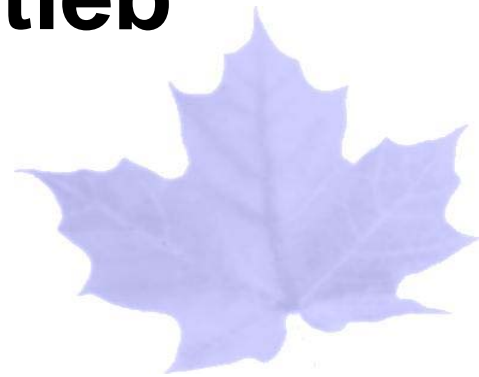


The Development of a Canadian Health Based Air Quality Index

**Dave Henderson, Dave Stieb
and Philip Blagden**



Environment Canada
Meteorological Service of Canada

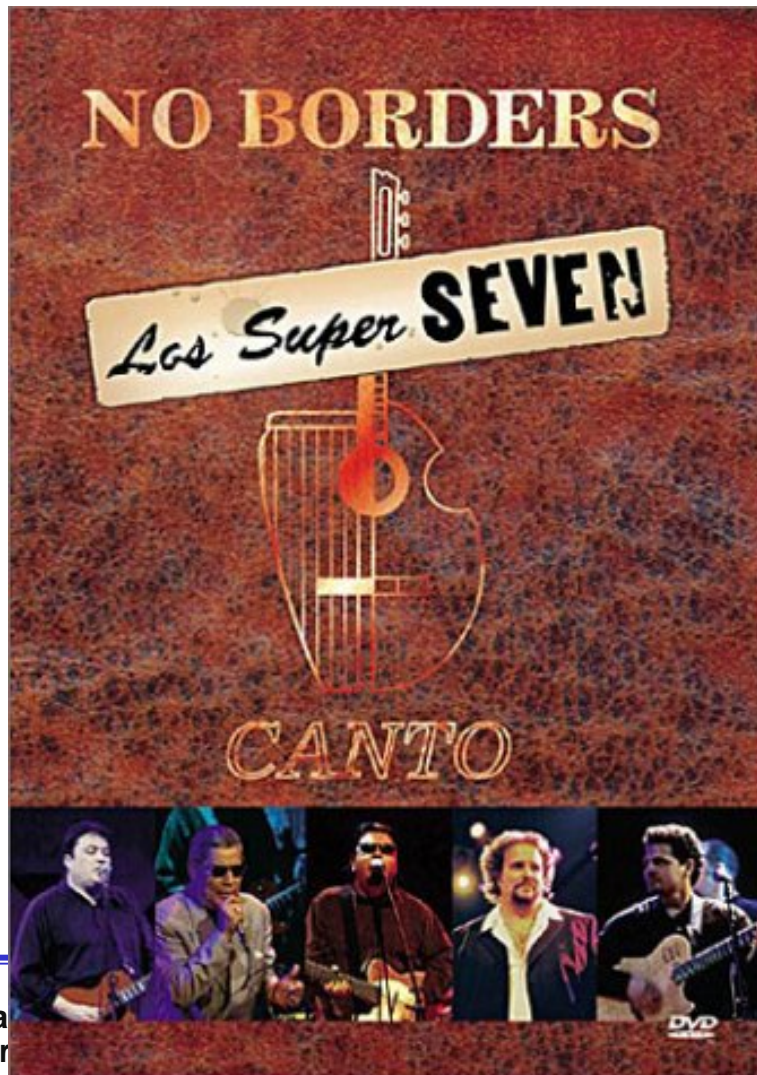
Environnement Canada
Service météorologique du Canada

Canada

Los Lobos

M

E



Environment Canada
Meteorological Service

Canada

Canada

National AQI Process

- **Multi-stakeholder process established in 2001 to develop an improved Canadian AQI**
 - Four workshops
 - Ongoing management committee
 - Transparency www.msc-smc.ec.gc.ca/CAQI/



The AQI Conundrum

"About 92% of the premature deaths and hospitalizations attributable to air pollution in Toronto occur when the air quality has been classified as good or very good by the provincial AQI."

