



Environment
Canada

Environnement
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Canada

The Canadian Urban km and sub km-scale Weather Prediction System



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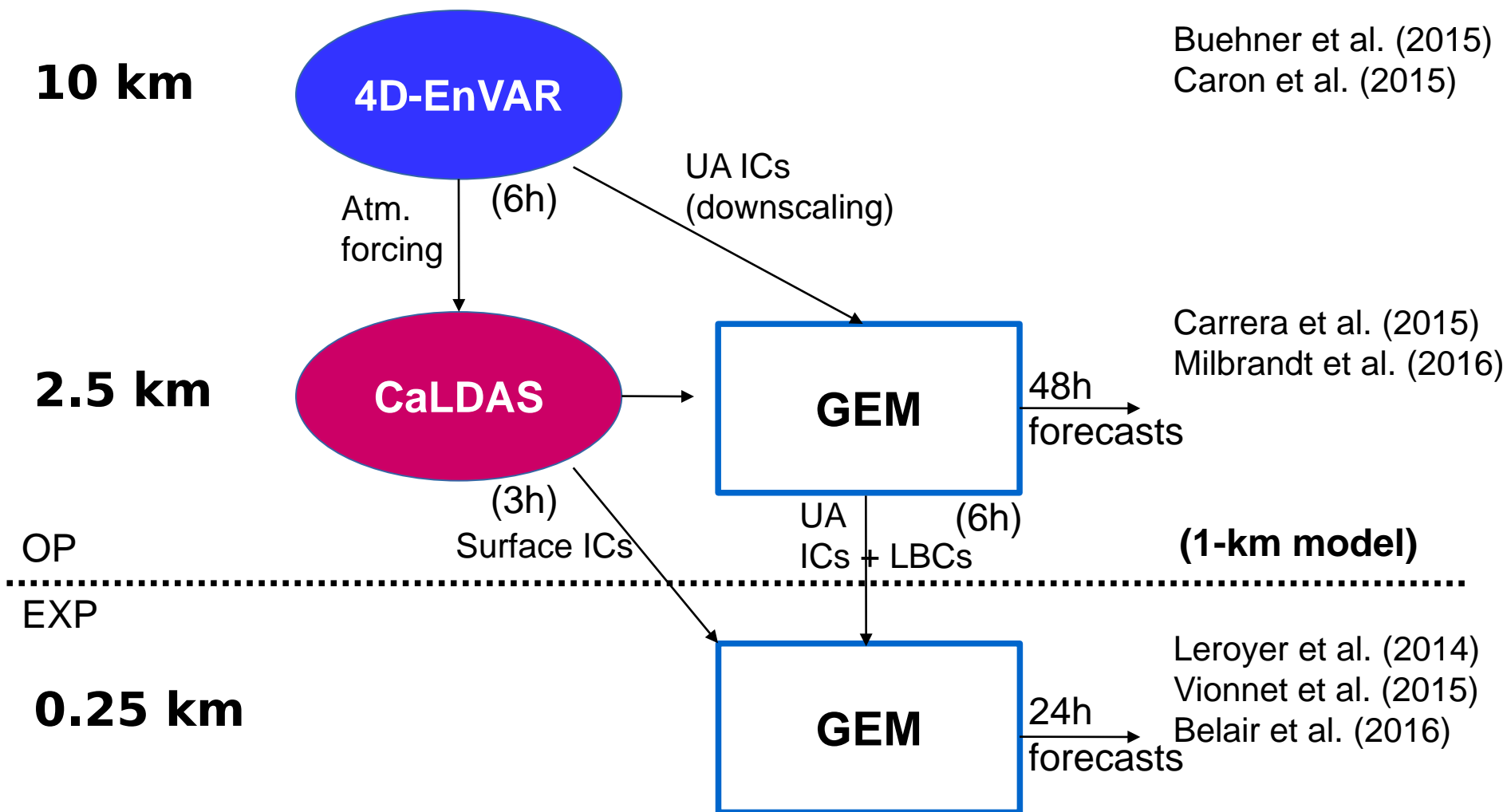
WSN16, Hong Kong, 28 July 2016



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The NUMERICAL PREDICTION SYSTEM



