Environnement Canada Environment Canada

Canada

High Resolution Atmospheric Data Assimilation and Modelling Aspects

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MEOPAR/CONCEPTS RELOCATABLE FORECAST PROJECT MEETING
Dalhousie University, Ocean Sciences Building, 1355 Oxford St., Room DOSB2-22
Nova Scotia, CAN
Friday, Nov 1st, 2013 (9h-16h)

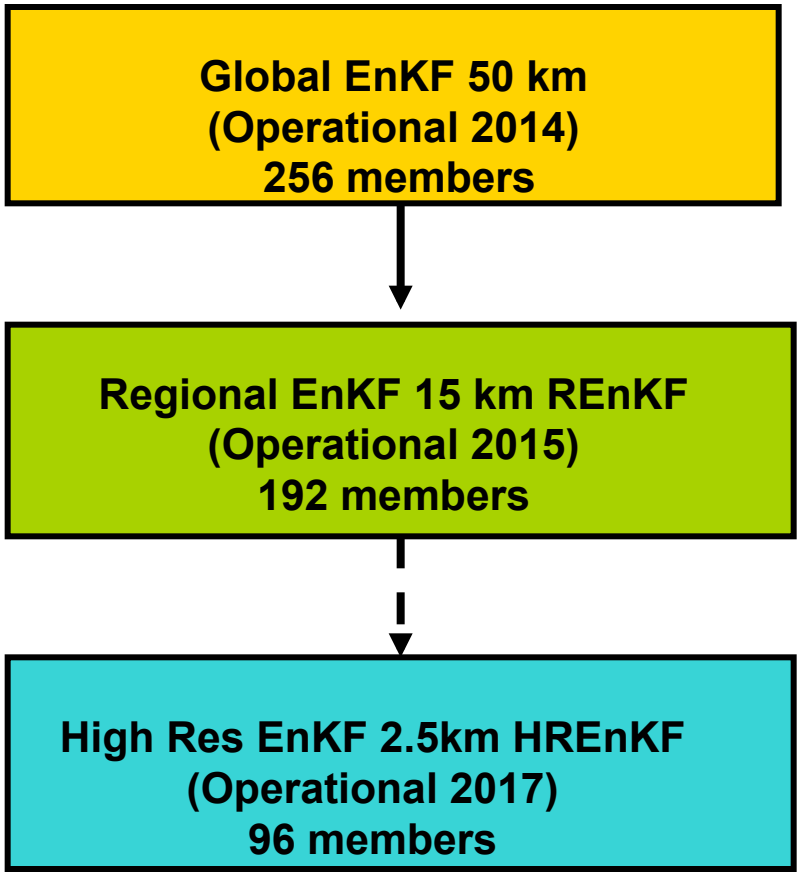
1 Meteorological Research Division, Data Assimilation and Satellite Meteorology Division (ARMA), Environment Canada, Dorval, QC, CAN.

Upcoming GEM and Data Assimilation Systems at EC

- **GEM global -> Yin-Yang at 15 km horizontal resolution globally.**
- **GEM Regional (Canada) at 2.5 km up to 36h.**
- **GEM Urban scale -> 250 m (HREnKF-2.5 km Pan Am)**

- **Starting 2015, EC Data Assimilation systems will rely fully on Ensemble Kalman Filters (ENKF) and Ensemble Variational Analysis (ENVAR) strictly.**