Toronto Public Health's 2001 report (Condition Critical: Fixing Our Smog Warning System)



Issues

- **Existing Index structure:**
 - emphasizes standards
 - Doesn't address combined effects of pollutants
 - Not directly based on health effects
- **Could an air quality index be developed that was directly based on the impact of air pollution on public health and convey to people the health risk associated with air pollution on a day to day basis?**
- **Will it work as a communication tool to help people to protect their health?**



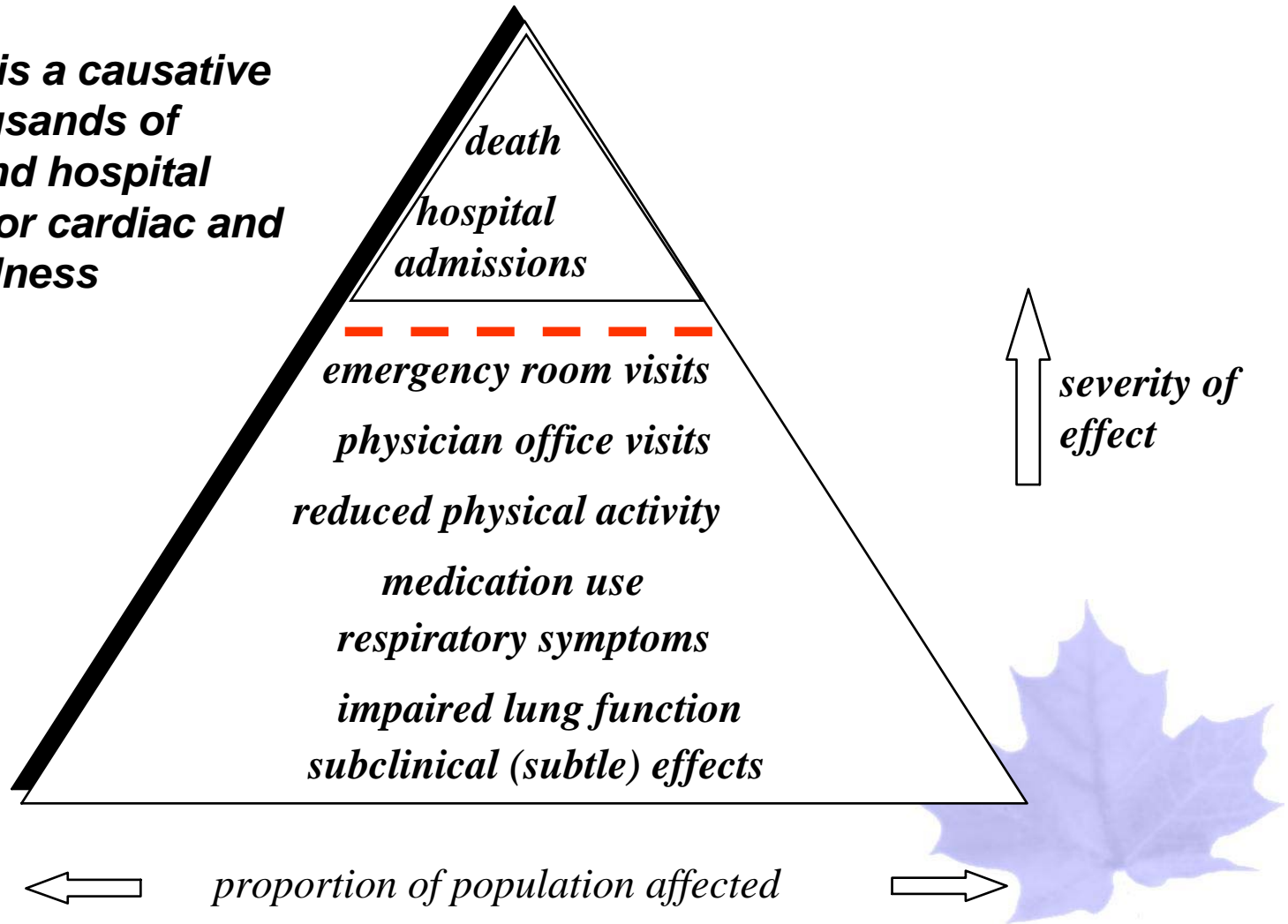
Our Approach to a Health Risk Based Index

- **Focus on acute impacts**
- **Consideration of multiple health endpoints**
- **Based on time series analyses**
- **Focus on Canadian data**
- **Multiple pollutants**



Health Effects of Air Pollution

Air pollution is a causative factor in thousands of mortalities and hospital admissions for cardiac and respiratory illness



Results of Health Analysis

- **Relative risk from mortality data reflect risk for the broad range of health outcomes**
- **Consistency across times series studies**
 - risk estimates agree with international meta analysis
- **Current risk formulation composed of O₃, PM_{2.5}, NO₂ and SO₂**
 - Dropped CO
- **3 hour rolling averages for pollutants**
 - Derived through statistical correlations
- **Choice of a 0-10 unbounded scale**



mortality risk coefficients from epidemiological studies

air pollution, mortality data for multiple cities, for reference period 1998-2000

