2015 Pan/ParaPan Am Games:

Environment Canada Science Showcase

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Acknowledgments (Abridged!)

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Outline

- Objectives
- Experimental Design
- Field Operations
- Next Gen Demo
- Summary

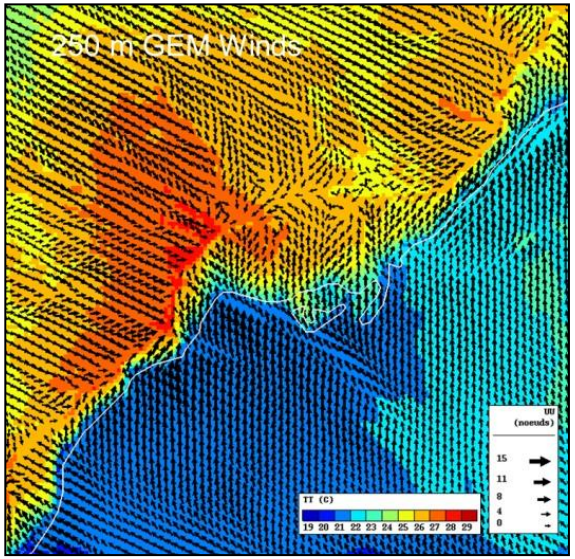
Pan American Games – July 10-26, 2015
Parapan American Games – August 7-15, 2015

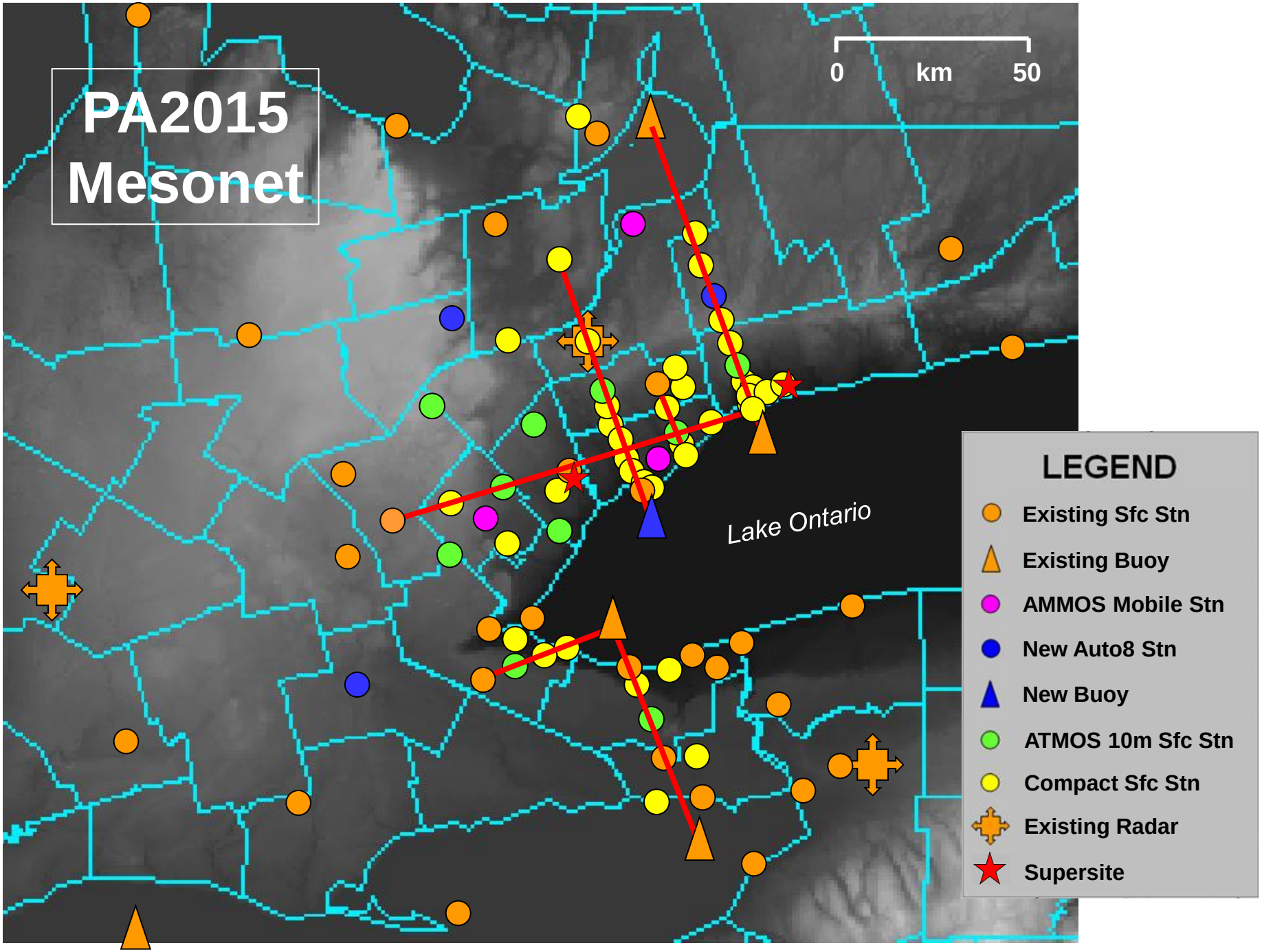
Objectives

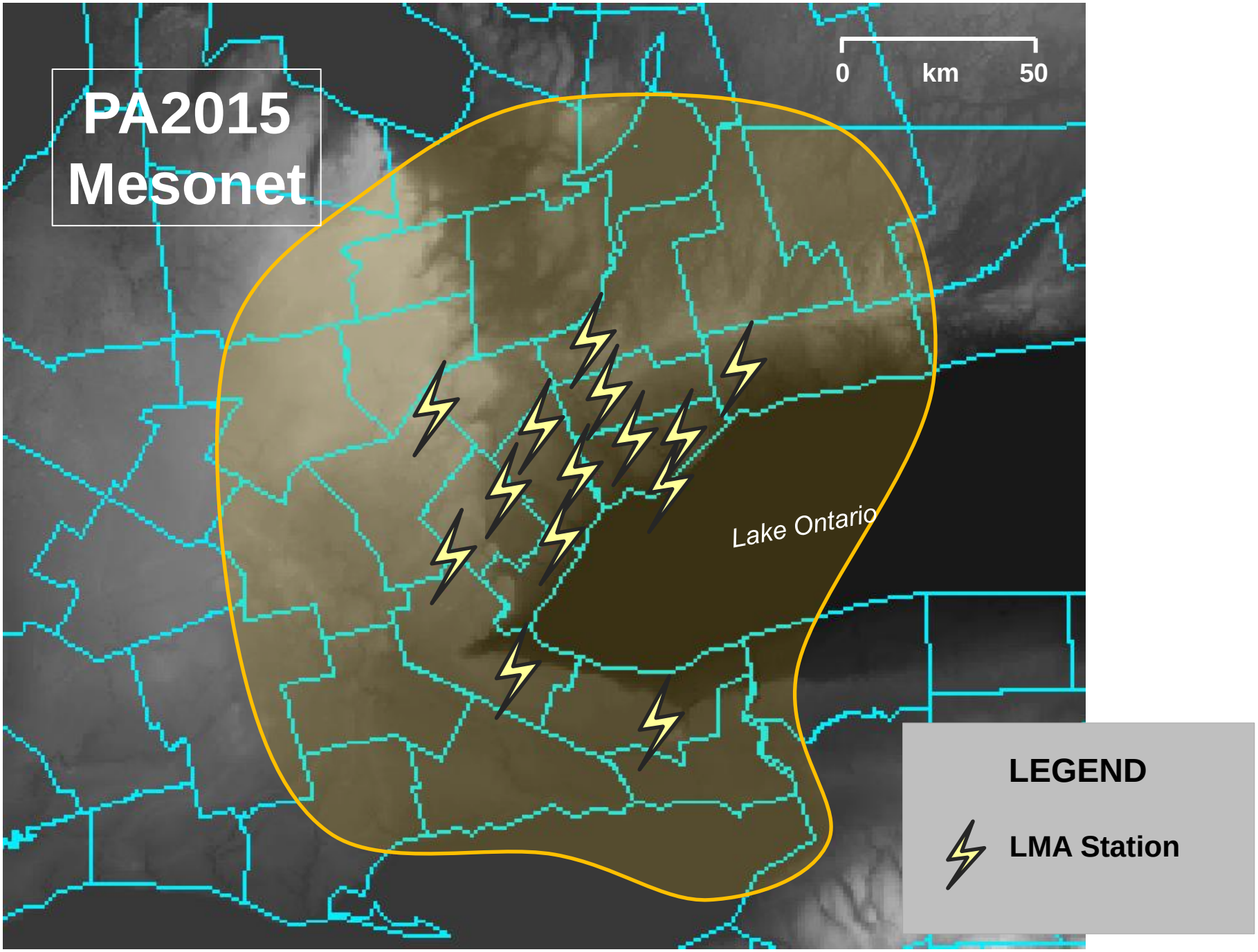
- Opportunity to align existing programs into a common vision and accelerate R&D progress (hard deadline!)
- PA2015 provided seed or influence resources, otherwise existing program resources
- Legacy data sets for process studies and model validation