Flow chart for ensemble of IC/BC for MEOPAR HREnKF



To obtain ensemble members

Better mesoscale systems

MEOPAR project

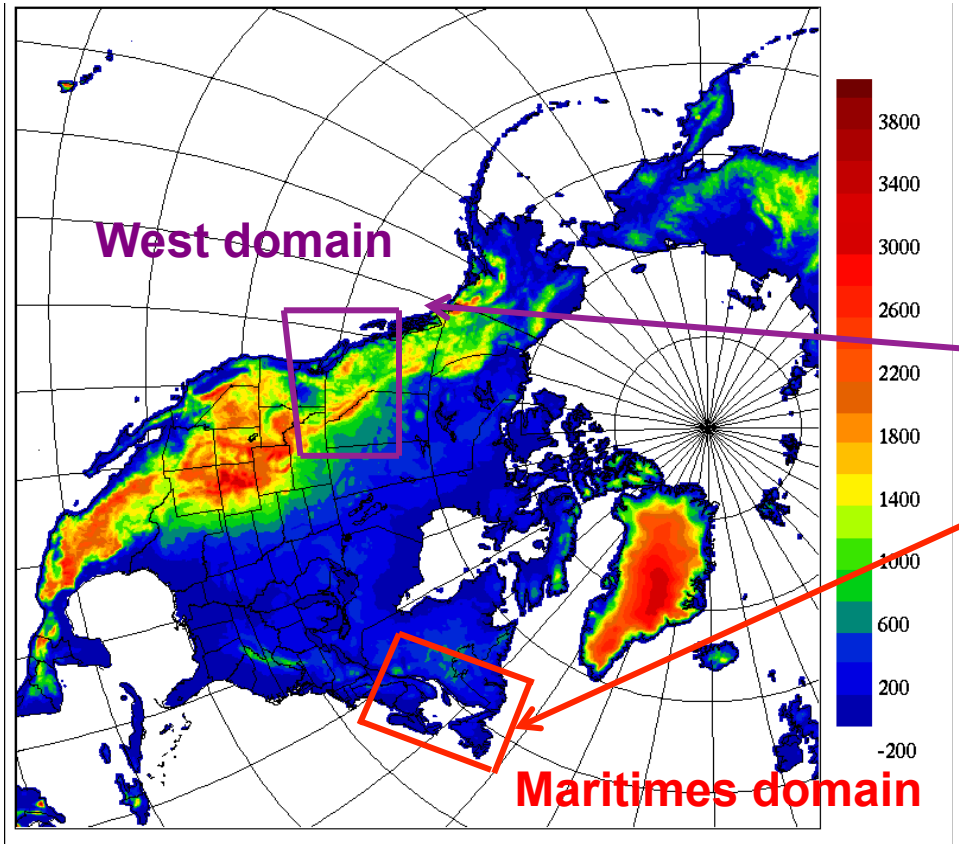
Current setup of HREnKF_2.5km

Maestro: 1.3.1-rc2
GEM_4.5.0-rc2
Conventional data assimilation

0000 1200 0000 0300 UTC

REnKF_15km 1-day cycling

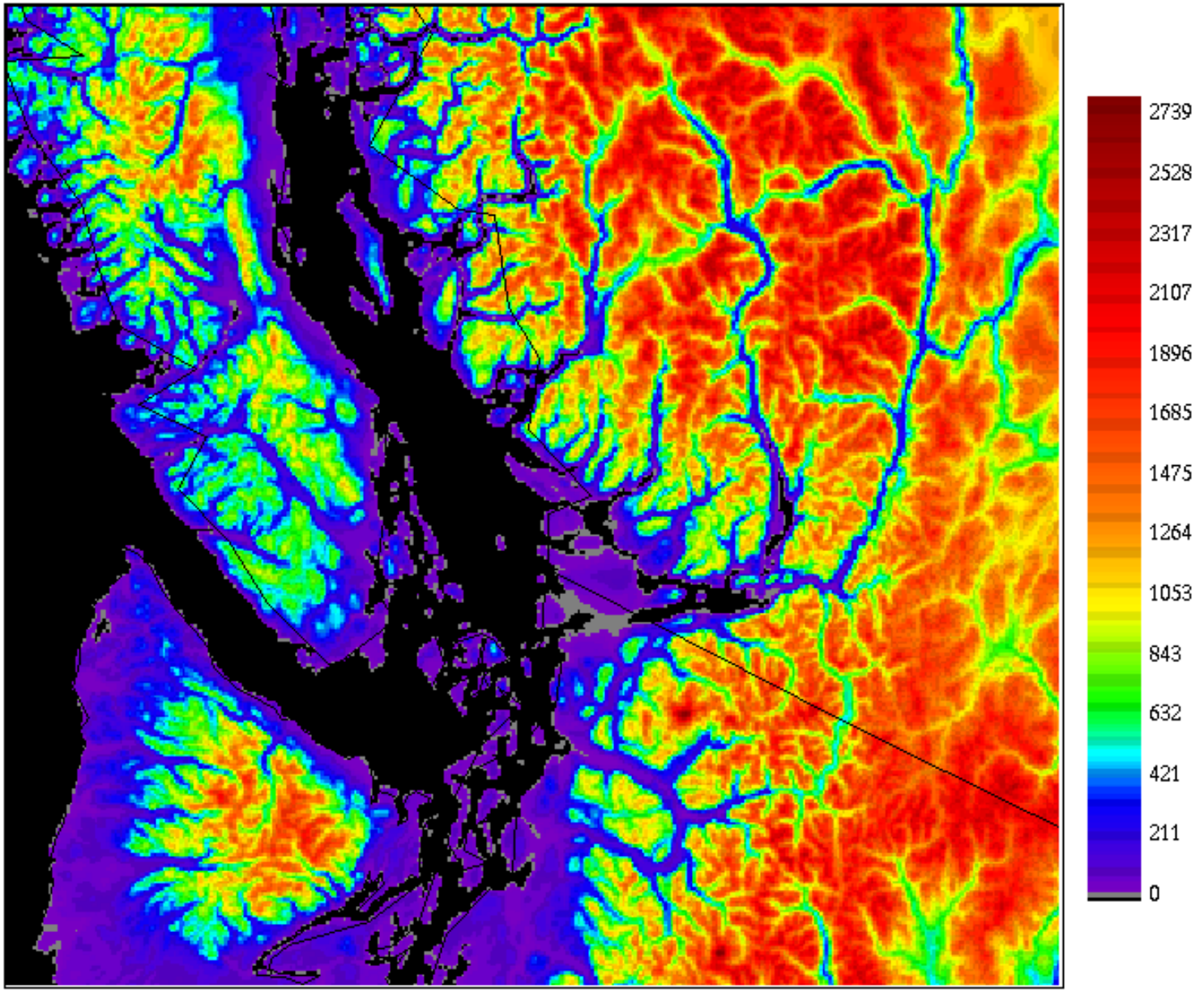
Hr_driver 12-hour
LBCs (15-min) 3df format



HREnKF_2.5km
(1-H cycling)

ME (Topography)

