Environnement et Changement climatique Canada | Environment and Climate Change Canada

Canadian Air Quality Forecasting and Information Systems

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Canada

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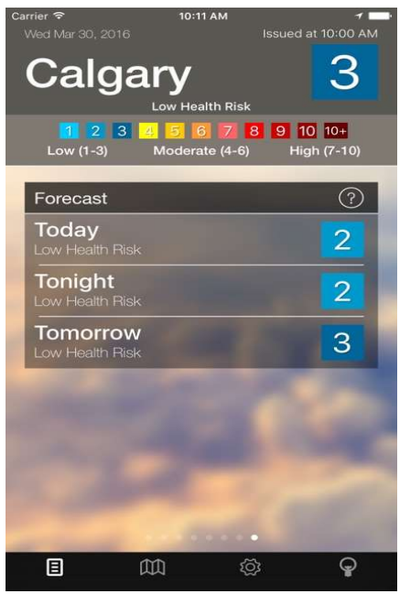
Canadian Operational AQ Forecast Program

- More than ***20-year-old program*** that has evolved from an O_3-only forecast program to a Canada-wide O_3, NO_2, $PM_{2.5}$ forecast program in 2007.

- Forecasts are communicated via the **Air Quality Health Index** (AQHI) which conveys the combined health risks of **$PM_{2.5}$**, **O_3** and **NO_2** on a relative scale and includes health messaging and health protection advice.

AQHI Apps

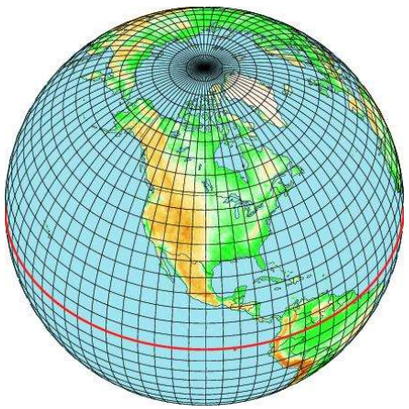


AQHI+ based on other pollutants (CO, SO_2, H_2S or TRS*) is also applied in some provinces if AQHI+>AQHI

*Total Reduced Sulfur Compounds

Canadian Air Quality Forecasting Systems

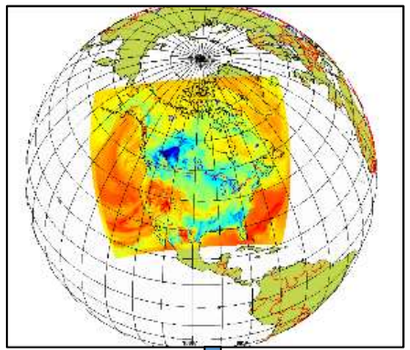
Global System



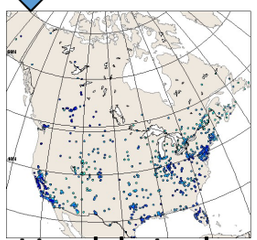
Research

Canadian air quality forecasting systems at different temporal and spatial scales

Regional System (10km)



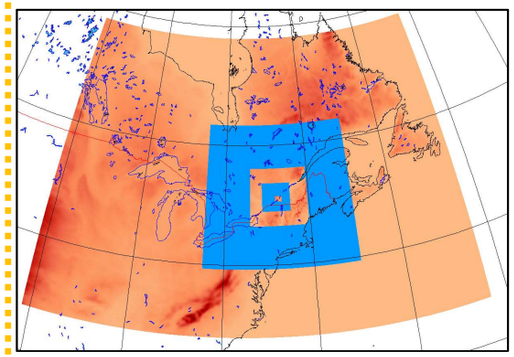
Surface level OA



Air Quality Health Index forecast and related early warning system

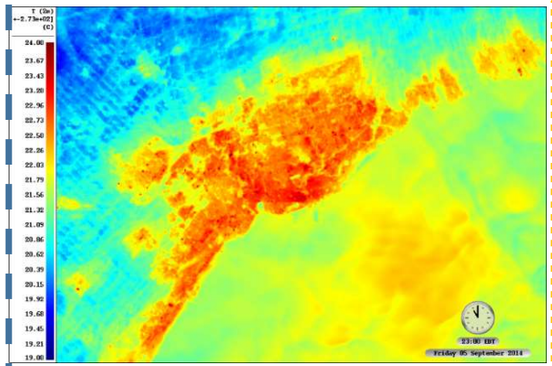
Operational

National/Regional System (2.5km)



