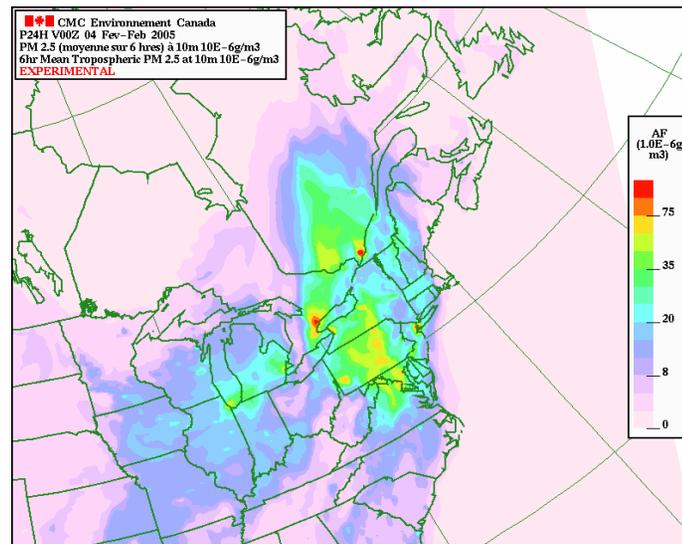


# Canada's National Air Quality Forecast Program



Michael C. Howe

CMAQ-ETA Focus Group Workshop

September 7, 2005



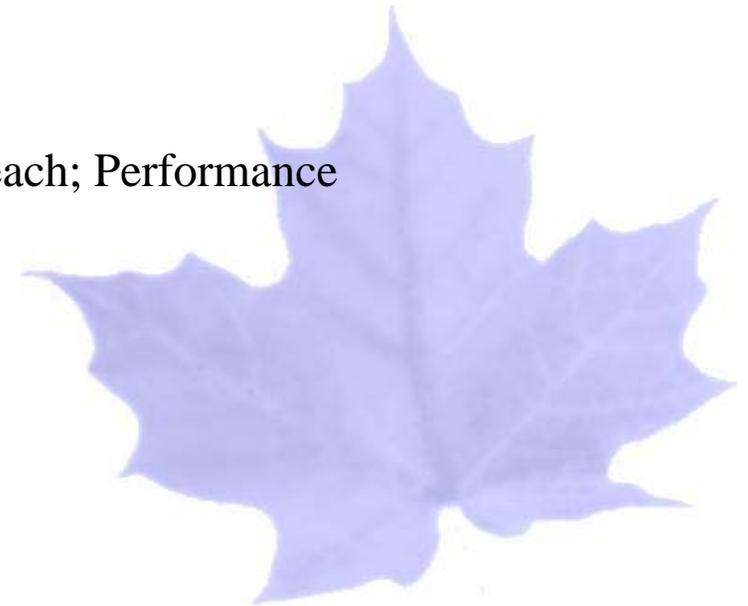
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# Canada's National Air Quality Forecast Program

- Overview: Clean Air Logic Model
- Program Structure
  - 4 pillars
    - Standardization; R&D/Modelling; Outreach; Performance Measurement
- Forecast Challenges
- Current Status
- Milestones
- Partnerships
- Models
- Future Plans