Experimental Design

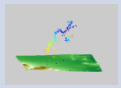
- 55 new surface stations
- 3 mobile met/AQ vehicles
- 2 ‘supersites’
- 250 m urban GEM model
- 14 station LMA
- Upper-air RAOB site
- 1 mobile AQ lab
- 2 instrumented boats
- 4 UV sensors
- 1 Waverider buoy
- Doppler LIDAR / UAV testing
- ecpass.ca for data / blogging



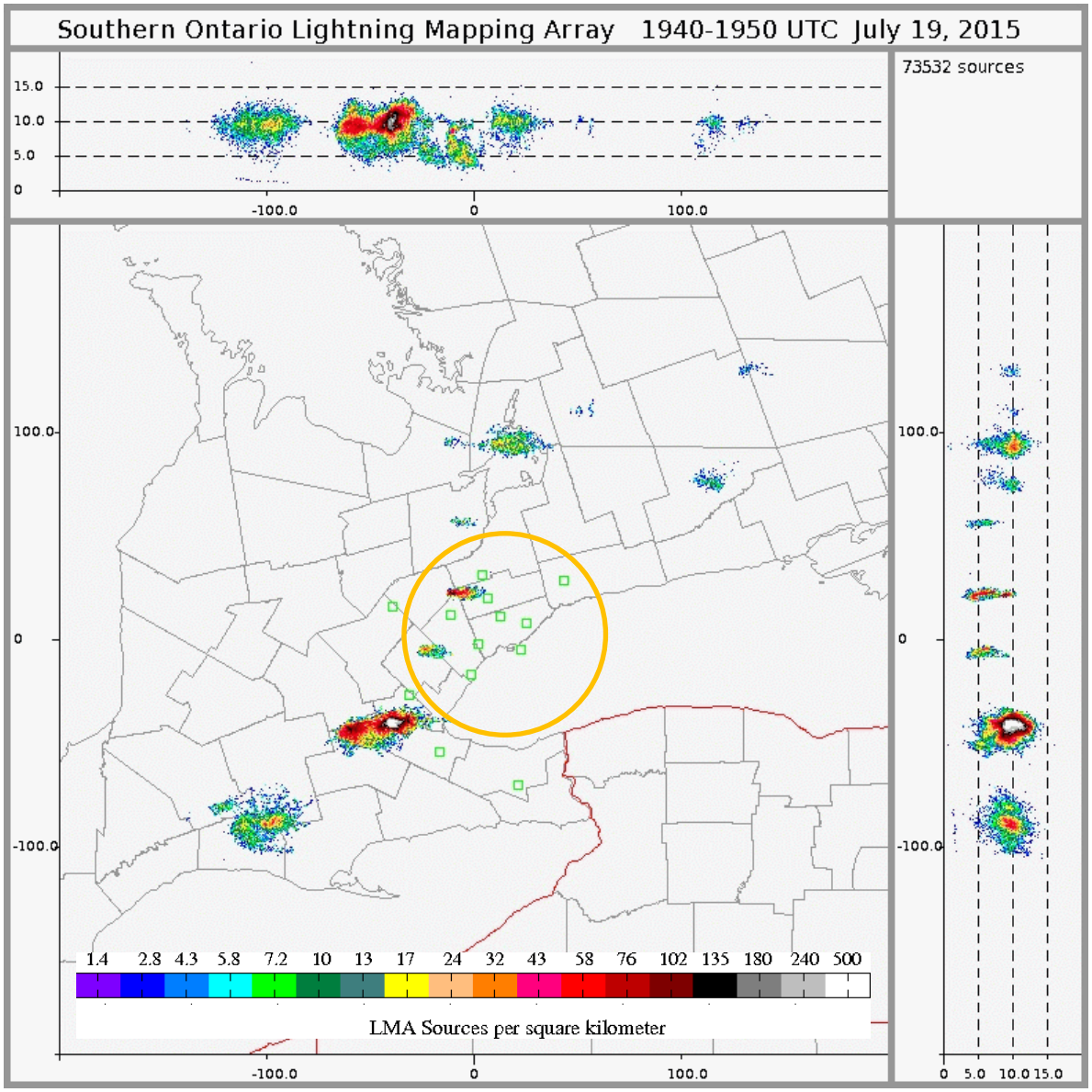

PA2015
Mesonet
0
km
50
Lake Ontario
LEGEND
Existing Sfc Stn
Existing Buoy
AMMOS Mobile Stn
New Auto8 Stn
New Buoy
ATMOS 10m Sfc Stn
Compact Sfc Stn
Existing Radar
Supersite


