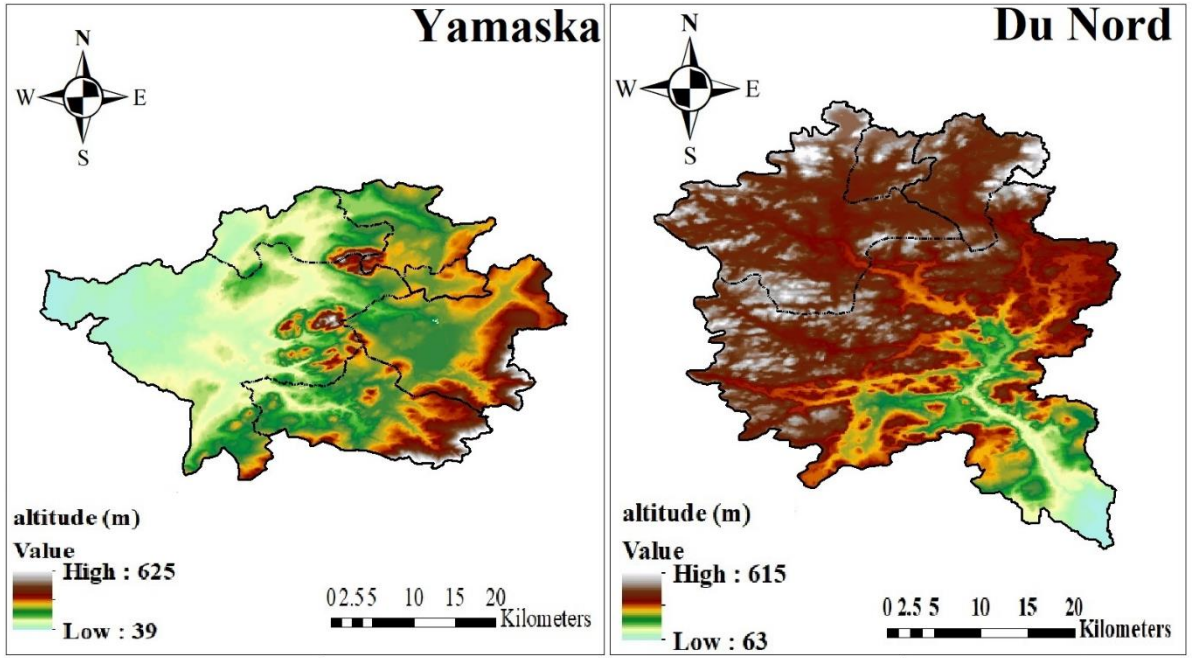
Table: The modeling efficiency statistics calculated for the test dataset in 3- and 24-hour time-steps (RF=Random Forest, Cal=Calibration).

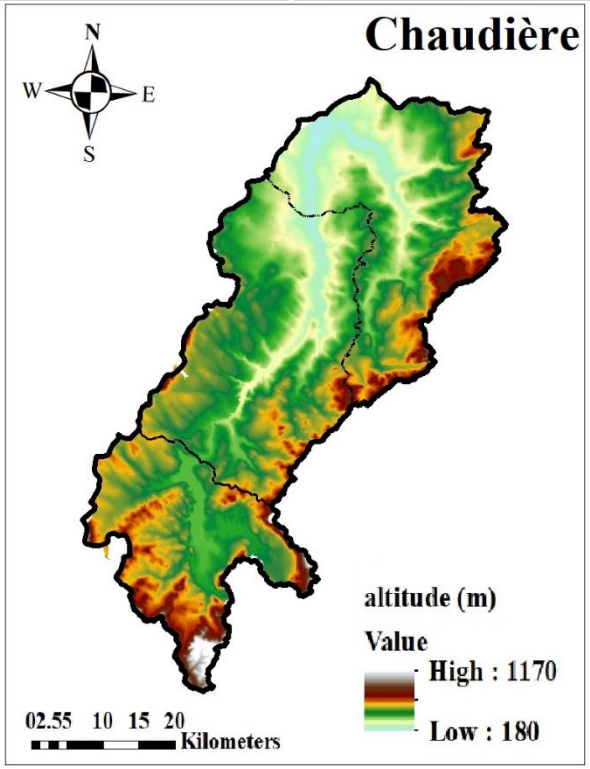
Statistics	**RF-3h**	RF-24h	**Cal-3h**	Cal-24h
Mean	**0.75**	0.68	**0.84**	0.88
Median	**0.76**	0.70	**0.85**	0.90
Standard deviation	**0.07**	0.12	**0.05**	0.07
Null hypothesis (t-test)	**1**		**0**	

