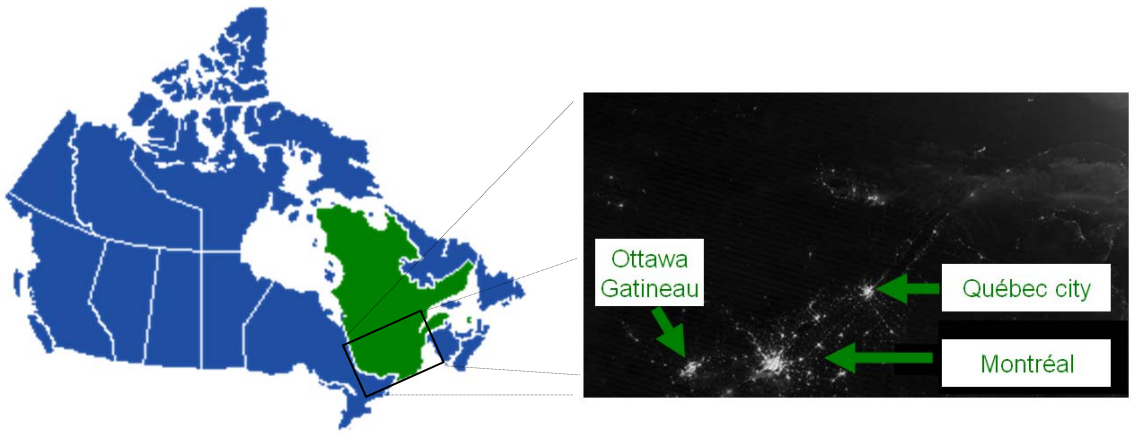
The use of the ClimEx ensemble for improving our knowledge of the future of flooding in Québec

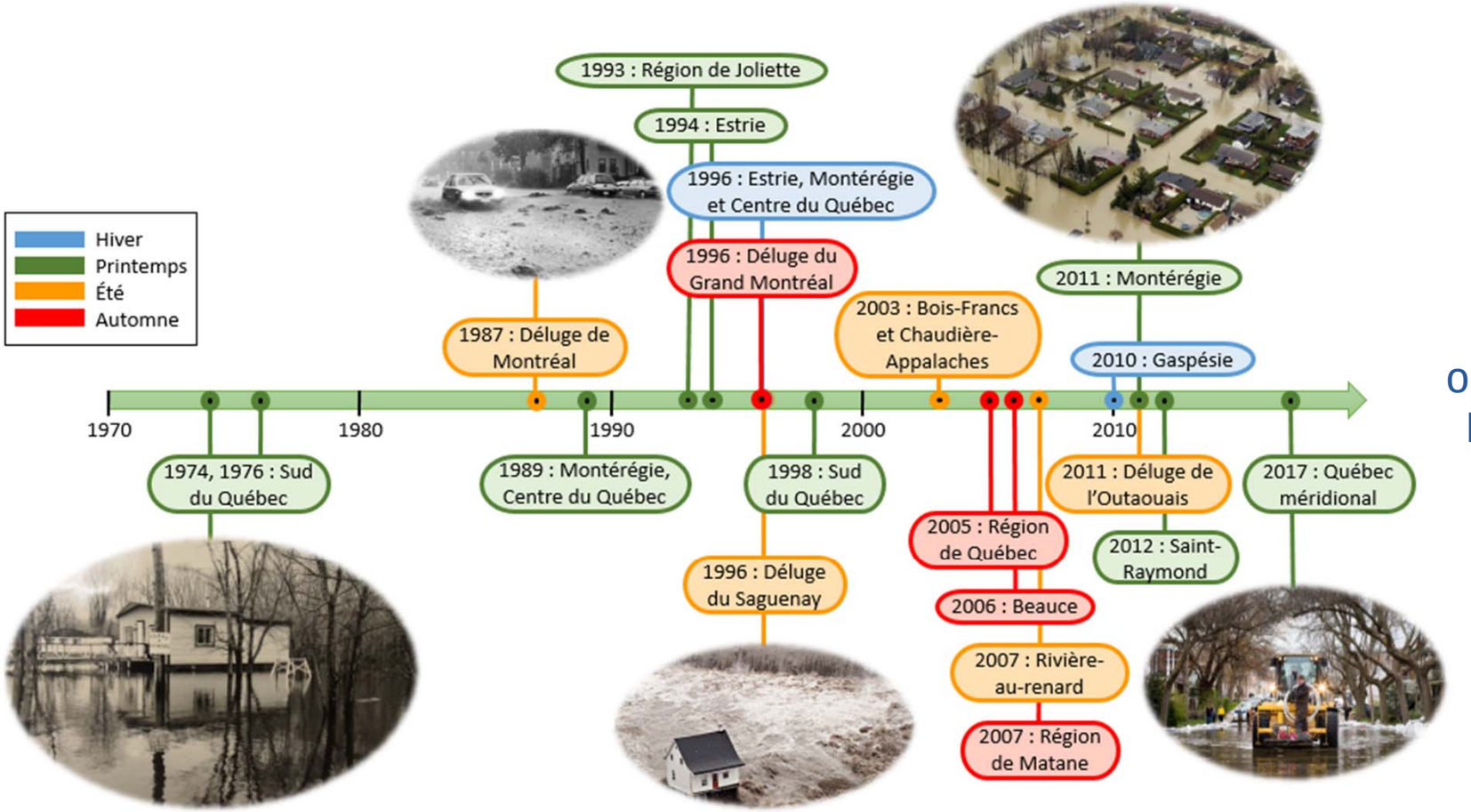
- Richard Turcotte -
Ouranos & MELCC-DEH