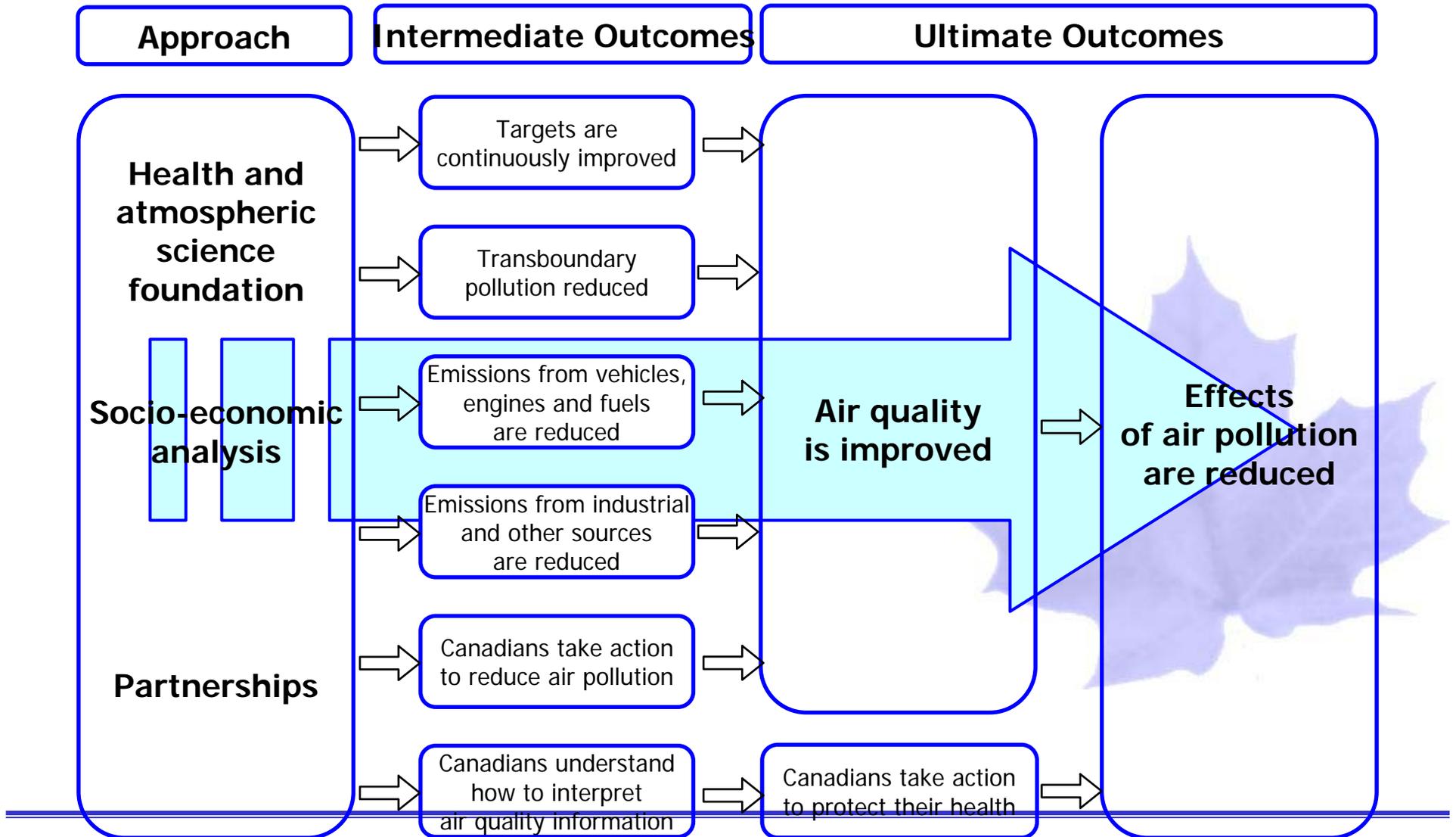


## **Overview:** Canada's National *Air Quality Forecast Program* is an important component of Environment Canada's Clean Air Structure

- **Results-based Management and Accountability Framework [RBMAF]**
- Program described in terms of the “**Clean Air Logic Model**”
  - Intermediate and Ultimate outcomes
  - Activities supporting the achievement of outcomes
- *Canada's Air Quality Forecast Program* is but one of several departmental and inter-departmental activities that contribute to achieving the outcomes



# Schematic of Clean Air Logic Model



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# “The survey says” ..... Canadians want and require access to information the future state of the quality of the air that that breathe

Clean Air is major priority of the Government of Canada. As such the *Air Quality Forecast Program* addresses this priority by:

- Providing susceptible individuals with daily air quality forecasts that they can use to reduce their health risks
- Supporting the reduction of pollutant emissions by individuals, organizations and communities i.e. behavioral change
- Supporting provincial & municipal air quality regulations
- Addressing the public “right to know” impending air quality conditions