Fig: Comparing calibration and regionalization simulations for the test dataset (RF=Random Forest, Cal=Calibration). a) Distribution of the regionalization and calibration KGE for 3-hour and 24-hour time-steps. b) Standardized distribution of calibrated and approximated parameters for 3- and 24-hour time-steps respectively.



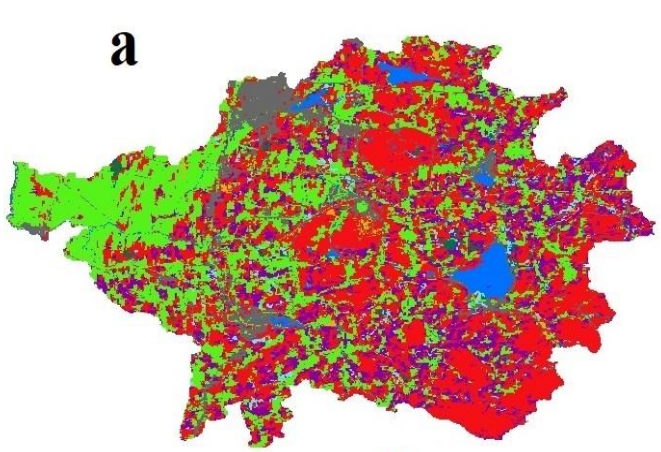


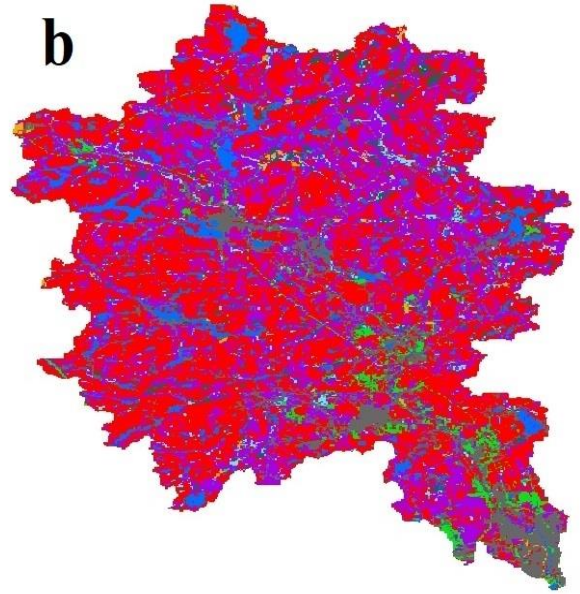


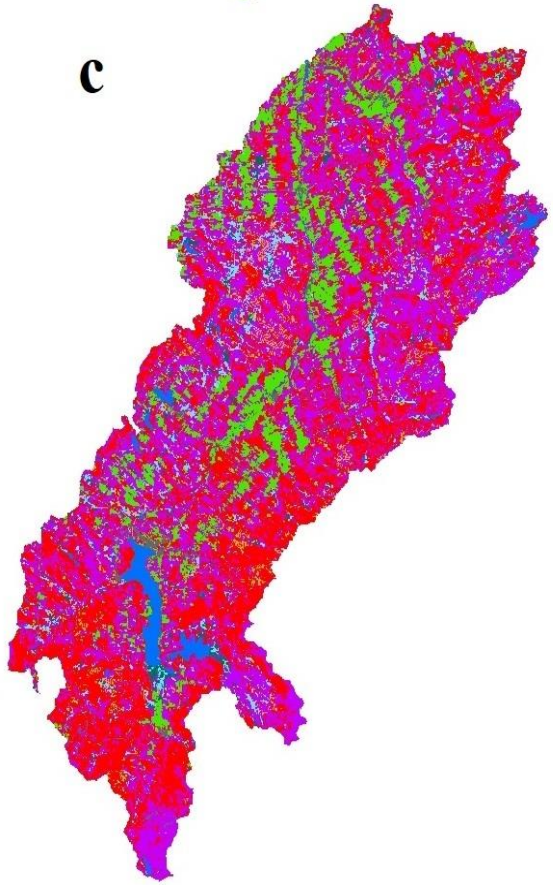