Water in Québec



- More than 20000 lakes, 4500 rivers and 5000 dam structures
- 3% of the world renewable water flows through Quebec
- Hydro-production mainly in the mid-north of Quebec
- Multiple water uses in the southern part of the province : 8 M inhabitants

A history of flooding in Québec



2019 ongoing Major flood

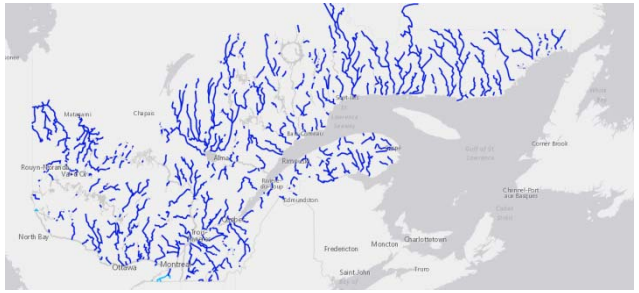
Recent projects

A Quebec Government project in response to the 2017 floods

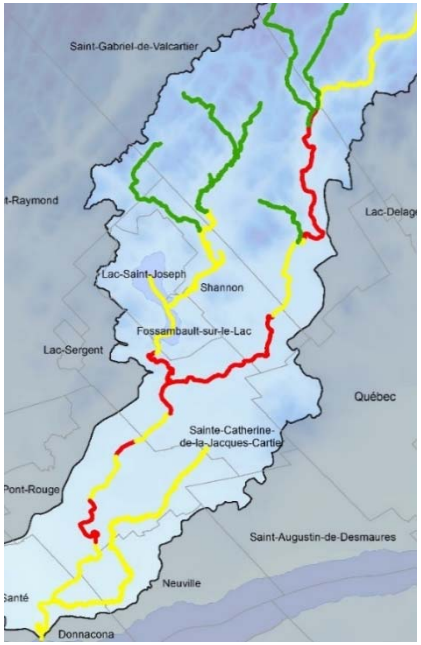
Objectives

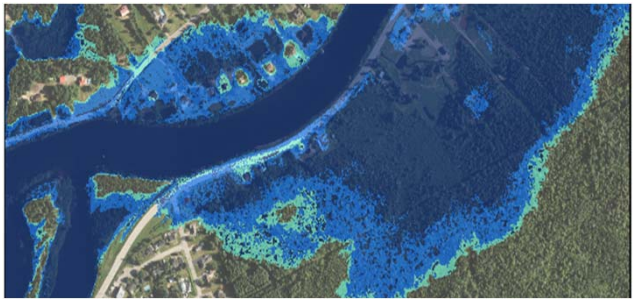
- Delineate the floodplains required for land use planning for a large part of southern Quebec while taking into account climate change;
- Improving real-time flood forecast to provide predictive mapping of areas that could be flooded within a few days.