# Air Quality Forecast Program Elements

**Systematic observations**



**Prediction**

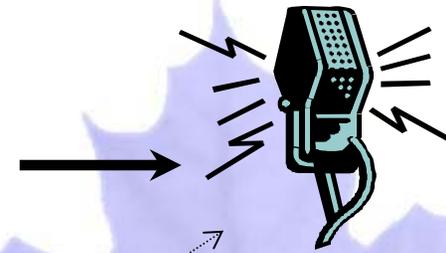
Super Computing Facility



Regional Weather Service Offices



**Service Delivery**



Partners

Ontario MOE



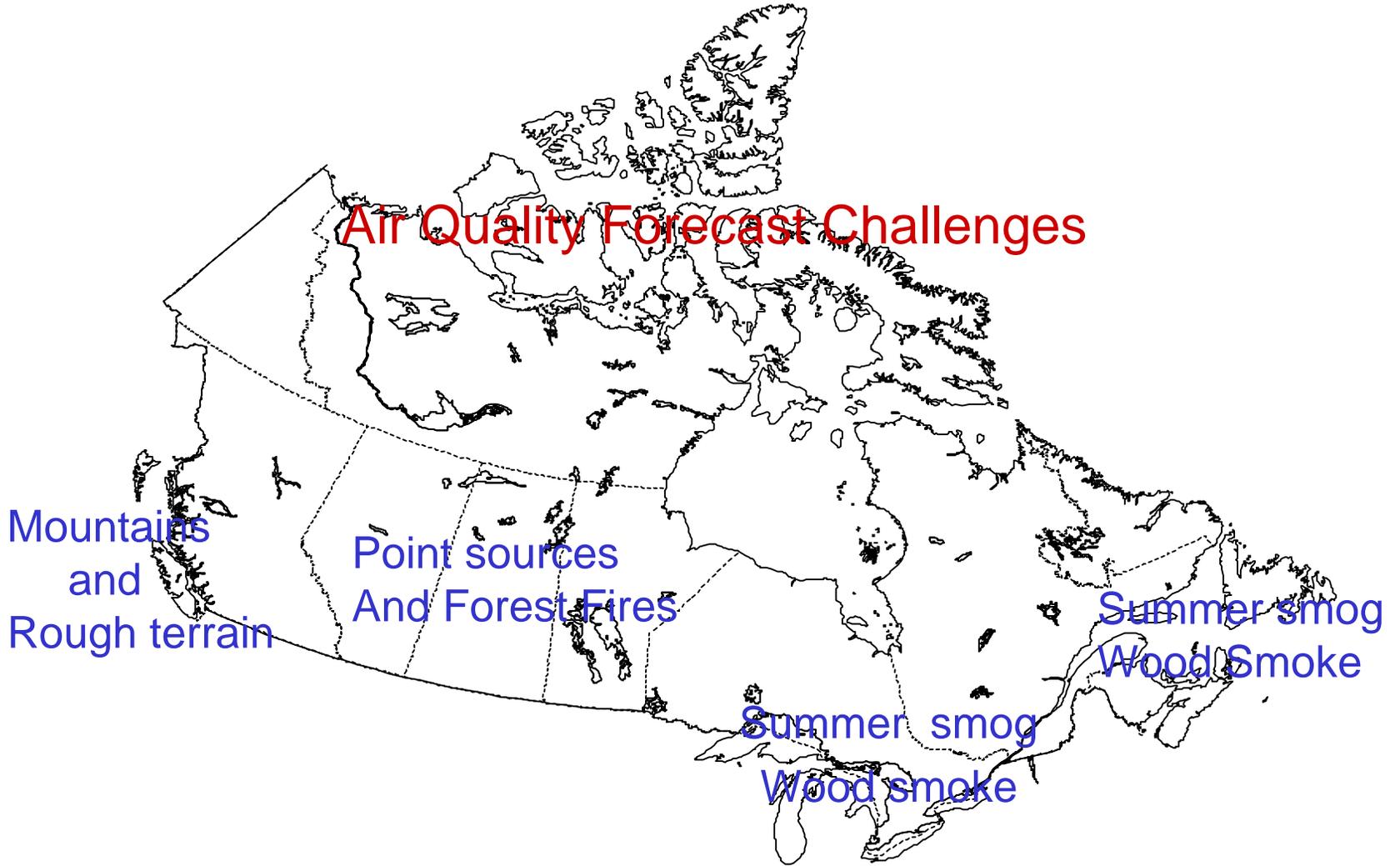
**Research & Development**



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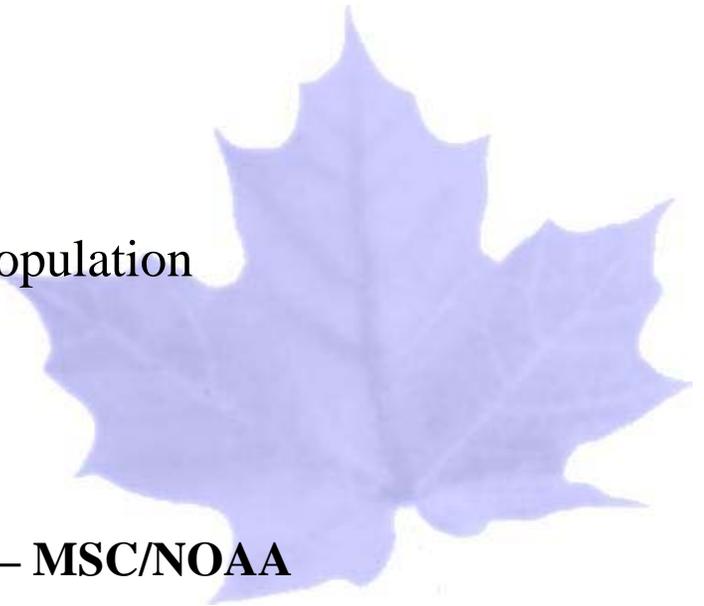
# **Current Program Status: Daily Air Quality Forecasts and related health information are now accessible to 75% of the Canadian population**

- **Atlantic Provinces**
  - Daily GLO forecasts **May-Oct inclusive**; Winter Dispersion (PM<sub>2.5</sub>) under development/Neural Network
- **Quebec**
  - Daily GLO forecasts available May – Sept inclusive for Quebec City, Montreal, Gatineau
  - Winter Dispersion (PM<sub>2.5</sub>) Forecasts for Montreal available Dec to April (**available year-round beginning fall 2005**)
- **Ontario**
  - Daily GLO/PM forecasts produced by OME **available year-round**
- **Manitoba, Saskatchewan & Alberta**
  - Automated Daily GLO forecasts for Edmonton, Calgary, Regina, Saskatoon & Winnipeg; Automated ventilation forecasts – **year round**
- **British Columbia**
  - Daily GLO/PM forecasts for LFRV, Victoria and the Okanogan Valley **available year-round**



## Important Milestones to Date.....

- 1993 Air Quality Advisory Program
- 1997 Atlantic Region Daily Forecast Pilot
- 2002 summertime forecast coverage 67% of population
- 2004 summertime forecast coverage 75%
  - **Operational Air Quality Training Program – MSC/NOAA**
  - PM included in AQI forecast in BC Ontario and Quebec



## .....Important Milestones to Date

- **CHRONOS** 48HR forecast maps for PM and Ozone across North American Domain
- Data assimilation combining CHRONOS model output with AIRNOW observations
- **NOAA Agreement re collaboration (Davidson/Meager/Howe)**
- **Model inter-comparison with US - ICARTT**
- 2005 - Testing of additive **Health-risk Based** Air Quality Index
  - Details later in presentation



# Partnerships/Collaborations are the “key” to any successful endeavor.....

## International

- EPA
  - Data exchange; AIRNow Ozone/PM<sub>2.5</sub> mapping; outreach collaboration
- NOAA
  - MSC/NOAA Operational Air Quality Working Group
- NOAA/EPA
  - CMAQ-ETA Focus Group
- GEOSS
  - Air Quality Early Warning System (User Interface Working Group/COP)