PA2015
Mesonet
0
km
50
Lake Ontario
LEGEND
LMA Station

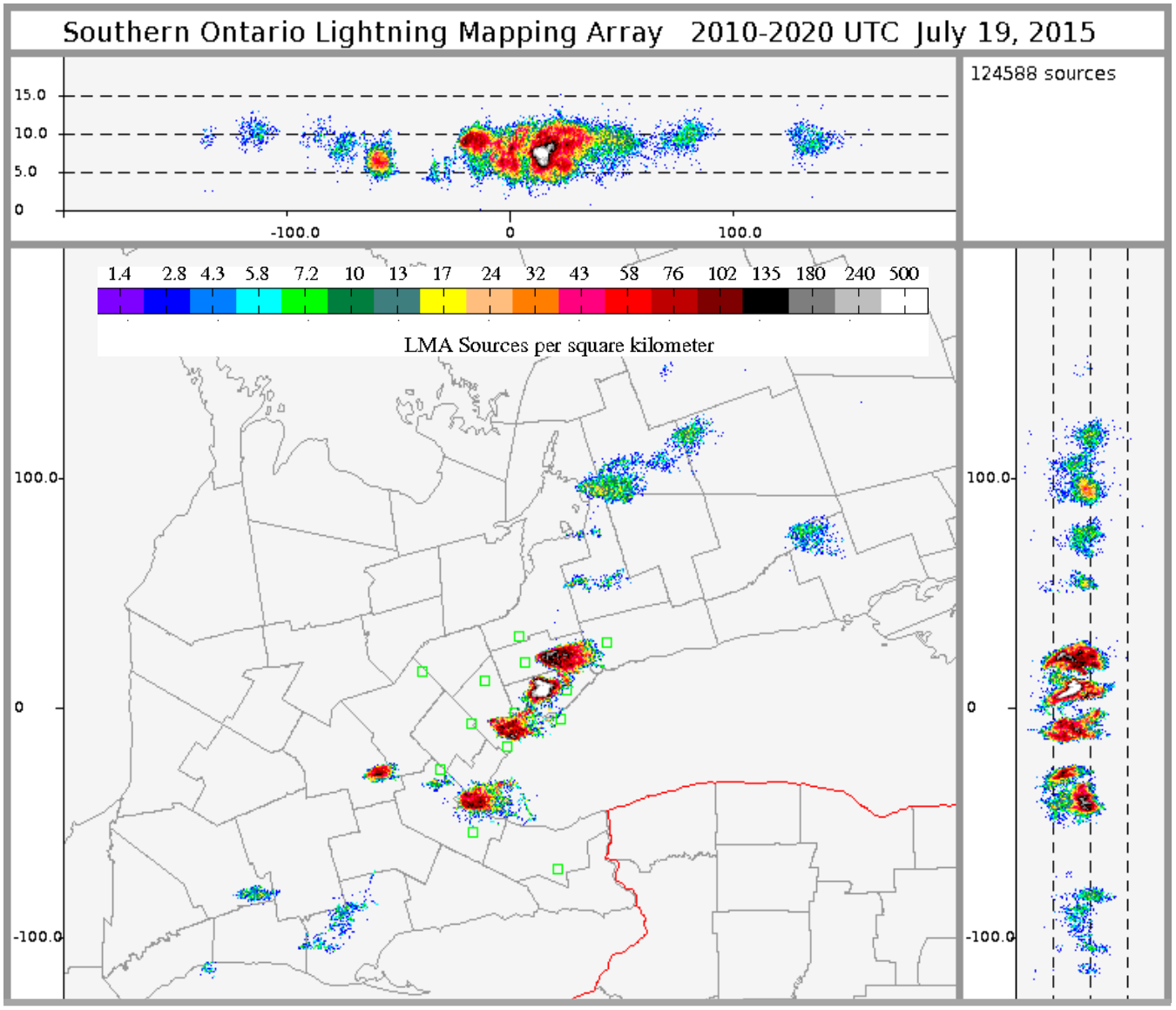
Field Operations - SOLMA

	SOLMA	CLDN
Observation Type  	Discharge sources 3 dimensions	Strokes/flashes 2 dimensions
Detection Efficiency	IC 100% CG not as good	CG excellent IC not good
Location Accuracy	Horizontal 10m (within array) Vertical 50m (within array)	Horizontal 500 m (provinces)
Time Accuracy	40-50 ns	50 ns
Operating Frequency	VHF	VLF/LF
Primary purpose	Research	Operations
Area of Coverage	Southern Ontario	Southern Canada
Number of Stations	14	84 (as of Oct 2013)
Baseline	~ 10-40 km	~ 150-350 km

