

# Water level extremes at ungauged locations along the St. Lawrence fluvial estuary

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#### Context



Review the standards for flood mapping and risk area definition



**Update flood maps** 

#### Context



### Water-level extremes along the St. Lawrence River



Need to reproduce the extreme dynamics at the climatological scale

### Water-level extremes along the St. Lawrence River



Need to reproduce the extreme dynamics at the climatological scale

## Characterize water-level extremes along the St. Lawrence under various climate scenarios



#### Characterize water-level extremes along the St. Lawrence



#### Characterize water-level extremes along the St. Lawrence Overall project methodology



- Select the relevant events to be simulated with the hydrodynamic model in the historical climate.
  - $\Rightarrow$  Account for the wide range of extreme characteristics.



- Produce the 2D hydrodynamics simulations [events] and the statistical reconstructions [continuous series] of water levels.
  - $\Rightarrow$  Reproduce all relevant features of the extremes.



- S Extend the hybrid simulation method to future periods.
  - $\Rightarrow$  No observations.





Records at 19 stations

Select the relevant events to be simulated with the hydrodynamic model in the historical climate [appendix].

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## Characterize water-level extremes along the St. Lawrence Estimate the events at unsampled locations

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2D water level maps Produce the 2D hydrodynamics simulations [events] and the statistical reconstructions [continuous series] of water levels.

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#### Statistical models:

- Non-stationary Harmonic Regression
- ◊ Geometrical Interpolator
- Recurrent NN (deep learning)

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- Model evaluation
- Model selection

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### Model selection and evaluation

Example: hydrodynamic simulation of an extreme event



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Second problem question

Provided data Can we define one/some event summary statistic(s) that can be used to evaluate the simulations [unsampled locations]?

3 simulations [events]: 2D water levels continuous reconstructions at 4 stations

### Problem statement

O How could one summarize the various characteristics of local extreme events and assess the dominant event types and features at unsampled locations?

② Can we use the defined event summary statistic(s) to evaluate the simulations and reconstruction?

> ⇒ Define an algorithm or a set of measures to summarize the event features and evaluate the quality of the reconstructions.

Water level extremes in the St. Lawrence

### Appendix



Detrended hourly water levels (20-yr moving average)



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Threshold selection: ~ 1 extreme / yr and stability of GPD parameters

Water level extremes in the St. Lawrence



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- Relative drop: at least 2/3 of peak



Detrended hourly water levels (20-yr moving average)

- Threshold selection: ~ 1 extreme / yr and stability of GPD parameters
- Relative drop: at least 2/3 of peak
- Minimum inter-event time: 27h + ½ of left event duration