Environment and Climate Change Canada | Environnement et Changement climatique Canada

Canada

Hydrological and Water Cycle Prediction

Research/Innovation/Development/Operations for:

Improved Water Information and Services for Water Resource Management, Water Security and Forecasting of Floods and Droughts

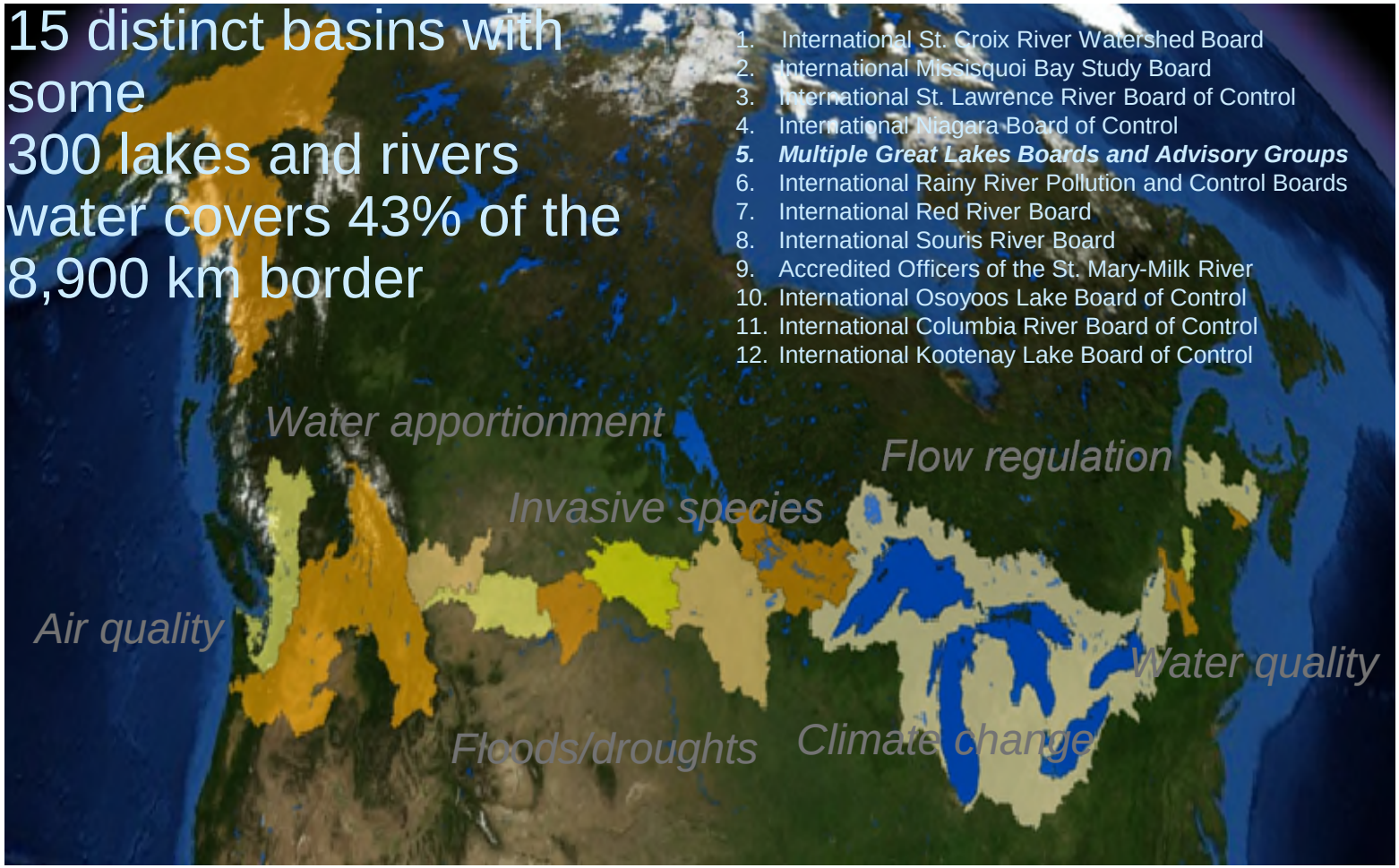
Réunion, Vancouver

Février, 2019

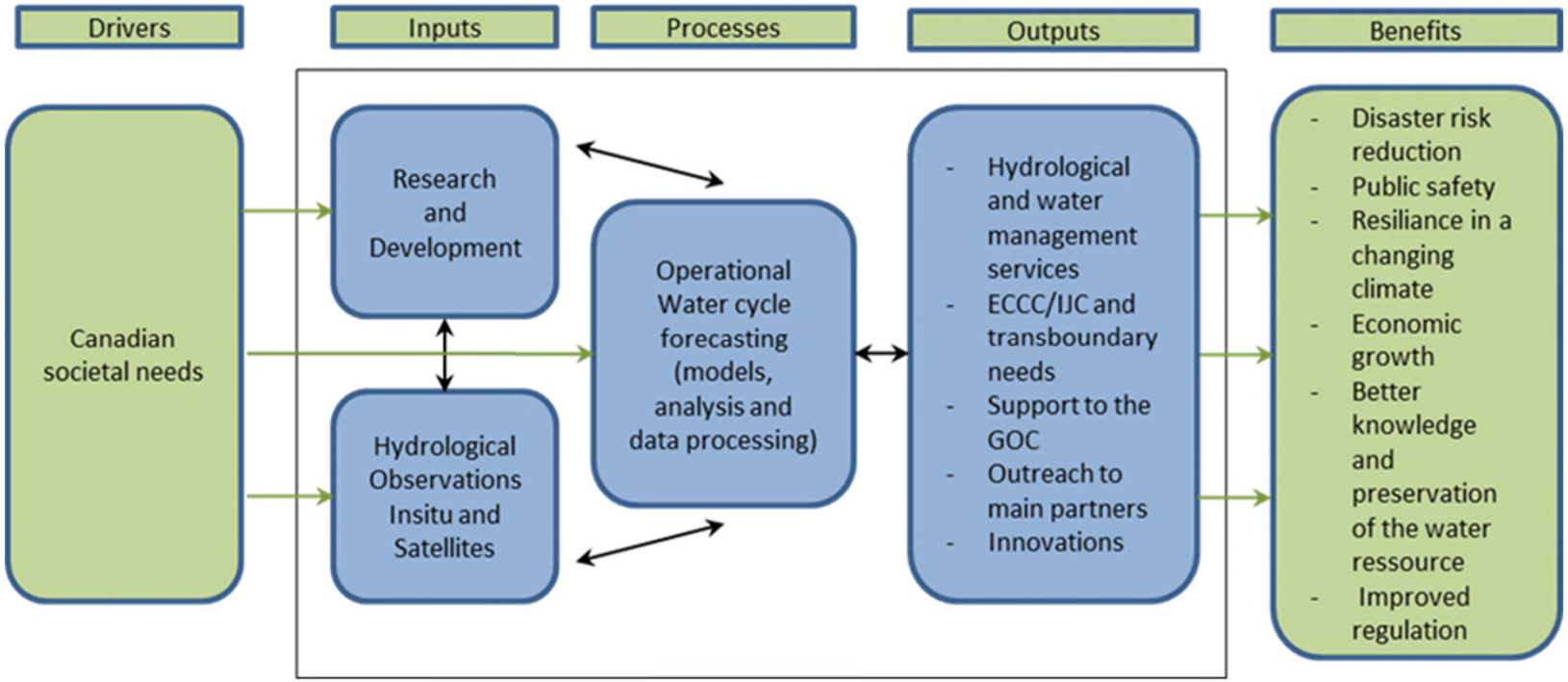
Objectives

- Science for Services:
  - The Research, Development & Innovation component will ensure the development of novel operational products, exploit predictability on all time-space scales, adapt to new emerging science, and promote research within the Canadian water community
- Deliver the underpinning science necessary to advance the prediction system through national and international coordination and collaborations;
- Co-design prediction systems that rely on research advances;
- Develop an integrated approach to research, development and operation;
- Ensure availability of data / models / tools for research purposes;
- Contribute to development of the observing system;
- 30-year reanalysis of forcing fields for model and product calibration;
- Key clients
  - International Joint Commission Boards of Control and Study Boards
  - National Hydrometric Program and MSC operational offices
  - DND and other departments
  - Provinces and Territories
  - Specialized Users (through products disseminated via Datamart/Geomet)

A numerical laboratory infrastructure in support to:
Boards Address a Range of Issues