Coverage of a large part of southern Quebec



Watershed scale

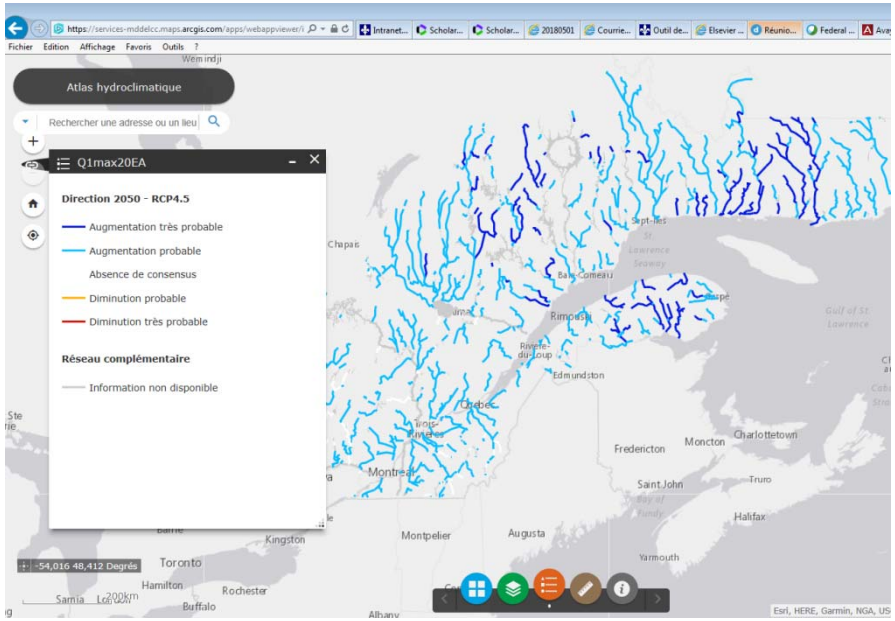




Flood extend and flood depths

Hydroclimatic Atlas of Québec (Vers. 2018)

Impact of climate change on river discharge



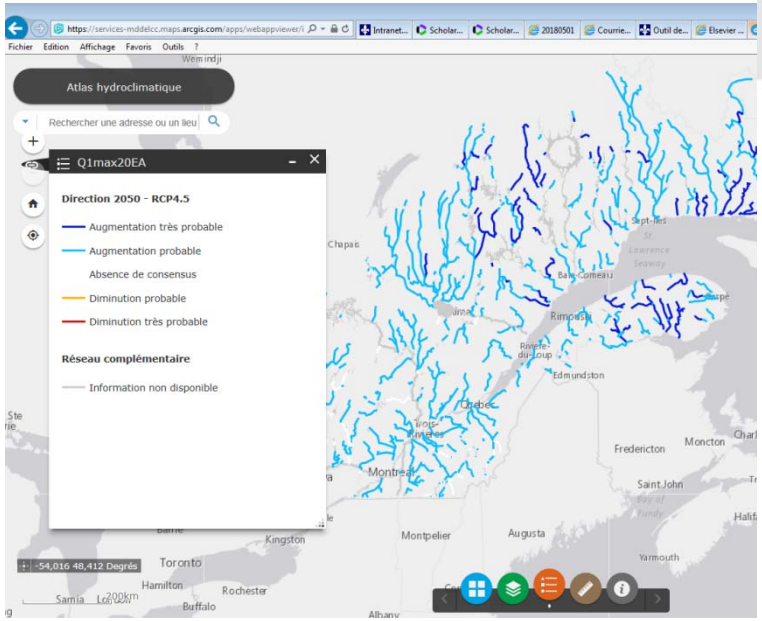
www.cehq.gouv.qc.ca/atlas-hydroclimatique/CruesEteAutomne/_Q1max2EA/index.html