Multiply mortality risk coefficients by daily air pollution concentrations – percent change in mortality

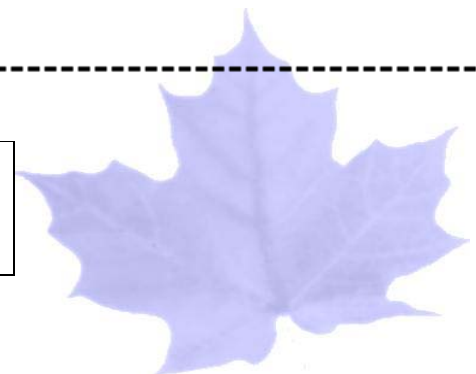
Development of AQI numeric scale using historical data

Create distribution of days according to percent change in mortality

Adjust values to 0-10 scale

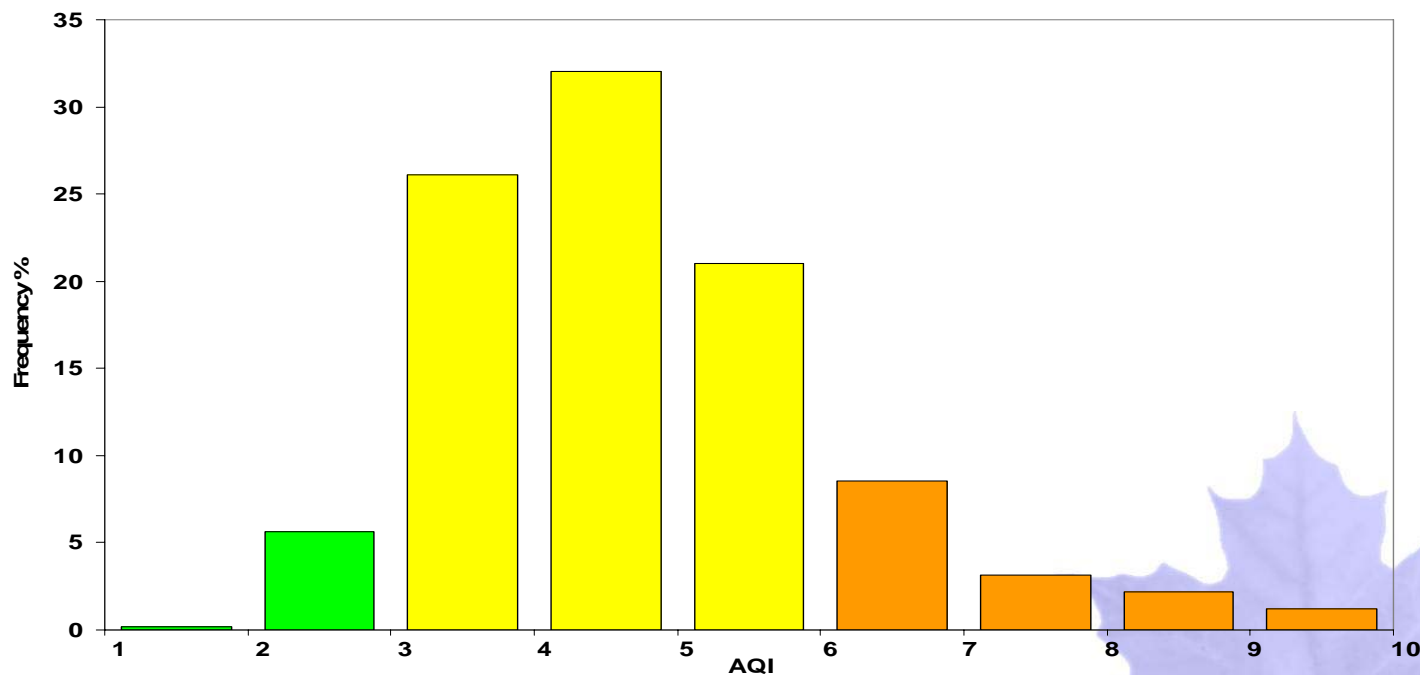
Application to current data to calculate index value

Multiply health risk coefficients by daily air pollution concentrations, adjust to 0-10 scale; value > 10 means it exceeds all values in 1998-2000 reference period



