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# Weather and Health Portfolio for the 2015 Pan and Para Pan Am Games Approach, Legacy & Lessons Learned

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# Context

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- Opportunity presented in December 2012 to contribute to the MSC Pan Am Agenda
- Weather and health portfolio was an umbrella for a range of activities encompassing areas of interest to partners
  - Combination of deliberate planning, adapting initiatives of interest to clients and opportunism
  - “what can we do to position the program for the future”
- Involvement in MSC Pan Am Working Group Activity (Science, Prediction and Services and Monitoring)



# Why a Weather and Health Partnership

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- Working with health partners allows the MSC to:
  - to acquire legitimacy and support in issuing health-related warnings
  - better understand their decision-making processes and their unique nature
  - Impact capabilities and capacity for longer term collaboration
- Leverage efficiencies of expertise and investment in weather forecasting, data management and warnings dissemination
- Pan Am is a demonstration opportunity to show what we all do best and how we collectively contribute to the goal of enhanced public safety



# Weather and Health Portfolio

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- Showcase of MSC Weather and Health Portfolio
  1. Service enhancement (existing services)
    - Operational
    - Reliance on the OSPC/Service for delivery of enhanced service
  2. Demonstration projects
    - Catalyst for showcasing **partnerships, expertise and technology** of relevance to setting future directions
    - Integrate/exploit other EC program directions
    - Not operational
    - Public Health as the primary client (Education as a secondary)
    - Look for legacy opportunities but not at the expense of expectations for continuance post-Fall 2015
    - No or minimal impact on the operations of the OSPC
  3. Evaluation



# Pan Am Weather And Health Portfolio

Theme	Activity
Air Quality	<p><b><u>Increase number of AQHI locations and provision of hourly forecasting for all locations and communities</u></b></p> <p>Enhancing AQHI model resolution (GEM-MACH 2.5 km)</p> <p>Firework: forest fire smoke modeling maps</p> <p>Air Sensors for Chemicals in the Environment (AirSENCE)</p> <p>Near Roadside Monitoring Study</p> <p>Web-based mapping for traffic related air pollution and route planning</p> <p><b><u>AQHI implementation in Ontario ... Pan Am driven</u></b></p>
Heat	<p>Multi-parameter weather monitoring network (mesonet)</p> <p>Urban-scale heat, humidity and stress indices predictions</p> <p>Urban Heat Island/Population vulnerability mapping</p> <p><b><u>Implementation of new health-based-criteria for Heat Warnings</u></b></p>
UV	<p>Enhanced and geospatially presented UV forecasts</p> <p>Investigation of cost-effective, real-time UV monitors</p> <p>Pilot warning with health stakeholders</p>
West Nile Virus	<p>Weather prediction to improve modelling estimates of risk</p>
Education	<p>OAGEE Pan Am Summer Institute on Weather and Health</p>
Dissemination	<p>Weather Active - Heat and AQ smart phone application</p> <p>Weather.GC.CA, EC Alert Me WISDOM</p>
Decision Support	<p>Heat Warning and Information System Service Scenario Exercise</p> <p>Weather health Information System for Decision Optimization Management (WISDOM)</p>

# Partners/Collaborators

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- Internally
  - Central (Ontario and Quebec), Pan Am Secretariat and AQ & Health Signature Project Team
  - S&T (AQRD, AQMAS, RPN, NAPS, etc...)
- The Province of Ontario
  - Ministry of Environment and Climate Change, Ministry of Health and Long-Term Care and Public Health Ontario
- Health Canada (Climate Change and Health and Air Health Affects)
- 10 Public Health Unit in the Pan Am Games area
  - Toronto and KFL&A Public Health in particular
- University of Toronto, York University, Waterloo University
- Toronto District School Board and ESRI Education
- Ontario Association of Geographers and Environmental Educators
- Ontario Sun Safety Working Group



# Pan Am AQHI Service



- Implementation of the AQHI for Games
- Addition of 2 AQHI stations (York University and Hanlan's Point) ... turn on July 2015
- Reporting of AQHI by location (8 locations – 6 in Toronto and 2 in Hamilton)
- Enhancement of forecasting ... 18 1 hour increments for locations and community values
- Smog and Air Health Advisory and Special Air Quality Statements available for Pan Am venues ... locations mapped by proximity to Pan Am venues
- AQHI alerts available through EC-Alert Me



# AQHI by Station and 18 hour Mock-ups

## Pan Am and Parapan Am Games

## Toronto Island - Hanlan's Point - Air Quality Health Index - Next 18 Hours

This table shows a provincial summary of current Air Quality Health Index (AQHI) values. Issued at: 6:00 AM EDT Wednesday 24 June 2015

### Toronto Island - Hanlan's Point

- Location**
- [Hamilton Downtown - and Kelly](#)
  - [Hamilton Mountain - and E. 18th](#)
  - [Toronto Downtown - and Wellesley](#)
  - [Toronto East - Kenne Lawrence](#)
  - [Toronto Island - Hanlan's Point](#)
  - [Toronto North - Yonge Finch](#)
  - [Toronto West - Islington 401](#)
  - [York University - Keele Campus](#)

**Current**

Calculated at: 9:00 AM EDT Thurs

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Low Risk (1-3)

#### At-Risk Population:

- Enjoy your usual outdoor activities
- Find out if you are at risk

#### Forecast Maximums

Issued at: 6:00 AM EDT Wednesday

Wednesday

Wednesday night

Thursday

#### Who is at risk?

People with heart and lung conditions are most affected by air pollution.