Nested Catchments

Parent Catchments

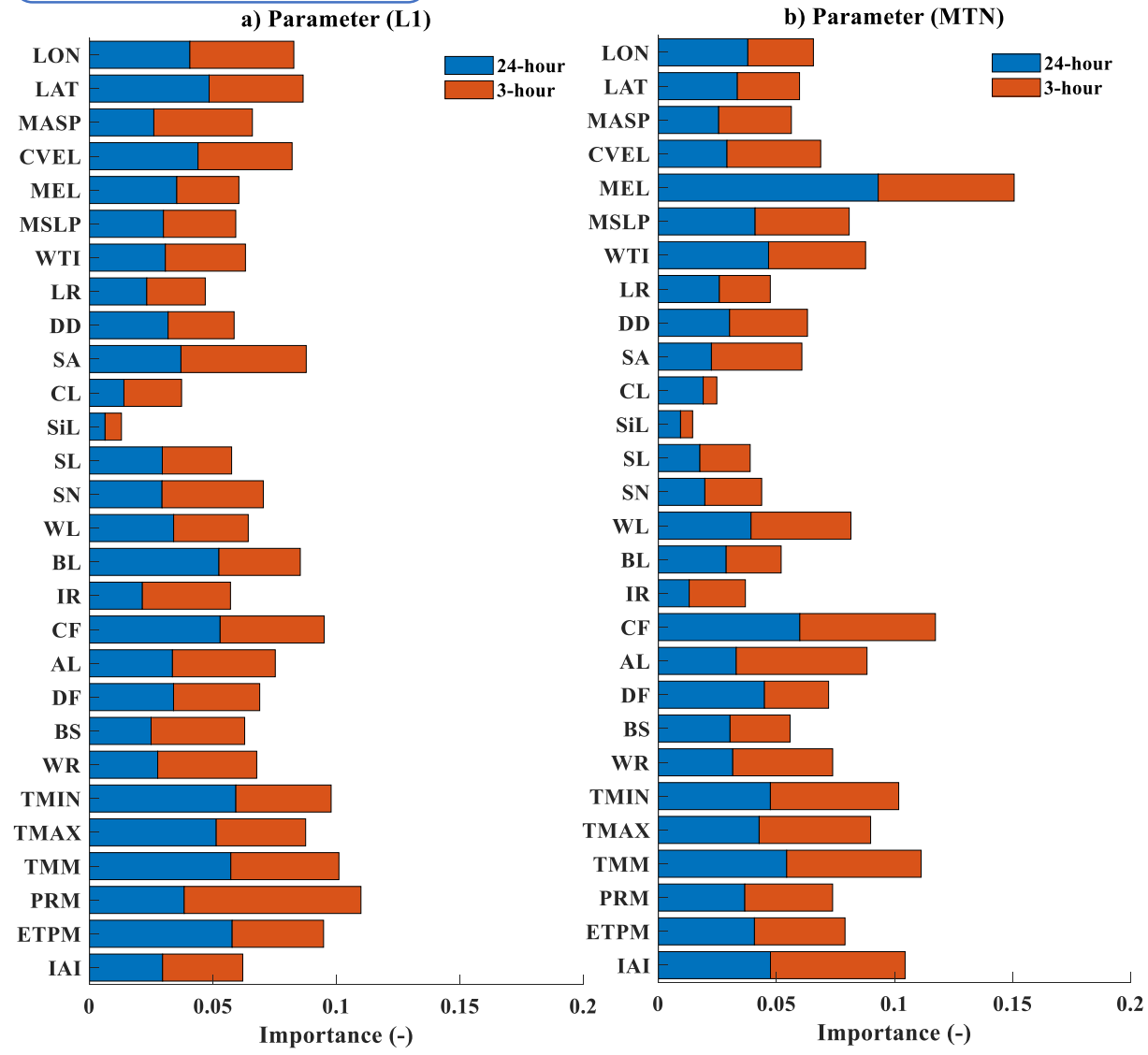




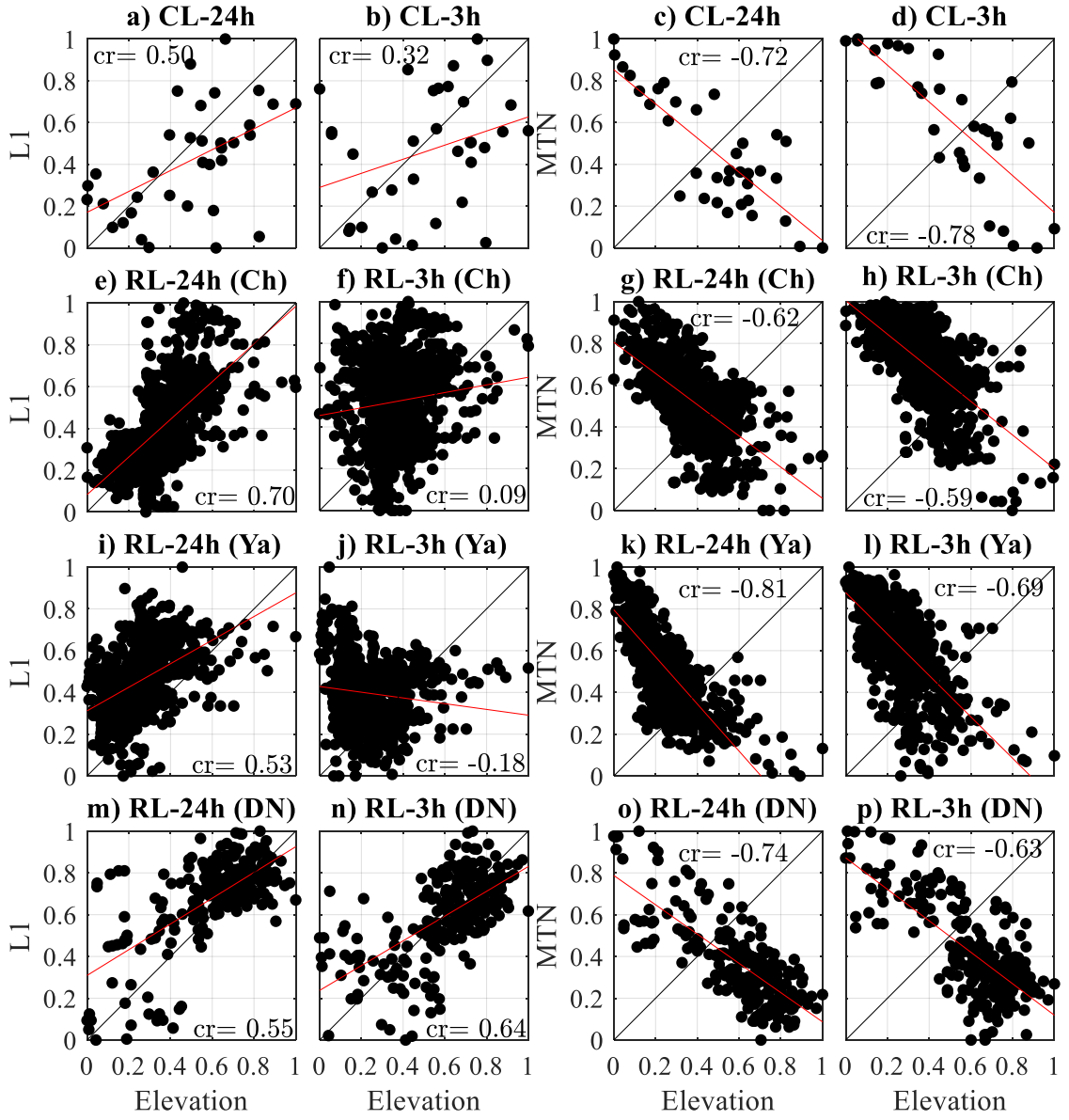


others
water
bare soil
deciduous forest
agriculture
coniferous forest
impermeable
bogland
wetland