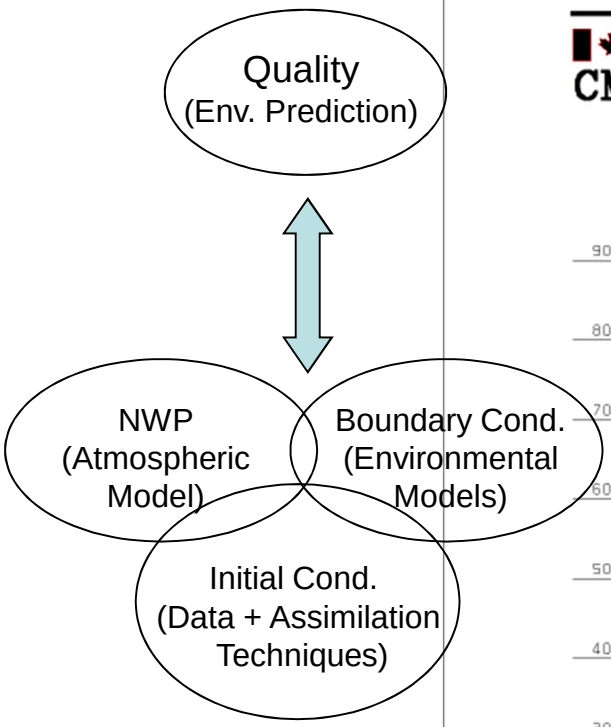


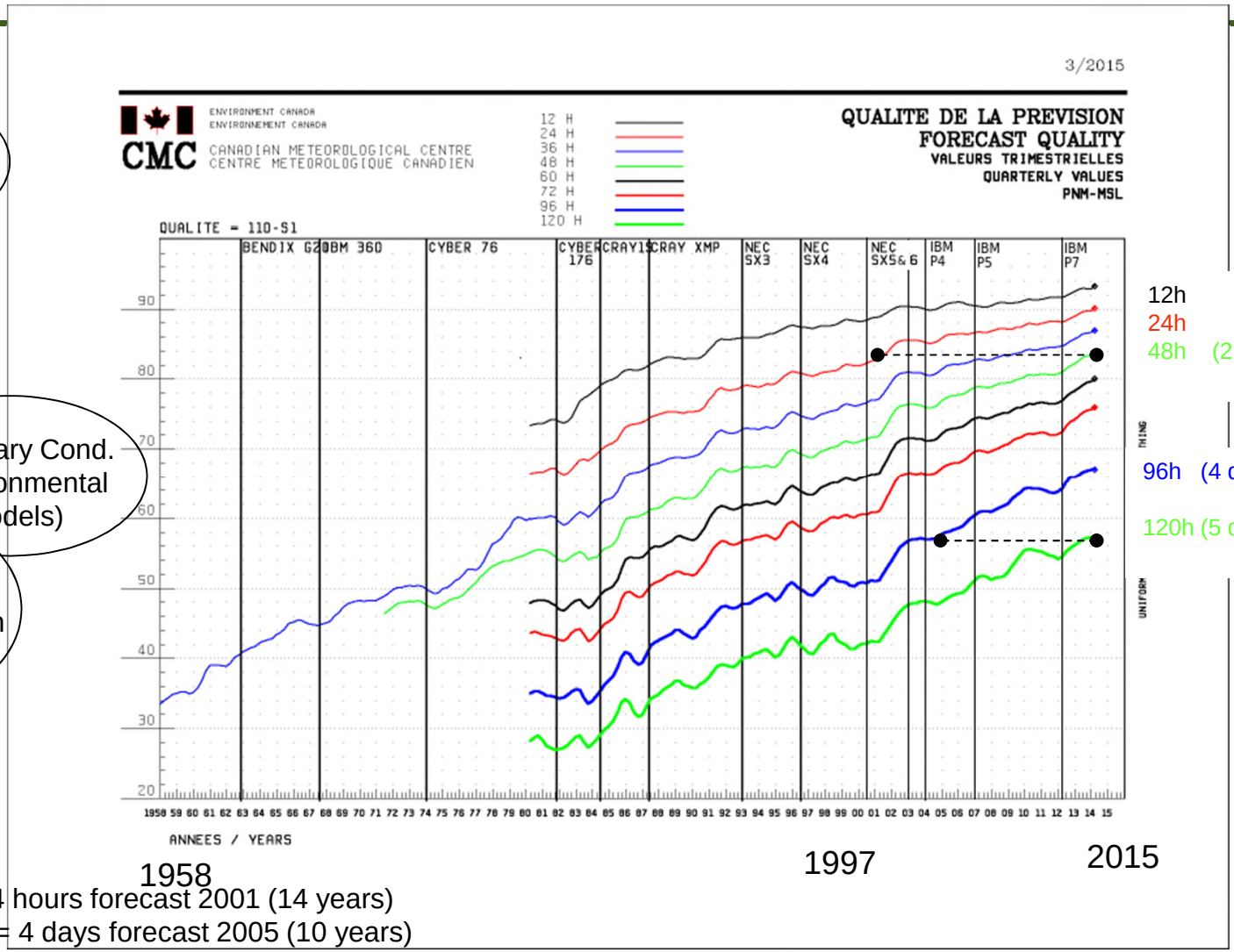
Science for Services (the Chain)



