

Modernizing ECCC's National Hydrological Service

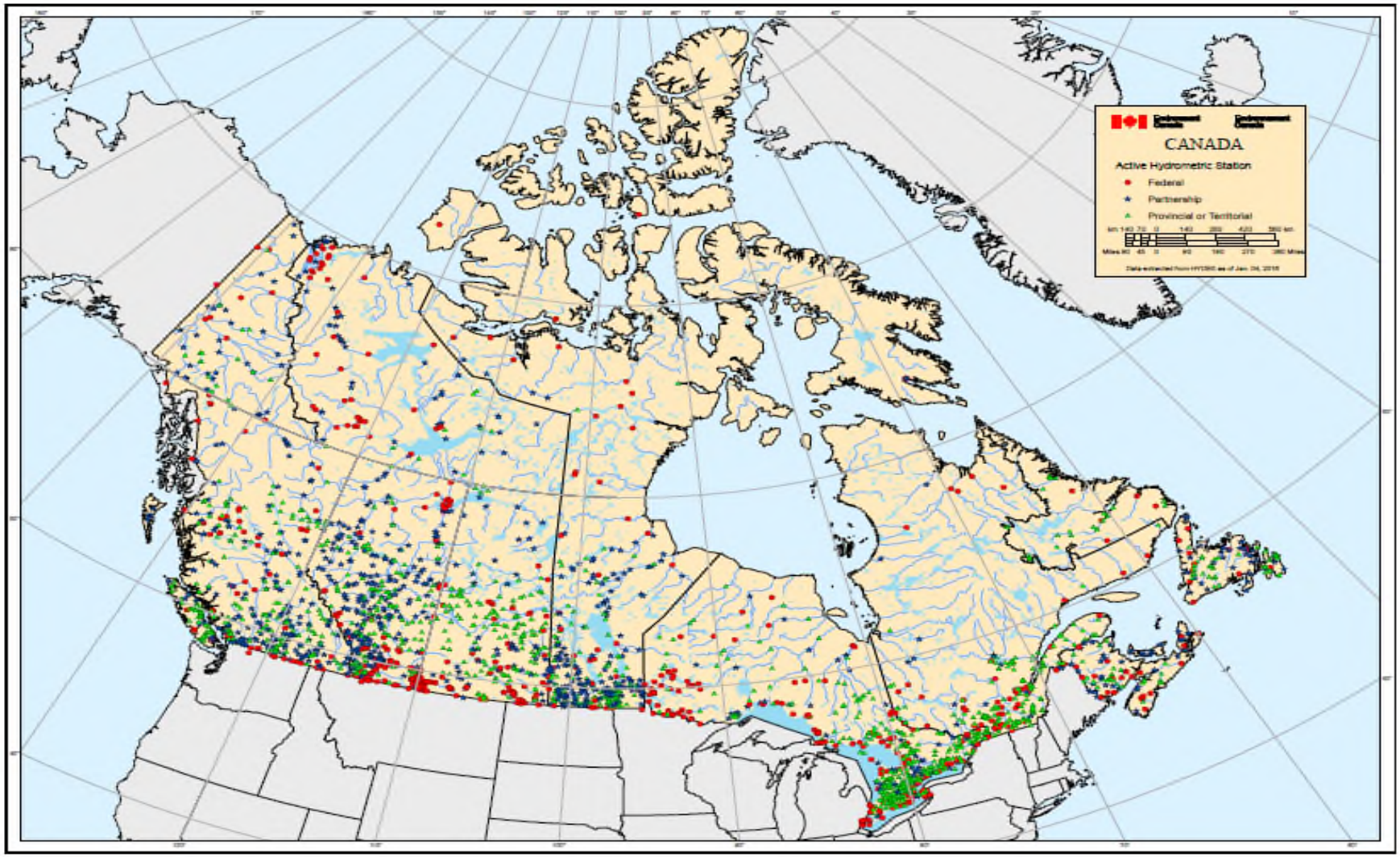
Dealing with shifting trends, technologies and evolving stakeholders