To find out if you are at risk, consult [the health guide](#), your

Date / Time (EDT)	Value
25 June 2015	
01:00	3 - Low Risk
02:00	3 - Low Risk
03:00	3 - Low Risk
04:00	2 - Low Risk
05:00	2 - Low Risk
06:00	2 - Low Risk
07:00	2 - Low Risk
08:00	3 - Low Risk
09:00	2 - Low Risk
10:00	2 - Low Risk
11:00	2 - Low Risk
12:00	2 - Low Risk
13:00	2 - Low Risk
14:00	2 - Low Risk
15:00	2 - Low Risk

#### Did you know...?

Ten seconds of idling can use more fuel than turning off the engine and restarting it.

2. Forecast issued at: 6:



Canada

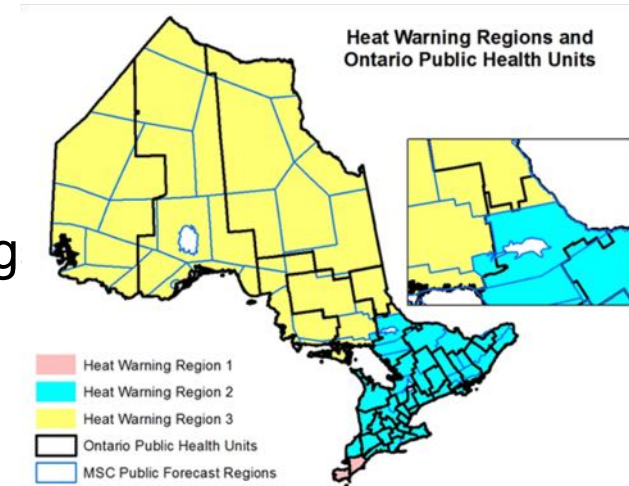
Canada

Canada



# Ontario HARS Warnings and Support

- Working with Health Canada, the province of Ontario and 36 Public Health Units to harmonize heat warnings and communications in Ontario
- Ontario Service and OSPC support Implementation around Pan Am 2015 with provincial rollout for Spring 2016
- Early notification, SWS (first event), Warning and De-escalation of Warnings

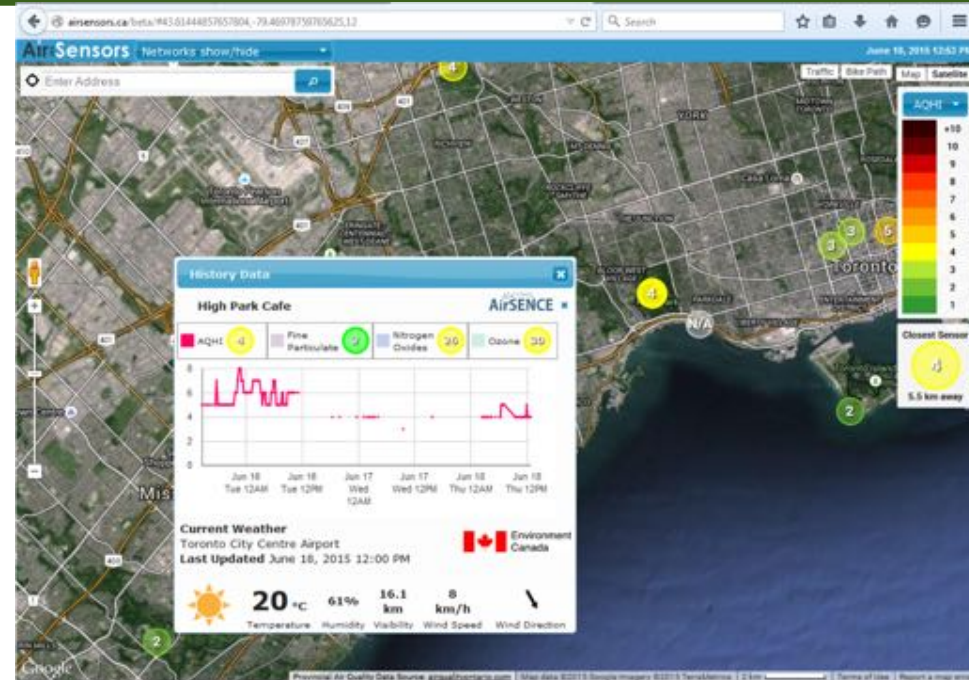


Heat Warning Region	Condition	Duration
Region 1	*Tmax ≥ 31°C and Tmin ≥ 21°C <u>OR</u> Humidex ≥ 42	2+ days
Region 2	Tmax ≥ 31°C and Tmin ≥ 20°C <u>OR</u> Humidex ≥ 40	2+ days
Region 3	Tmax ≥ 29°C and Tmin ≥ 16°C <u>OR</u> Humidex ≥ 36	2+ days



# AirSENCE (Air Sensor for Chemicals in the Environment)

- U of Toronto initiative
- Endorsed by the AQHI program in 2012 (part of Allergen Research Program)
- EC investment (2013-2014) investigating small sensor/battery technology
- 5 additional sensors for Pan Am... real-time data AQHI and pollutant data...
- Web accessible



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# Portable and Low-cost Air Quality Monitoring Device

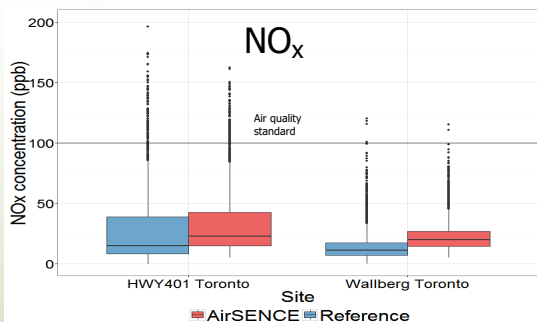


Figure 1: Box plot comparison of NO<sub>x</sub> measured by AirSENCE and reference instruments beside a major highway and in downtown Toronto

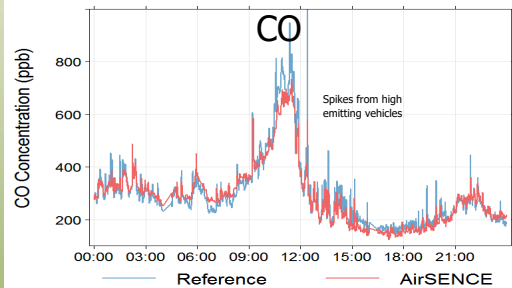


Figure 2: 1-minute averaged CO measured with AirSENCE and Reference instruments over a typical day in downtown Toronto.