Environmental Numerical Prediction

The quality of weather forecasts has systematically increased over the last four decades.



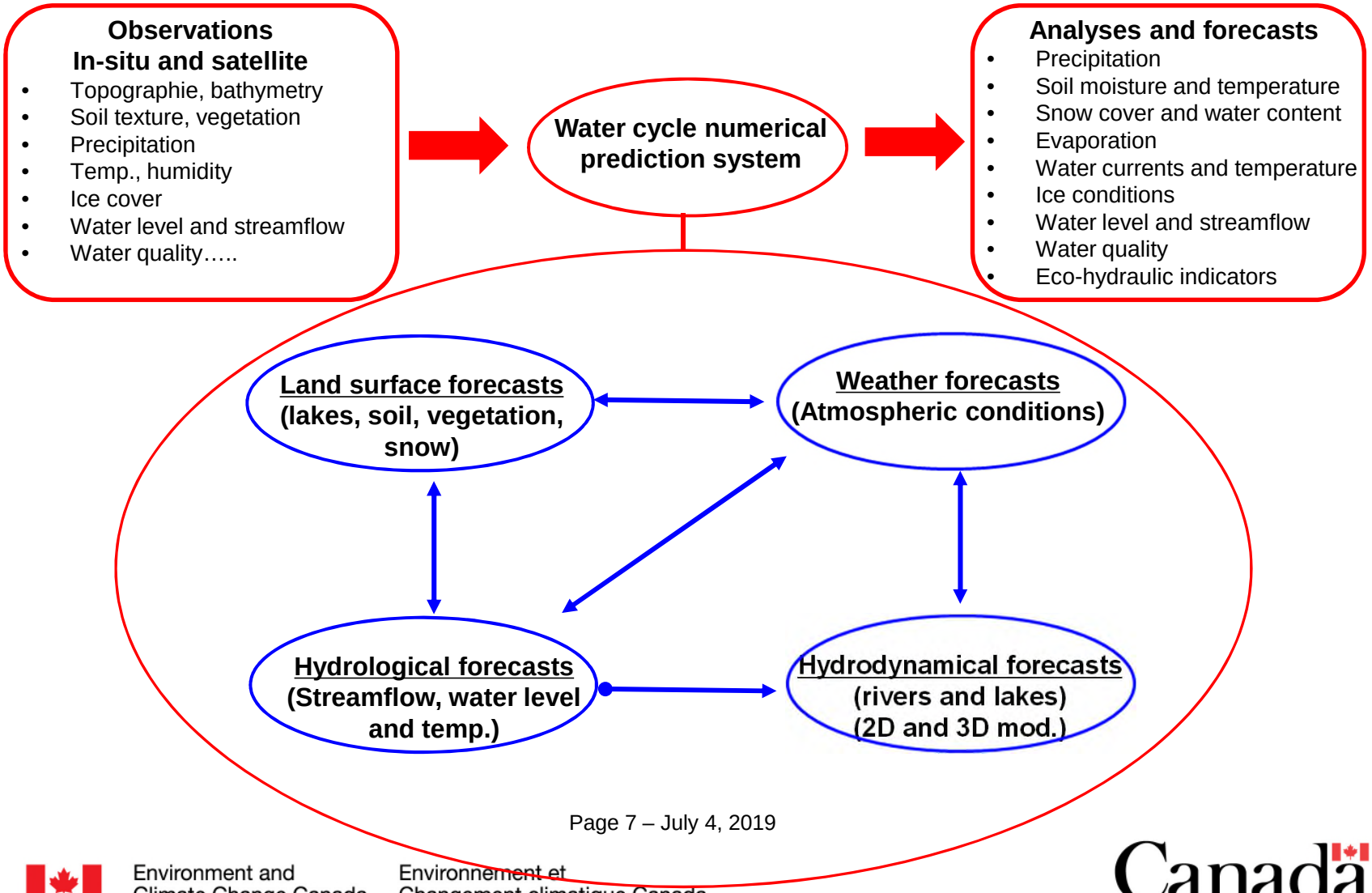


48 hours forecast 2015 = 24 hours forecast 2001 (14 years)
5 days forecast 2015 = 4 days forecast 2005 (10 years)