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Water Resources in MSC

- ECCC has a series of mandated responsibilities for water resources and it management in Canada
- In 2013, MSC recognized the convergence of interest and capacity between MSCs national hydrometric program delivered through the Water Survey of Canada and its transboundary water management obligations.
- A National Hydrological Service was developed as a new forward-looking vision to optimize and consolidate existing MSC program elements.
- More recently the desire for a national framework for prediction in water resources is being discussed
  - Meet transboundary requirements
  - Work with Provinces and Territories for flow guidance systems tied to NWP

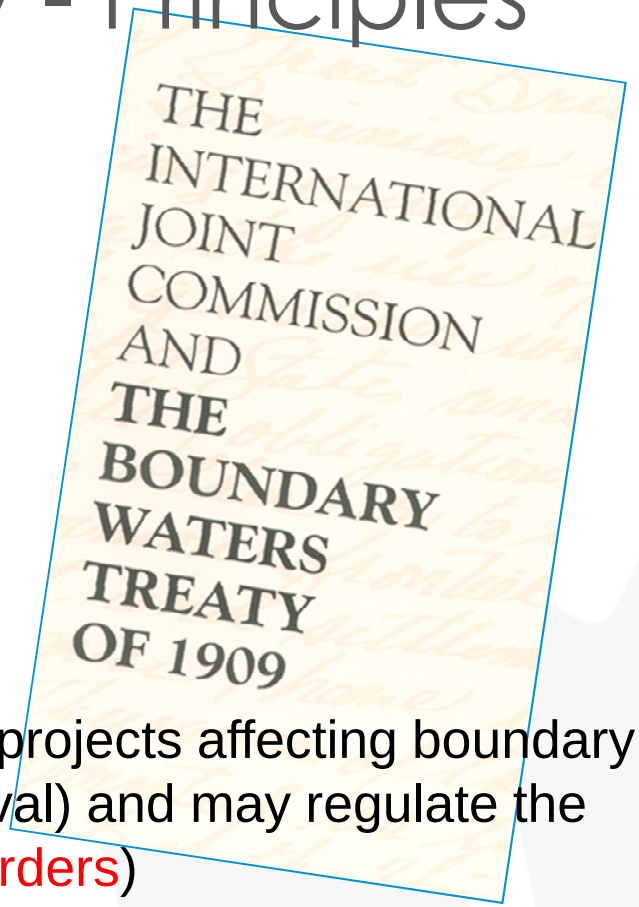
Costing arrangements



A cost-effective approach

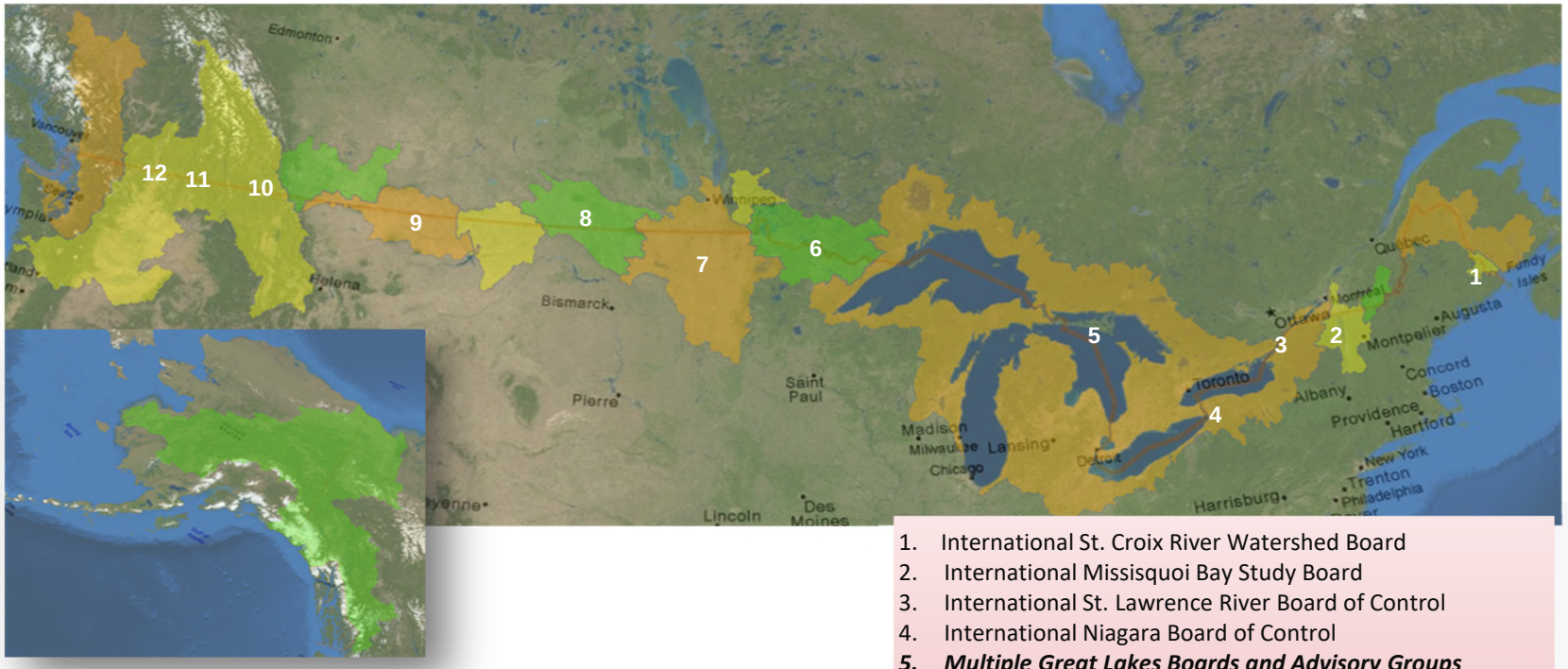
- Bilateral, cost-shared agreements with provincial/territorial governments for water level measurement and flow estimates
  - All provinces and territories.
- Integrated program to meet combined F/P/T needs
  - hydrometric monitoring network is operated by the MSC on behalf of agreement partners
  - data collection, analysis, interpretation, dissemination, training, technology, …
- Enables consistency in approach and economies of scale
  - national standards and procedures, rigorous technical recruitment and apprenticeship, uniform quality control, etc
  - high accessibility to nationally consistent and authoritative data

Boundary Waters Treaty - Principles



- Equal and similar rights to use of boundary waters
- Order of precedence of use – sanitary/domestic, navigation, power generation and irrigation
- Structures/diversions not to affect levels and flows on the other side
- Must not pollute water on either side to the injury of health or property on the other side
  - rules upon applications for approval of projects affecting boundary or transboundary waters (orders of approval) and may regulate the operation of these projects (review of orders)
  - investigates issues referred by governments and makes non-binding recommendations for resolution (references)
  - MSC-NHS lead agency with IJC MOU