Hypothesis II

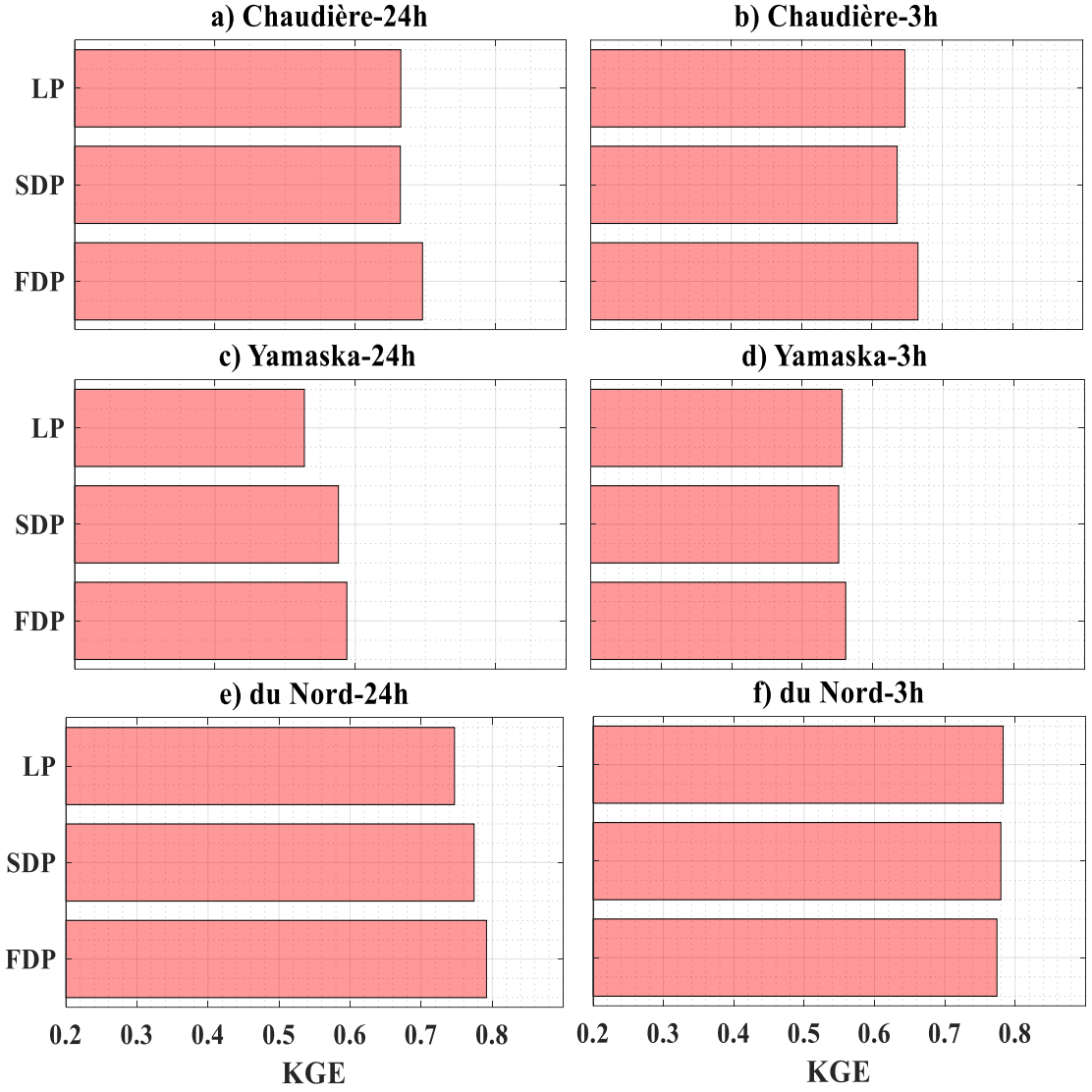


relative importance of predictor features in parameters approximated by RF for simulations with 3-hour time-step.