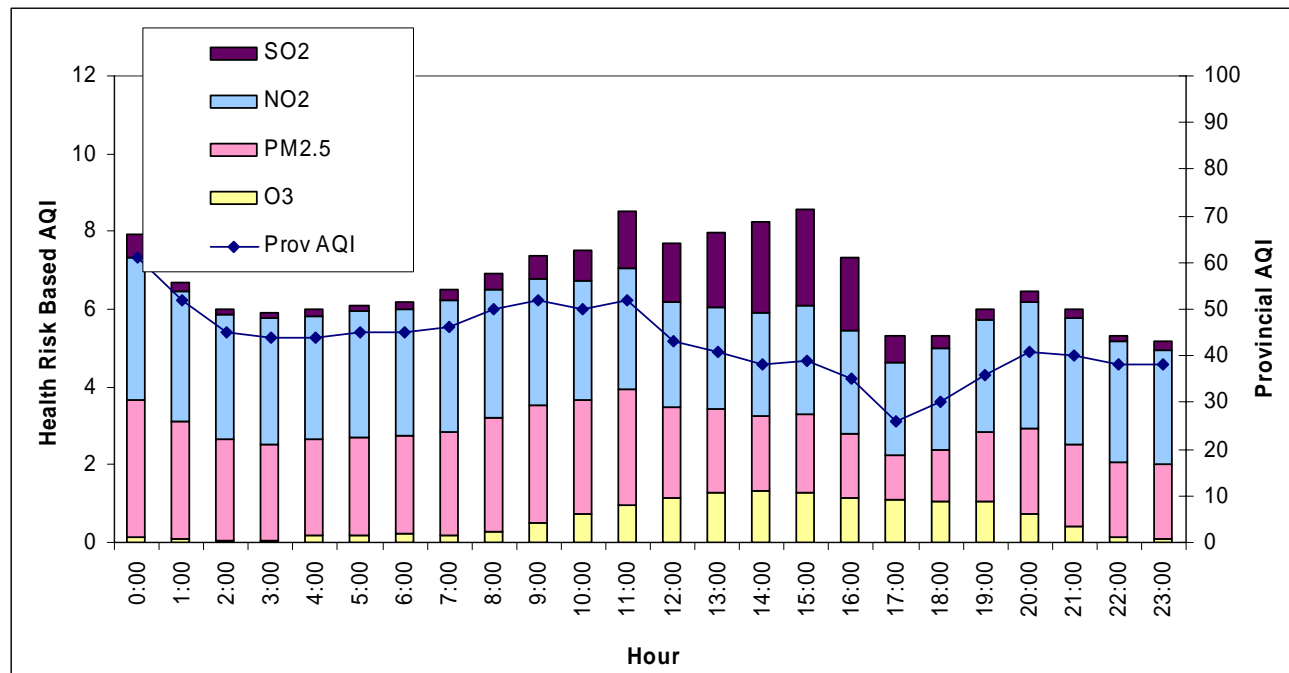
National AQI Reference Distribution

Frequency of days in AQI categories



Simulation of the Health Risk based AQI

Hamilton, Ontario October, 2003
(courtesy Ontario Ministry of the Environment)



Health Messaging and AQI Presentation

- **Multi-pollutant messages**
- **Health Advice to susceptible people and to general public**
- **Pollution Reduction Messages**
- **Message development being informed by:**
 - Past public opinion surveys and research
 - Public opinion research
 - Mental models work
 - Stakeholder health messages workshop – Dec 2-3, 2005
 - Focus testing (5 cities in Feb 2005)



Ongoing Challenges

- **Index Transitions**
 - Value in name change from AQI
- **Forecasting**
- **Coherent AQ information in border areas**
- **Accommodating regional flexibility within a national framework**
- **Air Quality Issues outside the risk model (e.g. odour, visibility)**
- **ROAD TEST – Pilots to determine**
 - Operability
 - Usability
 - Effectiveness
 - Public acceptance



Path Forward

Winter/Spring 2005

- Focus testing of health messages and AQI presentation

Late Spring

- Draft of a AQI Science Assessment document (peer reviewed)