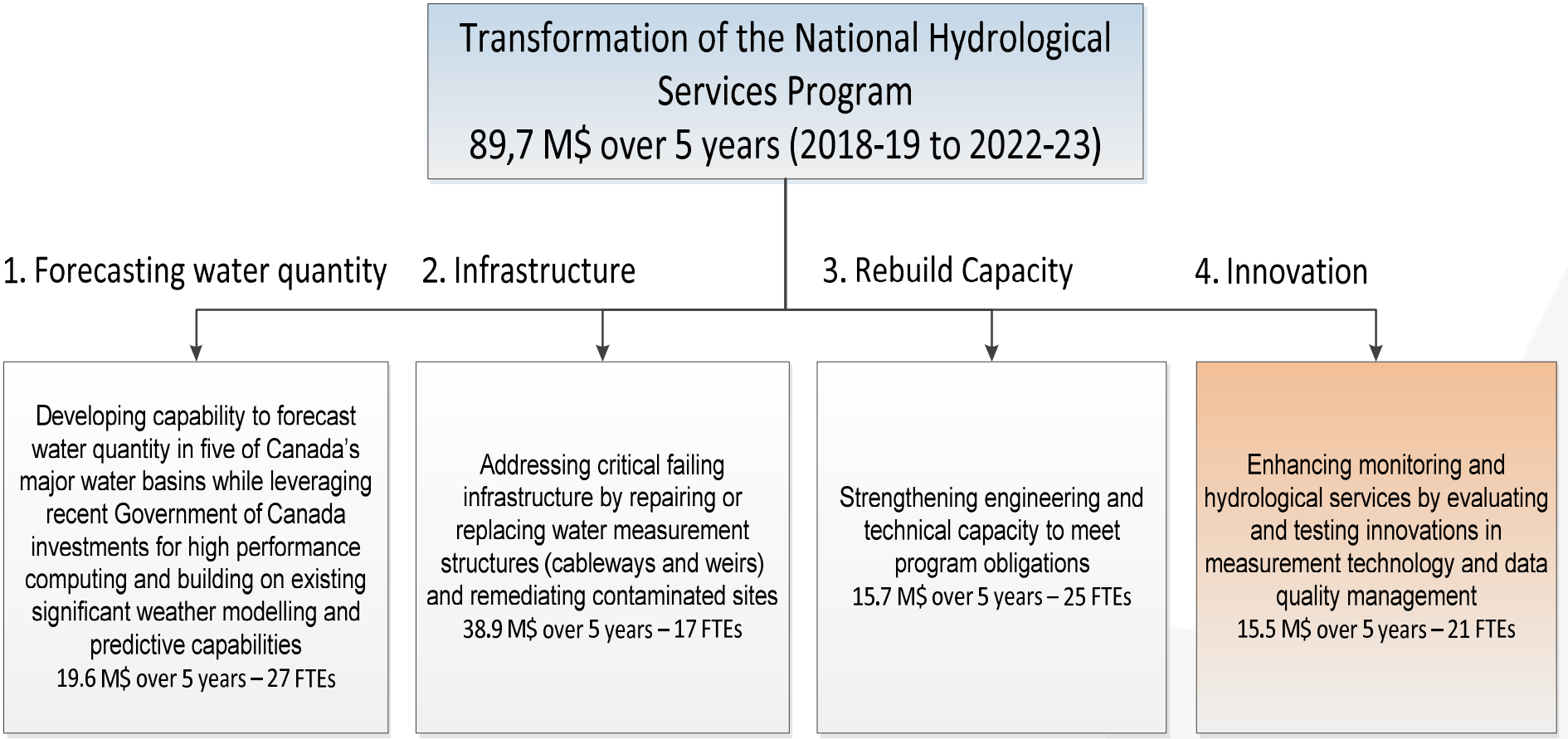
IJC Boards



15 distinct basins with some
300 lakes and rivers
water covers 43% of the 8,900 km border

1. International St. Croix River Watershed Board
2. International Missisquoi Bay Study Board
3. International St. Lawrence River Board of Control
4. International Niagara Board of Control
5. ***Multiple Great Lakes Boards and Advisory Groups***
6. International Rainy River Pollution and Control Boards
7. International Red River Board
8. International Souris River Board
9. Accredited Officers of the St. Mary-Milk River
10. International Osoyoos Lake Board of Control
11. International Columbia River Board of Control
12. International Kootenay Lake Board of Control

Transformation Plan



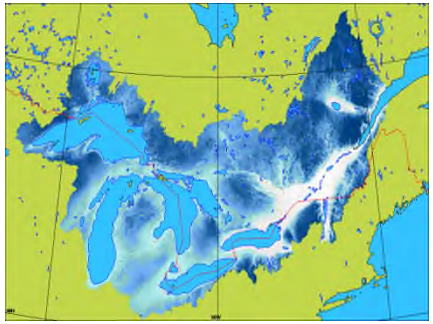
Hydrometric Renewal Component 1: Develop capacity to forecast water quantity

- With a consistent water forecasting capability, water quantity forecasts will be provided in advance of extreme events. This will provide greater data and information for decision making and provide provincial, territorial and federal agencies more lead time to take action and mitigate the impacts of water-related disasters. This would include locally based actions to reduce loss of life and property (e.g. sand-bagging). This system, when implemented, will significantly enhance Canadian capabilities, on par with the US, which has been developing this national capability for the last three years.