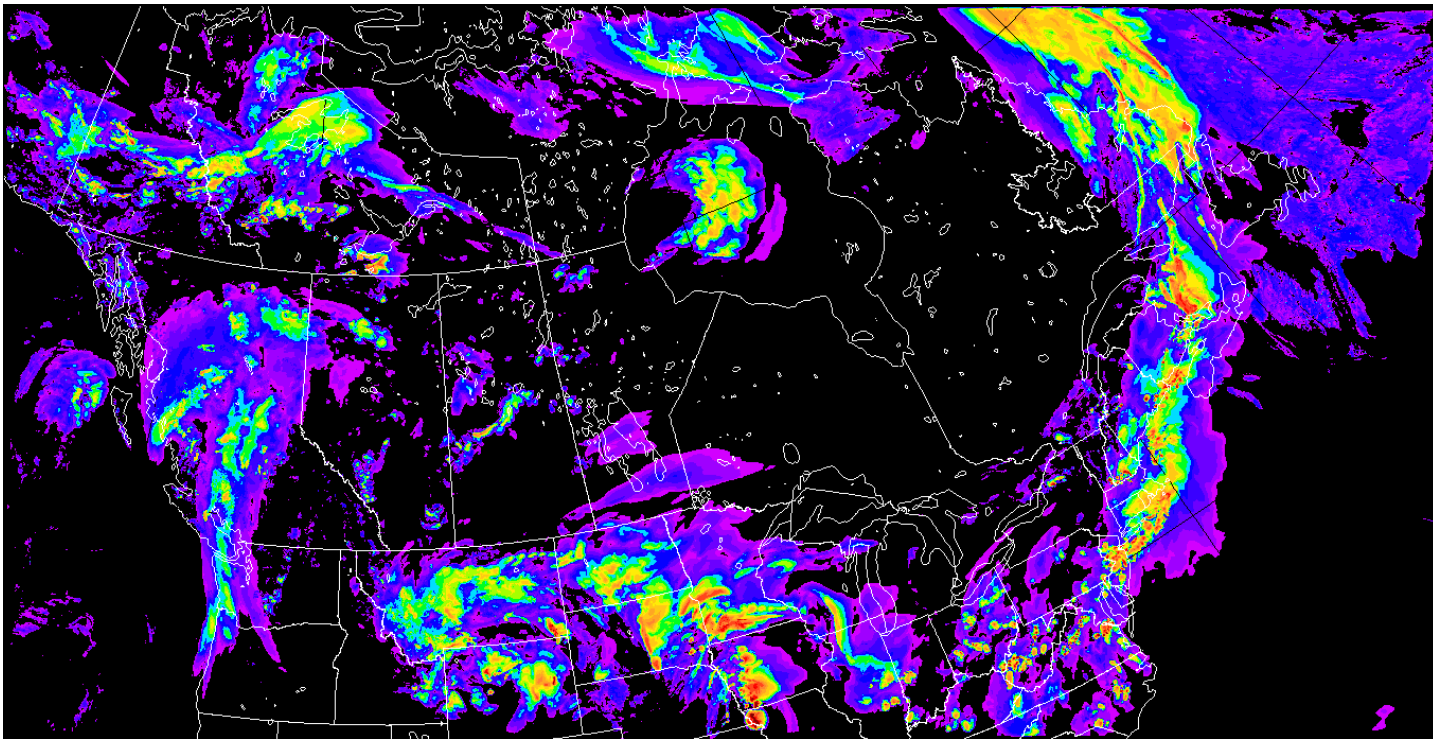
The 2.5-km GEM

4 x 48h runs per day, MSC-Operations

Transition of short-range guidance to this system

4D-EnVAR (10km) and CaLDAS (2.5km) for the initial conditions

Upcoming... 4D-EnVAR at 2.5km and TEB for cities



Column-max reflectivity

GEM 0.25km CONFIGURATION

Worth mentioning...

Implicit time scheme, semi-Lagrangian advection, terrain-following hybrid vertical coordinate – quite efficient and stable numerics / dynamics

Urban processes with TEB

Modified 1D turbulent mixing (mixing lengths proportional to model horizontal grid spacing)

Milbrandt and Yau cloud microphysics scheme (6 categories, 2 moments) – P3 also being tested.

NEW FOCUS on 0.25km GEM

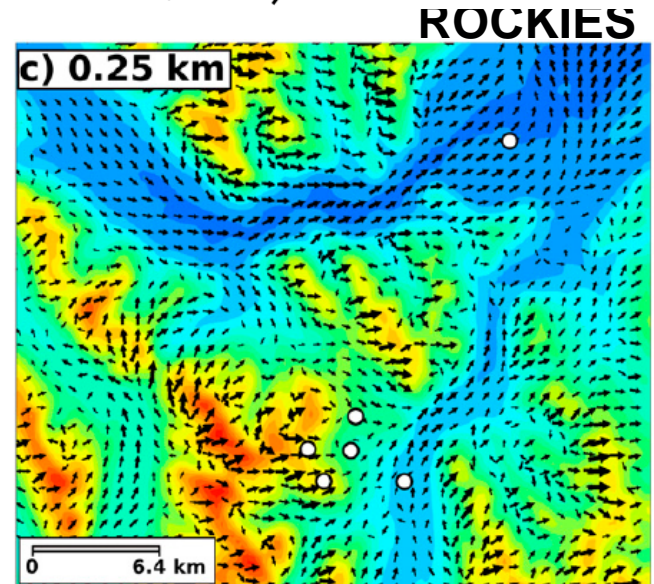
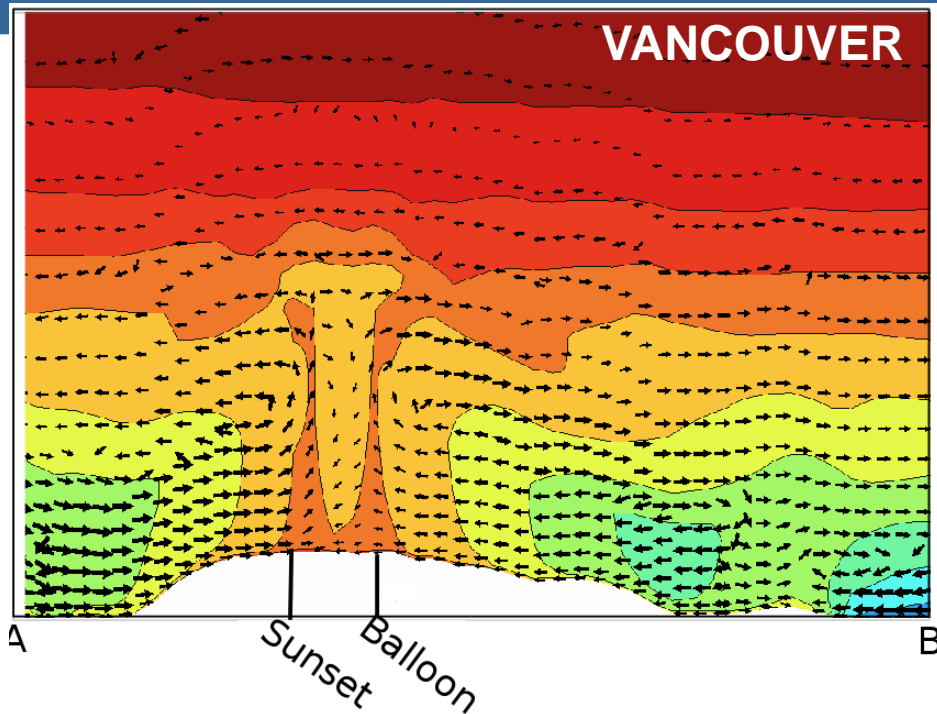
Coastal and mountain areas... tests over the Canadian West coast, tests over Sochi (Kiktev et al., submitted)