Level: 0 mb - Stamp: GENGEO - Interval: 0 * 1.0e+00 m

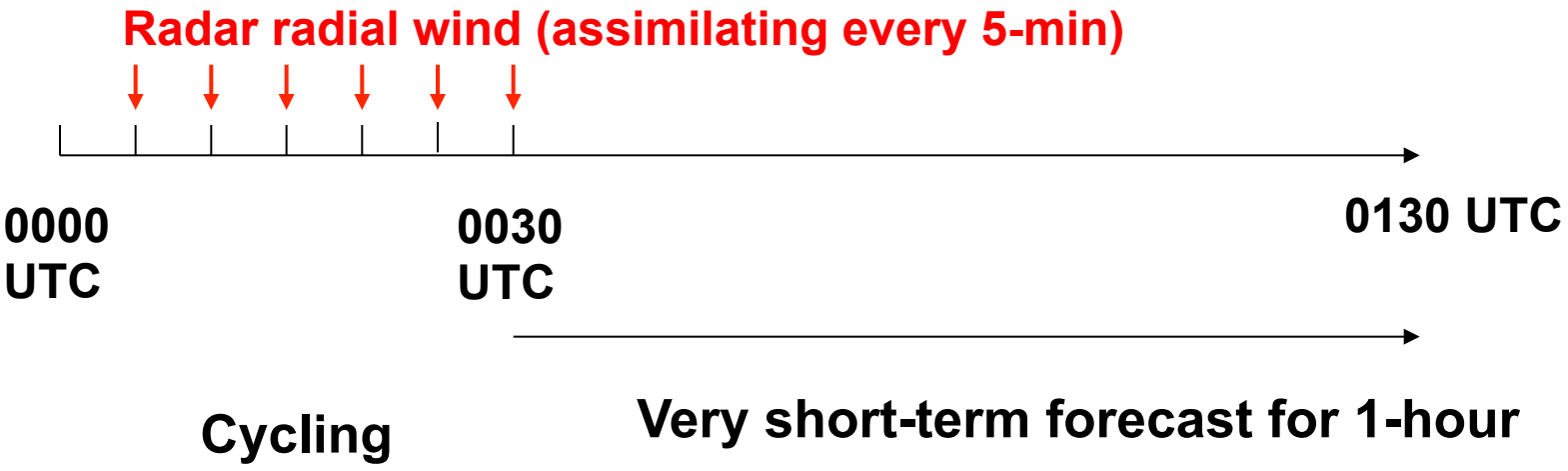


Climatological field valid 10:00Z October 10 1910

Radar Data Assimilation Cycling procedure

Control run: no radar data assimilation at all

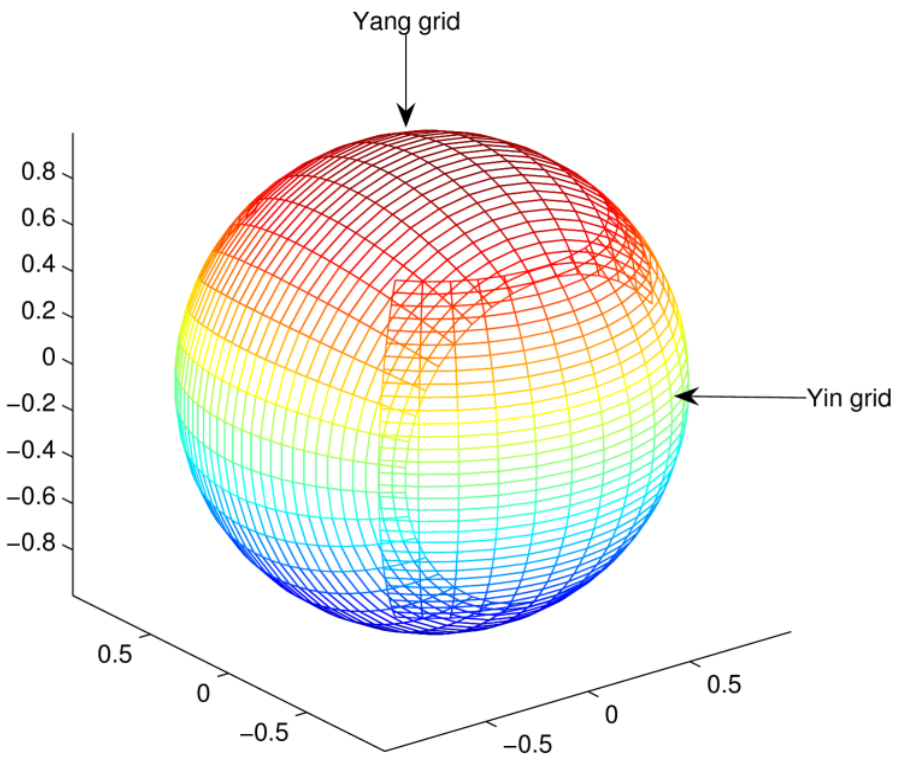
HR_EnKF: cycling for 30-min and launch the short-term forecast