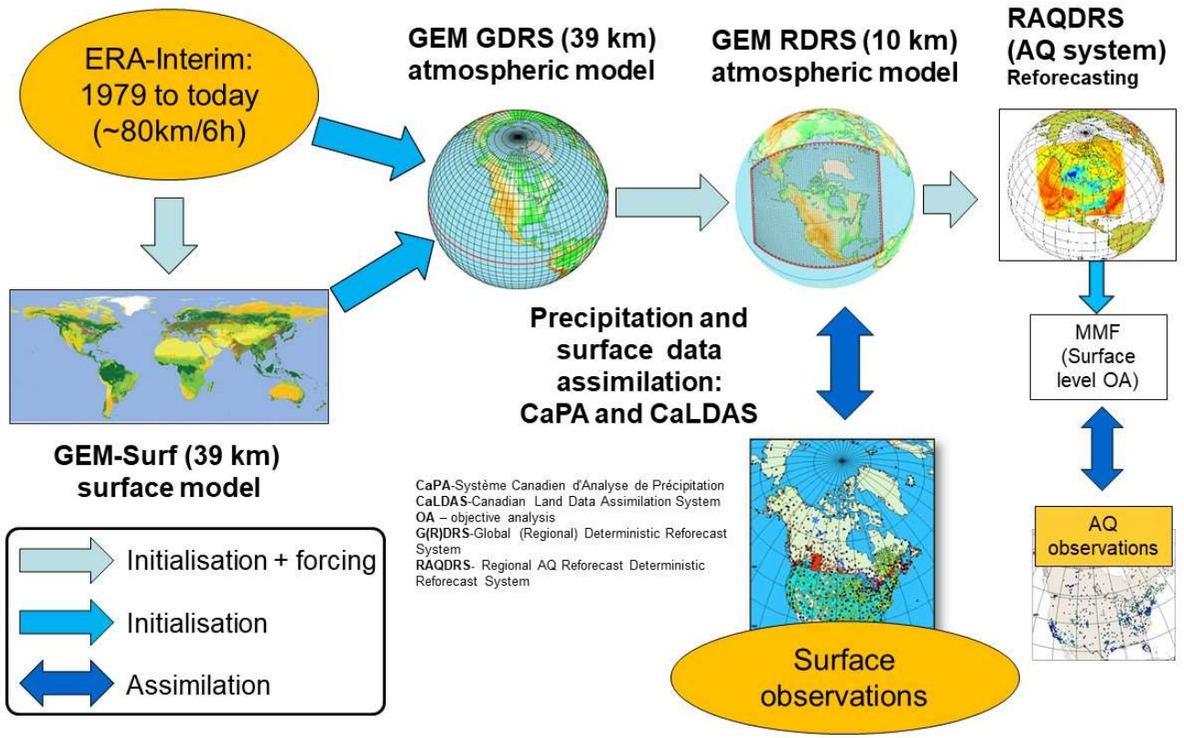
AQ Policy Modelling at 10km and 2.5km

Urban Scale System (250m)