Coastal urban areas ... tests over Vancouver (Leroyer et al. 2014)

Cities... tests over Oklahoma City (Husain et al. 2013, 2014)

Mountains, tests over the Canadian Rockies (Vionnet et al. 2015)

Severe weather over cities... tests over Tokyo (Belair et al., being submitted)



PAN AM GAMES 2015... TORONTO

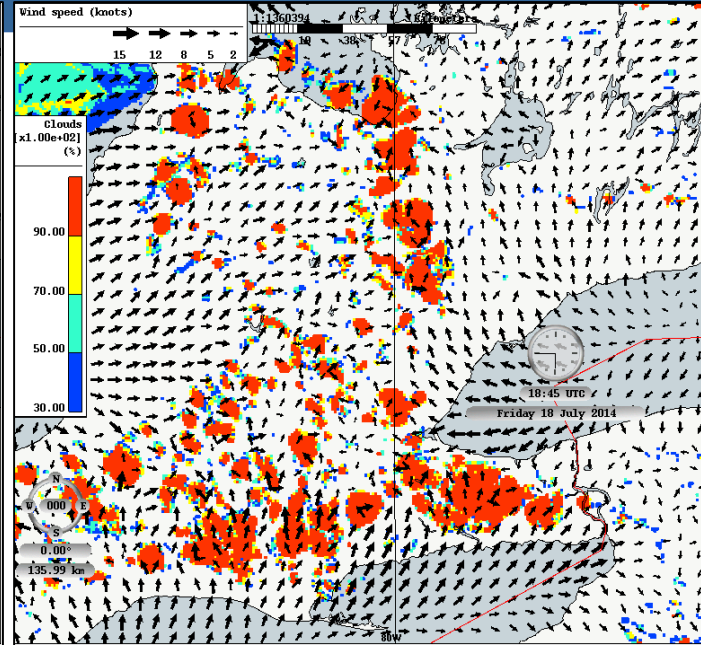
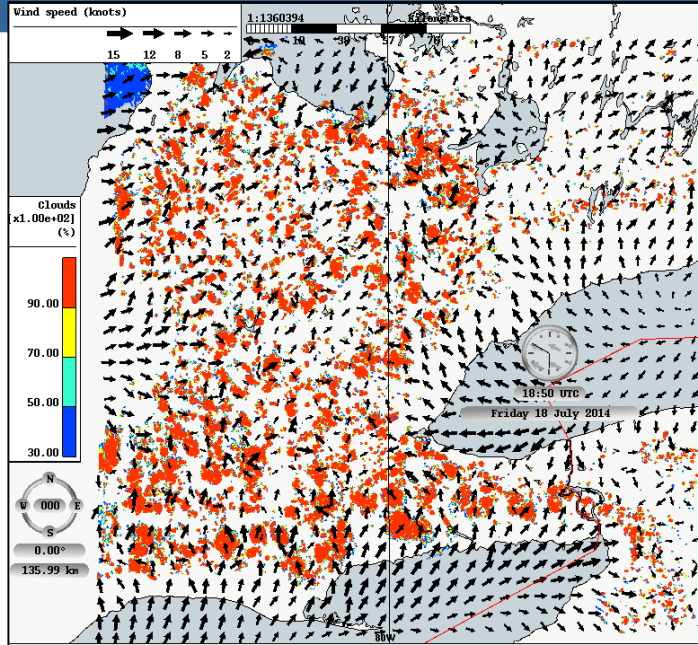
Interacting lake breezes

(18 July 2014)