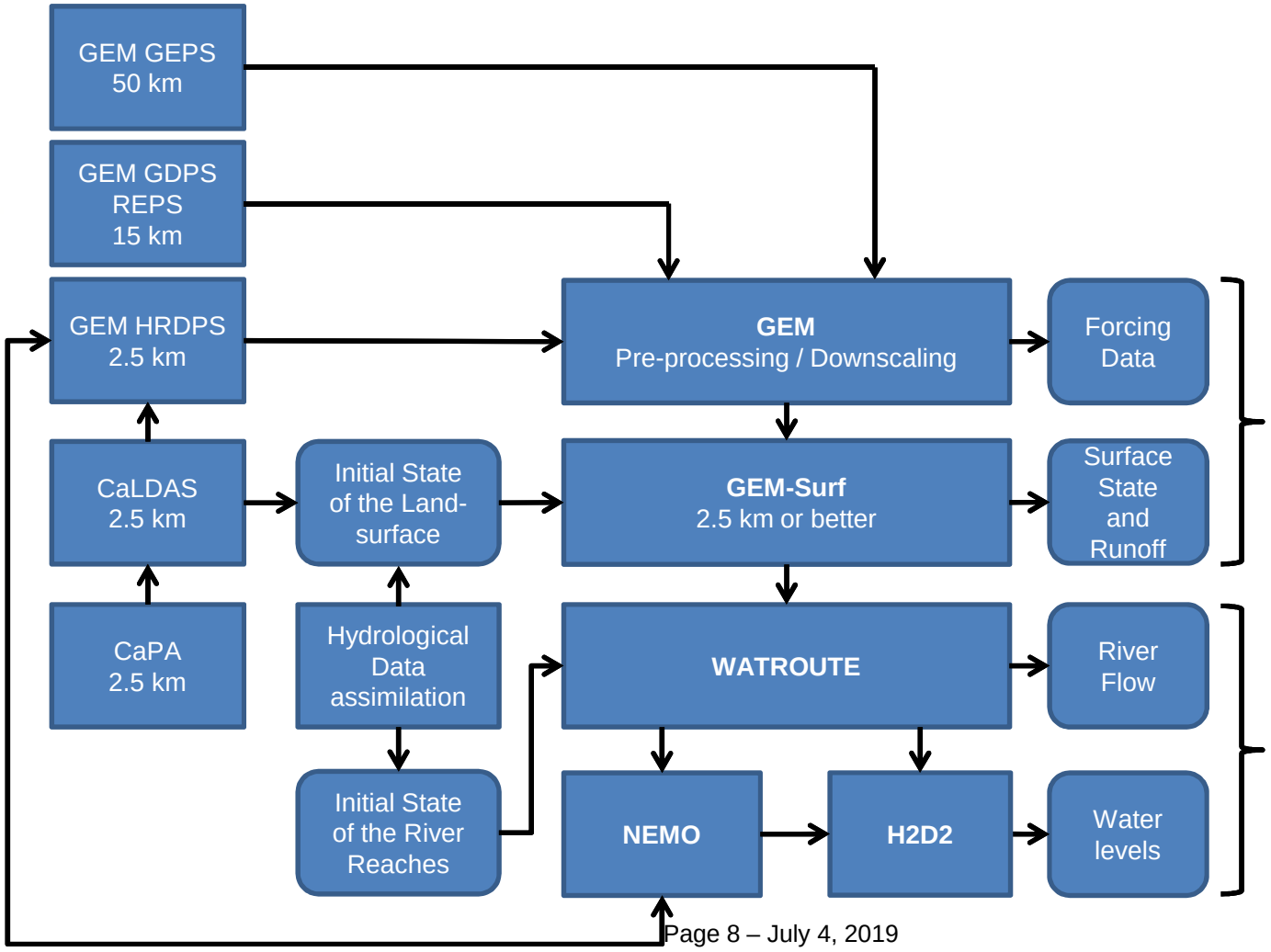
Important concepts to consider

- Atmospheric forecasts (initial conditions and models) are imperfect;
- Soil-vegetation-hydrology-snow-urban forecasts (initial conditions and models) are imperfect;
- The atmosphere is a chaotic dynamical system;
- This means that the time evolution of forecasts is sensitive to initial conditions and model parameters;
- This sensitivity brings the need for **probabilistic approach** to forecasted water cycle;