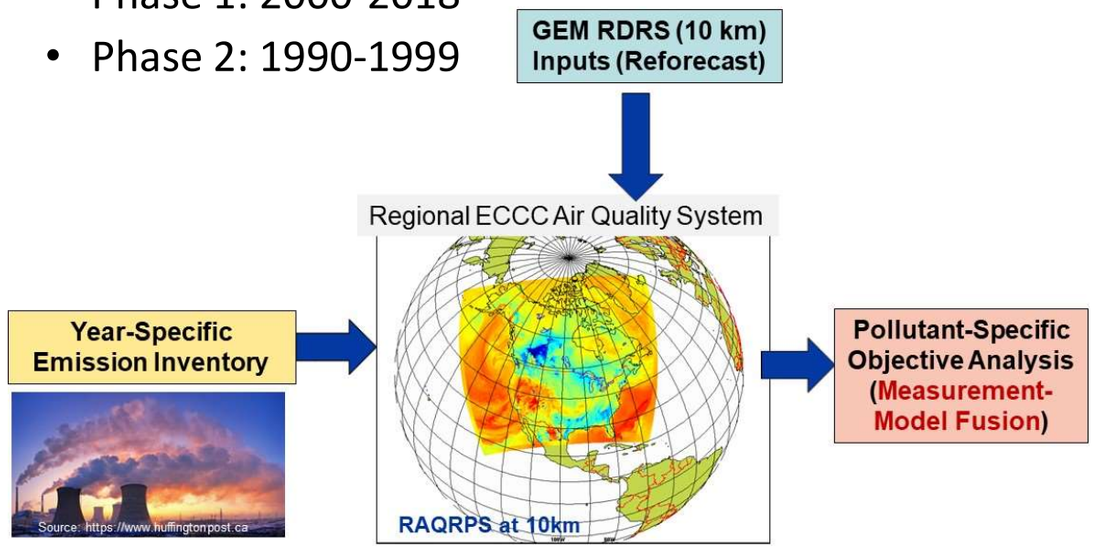


AQ Scenario/Policy Modelling with urban inputs - under testing

Reforecasting/Reanalysis (1990-2018)



- Targeted period **1990-2018**
  - Phase 1: 2000-2018
  - Phase 2: 1990-1999



ECCC is working on **reforecasting (1980-2018) all major ECCC forecast systems including AQ and surface pollutant specific Objective Analyses reforecasts.**
This project has more than 100 collaborators

URBAN SCALE MODELLING – UNDER DEVELOPMENT

Local Planning Tool- Urban features as an input for urban modelling scenarios – down to 250m

Vegetation changes (eg. number of trees) in street canyons. What would be the impact of added vegetation in an urban environment ?

Conversion of "green space" into urban

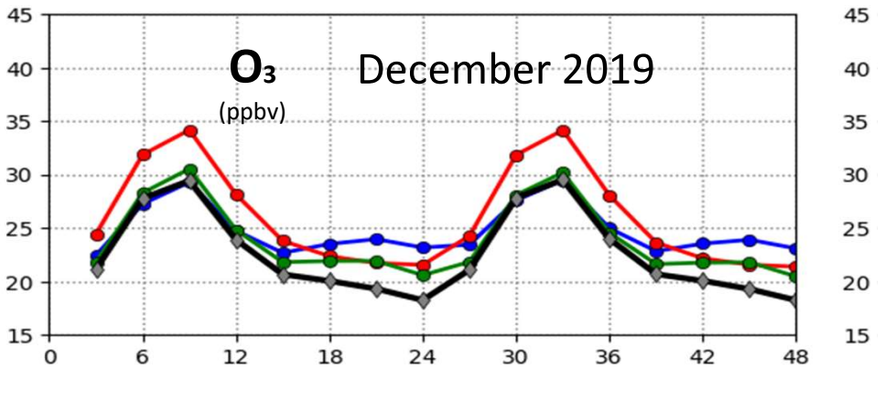
Impact of added green roofs

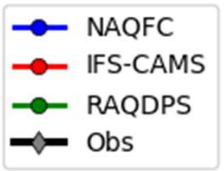
Building structure/height changes within city

Anthropogenic heat fluxes : scenarios with increased/decreased number of vehicles, air conditioners, etc.

Human/domestic pollution related activities : residential wood combustion scenarios (ex: stricter usage terms in Montreal), replacement of fuel to electric vehicles, etc