- The key deliverables will be:
  - An integrated water data and prediction service including developing, testing and implementing forecasts of changes in water quantity for five water basins. Great Lakes-St. Lawrence targeted completion by 2020 and by 2023 for Saskatchewan-Nelson, Mackenzie, Columbia and Churchill, which are facing the most critical water management issues.
  - Improved coastal water level information and services for flood risk alert management on the Atlantic Coast (targeted completion 2023).

ECCC's Current Earth System model

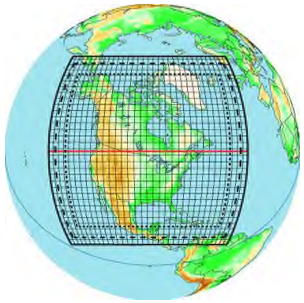
Hydrology/Hydraulics/Stream Ecology



GEM LAM (2 - 10 km) atmospheric model



GEM RDPS (10 km) atmospheric model

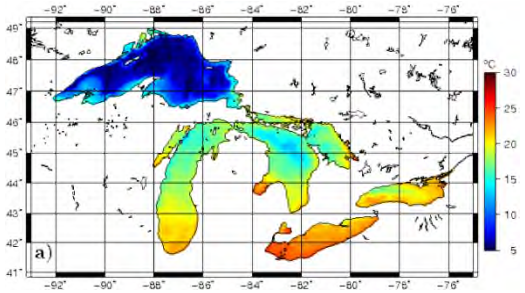


Runoff

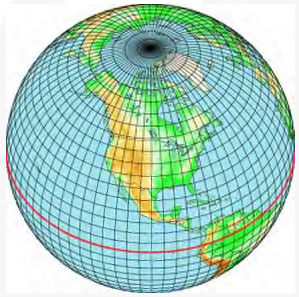
Streamflow

Turbulent fluxes

- 2 forecasts/day (00Z and 12Z)
- 48-h forecasts
- Assimilation cycle: direct insertion of RADARSAT ice cover and WSC streamflow



NEMO+CICE (2 km) ocean-ice model



GEM GDPS (25 km) atmospheric model

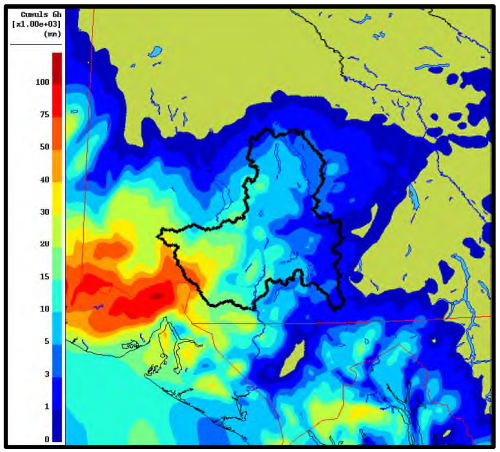
Canadian Precipitation Analysis

- Real-time QPE for Canada since April 2011
- Combines in-situ data and radar with GEM short-term forecast
- 6-h and 24-h accumulations
- 10-km for North America
- 2.5-km for Canada