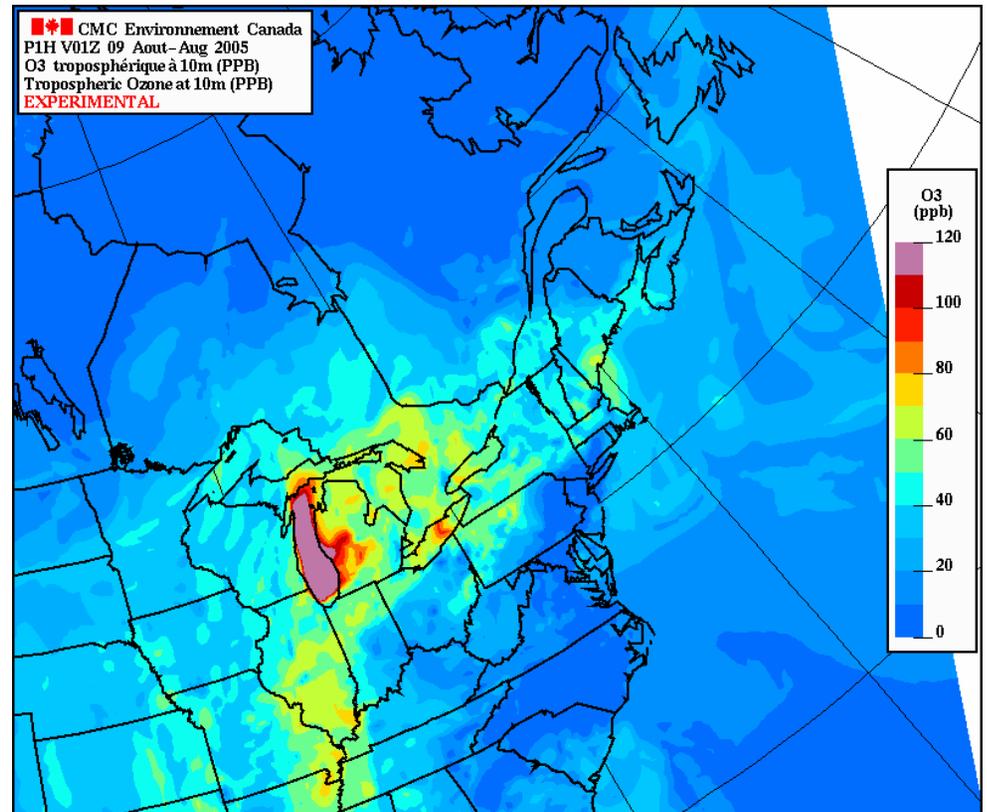
## Domestic

- Ontario Ministry of Environment – Responsible for Ontario development and product delivery
- Provinces/Municipalities – Data access and sharing agreements
- NGO’s – Outreach and awareness to Canadians i.e. Lung Association
- Media – Development and dissemination of “media friendly” products



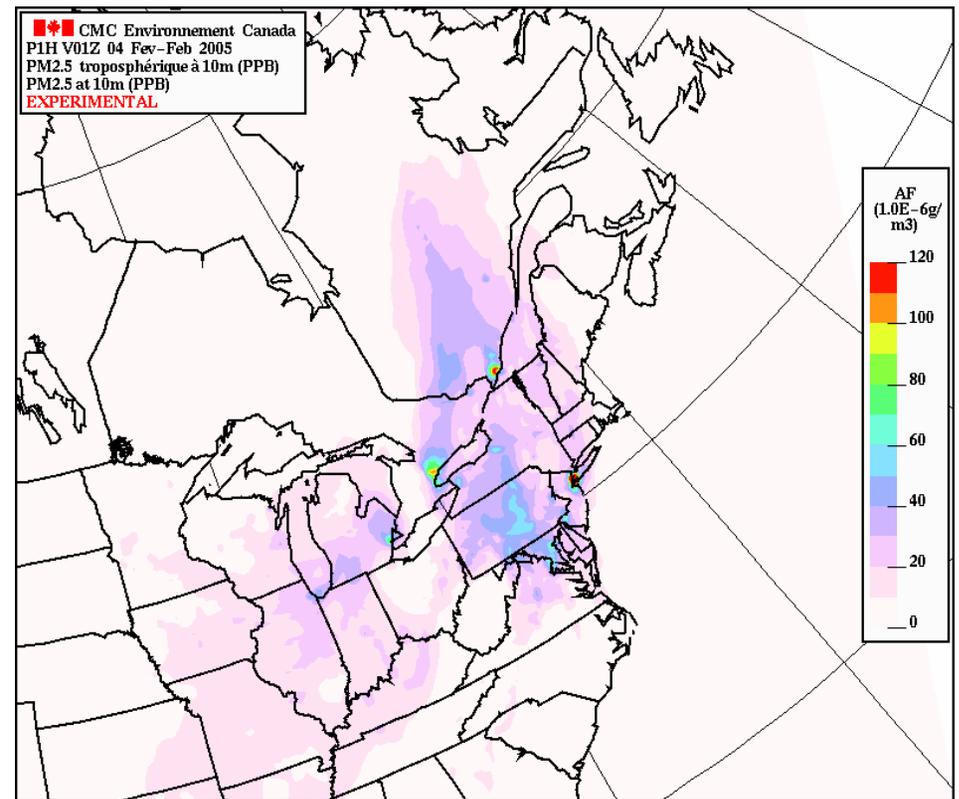
## CHRONOS: (Canadian Hemispheric & Regional NOx System)

- Issued 1X per day based on 00Z GEM run
- NOAM domain at 21 km (350X250)
- 24 vertical Gal-Chen levels to 6 km
- 2000-2001 emissions inventory with SMOKE
- Beis3/Beld3 biogenic emissions
  - f(T, radiation, vegetation)