Regional, North American, Multi-Model Operational AQ Verification System

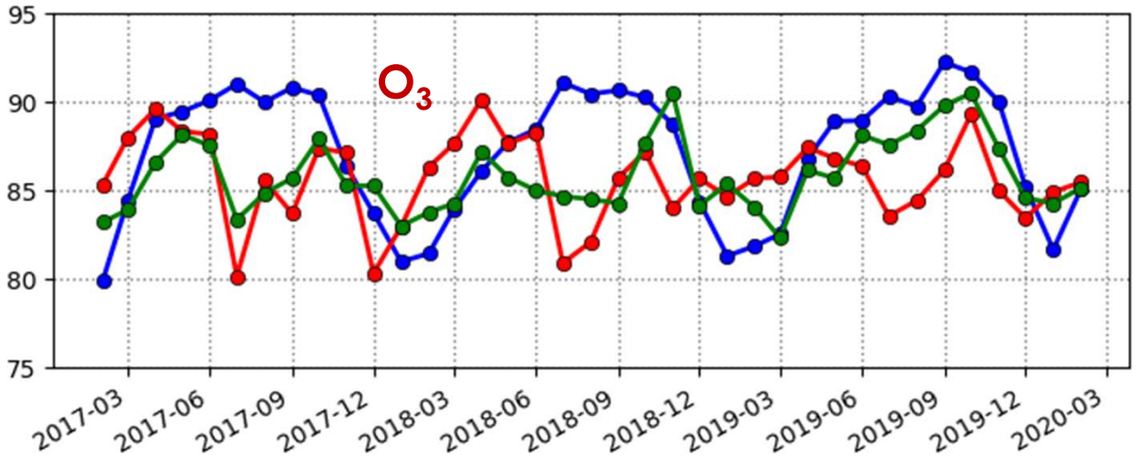


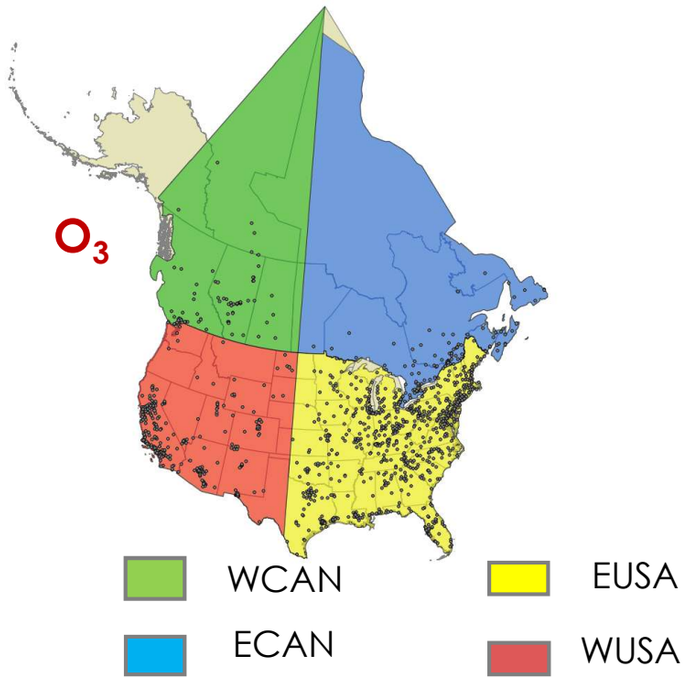


This centre takes into account forecast from IFS-CAMS (ECMWF-Copernicus), RAQDPS (ECCC-Canada), NAQFC (NOAA) and GEOS (NASA)