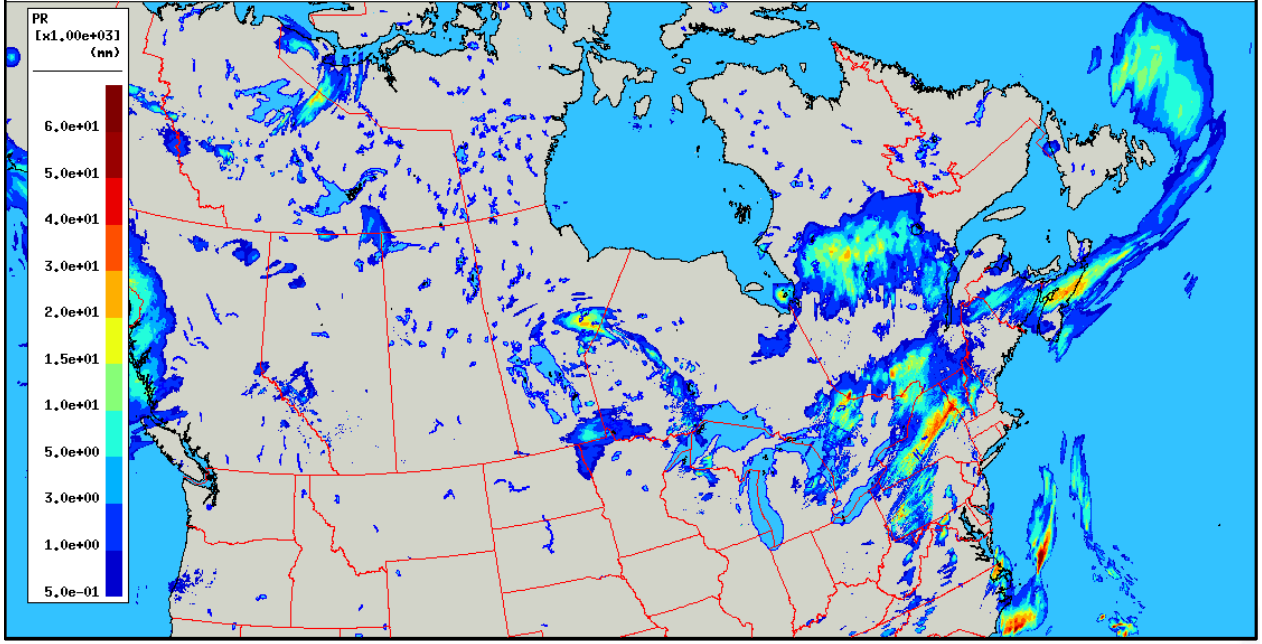
More details here:

http://weather.gc.ca/analysis

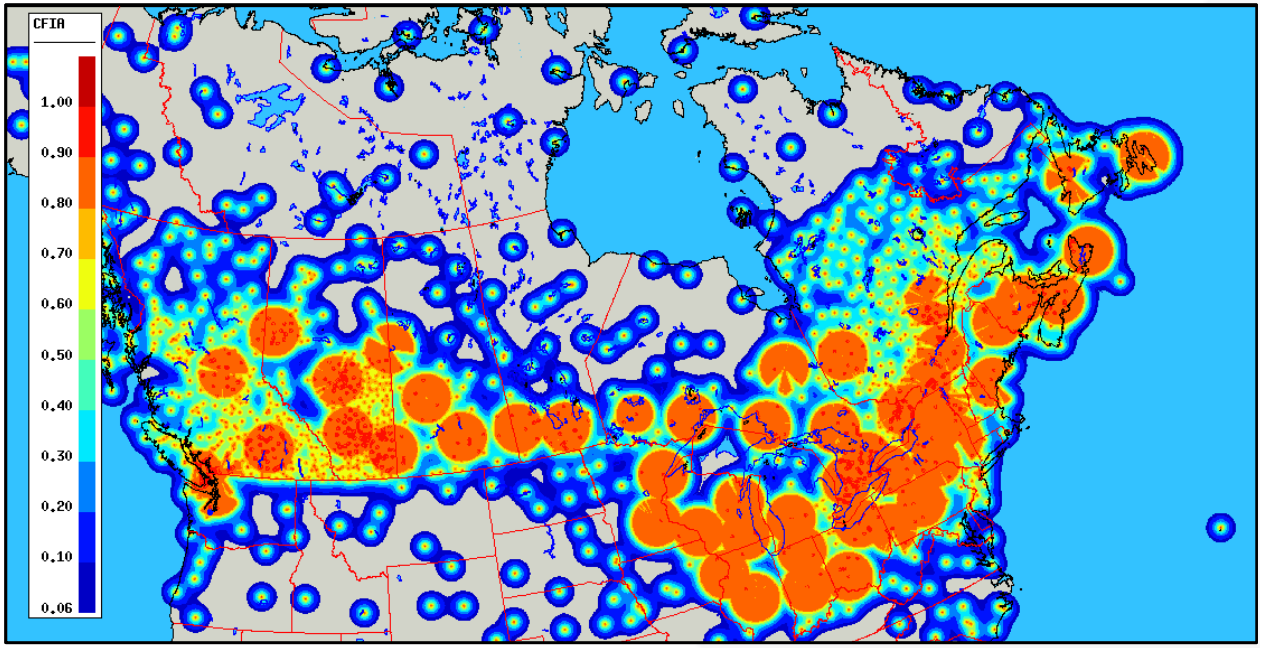
http://collaboration.cmc.ec.gc.ca/cmc/cmoi/product_guide/submenus/capa_e.html