- 1500 river reaches
- More than 100 climate simulations
- 4 time periods studied (1970-2000, 2030, 2050, 2080)
- Levels of confidence associated with hydrological projections

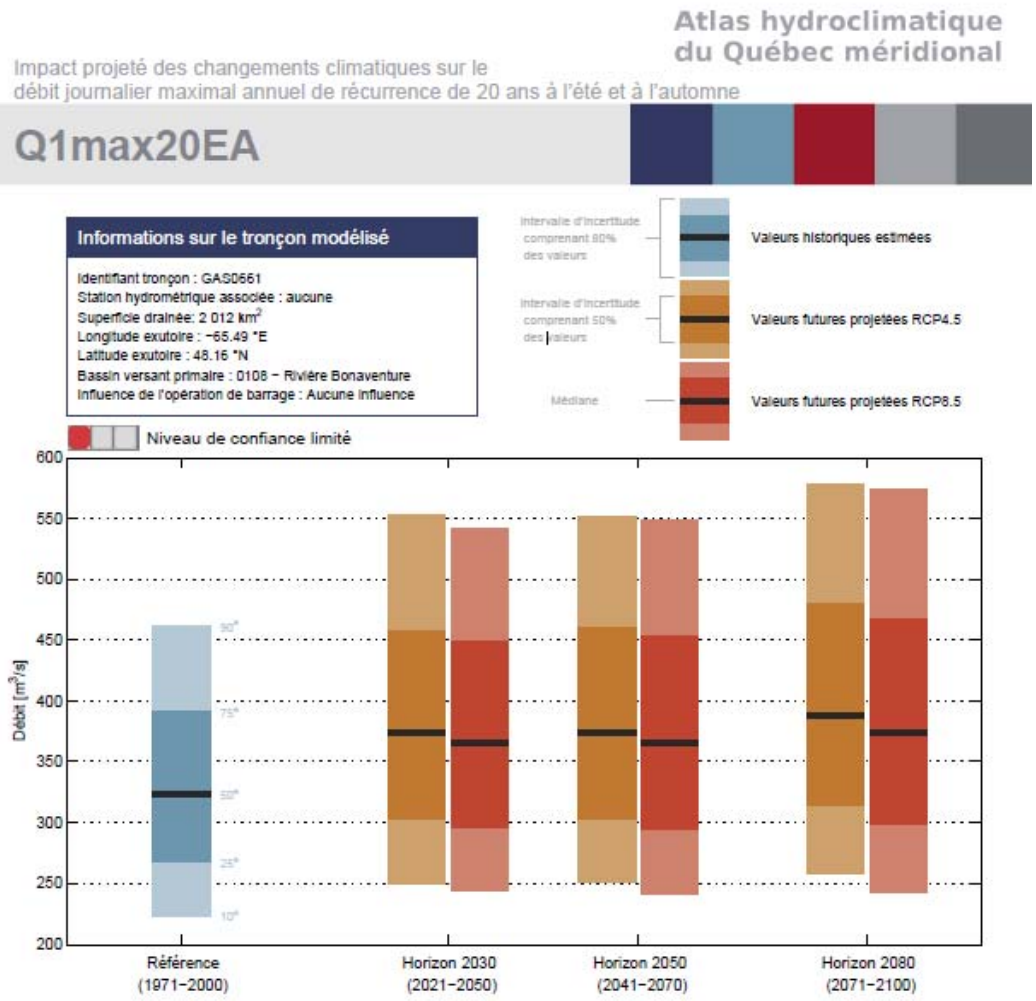
Environnement et Lutte contre les changements climatiques Québec

Hydroclimatic Atlas of Québec (Vers. 2018)