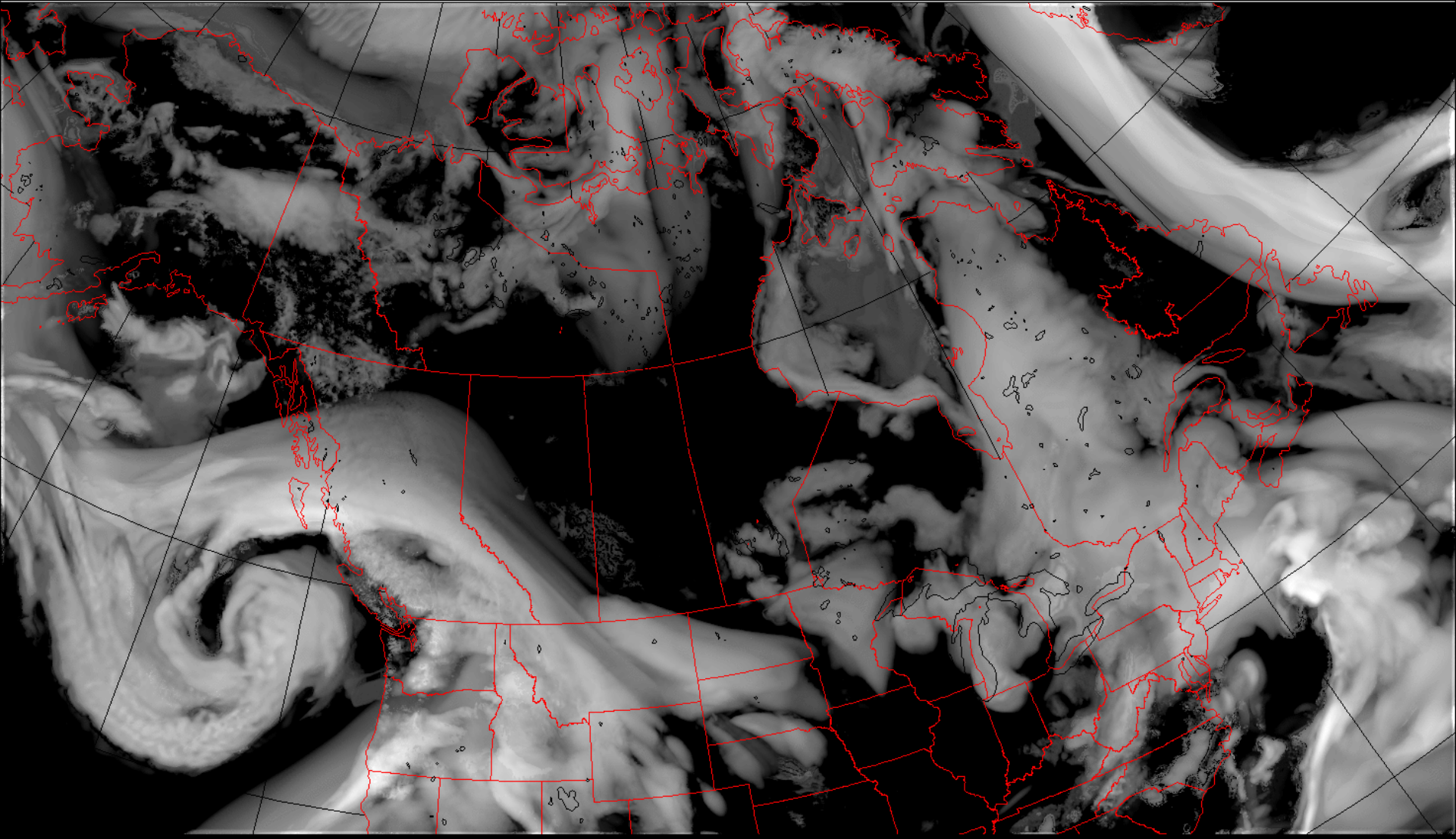


HRENKF-MEOPAR Most urgent steps before ocean coupling

1. Continue adapting Maestro suite (2013 …)
2. Introduce flexible time window into production of observation data files. (2013)
3. Bring Global EnKF and REnKF down to 3 h cycling (2014)
3. Harmonize REnKF/HREnKF for parallel one-way nesting
4. Port Radar data assimilation HREnKF code into the system (2014)
5. First HRENKF/MEOPAR application using conventional data not seen (i.e. flagged) in REnKF/GEnKF systems (2014).

Upcoming EC Global Forecasting system: Yin-Yang LAM-15 km Models (Abdessamad Qaddouri et al. RPN/EC)

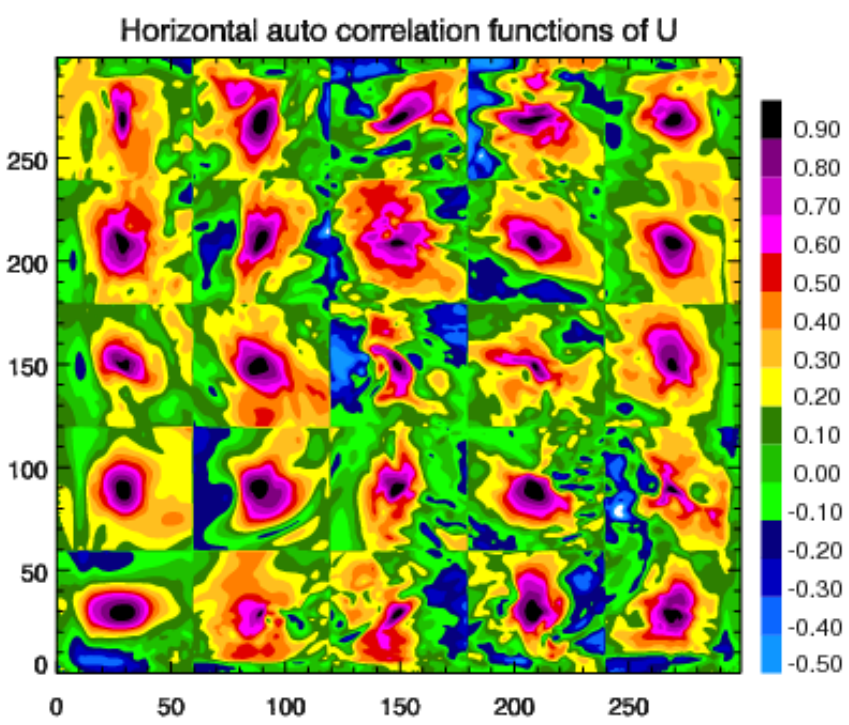


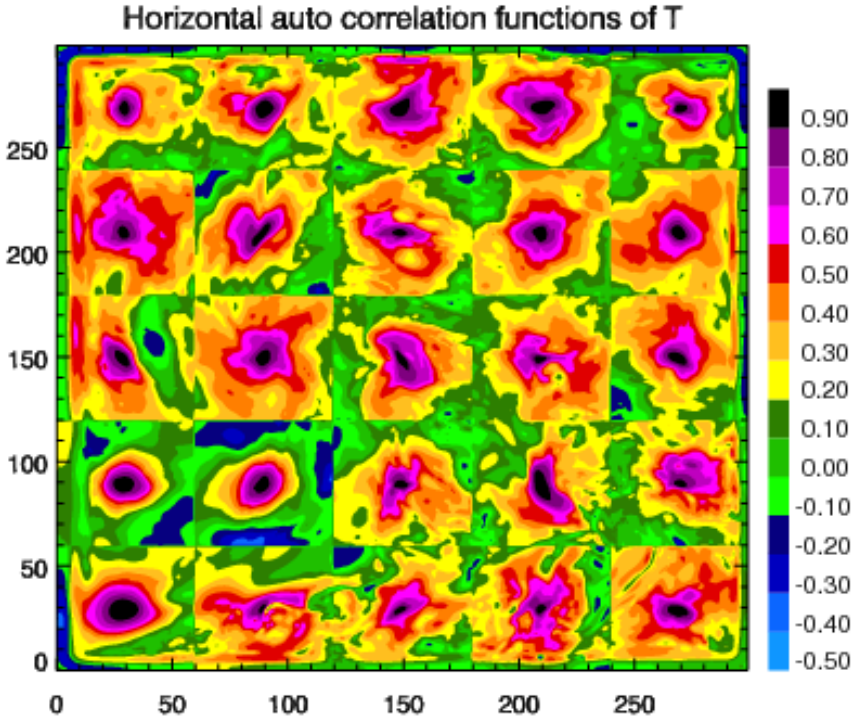


GEM-NATIONAL

- 2500 x 1310 grid-points; 58 Vertical level; 10x32x8 = 2560 CPU
- National Data Assimilation Cycle (driven by External DA System)