Summer 2005

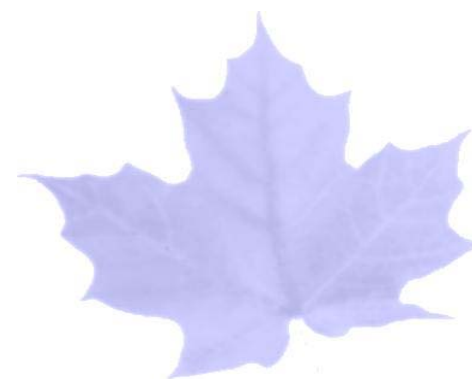
- Possible Pilots of the new AQI

Late Fall 2005

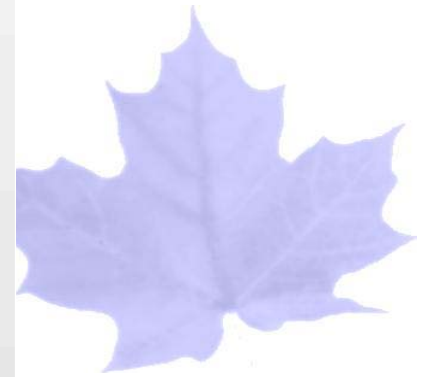
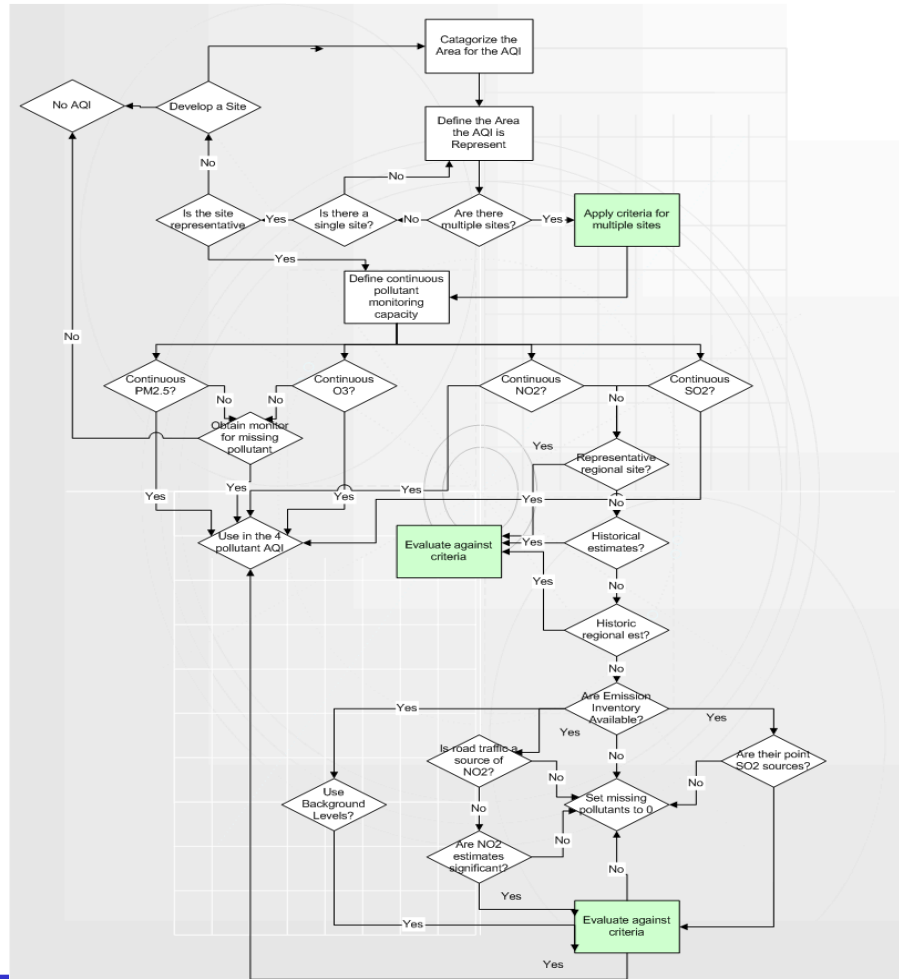
- Draft AQI Guidance document for Regions