CLOUD COVER STRUCTURE

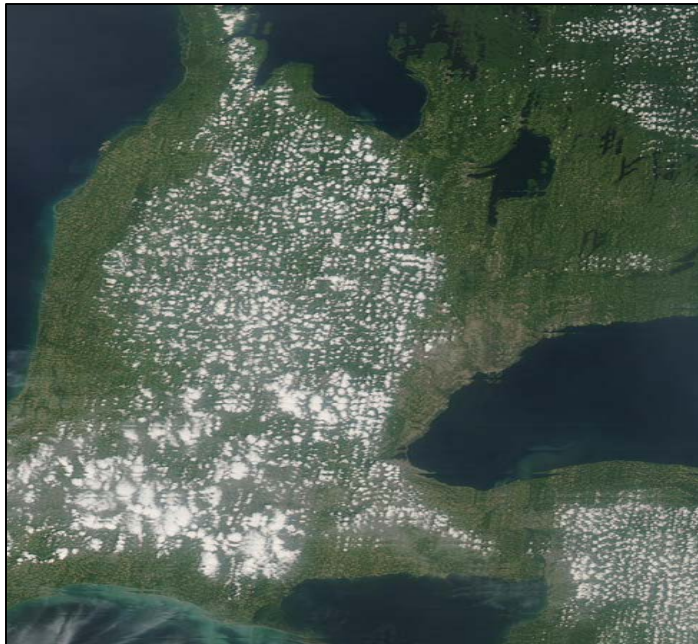
250 m



1 km

MODIS

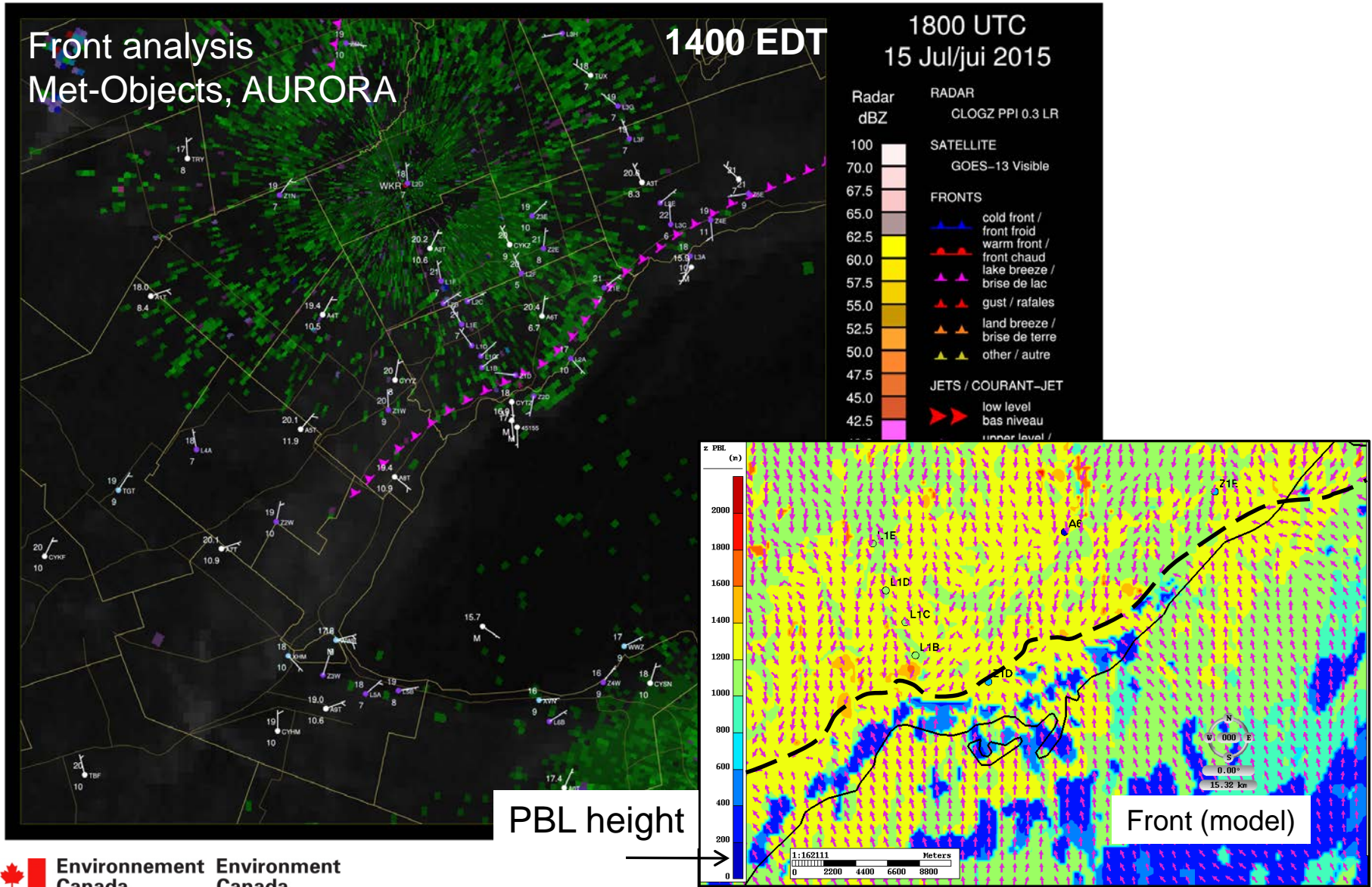
Aqua
250 m



Lake Breeze
Fronts From
MET-Objects
analyses
(19:00 UTC)