Error correlation of 15-min GEM-1 km Forecast at 800 hPa

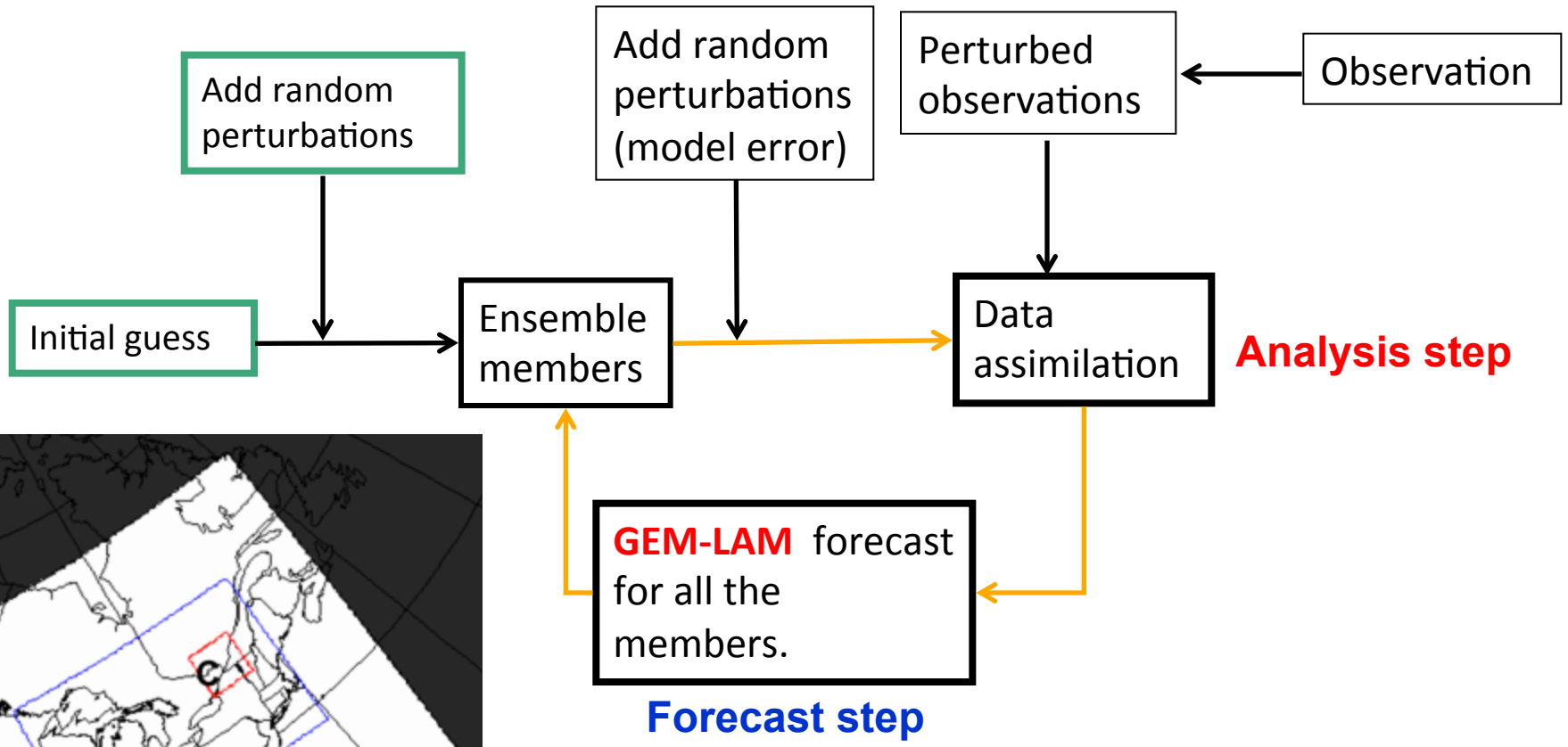


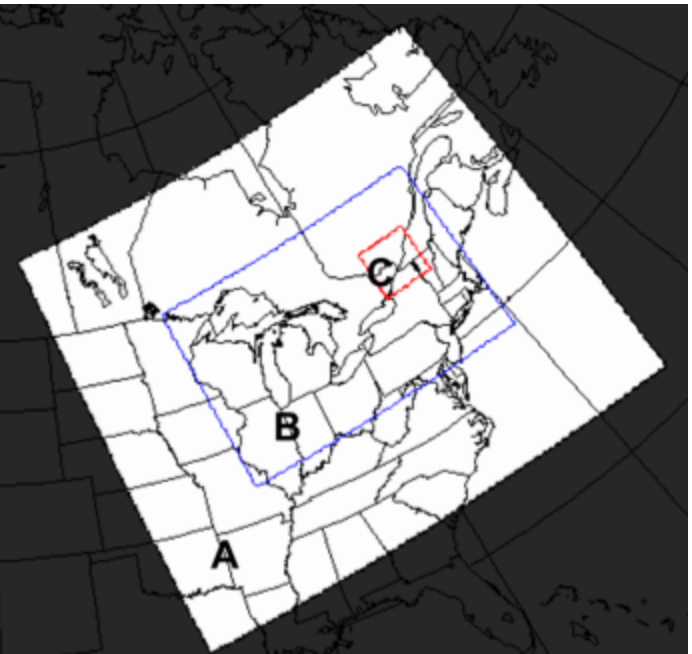


HRENKF

(in development at EC since 2010 by Luc Fillion, Kao-Shen Chung, Weiguang Chang, Frédéric Fabry, Monique Tanguay)