## CHRONOS: (Canadian Hemispheric & Regional NOx System)

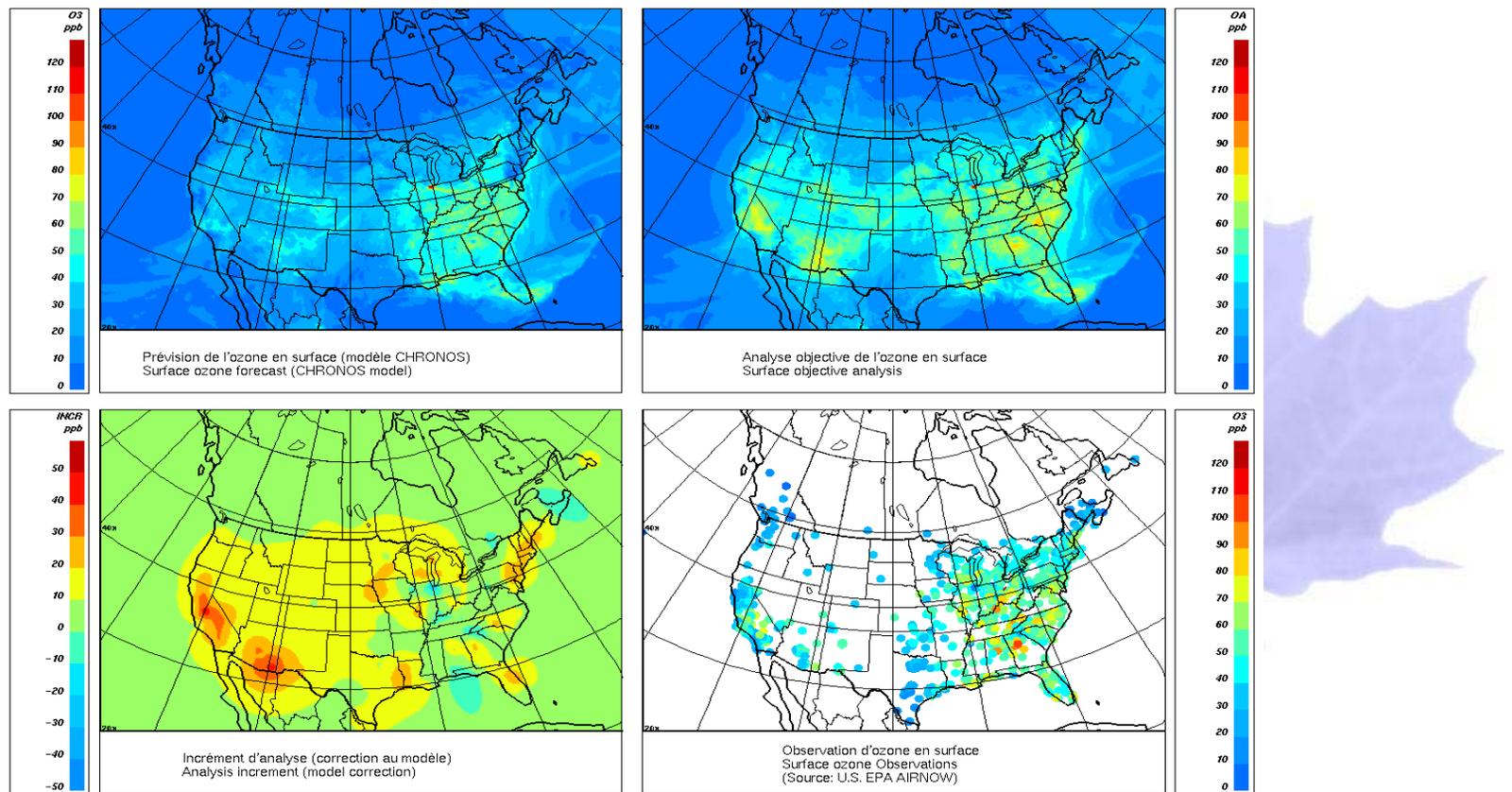
- ADOM gas chemistry + heterogenous chemistry
- No aqueous phase chemistry
- Semi-Lagrangian advection, diffusion
- Wet and dry deposition
- No convection
- Outputs:  $O_3$ ,  $PM_{2.5}$  and  $PM_{10}$



# CHRONOS - Objective Analysis



Lundi 25 Juillet 2005 à 18:00Z / Monday July 25 2005 at 18:00Z (EXPERIMENTAL)



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# Future Plans

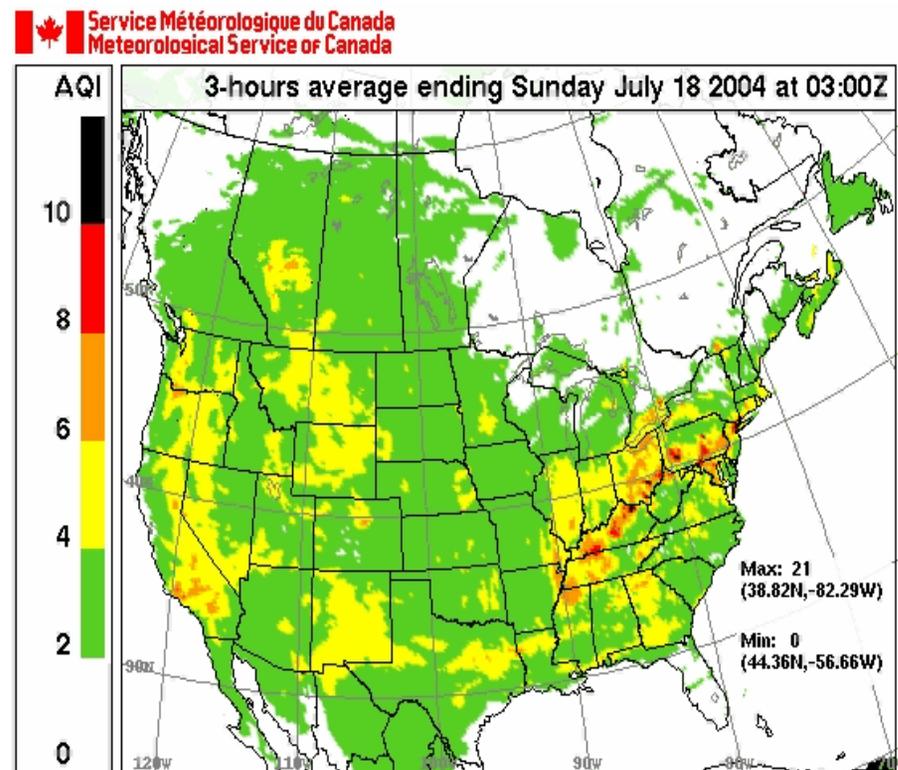


- National Product Standardization to continue
- Next generation model
  - Plans currently underway to replace CHRONOS
  - Intermediate step will see AURAMS capability operational by 2007
  - GEM-CHEM to follow
- GEOSS
  - International AQ Early Warning System
  - Environment Canada/EPA participation on User Interface Working Group
- New Health-Based AQI
  - Major change in the way we observe, report and forecast air quality