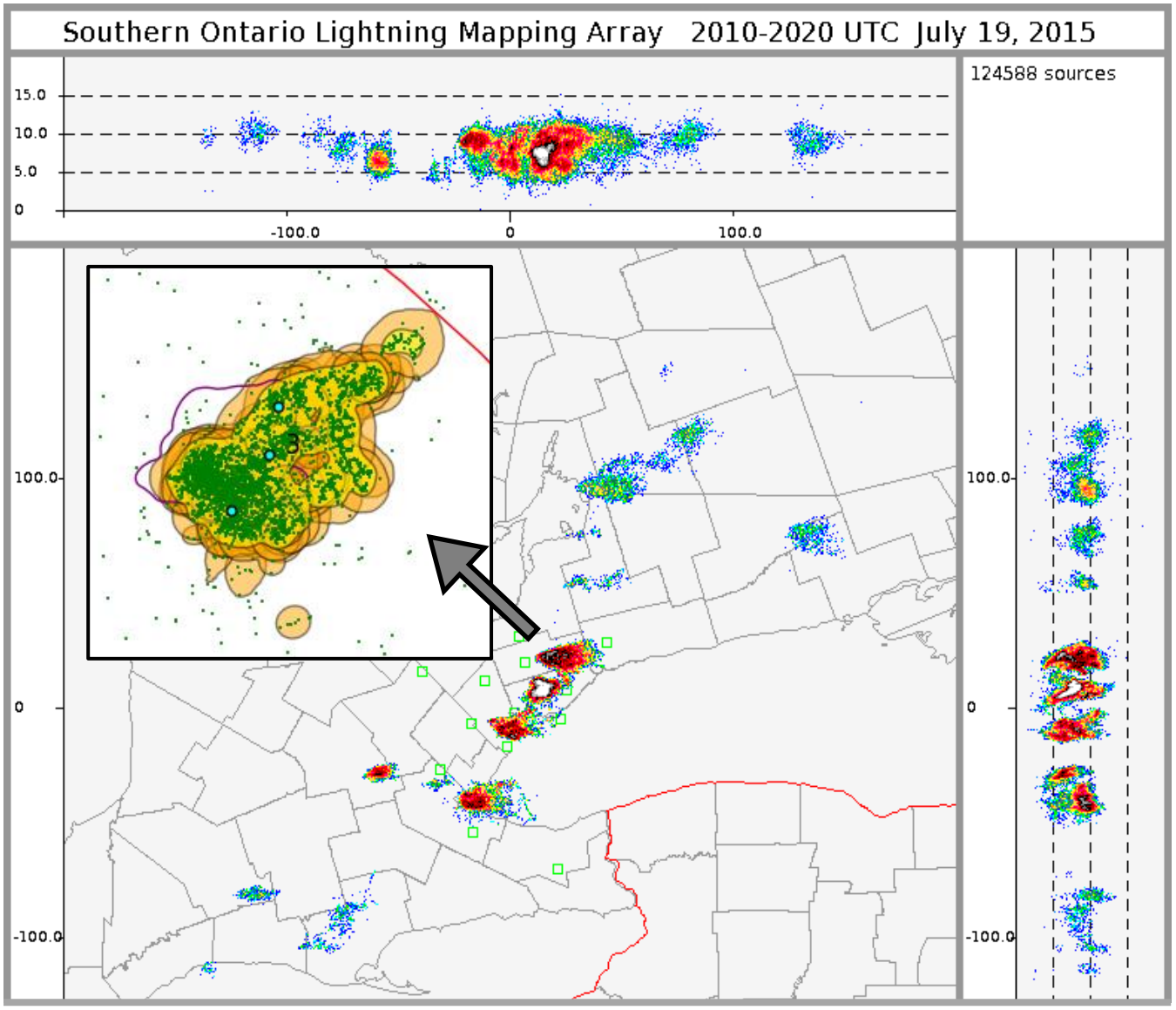
Field Operations - SOLMA



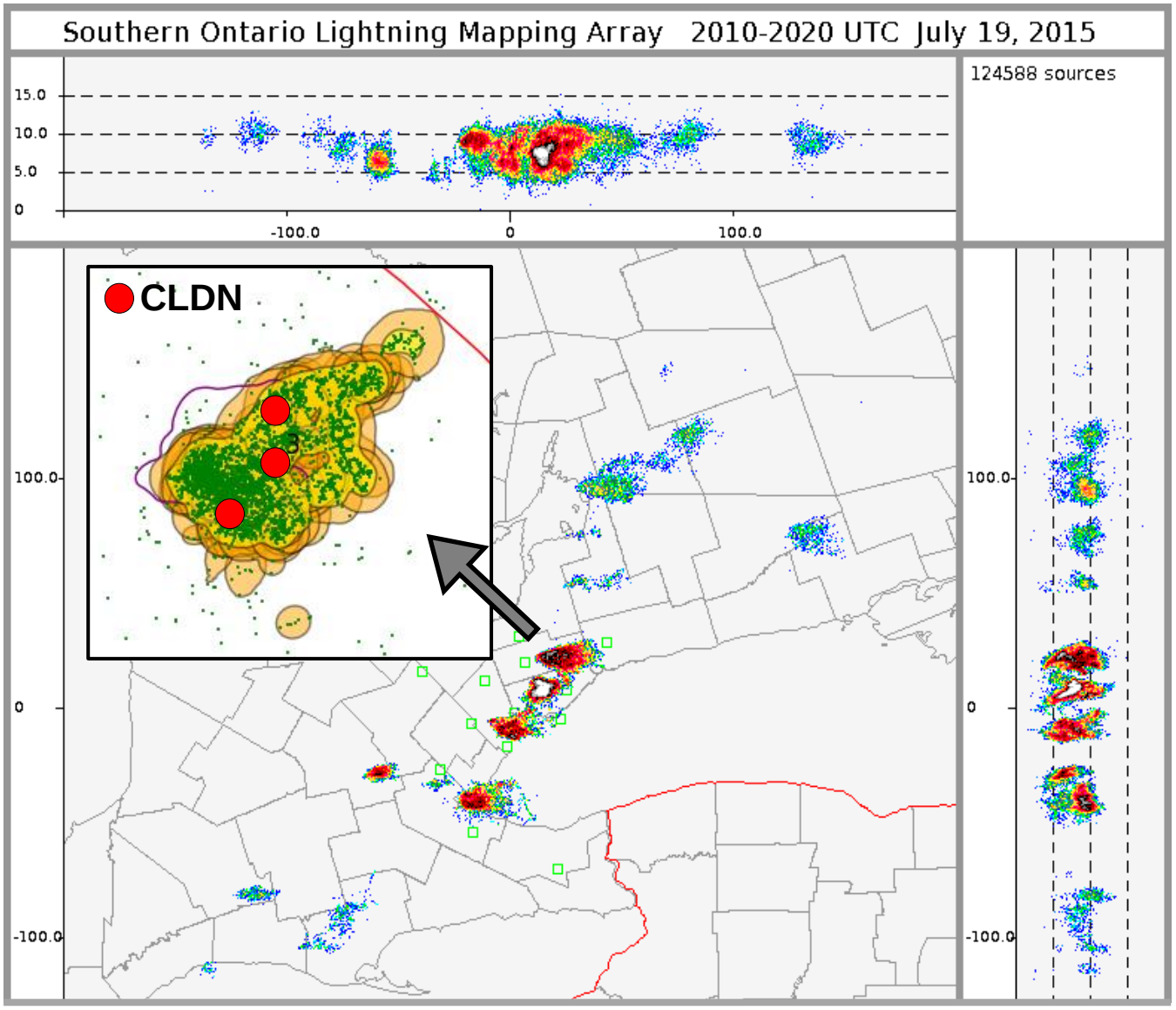
Field Operations - SOLMA



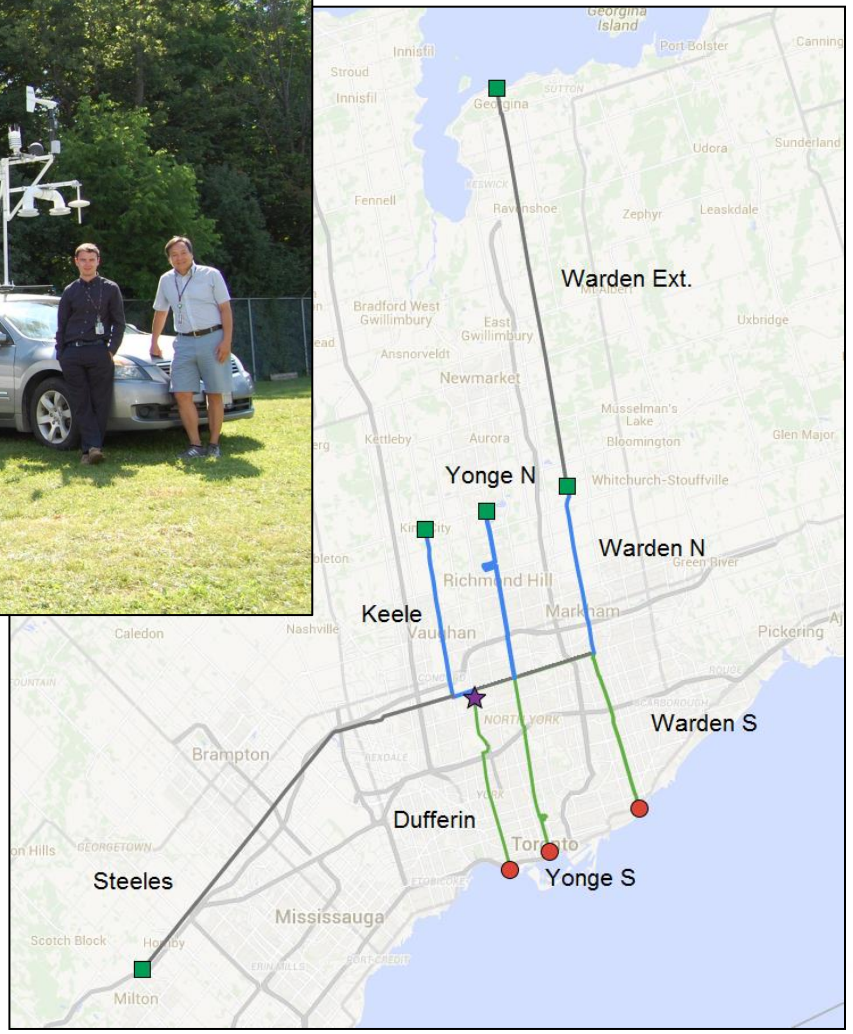
Field Operations - SOLMA



Field Operations - SOLMA

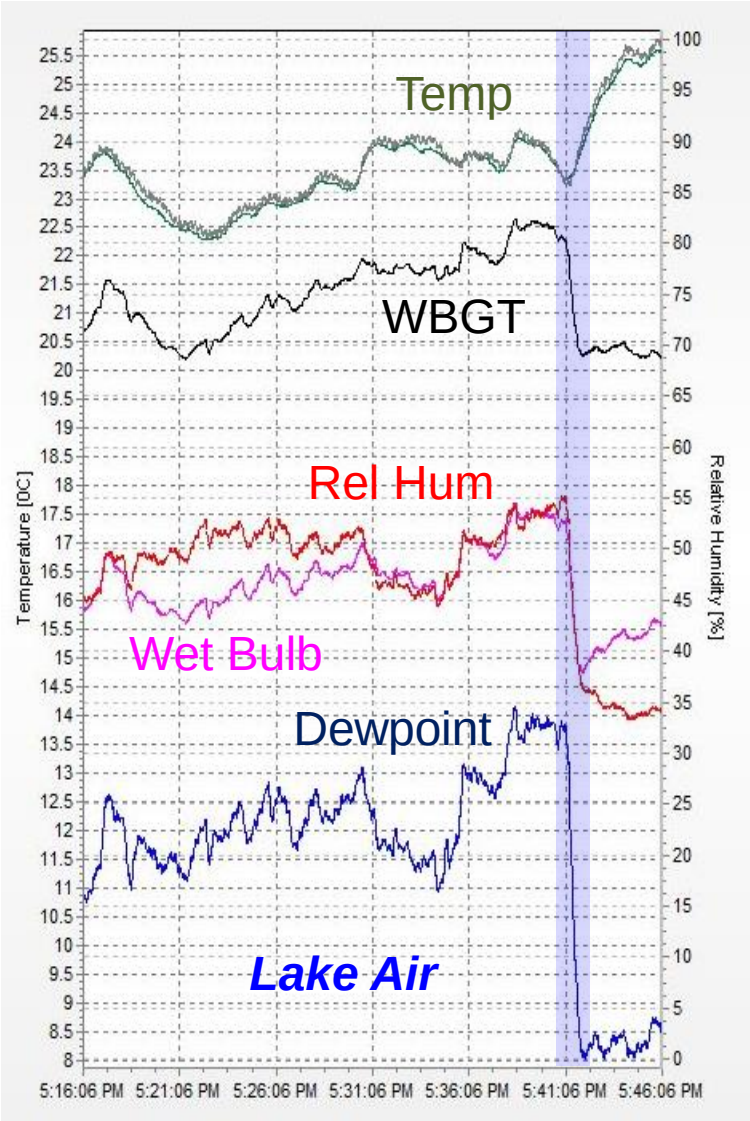


Field Operations - AMMOS

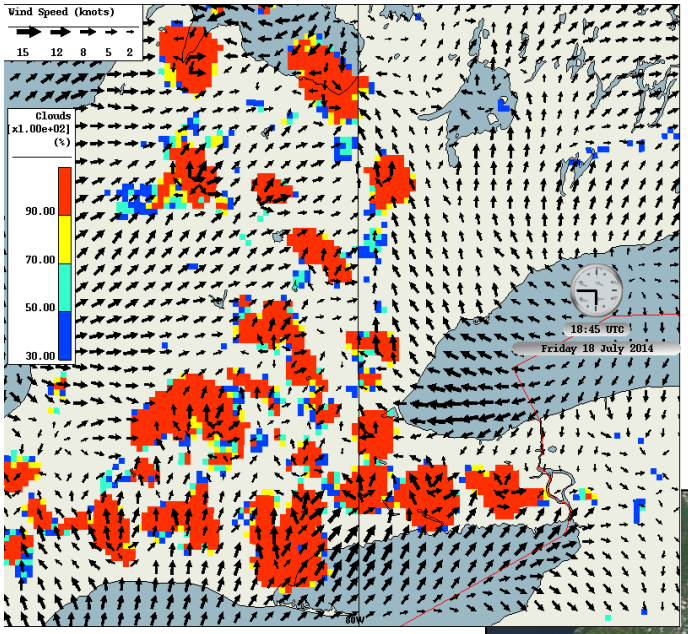


- Automated Mobile Meteorological Observing System (AMMOS) x 3
- Met + WBGT (@ 1 sec) + AQ