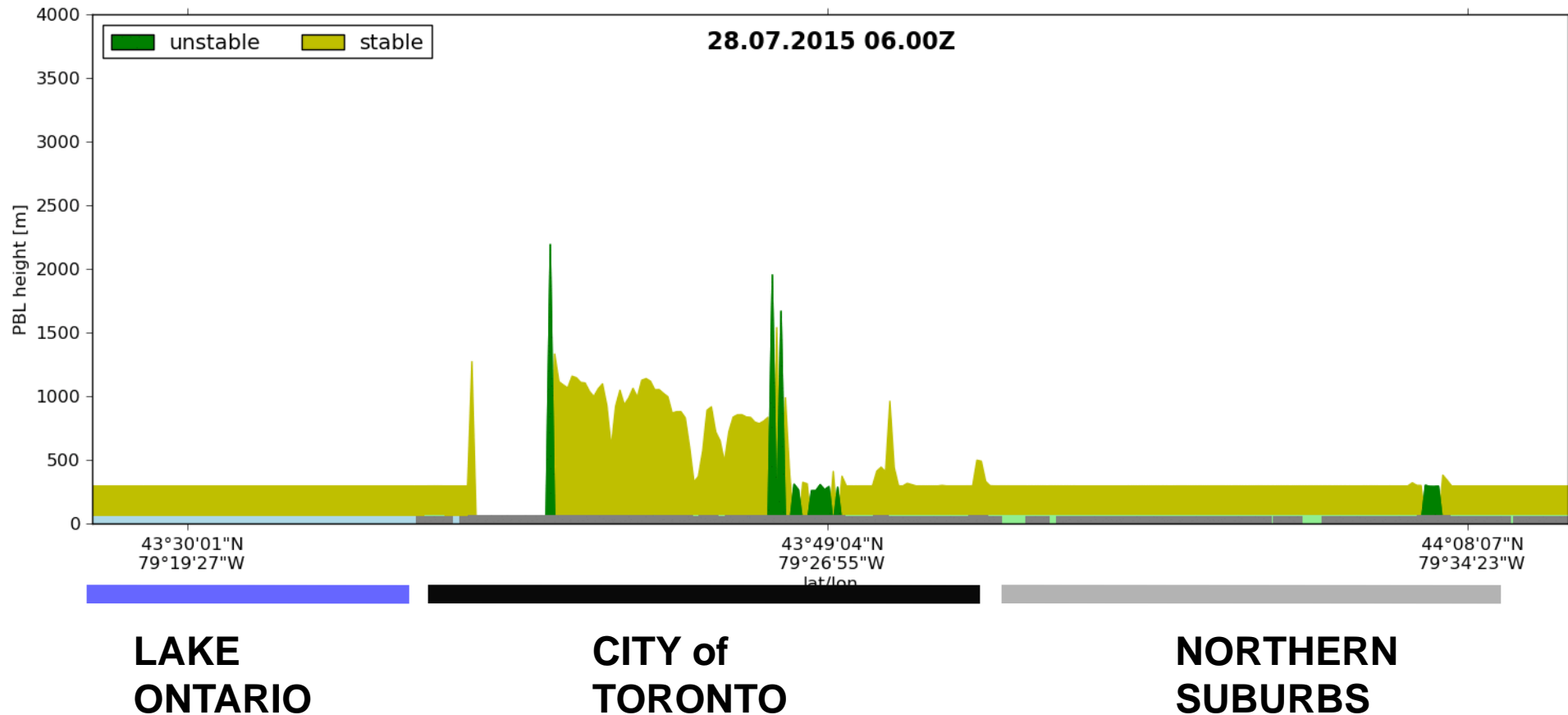
AURORA
Sills et al
2011

LAKE FRONT ANALYSES



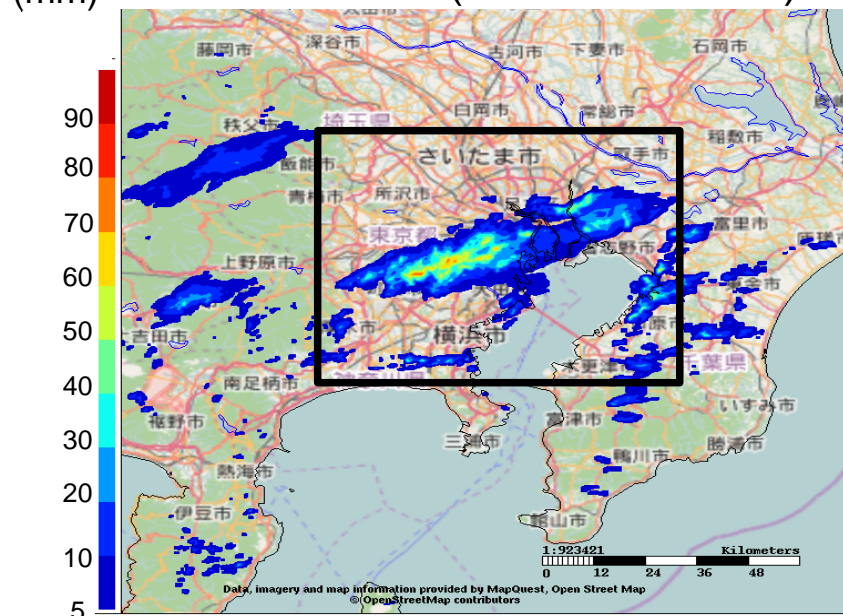
TIME EVOLUTION of PBL HEIGHT

STARTING on 0600 UTC 28 July 2015, ending 0600 UTC 29 July

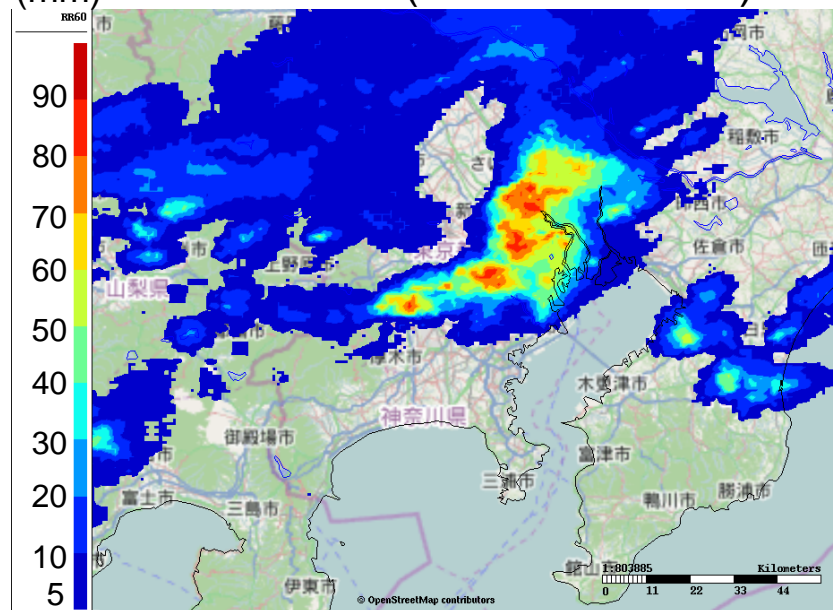


INTENSE PRECIP OVER TOKYO (TOMACS)

(mm) 0.25km: PR (07UTC-06UTC)



(mm) OBS: PR (07UTC-06UTC)