# Canadian Health-Based AQI

- Multi-pollutant Index
  - O<sub>3</sub>, PM<sub>2.5</sub>, NO<sub>2</sub> & SO<sub>2</sub>
- Index will be based on a scale from 0 -10+ with appropriate health sensitivity messaging
- Pilot currently underway in British Columbia with plans for an Ontario pilot later in 2005
- Four pollutant model output by spring 2007 to support AQI forecasts and adoption by jurisdictions
- Will require targeted and coordinated outreach US/Canada



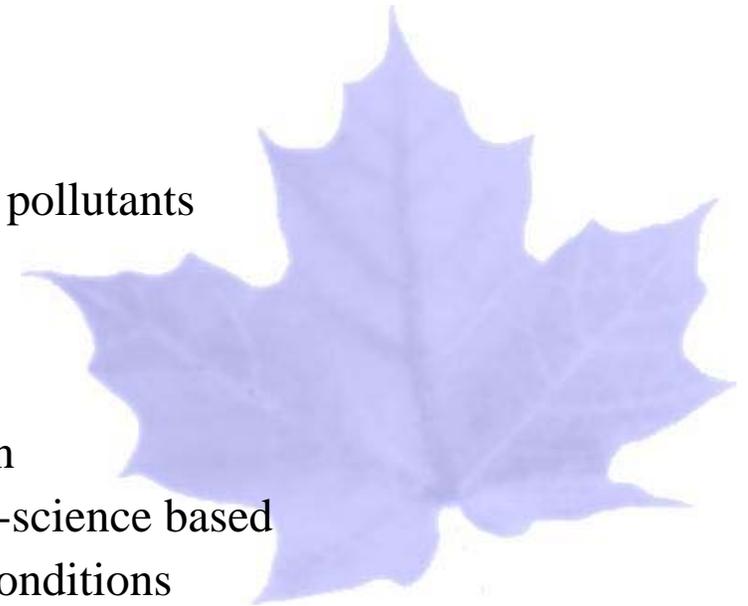
# Canadian Health-Based Air Quality Index

## The Current Canadian AQIs

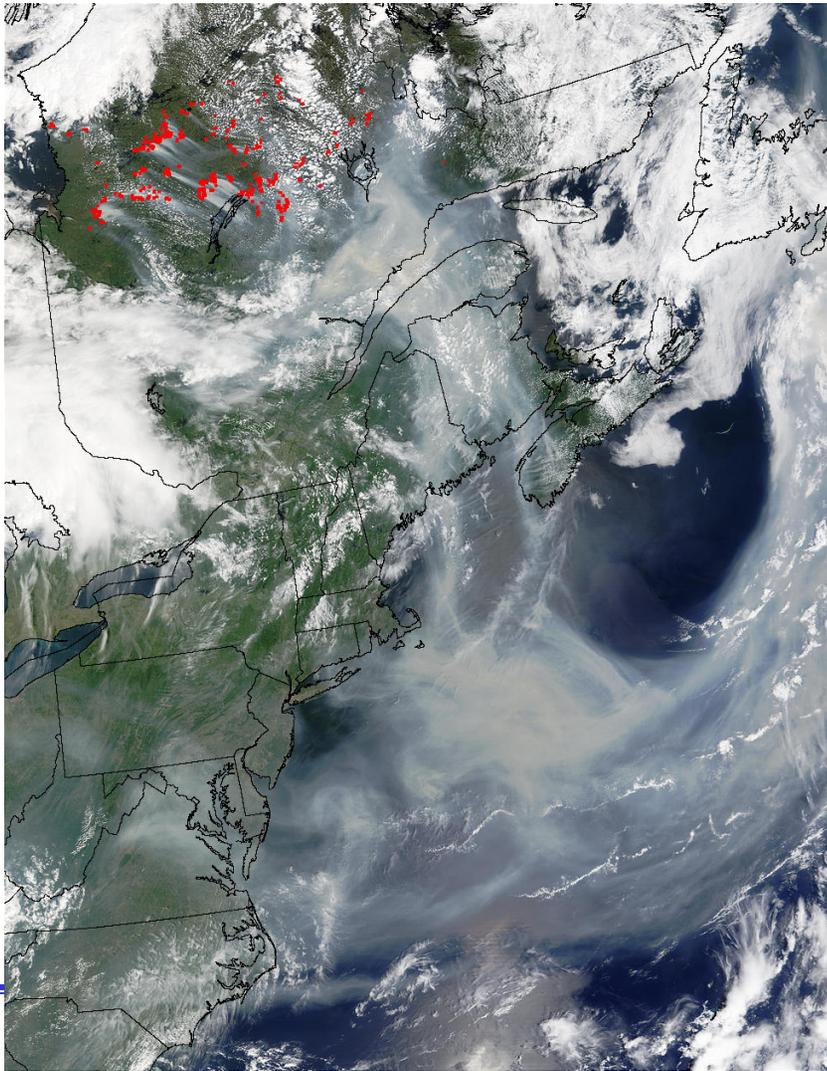
- Emphasizes AQ standards
- Not nationally consistent
- Does not address the combined effects of air pollutants

## New Index

- Developed as a tool for personal health protection
- Responsive to atmospheric conditions and health-science based
- Used to communicate measured and forecasted conditions
- Combined health risk attributed to 4 air pollutants
- Supported with health action messages for at risk and general populations