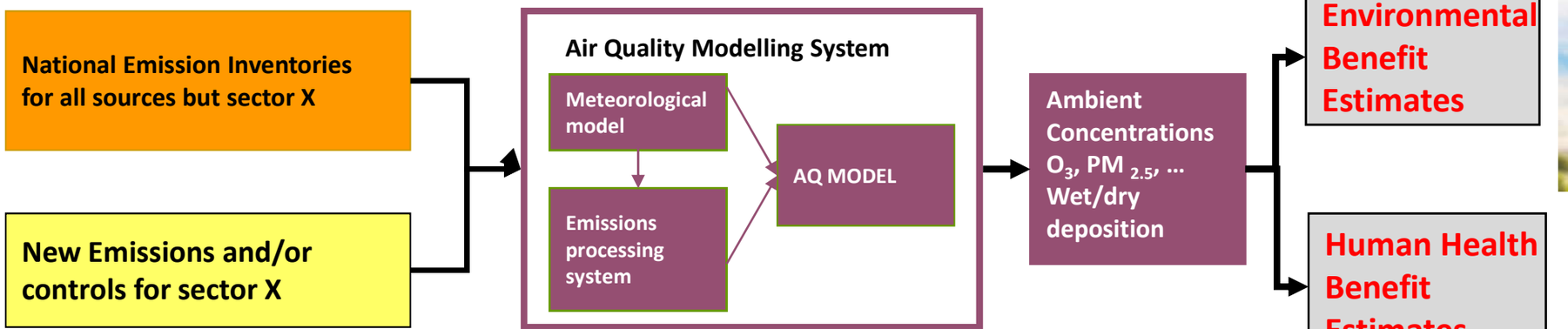
Air Quality Performance Index

AQPI[O_3,NO_2,$PM_{2.5}$]= 100*AVG [**FAC2** , **R** , (1-ABS(**MFB**/2))]





POLICY MEASURES -FROM AQ MODEL TO SCENARIO TO BENEFIT



- **AQ modelling system allows to investigate different emission scenarios, "what if" questions**
  - Develop a reference simulation with reference emission levels
  - Perform additional simulations with modified set of emissions to reflect the emission controls that are being considered
- **Information generated:**
  - **Estimates on magnitude and location of changes in air quality caused by the proposed changes in emissions**
  - Allow calculation of health or ecosystem benefit estimates & comparison to cost estimates
  - Only 1 way interactions – no weather or climate feedbacks

Air Pollution Health Impact Assessment

Health Canada's Air Quality Benefits Assessment Tool (AQBAT)

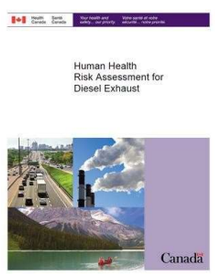
- Annual population health and welfare benefits or damages in Canada due to incremental change in air pollution
- Consider past, current or future scenarios
- Includes mortality and morbidity outcomes, and economic valuation of outcomes

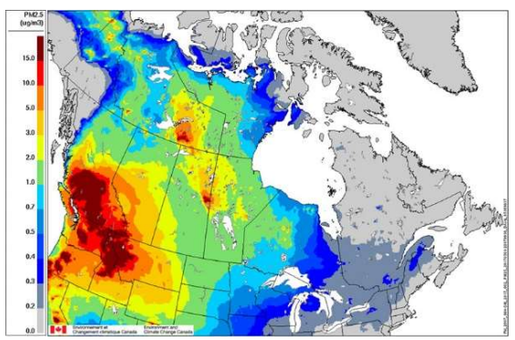
Applications:

- Cost-benefit analyses for air pollution regulations and air pollution health co-benefits of GHG regulations (http://canadagazette.gc.ca/rp-pr/p2/2015/2015-07-29/html/sor-dors186-eng.html)
- National health burden from air pollution (http://publications.gc.ca/site/eng/9.874080/publication.html)
- Wildfire smoke (doi.org/10.1016/j.scitotenv.2020.138506)
- Sector-specific health impacts: e.g. diesel exhaust (http://publications.gc.ca/site/eng/9.810907/publication.html)