- Sampling lake-breeze fronts, gust fronts, heat stress, air quality and urban heat island effects

Field Operations - AMMOS

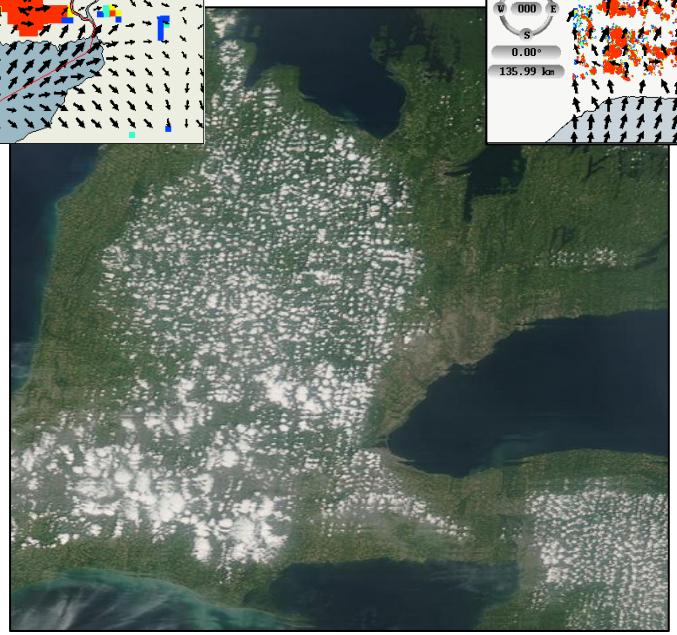


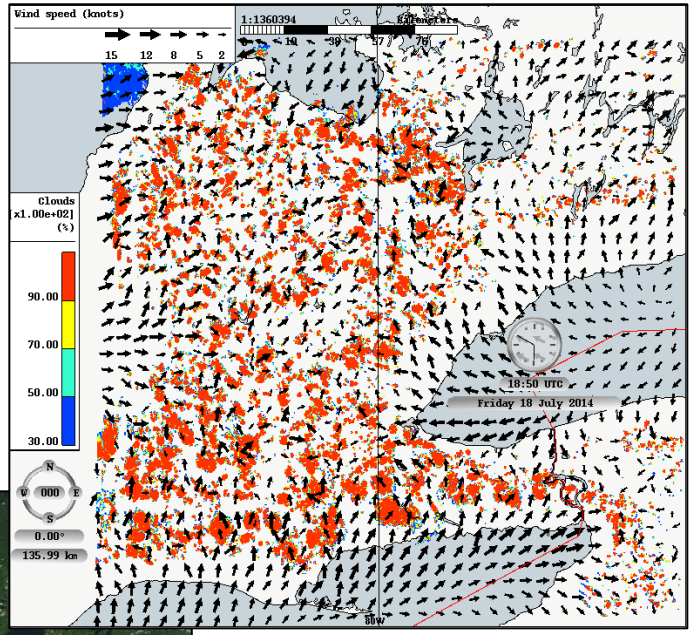
250 m urban GEM-LAM Model



2.5 km

MODIS

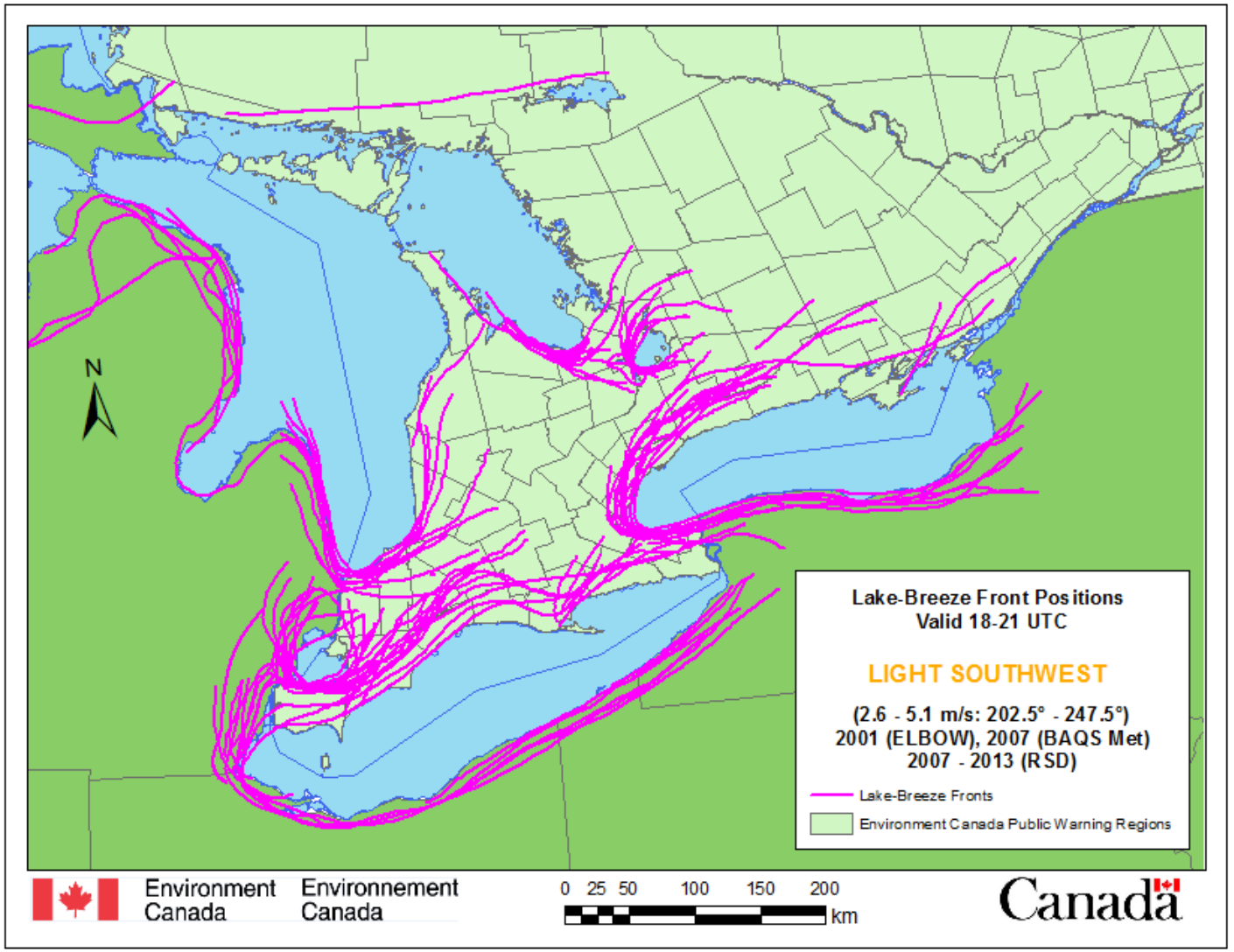




250 m

- Cascade from 2.5 km to 1 km to 250 m
- 1048 x 1048 grid cells in 250 m domain
- 24-hour integration
- Running time 1h 30m with 1824 CPUs