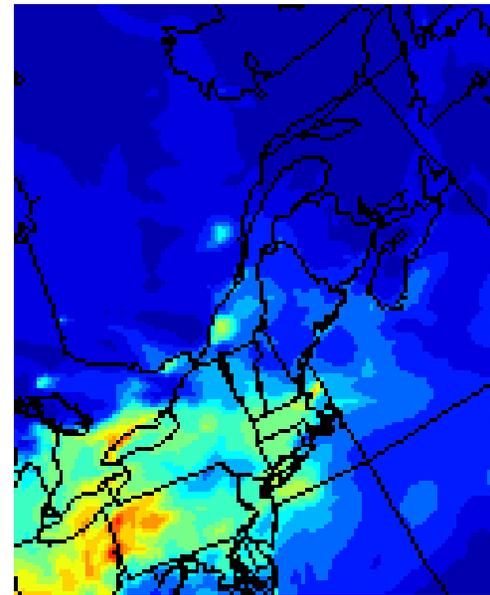


# Forest Fire: July 8, 2002

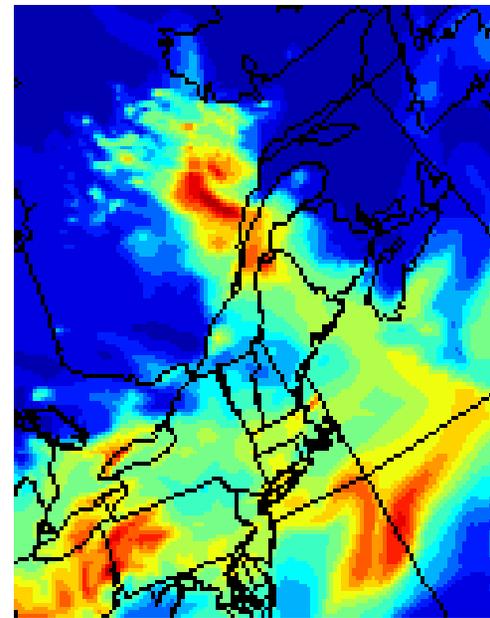


Terra MODIS 1629-1641 UTC (NASA)

Meteorological Service of Canada Environment Canada



CHRONOS control run 16Z July 8



CHRONOS with forest fire emission

( $\mu\text{g}/\text{m}^3$ )

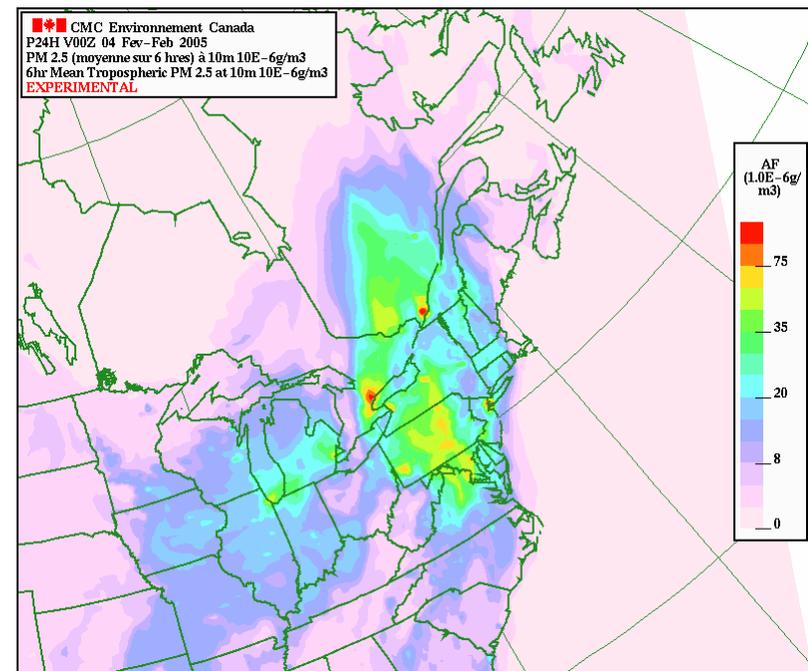
# Summary: Will move forward with implementation of the 4 pillars – Standardization, R&D/Modeling, Outreach and Performance Measurement

- National standardization of data/product format and accessibility
  - Transition from a “**weather forecast**” to an “**environmental forecast**”
  - Move to year round forecast production
- Implementation of the health risk-based AQI (proposed 2007)
- Developing methods to increase Canadian's awareness of the use of the *Air Quality Forecast* as a decision-making tool
  - New interactive website/consolidation of air quality forecast information
  - Engaging the Warning Preparedness & Outreach Meteorologist community



# Summary: Continued

- Increasing use as a regulatory tool
- Research and Development
  - Model improvements including  $NO_2/SO_2$  forecasting capability/data assimilation
  - Forest Fire Emission capability
- GEOSS
- Product verification and outreach performance measurement will provide required feedback for next steps
- Ongoing collaborative efforts with EPA/NOAA will lead to improved product for the benefit of citizens in both the US & Canada