Canada Gazette Part II

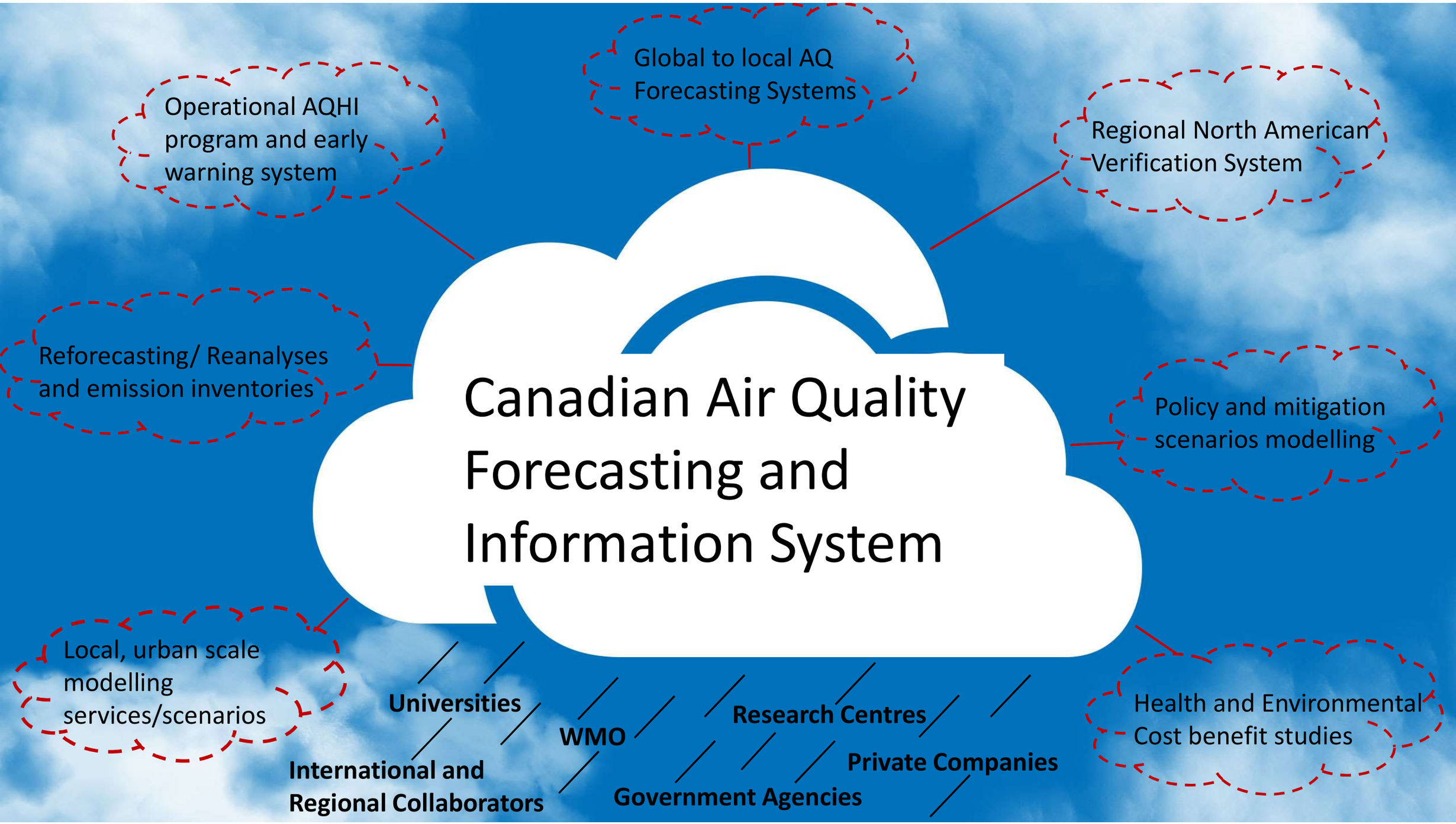
Gazette du Canada Partie II





Canadian Air Quality Forecasting and Information System

Operational AQ Early Warning System	AQ Forecasts are communicated via Air Quality Health Index. Early warning system is a part of national program.
AQ data at different temporal and spatial scales	From global to local. Different temporal and spatial scales are used for different purposes.
Emission Inventories over North America	Over North America, historical (1990-up to day). Emission scenario inventories.
Policy and mitigation measures	Applied to reduce the negative impacts of air pollution. Done generally in collaboration with national health and environmental agencies.
Reforecasting / Reanalyses	Currently 1990-2018; Useful for climate trend analyses, health studies, policy making and scientific agencies, research programs, ecosystem studies, environmental health consortiums, etc.
Coordination of national activities to facilitate seamless provision of atmospheric composition information at various scales	Part of our air quality related activities. Done in partnership with our collaborators.
National Health and Environmental Agencies	Principal collaborators, especially for policy, health and environmental studies


Global to local AQ Forecasting Systems
Operational AQHI program and early warning system
Regional North American Verification System
Reforecasting/ Reanalyses and emission inventories
Canadian Air Quality Forecasting and Information System
Policy and mitigation scenarios modelling
Local, urban scale modelling services/scenarios
Universities
WMO
Research Centres
International and Regional Collaborators
Government Agencies
Private Companies
Health and Environmental Cost benefit studies

THANK YOU

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