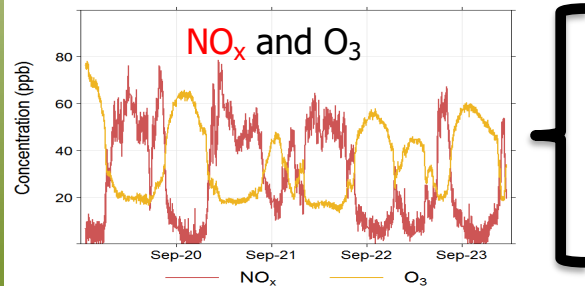


Figure 3: 1-minute averaged NO<sub>x</sub> and O<sub>3</sub> measured by AirSENCE in Beijing at Peking University

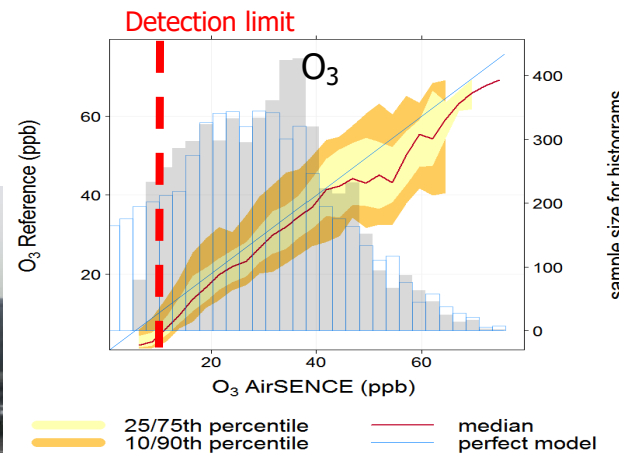
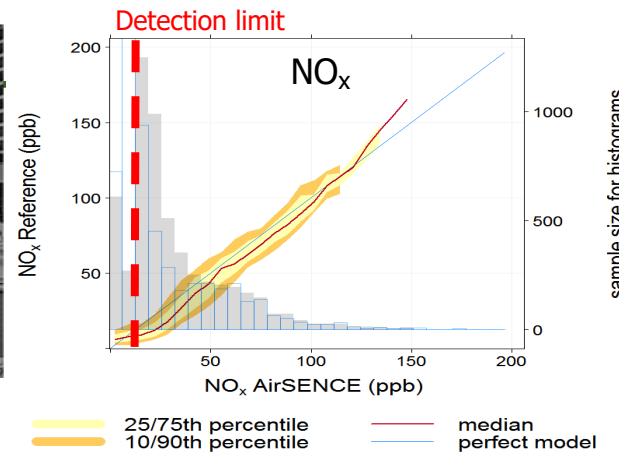


Figure 4: Conditional quantile: the median, 10<sup>th</sup>, 25<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentile of AirSENCE O<sub>3</sub> and NO<sub>x</sub> values are plotted against reference values. The blue histogram is for reference values and the grey histogram is AirSENCE.

# Testing Small UV Sensors

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- Four Kipp and Zonen UV sensors were deployed for the Games
- UVA & UVE
- Reporting real-time UV
- Used to validate new UV modeling



# Pan Am Games Summer School on Weather and Health

- July 6-10<sup>th</sup> in Toronto
- 25 teachers ( international participation from Hong Kong)
- Jointly organization with the Ontario Association of Geographers and Environmental Educators (OAGEE), ESRI Canada and O
- Air Quality, Heat Health risks, UV with focus on GIS technique
- Follow-up presentations at OAGEE AGM in the Fall 2015
- Day at Downsview (Pan Am Science presentations) and other field trips
- Excellent feedback