Prediction Framework for Water Services
(Water cycle prediction system)

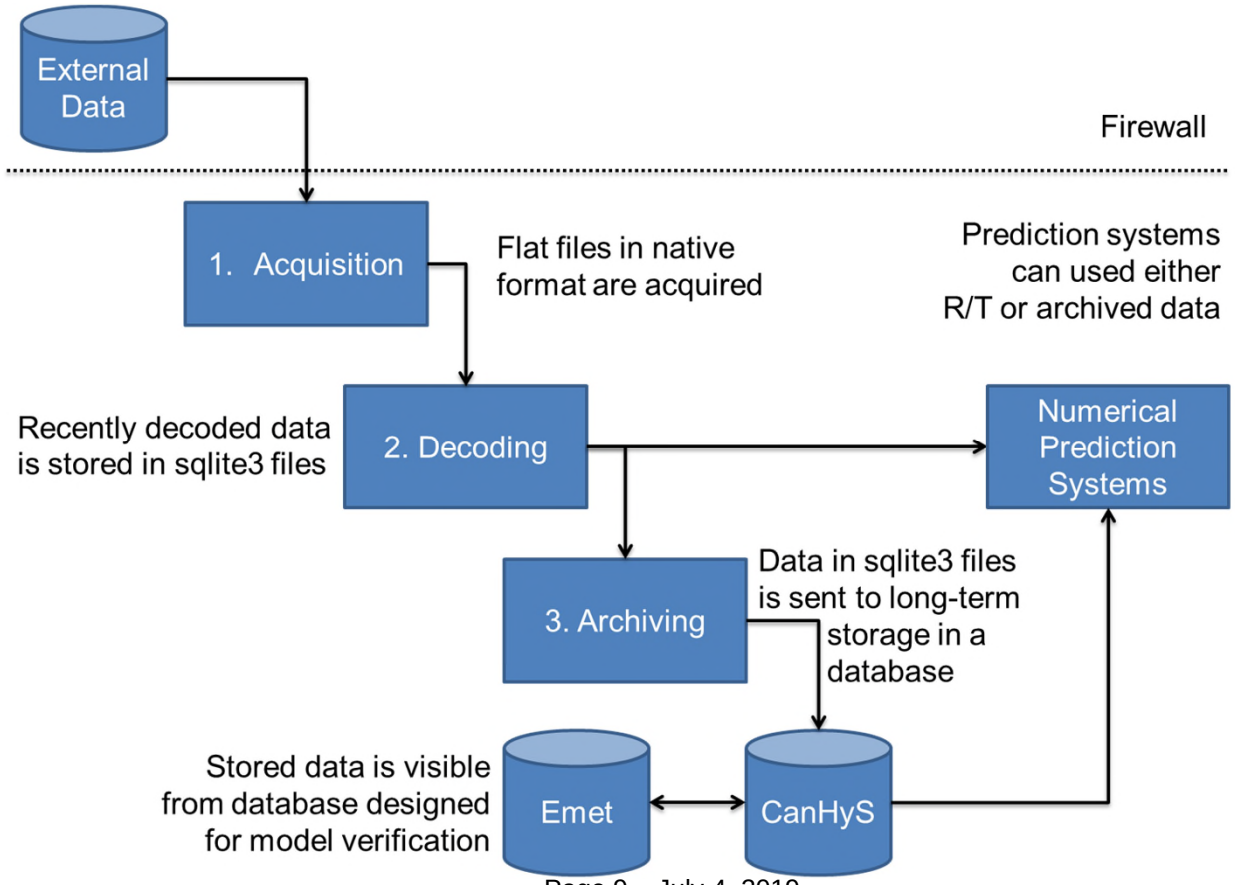


Vision for the hydrological forecasting system

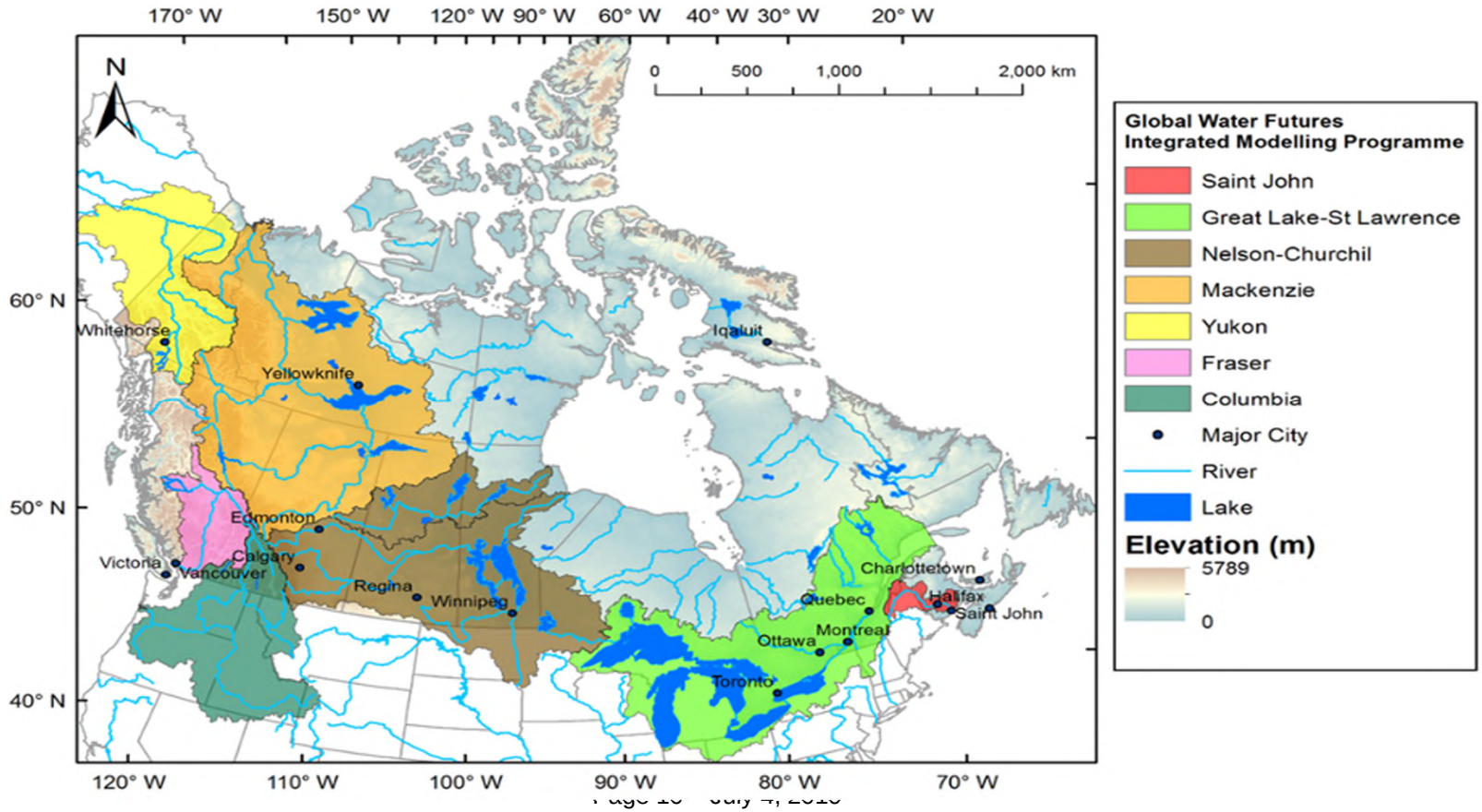


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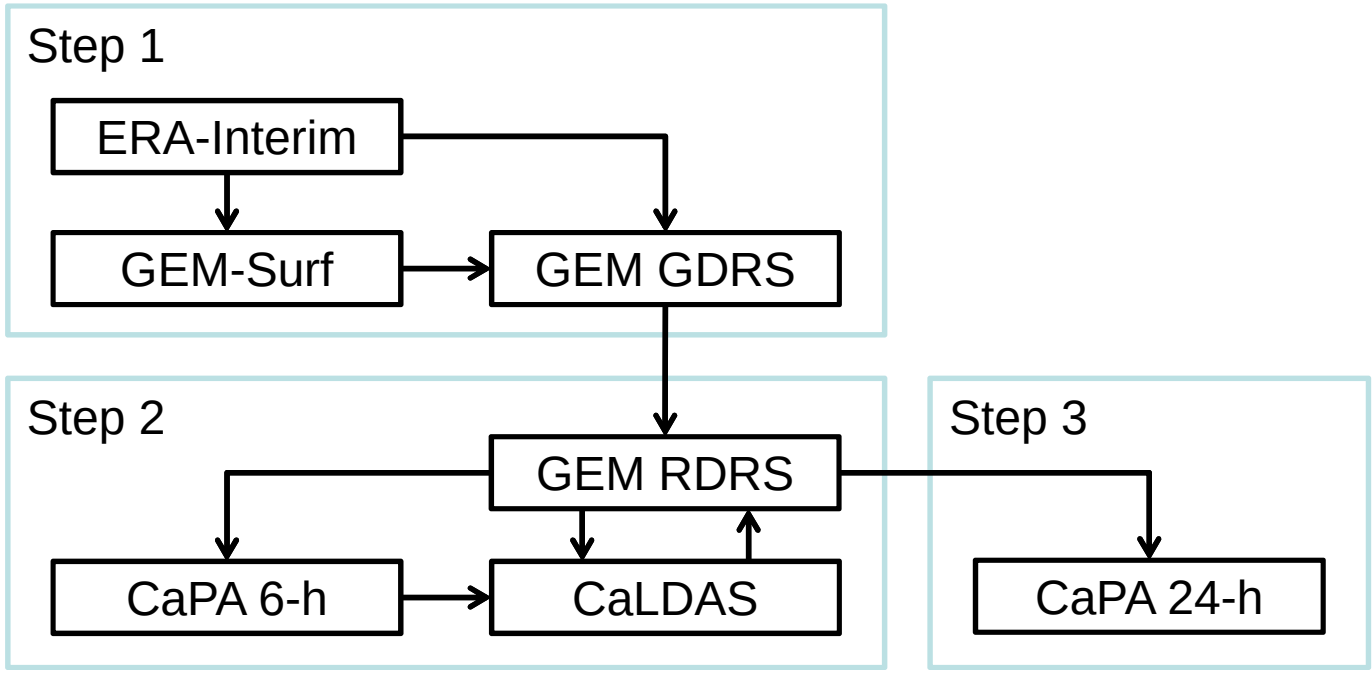
Hydro data acquisition system envisioned to feed the prediction tools



Prioritized watersheds



A reanalysis system adapted to our country
(forcing fields for model and product calibration 30-year)



So where are we…

Existing numerical prediction systems

- Existing systems and products:
  - QPE (Quantity Precipitation Estimate)
    - CaPA
  - Canadian Land Data Assimilation System (Caldas)
    - Soil moisture and temperature
    - Snow analysis
    - Vegetation state
  - QPF (Quantity Precipitation Forecast)
    - HRDPS,RDPS, REPS, GDPS, GEPS, Seasonal…
  - 2D St. Lawrence nowcasting and forecasting system
    - Water levels and currents