Impact of climate change on river discharge



www.cehq.gouv.qc.ca/atlas-hydroclimatique/CruesEteAutomne/_Q1max2E



Environnement et Lutte contre les changements climatiques Québec

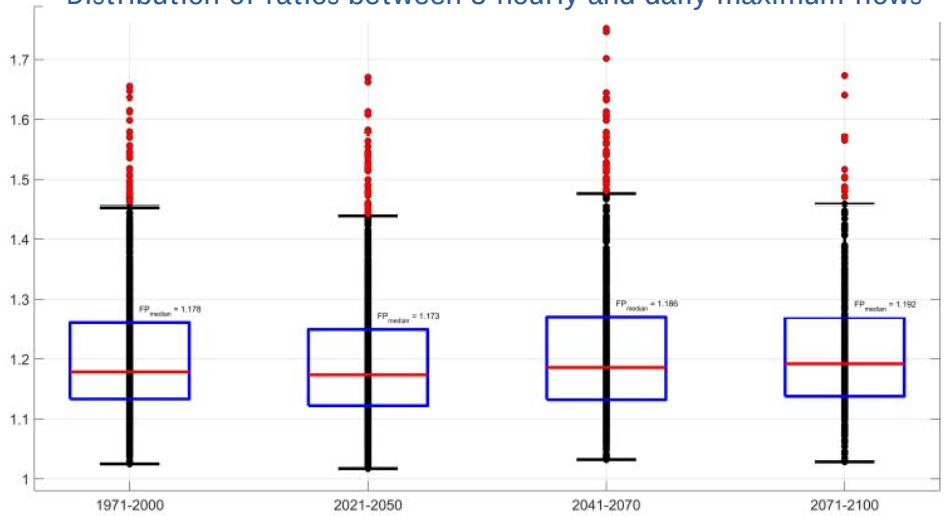
Application of ClimEx

Improving the level of confidence in flood projections

- ClimEx will be used :
  - to better assess statistically rare floods
  - to better evaluate the impact of climate change in small watersheds

- ClimEx was already used :
  - to analyse if doing simulations at daily time step is a good strategy for studying climate change and floods

Distribution of ratios between 3-hourly and daily maximum flows

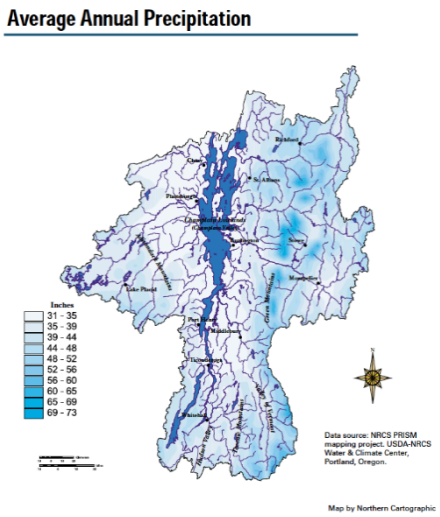


Preliminary results - Mailhot et al. 2019

Environnement et Lutte contre les changements climatiques Québec

Richelieu river/lake Champlain USA/Canada project following 2011 flood

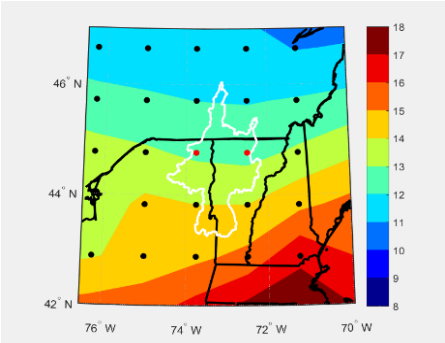
- Accounting for Climate change is mandatory for IJC studies
- CLIMEX was used to better assess climate change impacts on snow falls in mountainous areas