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# WISDOM

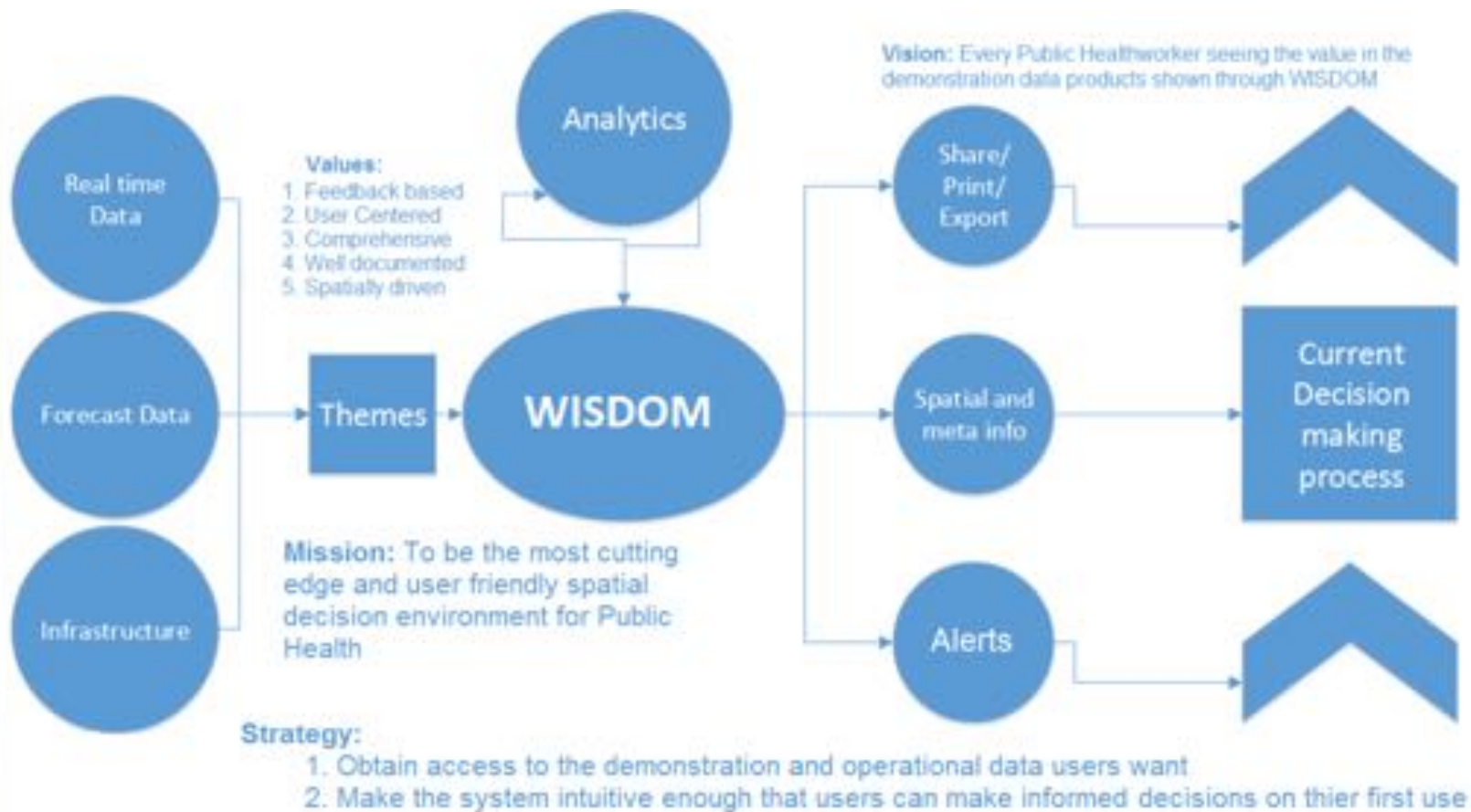
## Weather and health Information System for Decision Optimization and Management

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- Developed in collaboration with Kingston Frontenac Lennox and Addington Public Health
  - Based on PHIMS (Public Health Information Management System)
- Common Operating Picture – Situational awareness tool for environmental risks related to public health
  - Custom ESRI GIS platform
  - Responsive design
  - Password protected
- Integration of monitoring/prediction with health outcomes
- Provinces interested in health awareness platforms for real-time, static and predictive spatial data
- Integration with EC Alert Me ... “the tap on the shoulder”



# How does it support decision process?



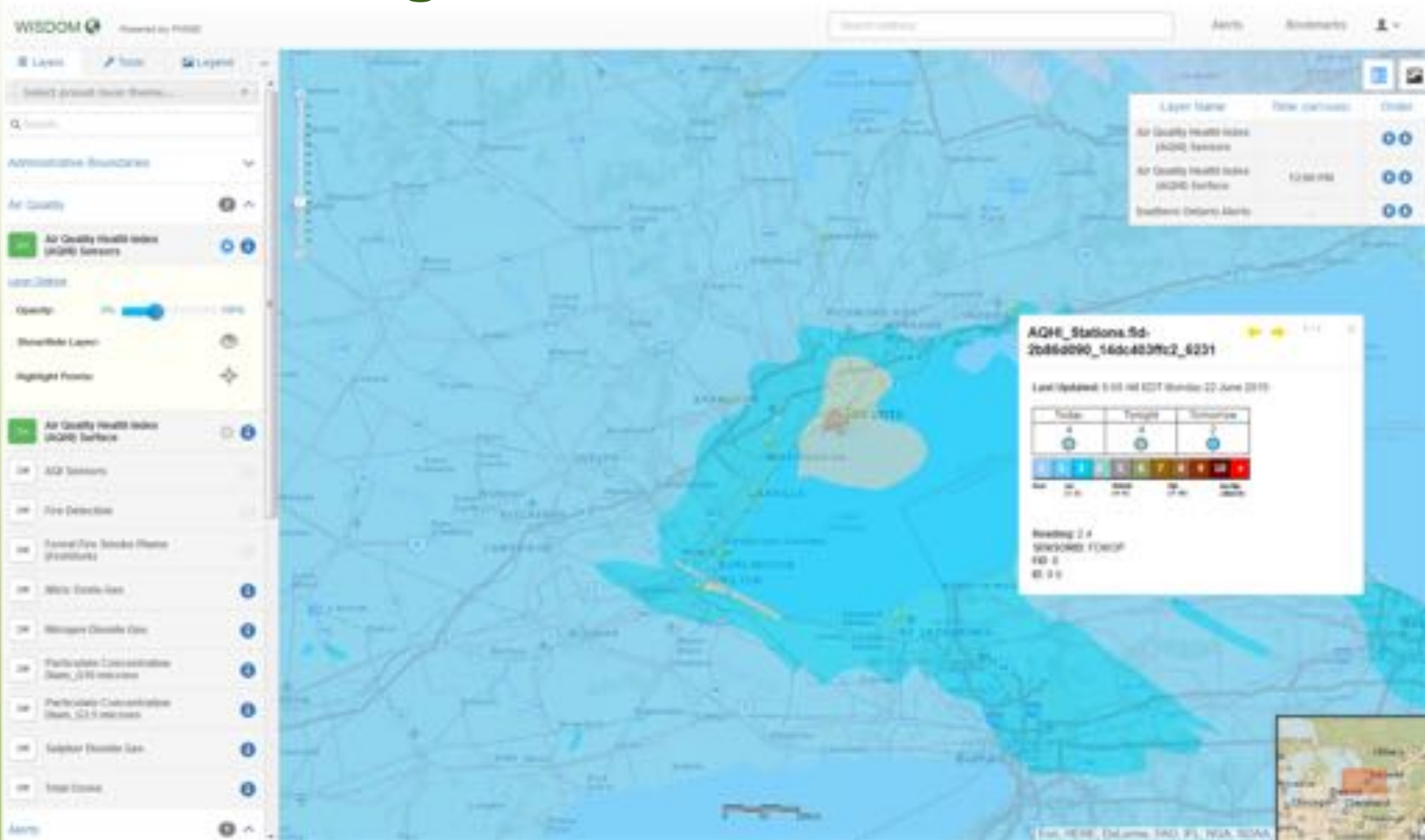
# Data In WISDOM: Focus on the geospatial