  - Great-Lakes/St. Lawrence water cycle forecasting system
    - NBSE (Net Basin Supply Estimate)
    - NBSF (Net Basin Supply Forecast)
    - Water levels
    - Currents, water temperature and Ice
    - Hydrological forecasts
  - Land surface forecasting systems
    - Soil moisture and temperature, Snow, vegetation
    - Urban conditions

Key Milestones and Target Dates

Expected Implementation Date	*Major Milestones*
2018-19	• Establishment of grants and contributions program completed by the end of the first year • Short-range land-surface water availability forecasting system operational for identified watersheds (48 hours) • Stream flow and lake water level short-range forecasting systems operational in the Great Lakes and St. Lawrence River basin (48 hours)
2019-20	• Automated reporting of observation quality issues to Monitoring directorate • Short-range stream flow forecasting system operational for the Nelson-Churchill (48 hours) • Long-range land-surface water availability forecasting system operational for identified watersheds (16-32 days) • Experimental automated coastal flood risk products for the East Coast
2020-21	• 24/7 data acquisition systems required for water level and flow prediction • 24/7 data dissemination of water related observations and forecast products • Experimental automated coastal flood risk alert system for the East Coast
2021-22	• 30-year reanalysis of forcing fields for model and product calibration • Long-range probabilistic stream flow forecasting system operational for the Great Lakes, St. Lawrence, Nelson-Churchill (16-32 days) • Coast flood risk products calibrated against model climatology for the East coast
2022-23	• Long-range probabilistic stream flow forecasting system operational for the Mackenzie and Columbia (16-32 days) • Long-range ensemble coastal water level forecasting system operational for the East Coast (up to 16 days) • Methodology and support for network planning and optimization