LBF Locator Charts - Light SW Flow

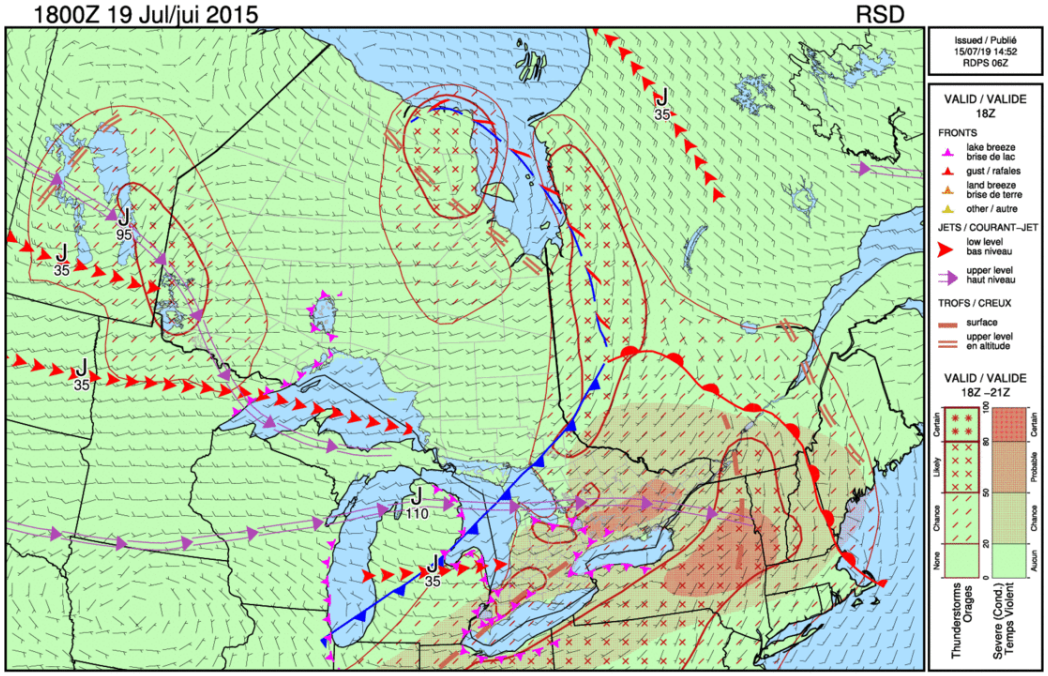


Next Gen Forecast Demonstration

iCAST – interactive Convective Analysis and Storm Tracking

- Integrates alerting, nowcasting and forecasting functions using *MetObjects* – focus on summer convection
- *Multi-scale and area-based* – facilitates forecaster analysis / diagnosis / prognosis from synoptic scale down to storm scale and from T0 (analysis) to T0+72 h
- Find '*optimal human-machine mix*' at each scale
- *Forecaster works on meteorology, not products* → increases 'situational awareness'
- Incorporates *real-time verification* scoring
- Tested / evaluated via Research Support Desks (RSDs) at including Pan/ParaPan Am Games periods
- Functionality being transferred to MSC's NinJo workstation

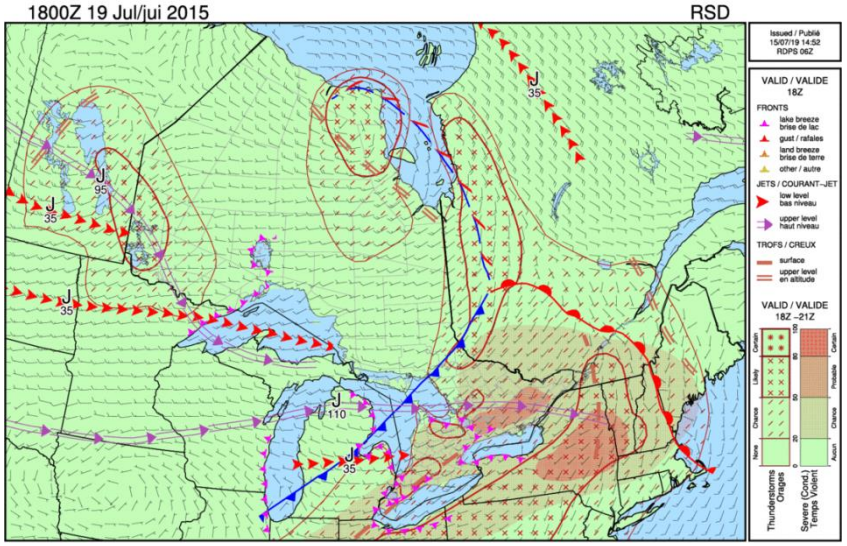
RSD1 Synoptic Space / Time Scale

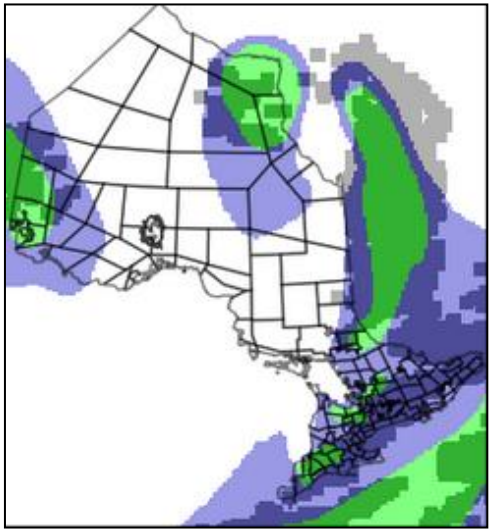


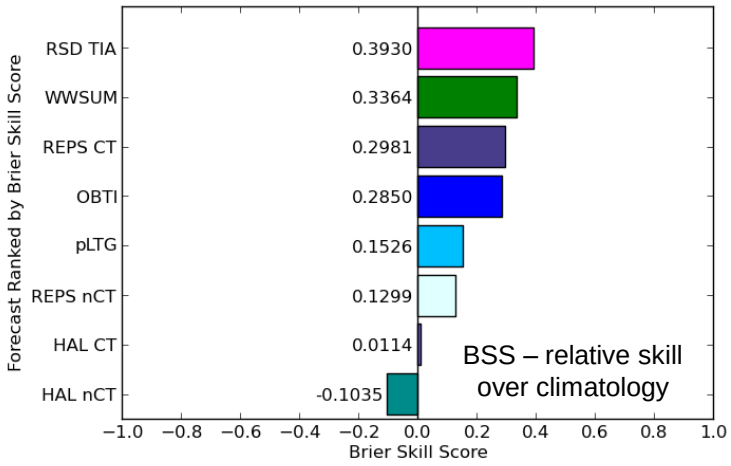
MetObject-based prognoses for T0+3 hr to T0+72hr:

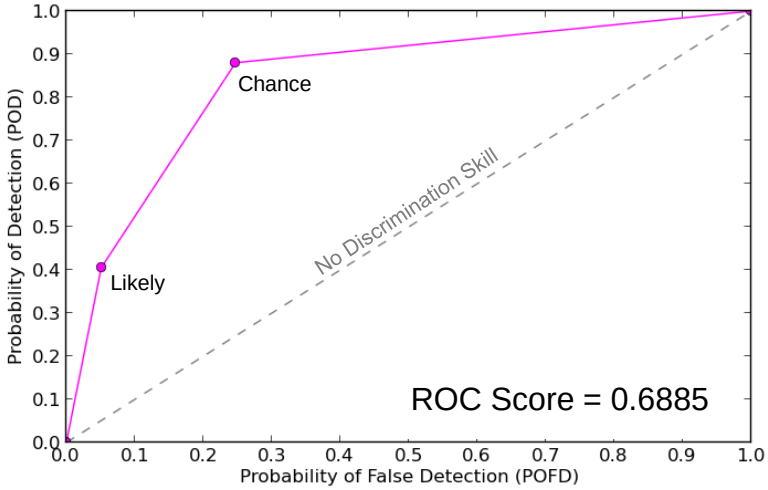
- Synoptic-scale and mesoscale features important for convection based on observations, det/ens NWP guidance, conceptual models, etc.
- Probabilistic areas for thunderstorm likelihood and severity
- Derived outlooks, interpolated animations, time series, verification products

Real-Time Verification

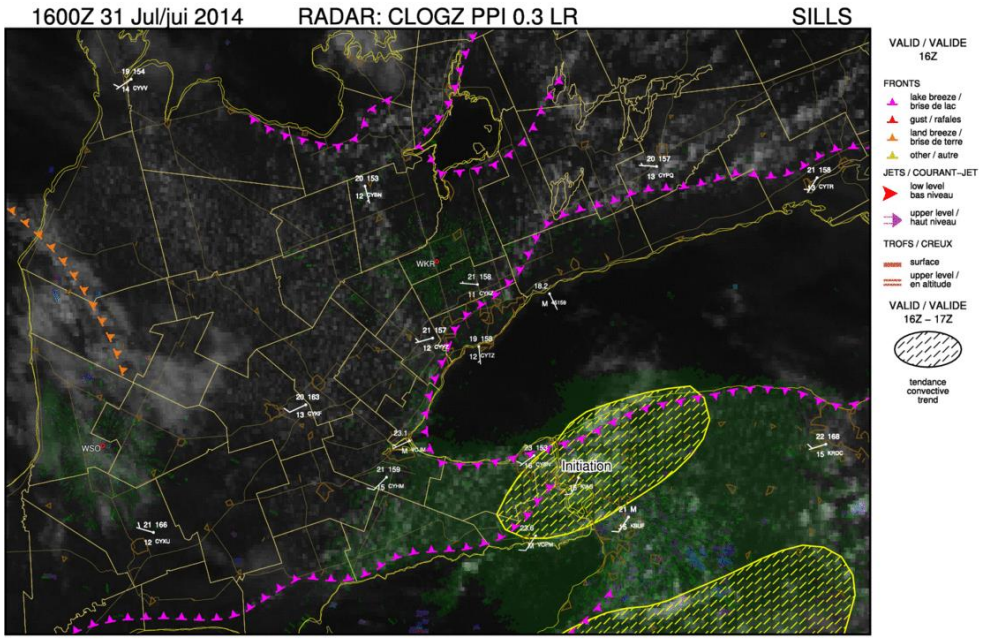








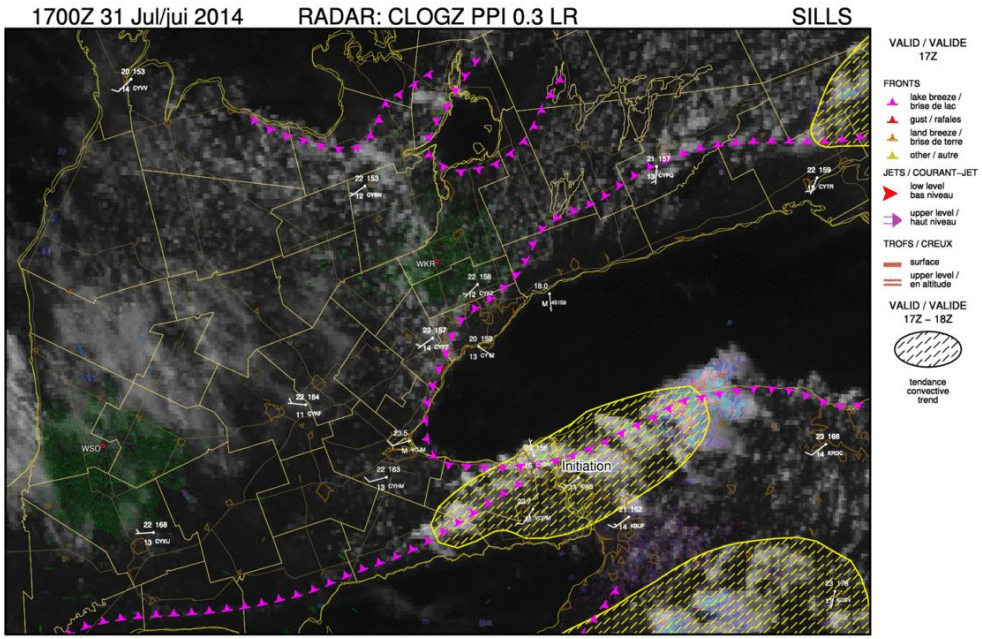
RSD2 Hourly Mesoscale Analysis



MetObject Analysis / Nowcast

• Forecaster synthesizes satellite, radar and surface weather stations obs / rapid update cycle NWP, and makes use of library of conceptual models to identify convection-inducing features (e.g. lake-breeze fronts, gust fronts) and nowcast areas of thunderstorm development