Spring 2006 – Winter 2006

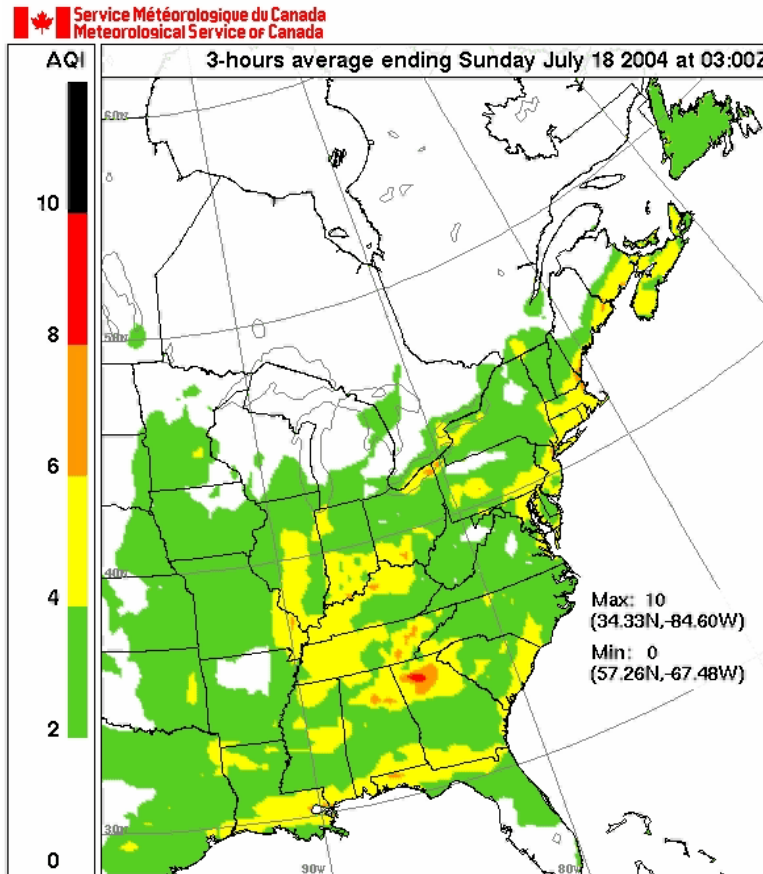
- Shadow program in AQI jurisdictions



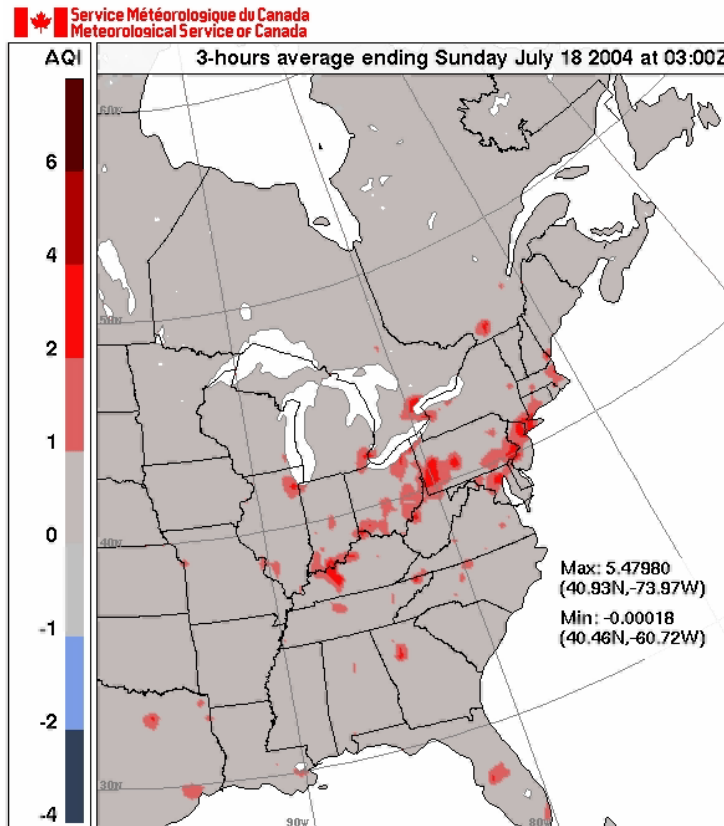
Protocol for Missing Pollutants



4 Pollutant AQI Forecast AURAMS model



Forecasting for NO₂ and SO₂ 4 -2 Pollutant Difference from AURAMS model



PM and Ozone Drive the AQI

- **Currently under the IQUA formulation**

- Ozone – national

80 ppb ozone (1hr. av.) = 50

PM at various jurisdictional values.

Quebec/Montreal

35 ug/m³ PM_{2.5} (3hr. av.) = 50

Ontario

45 ug/m³ PM_{2.5} (3hr. av.) = 50

Alberta

80 ug/m³ PM_{2.5} (1hr. av.) = 50

British Columbia/GVRD

50 ug/m³ PM₁₀ (24hr. av.) = 50

Atlantic Provinces, Man. & Sask are all examining Quebec formula

- **Jurisdictions currently reporting daily AQIs with PM_{2.5} included, Montreal, Quebec, Ontario and Alberta. Vancouver reports PM₁₀**