19-h integration

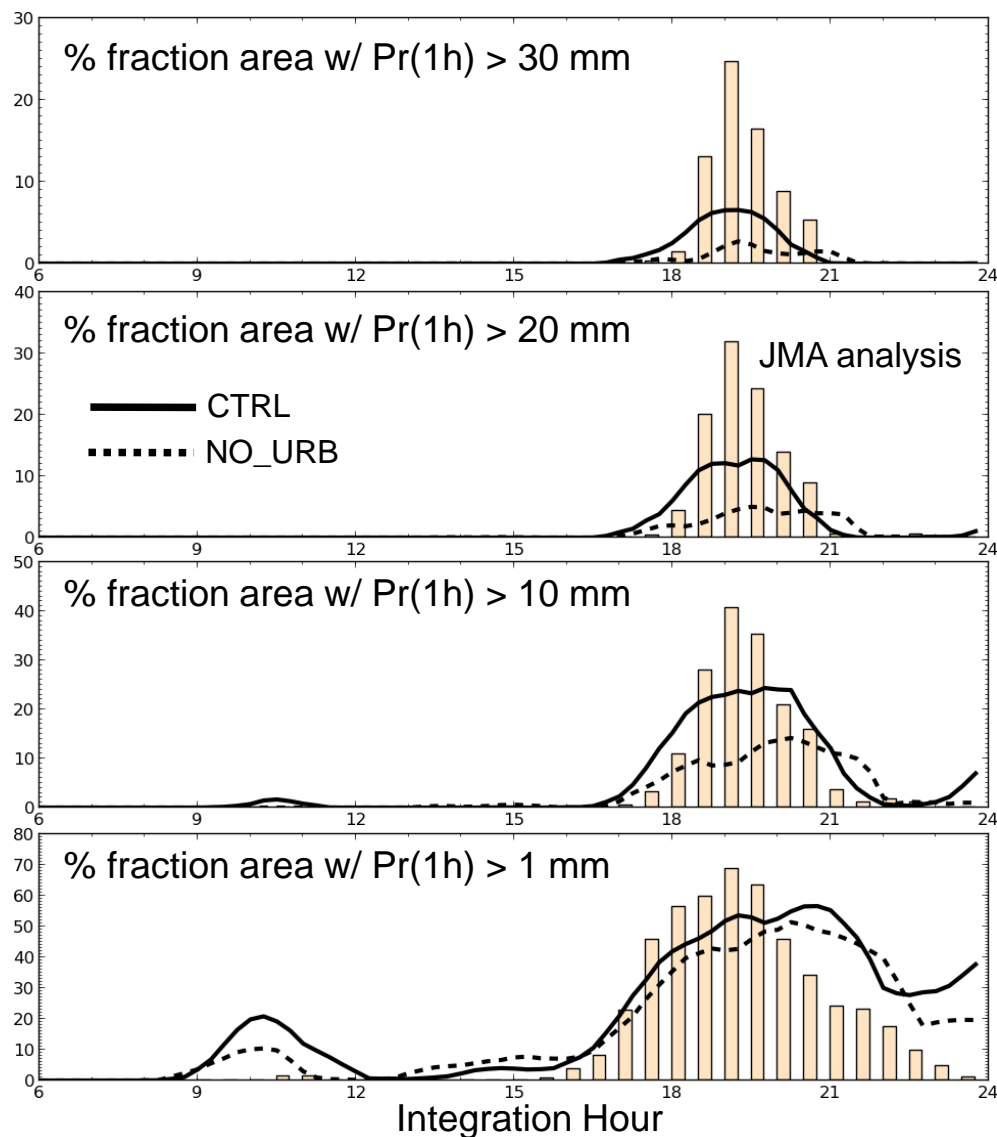
26 August 2011

TOMACS... A field campaign in the Tokyo metropolitan area with dense observation network was conducted by MRI, NIED and 12 research groups for the summers of 2011-2013.



TIME SERIES of PRECIP OVER TOKYO AREA

Percent fraction area covered by hourly precipitation greater than 1, 10, 20, 30, and 50 mm.