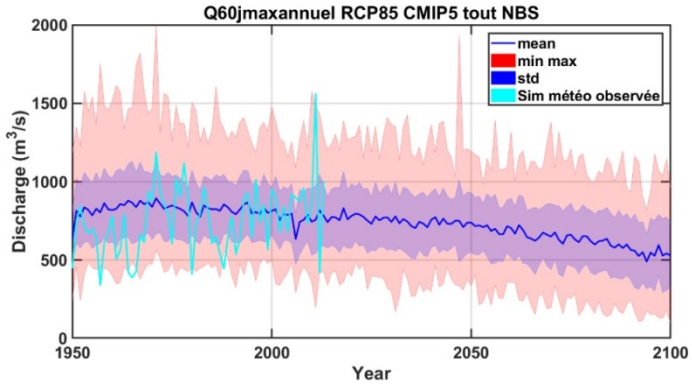


Richelieu river/lake Champlain USA/Canada project following 2011 flood

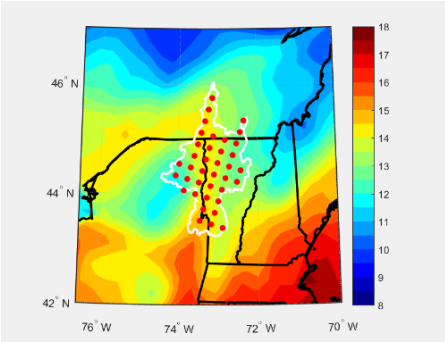
Projections of spring flood volumes

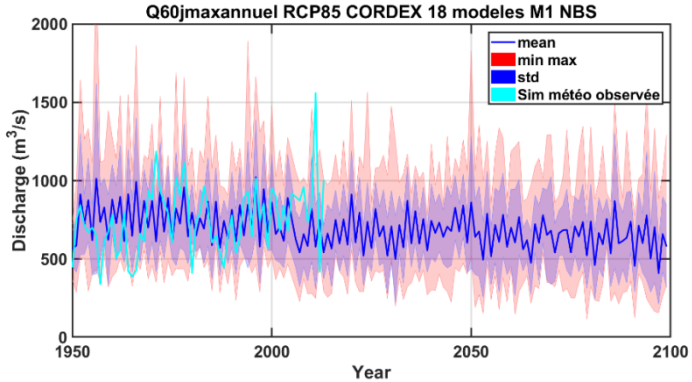
CMIP5



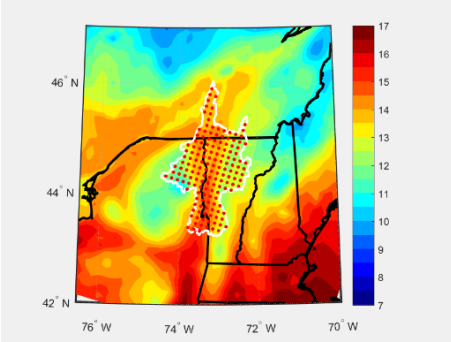


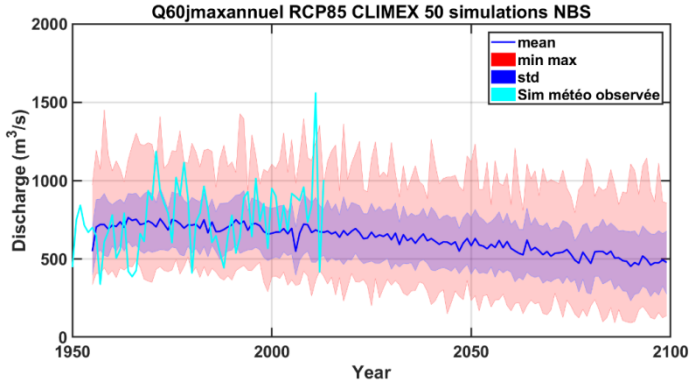
CORDEX





CLIMEX





Lucas-Picher et al. (2019)

Key messages

- Practical projects in Quebec need more and more to account for climate change
- Quebec government has developed and updated an hydroclimatic Atlas that serves as a tool for that objective
- ClimEx is an answer to the need for improving the level of confidence in flood projections in the Atlas
- ClimEx is used in actual projects regarding floods involving the Quebec government