- The value of our MSC geomet service can not be understated
- Operational (available to public or used operationally)
  - Real time Heat (temperature, humidity), AQI, AQHI, heat indices, Firework, radar and CMC operational GEM and GEM-MACH 10km
  - Warnings and Special air quality/weather statements
- Socio-economic and psycho-social static data
  - To support interventions with vulnerable populations
- Showcase products (demonstration of capability, etc )
  - Mesonet weather network (60 stations)
  - Urban scale model output of heat stress indices
  - Urban Heat Island and vulnerability mapping
  - High resolution GEM-2.5
  - Real-time UV, new UV forecasting
- PHU infrastructure (e.g., daycares, cooling stations, etc)

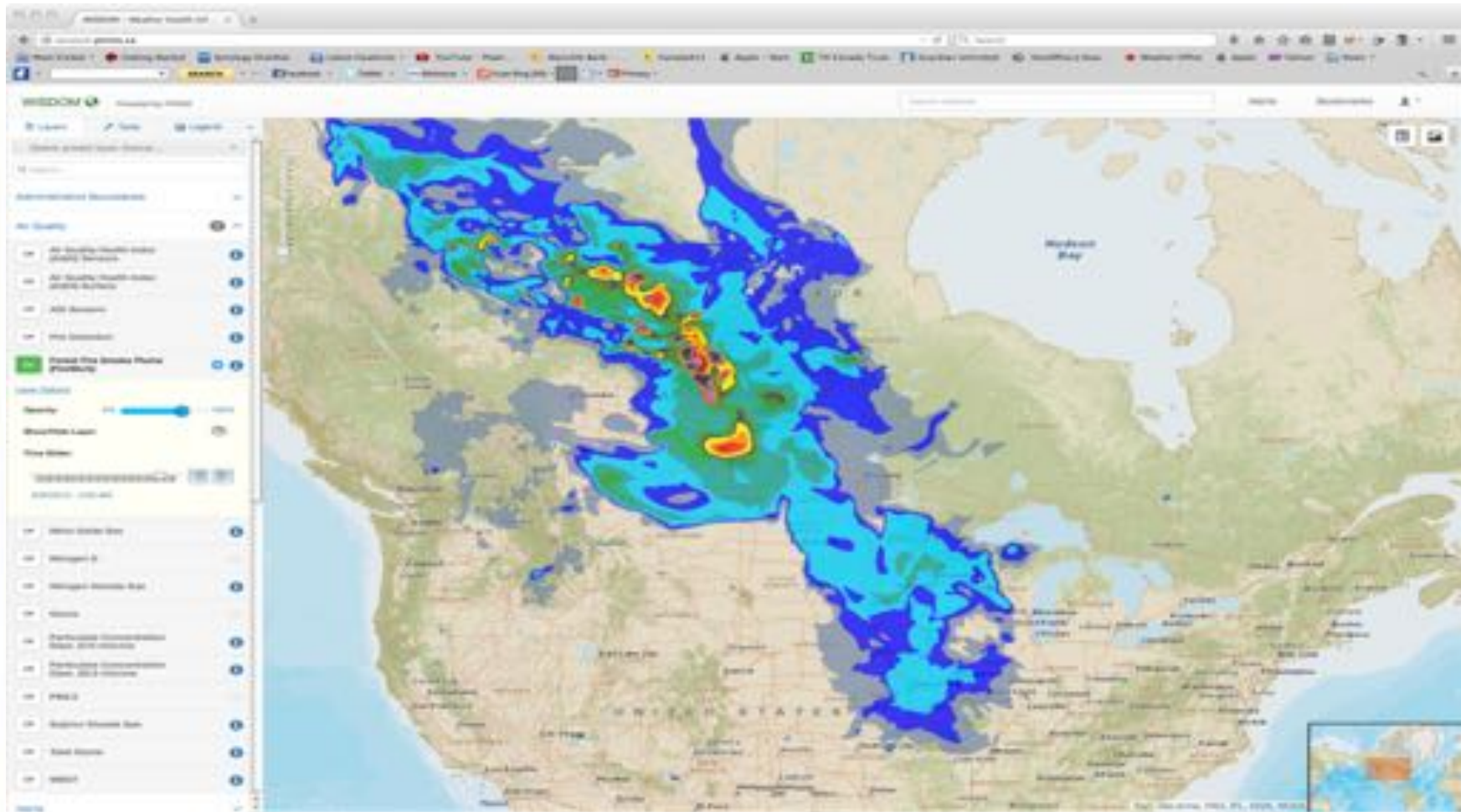




# AQHI Modeling (2.5km) and AQHI Readings and Forecasting

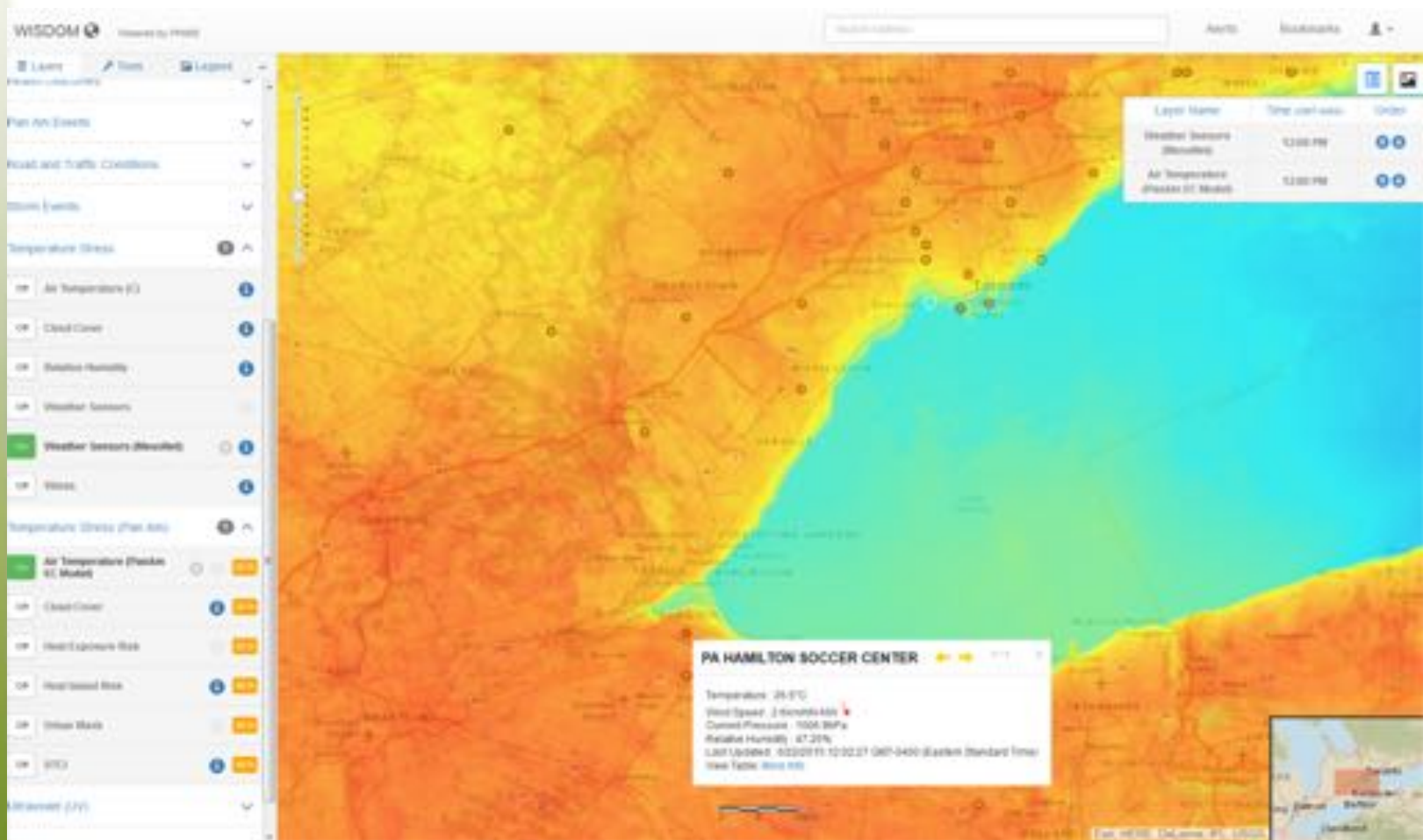


# FireWork: Surface Concentrations of Wildfire Smoke

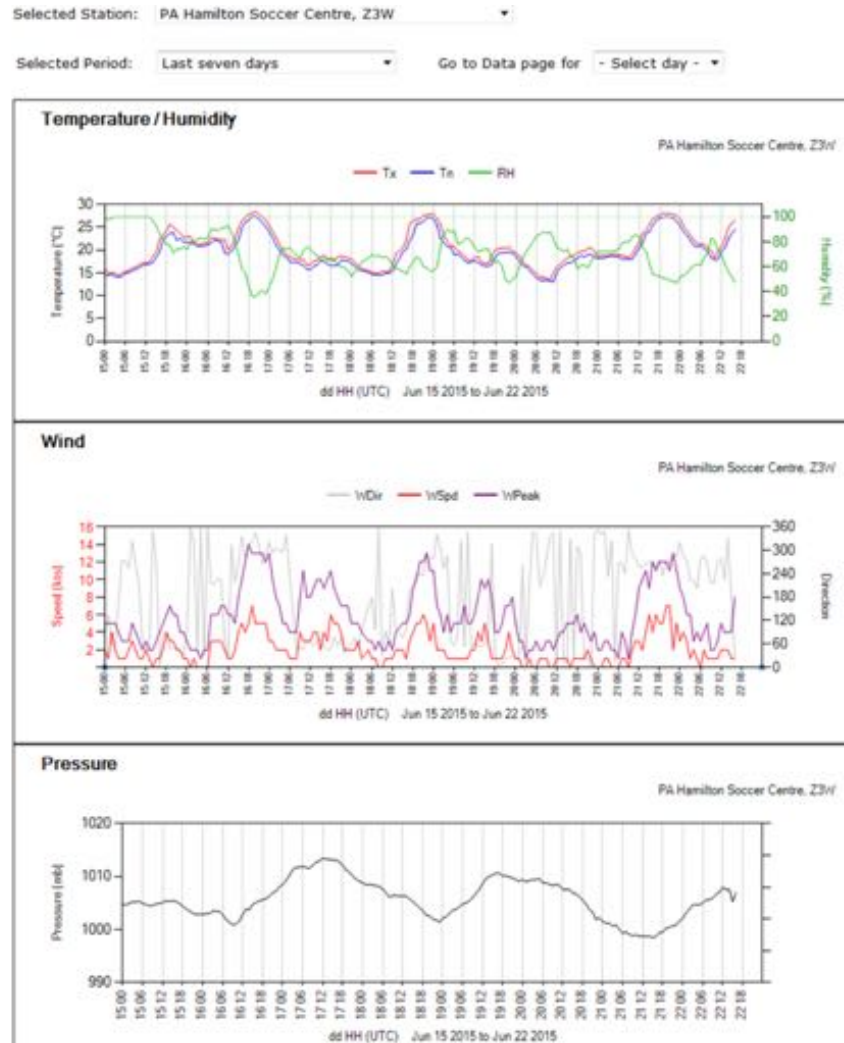




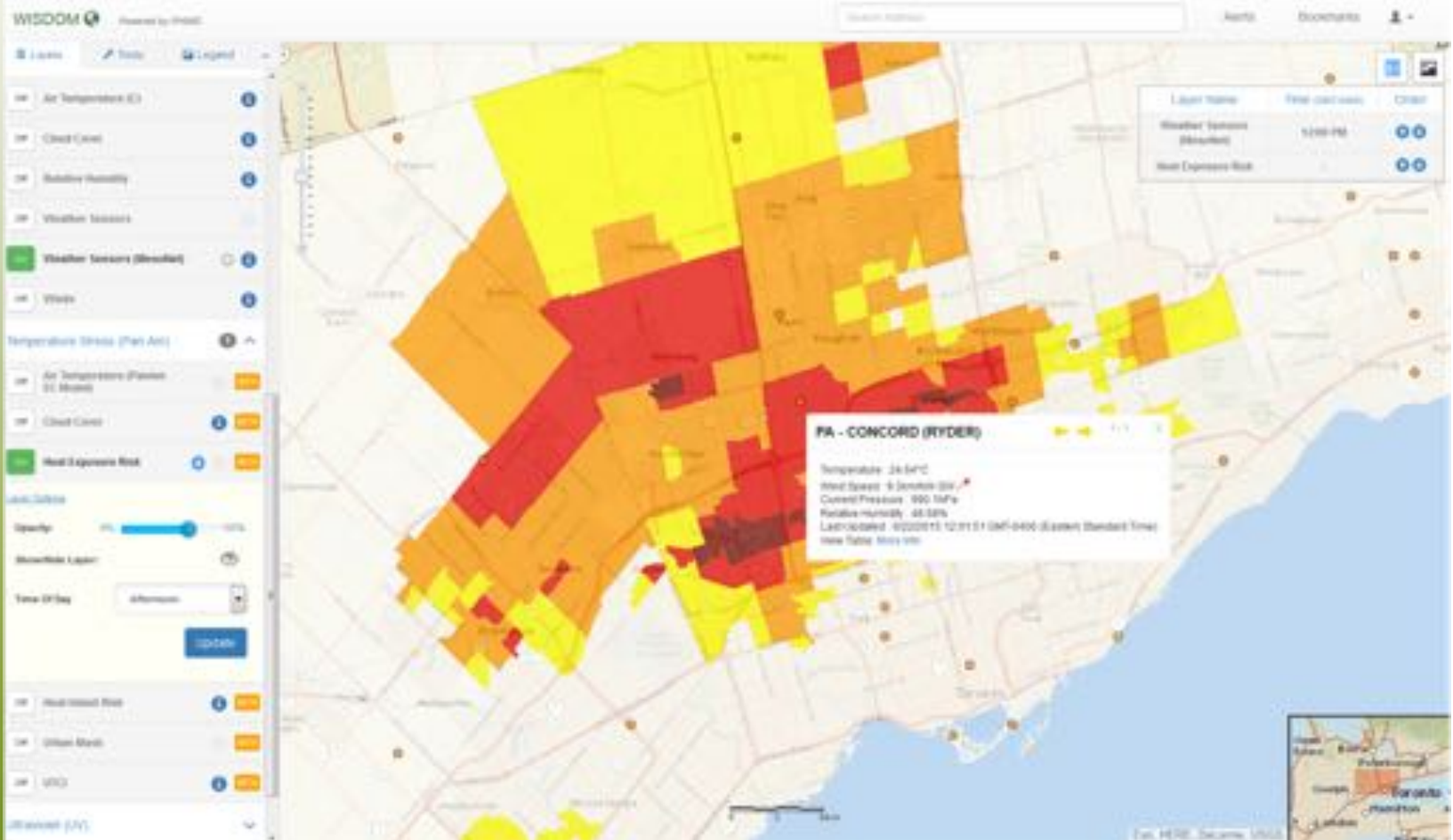
# Urban GEM Temperature(250m) and Mesonet