10.9 mm watershed average for basin 08AB001 valid at 06 UTC on February 14, 2017

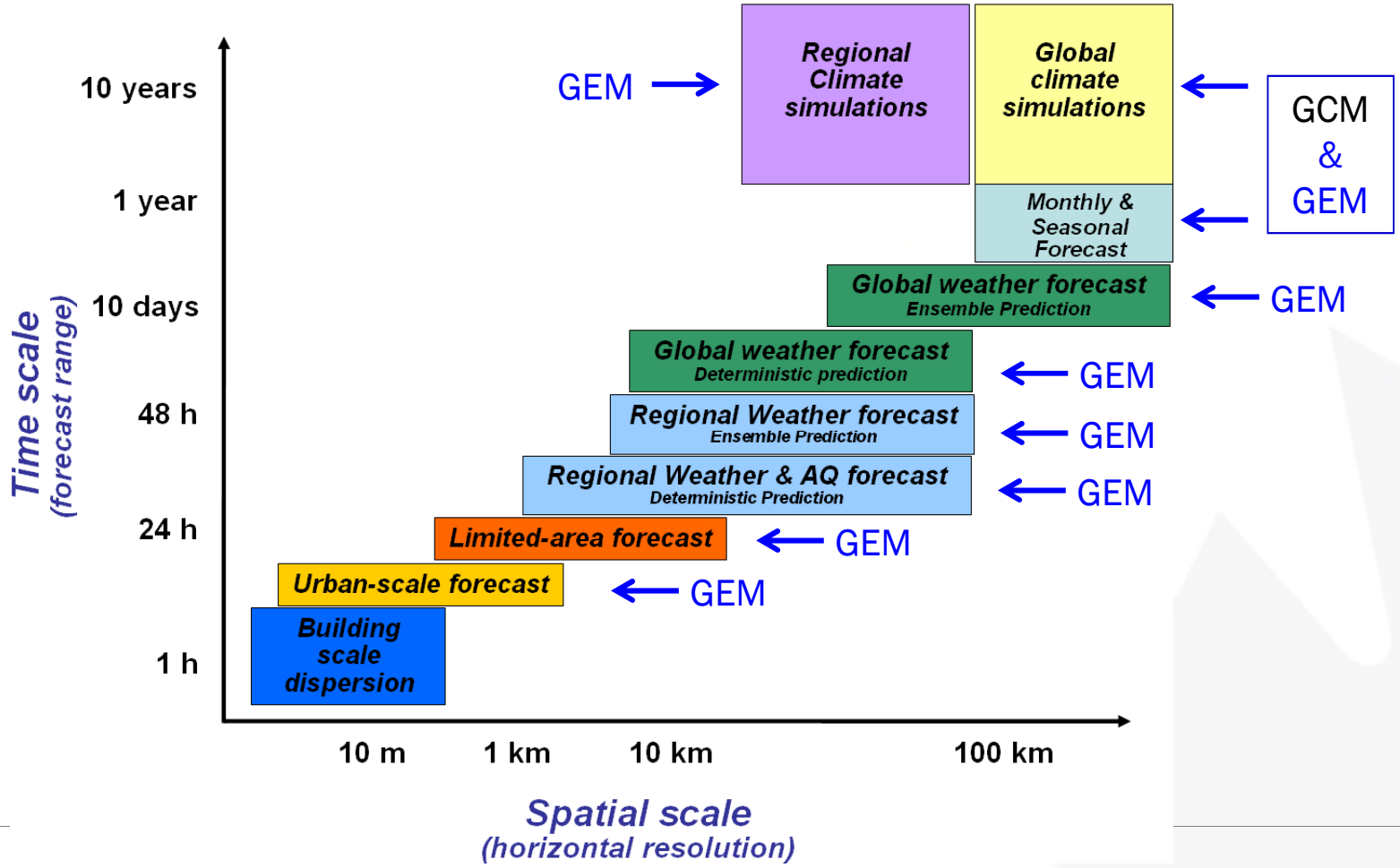


6 hour total precipitation analysis at a resolution of 2.5 km valid at 18 UTC on July 1st , 2017



Confidence Index of the Analysis (CFIA) valid at 18 UTC on July 1st , 2017

Modeling systems running on ECCC supercomputer



Hydrometric Renewal Component 2: Address Critical Failing Infrastructure

- As part of the engineering requirements for the NHS over the last 100 years, various monitoring structures in and around waterways have been constructed to support the water measurement process. These include in-river structures (weirs), adjacent-to-river structures (stilling wells) and over-river structures (cableways). In the absence of these structures, reliable water measurements are not possible. Some of these structures are now obsolete or structurally compromised; located at active hydrometric sites; or have not yet been decommissioned (removed) and therefore are still in place at inactive hydrometric sites.

- With this investment, ECCC will address the most critical, degraded, hydrometric monitoring infrastructure to reduce risks to workers and public safety, and to sustain program operations in order to meet federal obligations.

Why Cableways?

- **Historically, used to reduce risk by keeping engineers & technicians out of dangerous waters.**
- **Allows for measuring stream discharge at sites with optimum hydraulic characteristics if no other methods feasible.**
- **Provide an alternative to bridge measurements**



Hydrometric Renewal Component 4:
Evaluate and test innovations in measurement technology and data quality

- International experience (US and Europe) indicates that the adoption of new data standards and measurement methods and the use of new monitoring technologies have great potential to increase the quality and safety of operations while reducing costs and reliance on expensive traditional infrastructure. The NHS has had limited capacity to explore, evaluate and integrate the use of modern methods over the past ten years.