RSD2 Hourly Mesoscale Analysis



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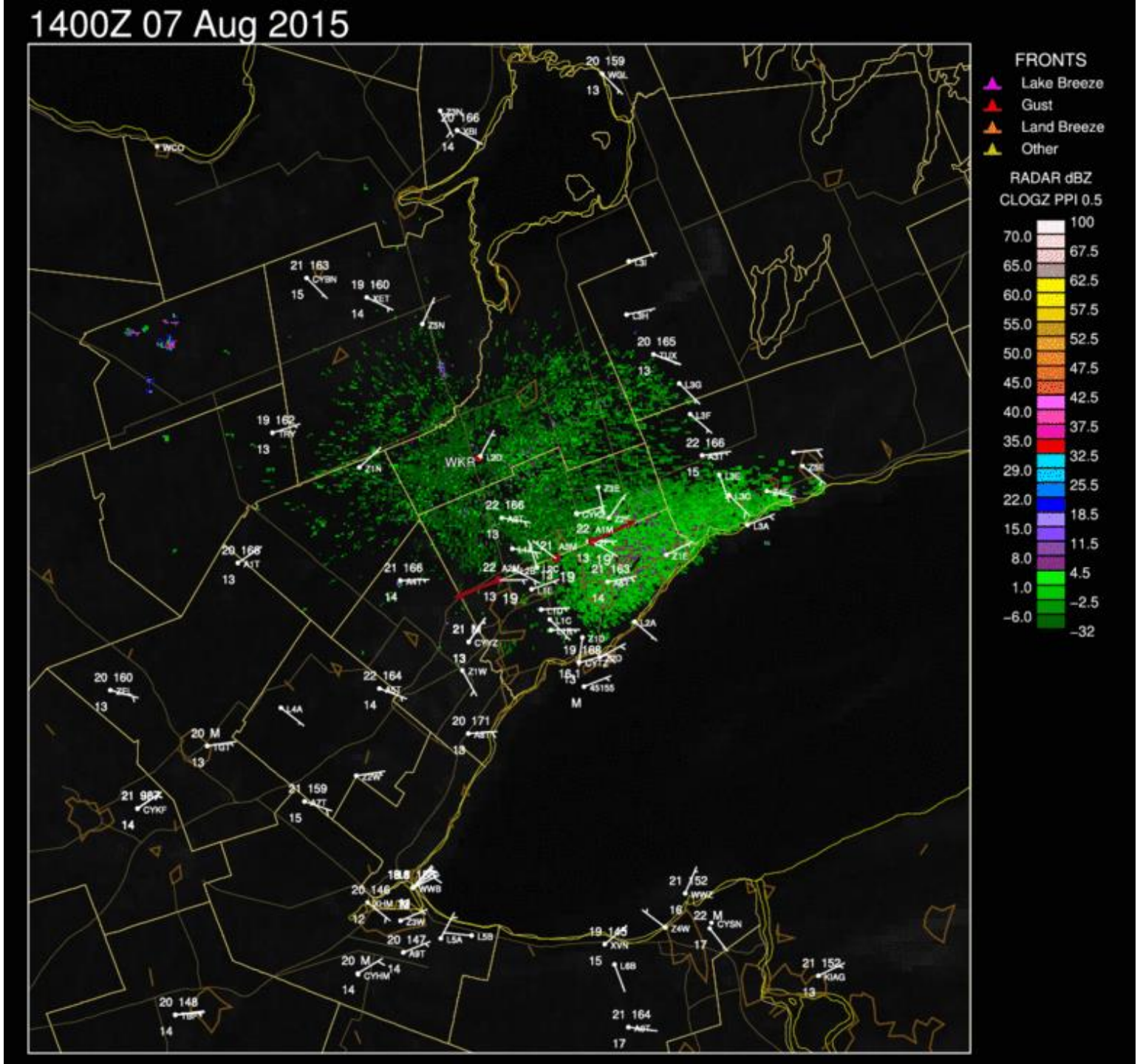
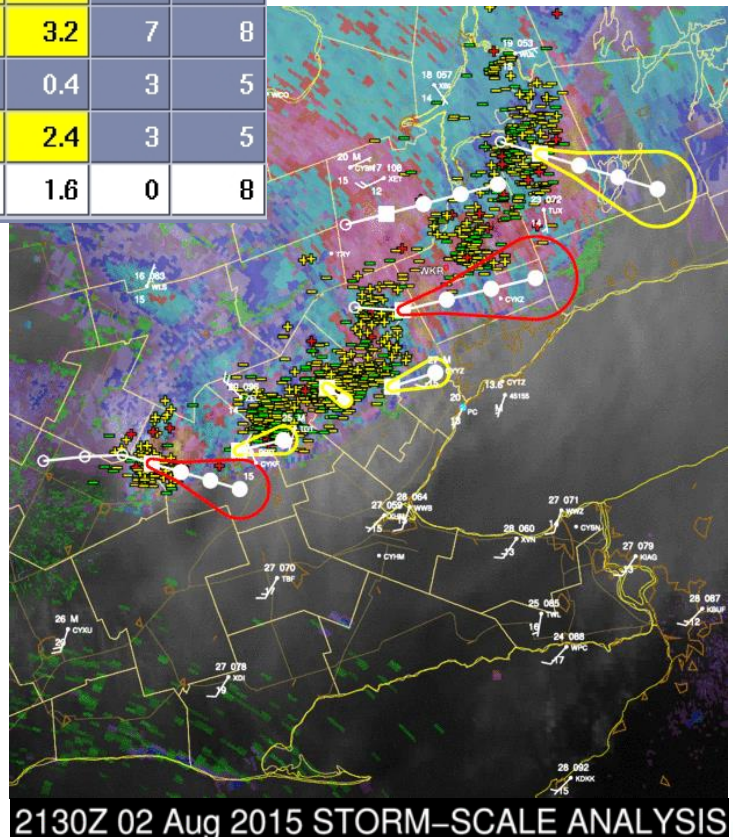

1400Z 07 Aug 2015
FRONTS
Lake Breeze
Gust
Land Breeze
Other
RADAR dBZ
CLOGZ PPI 0.5
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
29.0
22.0
15.0
8.0
1.0
−6.0
100
67.5
62.5
57.5
52.5
47.5
42.5
37.5
32.5
25.5
18.5
11.5
4.5
−2.5
−32
WKR

RSD2 10-min Storm scale

ID	Dist	Dir	Location	Mean Vel (Km/Hr)	Radar	Rank Weight	Rank T+10	Rank T+20	Rank T+30	Hail (mm)	MESH (mm)
347	231km	WNW	Tobermory	298/30	WGJ	3.8	4.4	5.1	5.8	38	22
349	305km	NNW	Tobermory	282/28	WGJ	2.4	2.6	2.8	3.0	11	10
348	318km	WNW	Tobermory	277/33	WGJ	2.3	2.6	2.9	3.2	7	8
345	18km	WSW	Nicolet	283/36	WMN	1.8	1.3	0.8	0.4	3	5
341	326km	WNW	Tobermory	359/10	WGJ	1.8	2.1	2.2	2.4	3	5
350	285km	SSE	Thunder Bay	N/A	WGJ	1.6	1.6	1.6	1.6	0	8

- New prototype approach to severe thunderstorm nowcasting and alerting
- Forecaster manages ‘track’ MetObjects and associated intensity trends for significant storms
- Warn on the *nowcast* location and intensity – increases *lead time*
- Alerts derived from the MetObjects

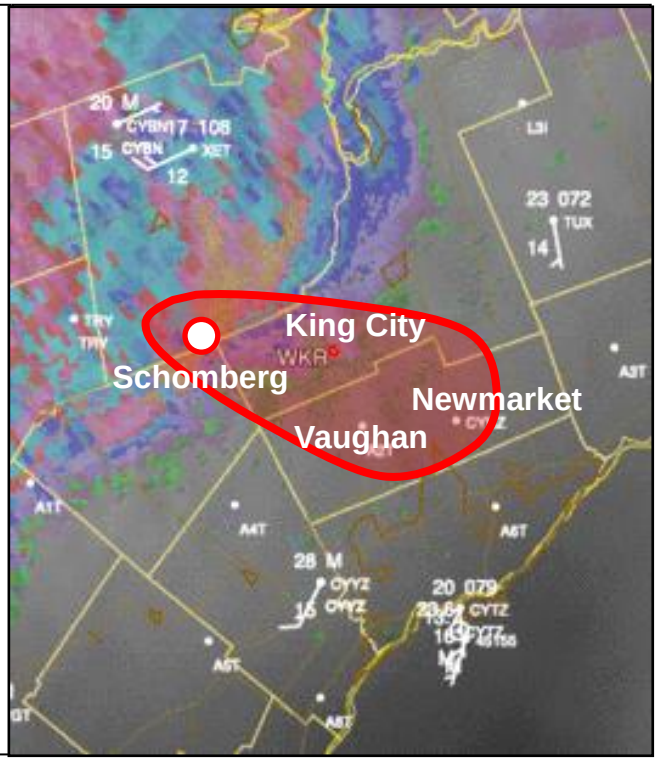


Product Generation

SEVERE THUNDERSTORM WARNING FROM ENVIRONMENT CANADA AT 5:00 PM EDT SUNDAY 2 AUGUST 2015.

SEVERE THUNDERSTORM WARNING FOR: =NEW= AREAS NEAR SCHOMBERG, KING CITY, VAUGHAN, RICHMOND HILL, AND MARKHAM

A SEVERE THUNDERSTORM PRODUCING QUARTER-SIZE HAIL, DAMAGING WINDS TO 100 KM/H AND HEAVY RAIN LOCATED 1 KM WEST OF SCHOMBERG IS MOVING SOUTHEAST AT 40 KM/H. THIS STORM IS EXPECTED TO REACH VAUGHAN AT 5:25 PM EDT.



Multimedia Alert Product Example

Summary

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- The Toronto 2015 Pan / ParaPan Am Games provided a focal point for collaborative science activities and accelerated a number of projects
- Scope kept growing right up until the Games!
- Large quantity of data to quality control and analyze for process studies and hi-res model validation – numerous reports, presentations and publications anticipated
- Toronto Summer Olympic Games in ***2024***???

Thank you!