# Questions?



Environment Canada

Environnement Canada

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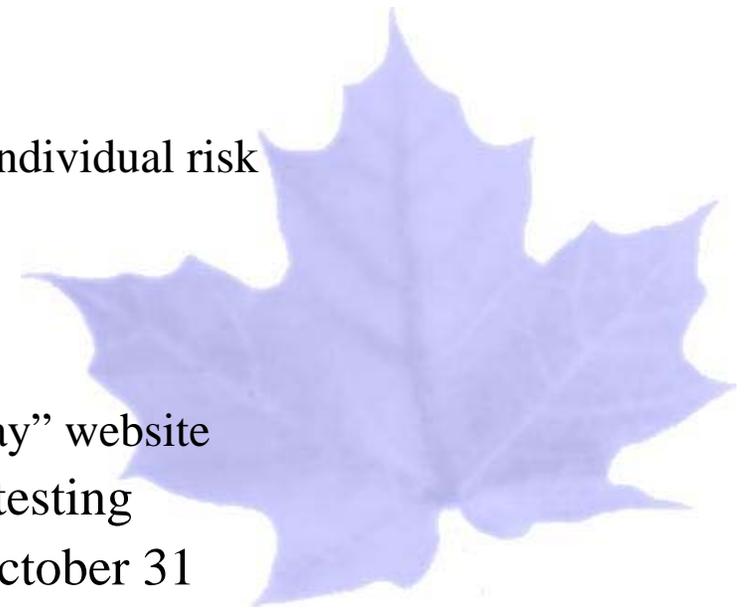
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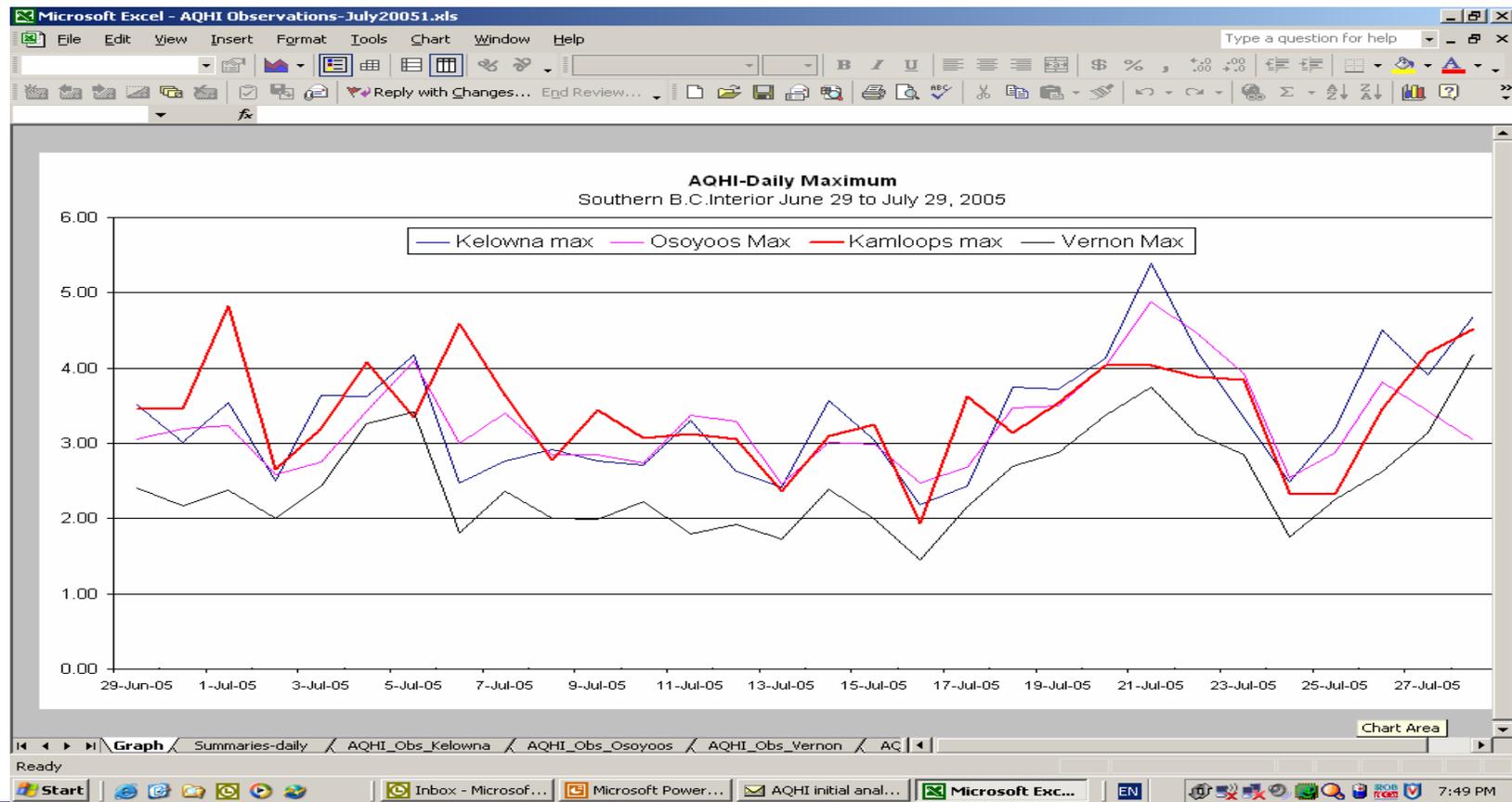
# Thompson/Okanagan AQHI Pilot

- BC Environment/ BC Interior Health/BC Lung
- Kelowna, Kamloops, Osoyoos and Vernon
- 4 pollutant forecast from PYR MSC
  - Neural networks forecasts of total AQI and individual risk
- National guidance and regional flexibility
- Phased Implementation
- Focus on web-based dissemination (2 sites)
  - BC Environment and branded “AirPlay Today” website
- Results incorporated for next round of AQI testing
- Public component of pilot September 1 – October 31



# Early AQHI Shadow Pilot Results

(courtesy of BC Environment)



# Path Forward

- Province of Ontario developing options for a late 2005 pilot of the health-based AQI
- Developing an AQI Guidance and Assessment document for the publication in early 2006
- National shadow pilot Spring 2006
- Four pollutant model output by spring 2007 to support AQI forecasts and adoption by jurisdictions
- Ongoing discussions with USA EPA on reducing confusion in border areas