McGill



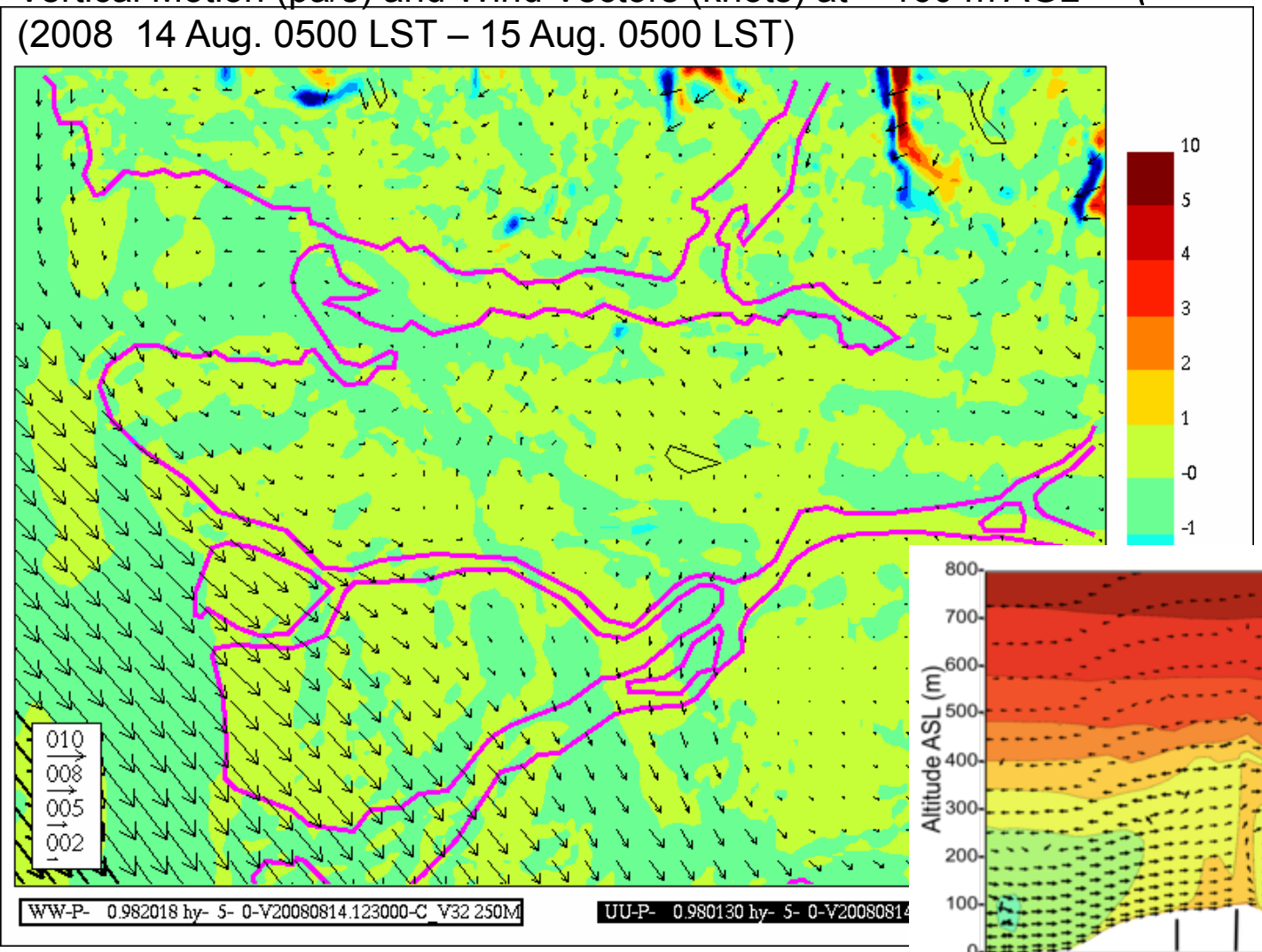


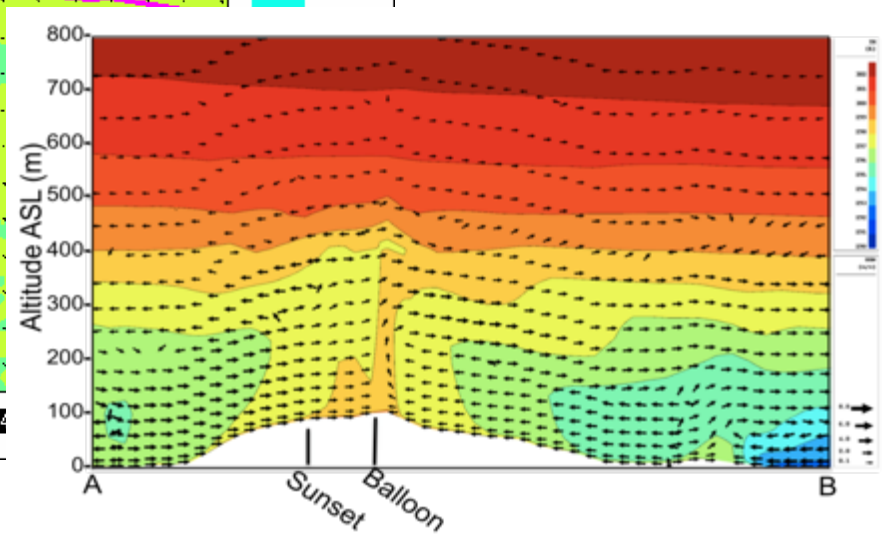
A: LAM15
B: LAM2p5
C: LAM1 300x300 (MTL region)

Vancouver, British Columbia, Canada (EPiCC)