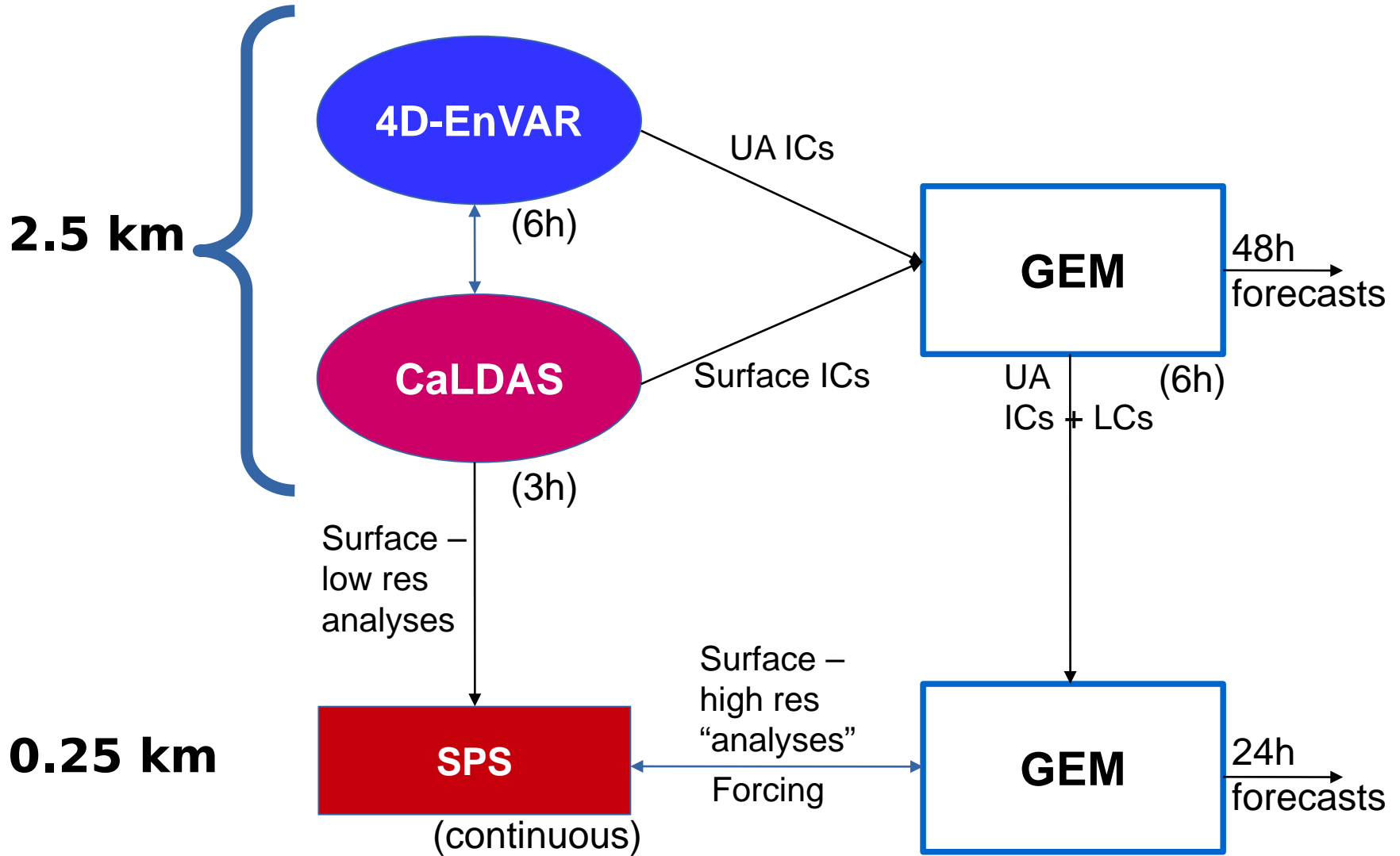


IMPLEMENTATION STRATEGY (GEM 0.25 km)

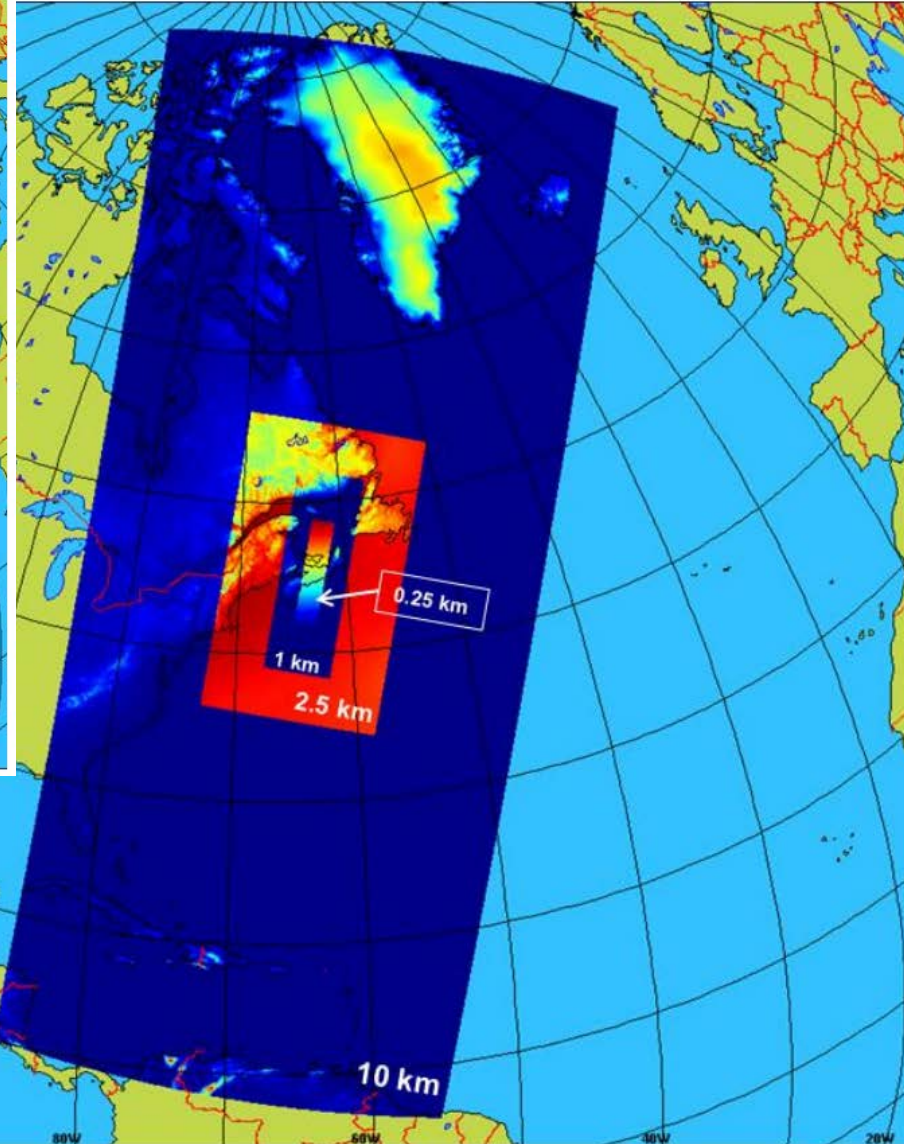
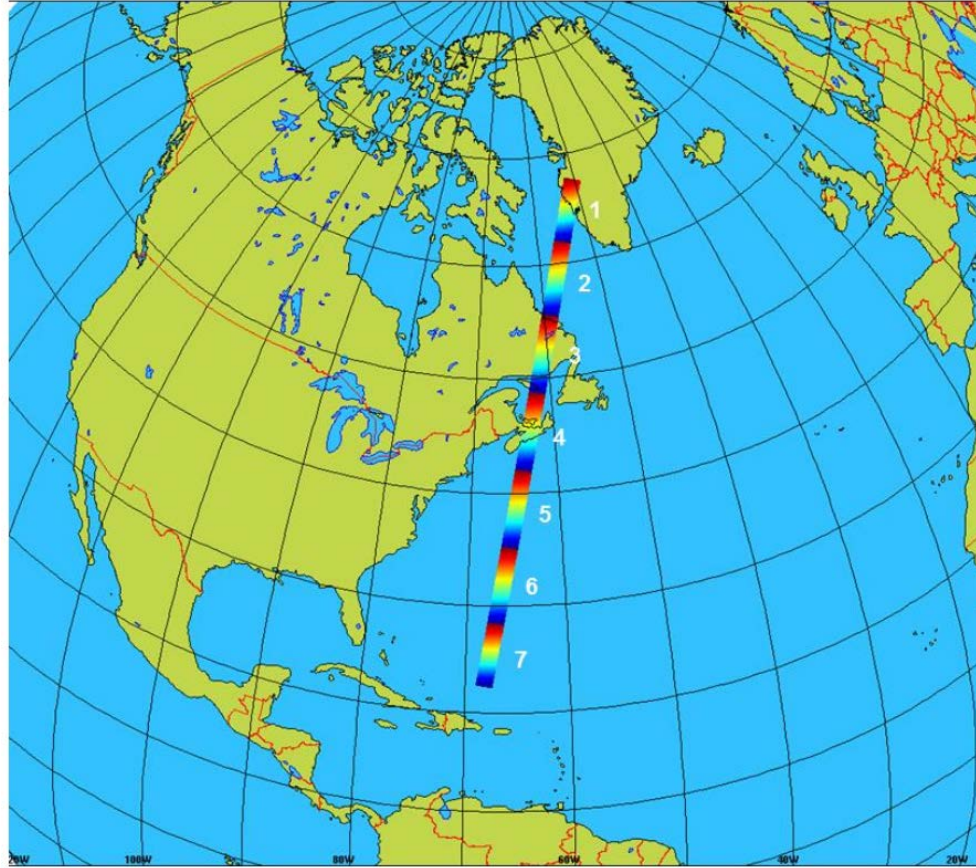
- A) *Over a few selected areas... cities like Montreal, Toronto, Vancouver are first choice, but some have other ideas (e.g., northern areas, mountains)*