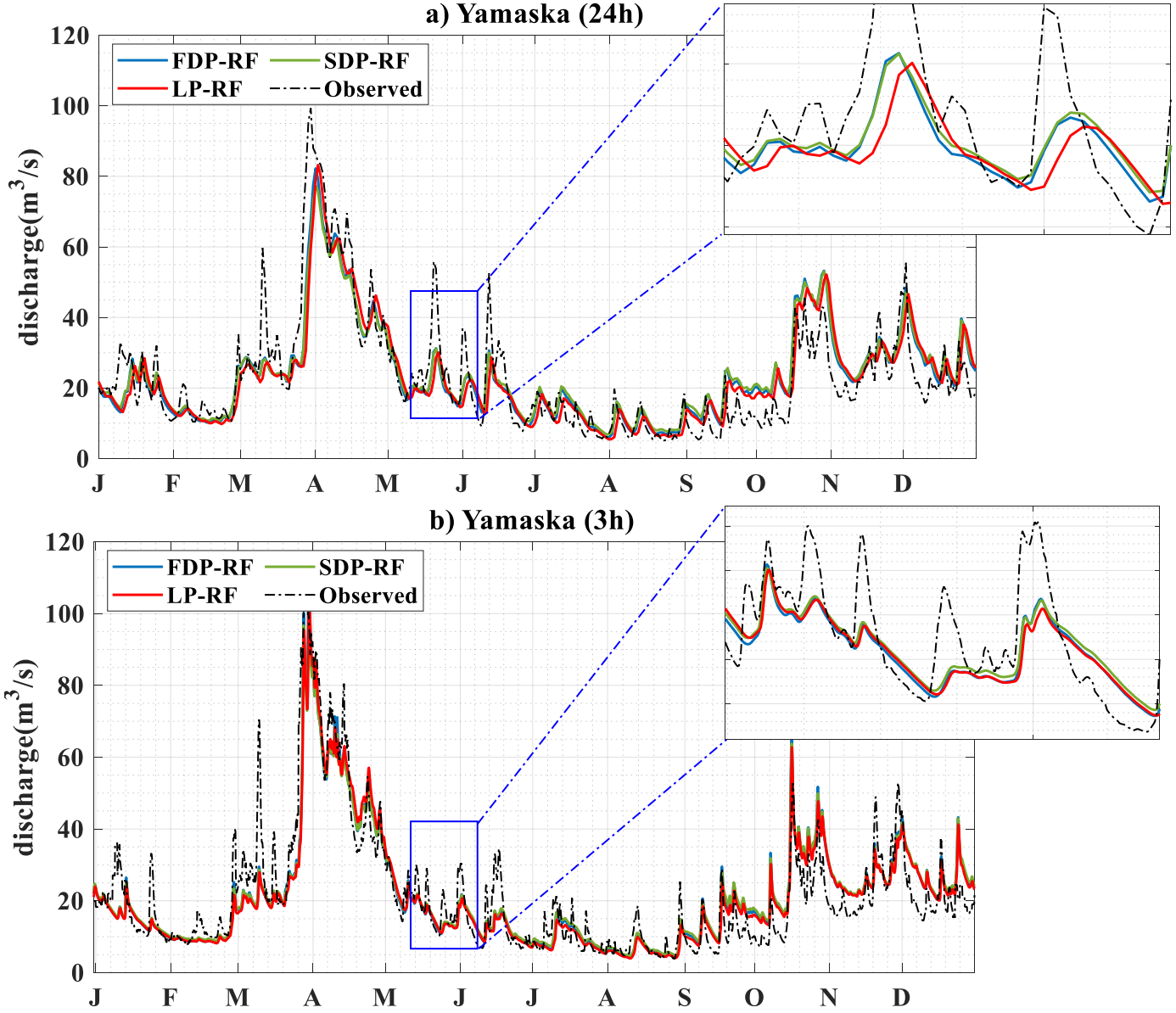


Spatial correlation of RF approximated parameters (L1 and MTN) and elevation: a to d- catchment level (CL) parameter resolution; e to p- RHHU level (RL) parameter resolution. Ch, Ya, and DN represent Chaudière, Yamaska, and Du Nord catchments respectively. The red line shows the least squares regression line.

Hypothesis III



Average efficiency of RF simulations for each nested catchment at different levels of parameter discretization: Fully Distributed Parameters (FDP), Semi Distributed Parameters (SDP), and Lumped Parameters (LP).



Mean annual hydrograph for the Yamaska catchment.

Hypothesis III

I. Finer time-step adds more information ☑

II. The parameters approximated by RF are spatially consistent and transferrable across the scales.
   - 24-hour ☑
   - 3-hour ☒

III. More spatially representative predictors will improve performance of regionalization
   - 24-hour ☑
   - 3-hour ☒

Thank You

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