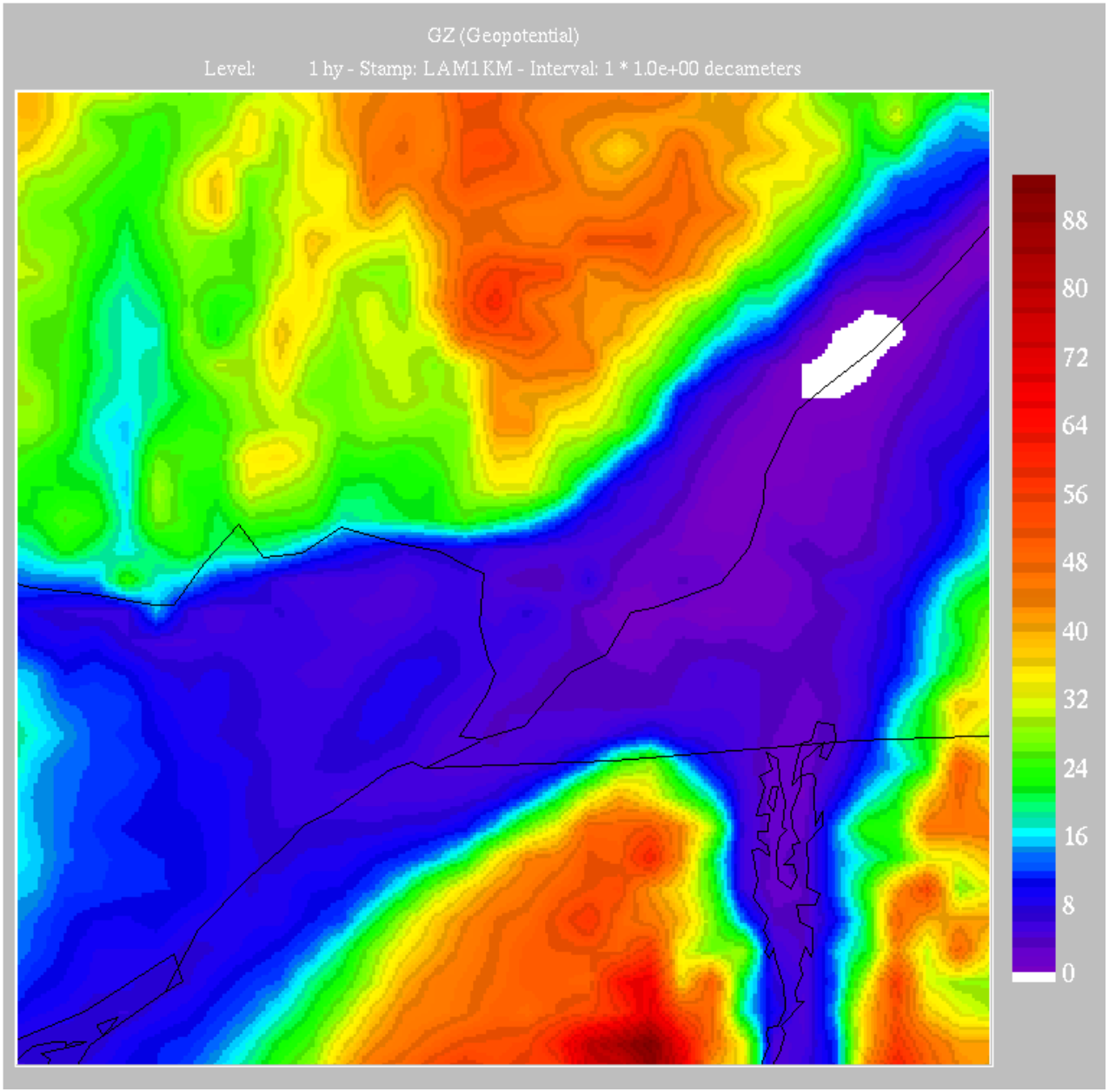
Leroyer et al. (2013):
250-m modeling of sea breezes over Vancouver (to be submitted)

Vertical Motion (pa/s) and Wind Vectors (knots) at ~ 160 m AGL
(2008 14 Aug. 0500 LST – 15 Aug. 0500 LST)