- B) *Anywhere, anytime... based on requests and events*

IMPROVEMENTS DESIRED



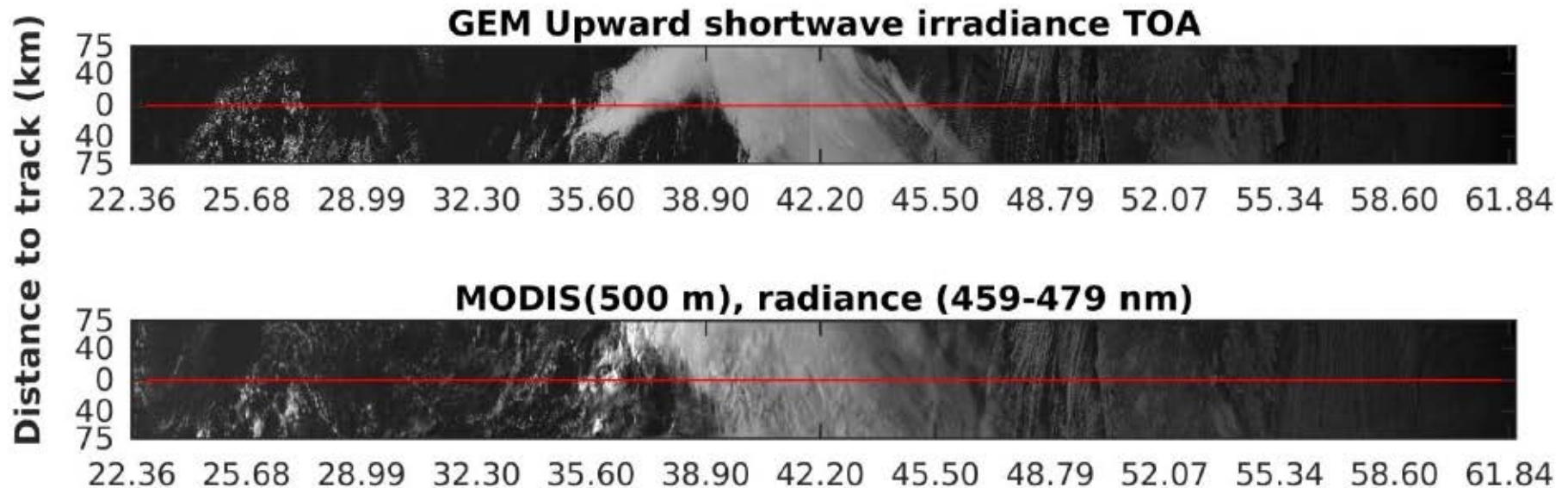
ALONG-TRACK GUIDANCE



(Courtesy of Zhipeng Qu
and Howard Barker,
ECCC)

COMPARISON with MODIS CLOUDS

39316D, 2014-12-07, 17:30 UTC, GEM



(Courtesy of Zhipeng Qu and Howard Barker, ECCO)

ECDC's high-resolution system not currently built for rapid refresh, with nowcasting applications

Emphasis is on quality after spin up (> 6h forecasts)

R&D for nowcasting + rapid refresh ongoing