- The goals of this component are to strengthen national data systems, to work with other sectors such as industry and academia to test innovative new technologies, to improve the ability of the NHS to integrate promising new technologies into its operations, and to keep pace and innovate in a rapidly evolving technological environment.
- These innovative advancements include implementing the newest generation of hydrometric data production systems, advancing systems performance to meet the real-time needs for water resource management; testing and implementing new technologies to improve the quality and efficacy of data collection; and improving the distribution of products and services by employing modern data dissemination platforms.
- In addition, an expanded suite of innovative products will be developed to support decision-making involving water resources made possible through the proposed incremental analytical capacity. Development and implementation of both the data production and data dissemination systems will be undertaken throughout the project timeline, improving system redundancy and 24/7 operations.

Themes

1. Increasing efficiencies in data production and information management
2. Modernizing flow measurement and estimation methodologies
    - GWF Big Data and Drone Deveopment
3. Improving products and services
    - GWF big data
4. Standards, Procedures and Quality Management

Meeting Outcomes

First ever National Workshop on Flood Forecasting

- A new step forward in ECCC for earth systems approach to Hydrological Modelling
- Much like Hydrometric Program, and given shared and some exclusive responsibilities – how can we work together

- ECCC will provide flow information and predictions
  - Limited in reliability depending on controls
  - Will not forecast levels
  - Compatible with products like FEWS
  - What about real-time data ?
  - ……
- Think about
  - products and services that would be useful for your operations
  - Upgrade provincial system
  - Should the be compatible with ECCC models ?