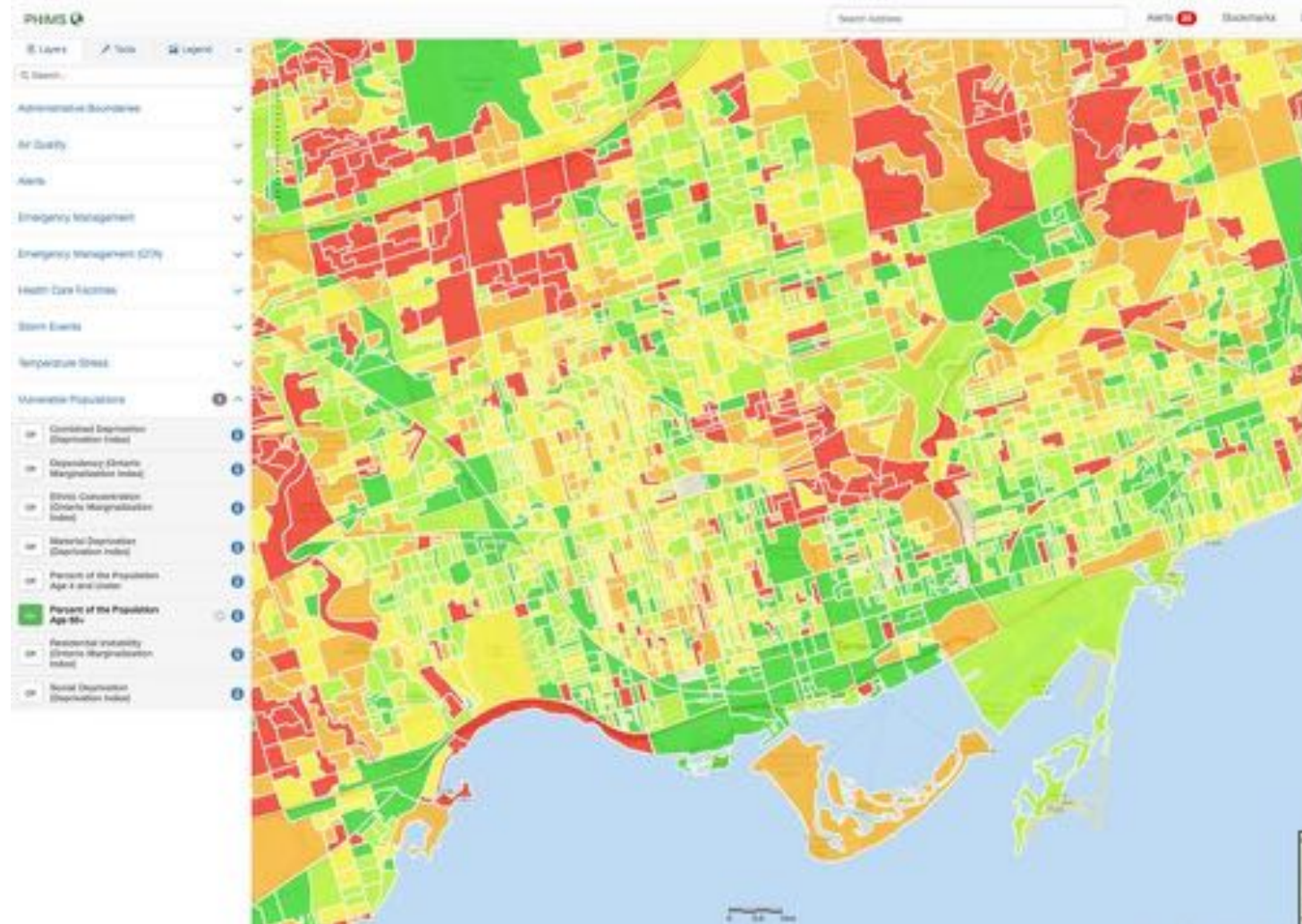
# Historical Record Through FRODO



# Heat Vulnerability Mapping



# Socio Economic/Population Vulnerability



# Evaluation

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- Establish baseline understanding of decision making of PHUs
- Focus is on the value of partnerships and service
  - Assessing the value of
    - the service offerings;
    - products available through WISDOM; and
    - the value in spatially presenting forecasts and supporting data
- Surveyed Public Health Units between the Pan and ParaPan Am Games on the heat and use of WISDOM
- Followed with interviews/discussions and formal survey process in the case of heat service





# How did we do

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- Accomplished every activity within the portfolio
- WISDOM had a 98.5% uptime performance during the Games
  - geomet service reliability improved throughout
- Accomplished our primary goal of enhancing our relationship with health partners in the Games area
- Anecdotal comments on the value of WISDOM and elements of the portfolio varied
  - Larger health units (with resources) found significant value and support for decision making
  - Smaller units were a bit overwhelmed
  - Many unexpected surprises



# Pan Am Legacy

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- Presentation WWOSC (August 2014)
  - *Managing heat health hazards in a climate of change: Mitigating risks for extreme weather in preparation for the Pan Am Games*
- Presentation - Toronto Public Health Forum (March 2015)
  - *Real-time, predictive mapped weather data: innovations to protect vulnerable people during extreme temperatures*
- Presentations to the AMS Conference (January 2016)
  - *Extreme Temperatures TO2015 Pan Am Games: Heat Stress Impacts*
  - *Heat Health Warning Systems in Canada: Development, Implementation and Assessment*
- Special Session on Weather and Health at CMOS in Fredericton
- In Progress
  - Story Board for Health and Weather Pan Am data – developed with ESRI Education
  - Case Study of the Ontario Harmonized Heat Warning and Information System



# Pan Am Emerging Legacy (cont)

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- New service offerings for AQHI and Heat Warnings
- Contributions to the Pan Am Legacy Dataset
- Contribution to the MSC Games Report
- Working with researchers on health and AQ studies (Texas Tech, Toronto Public Health, KFLA and U of T)
- Better understanding of weather and health linkages in Ontario schools
- Test-bed to develop and test the revitalization of a UV index program



# The Value of the Games

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- Externally, by capitalizing on the opportunity of the Games we:
  - Confirmed the power of partnerships
  - Encouraged partners to implement or risk in piloting new services
  - Used as a springboard for the propagation of national service offerings
  - Leveraged resources from other partners
  - Demonstrated to partners cutting edge science/modeling and monitoring
  - Better understood client needs/decision-making
  - Saw the “Knock on effect” ... partners collaborating independently



# Value (cont)

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- Internally, development and execution of the Health Portfolio:
  - Allowed us to partner with our colleagues in an overall impressive MSC effort
  - Elevated the profile of a relatively young service
  - Opened the door for subsequent, numerous internal collaborations
  - Allowed us to test some impressive technology as support for possible new service directions



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# THANK YOU

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