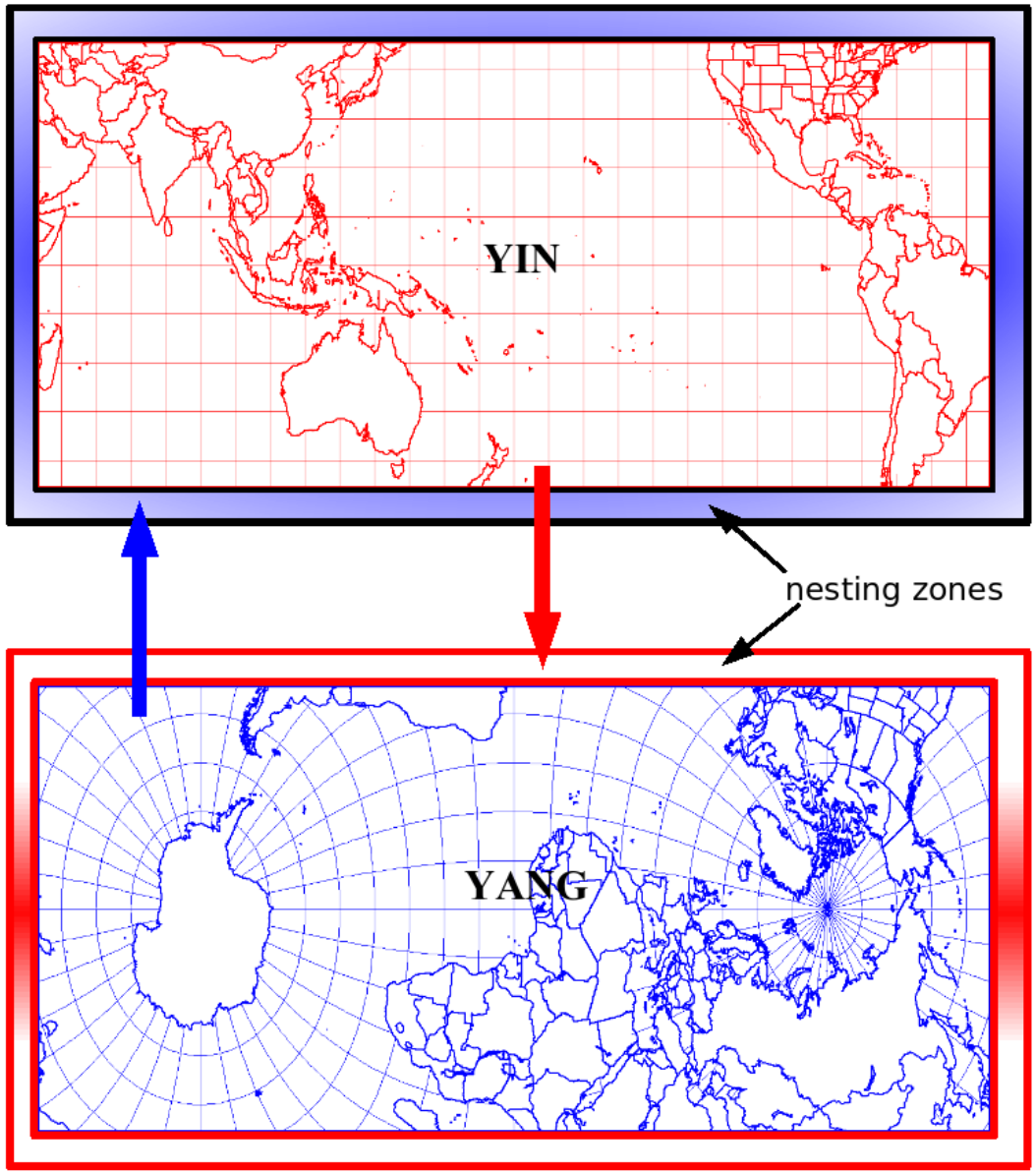




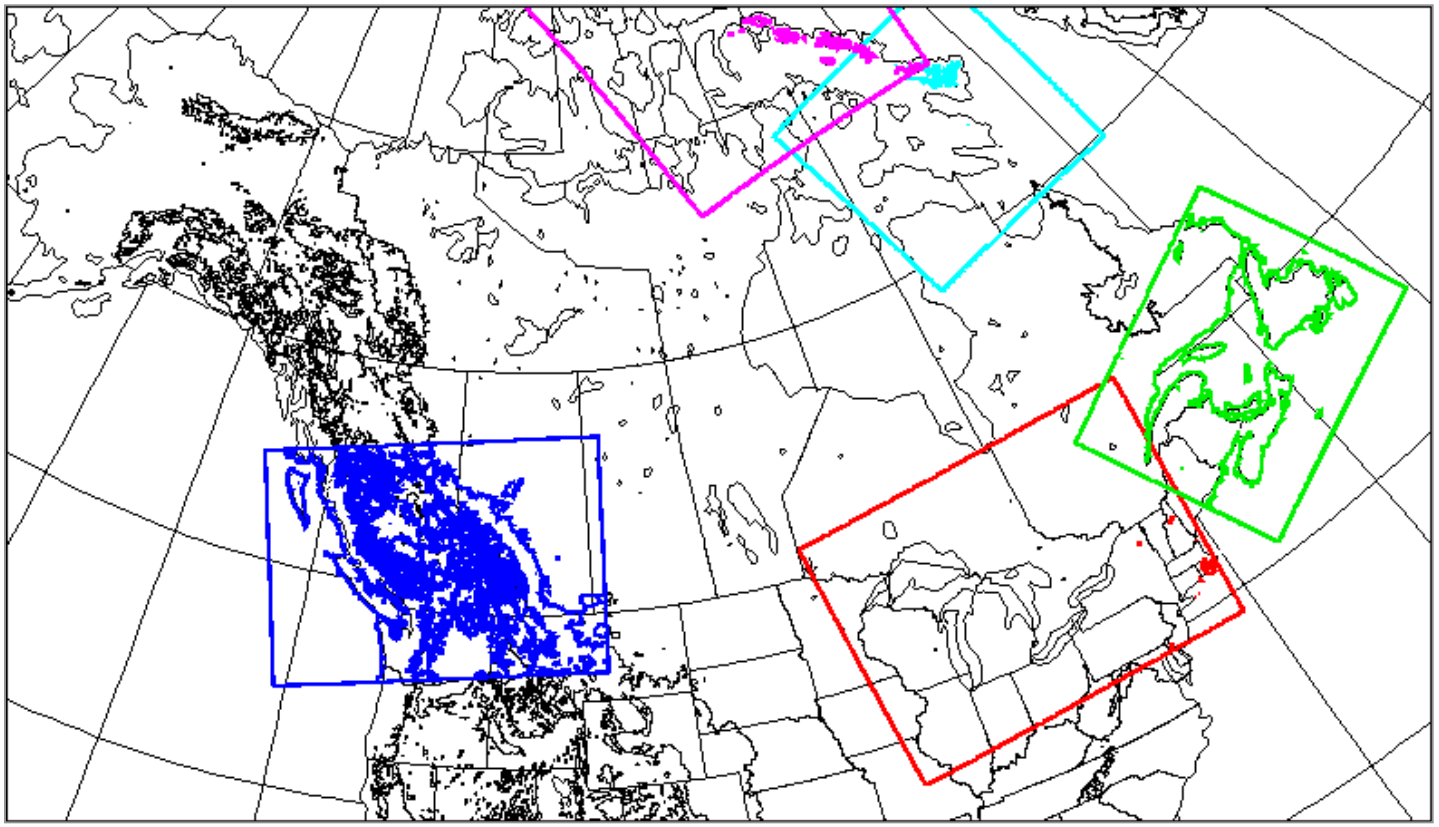
Topography of the Montreal region



Data Exchange between Yin and Yang subgrids



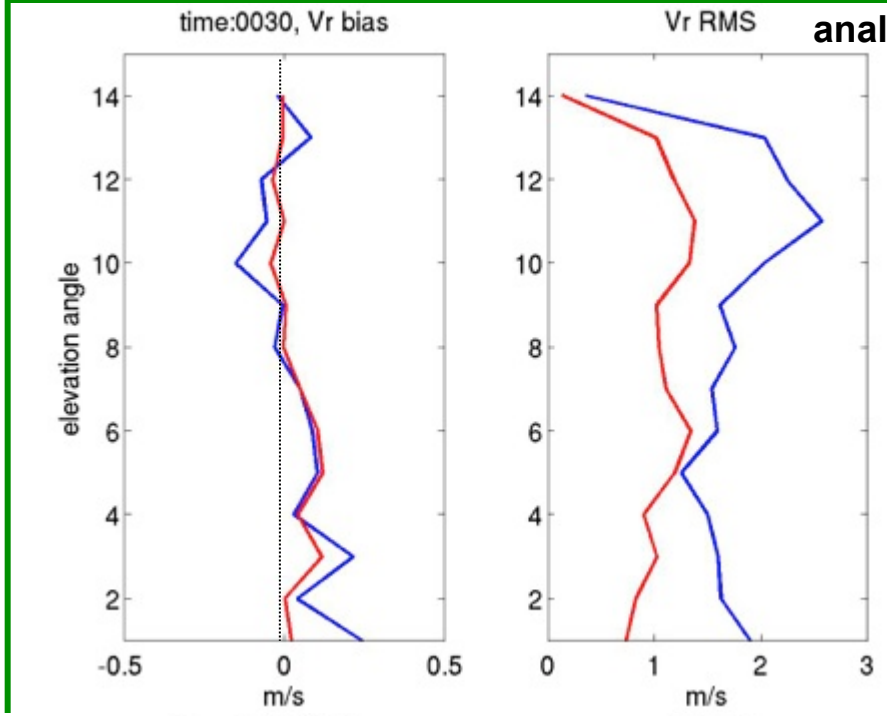
Operational GEM-2.5 Km Grids

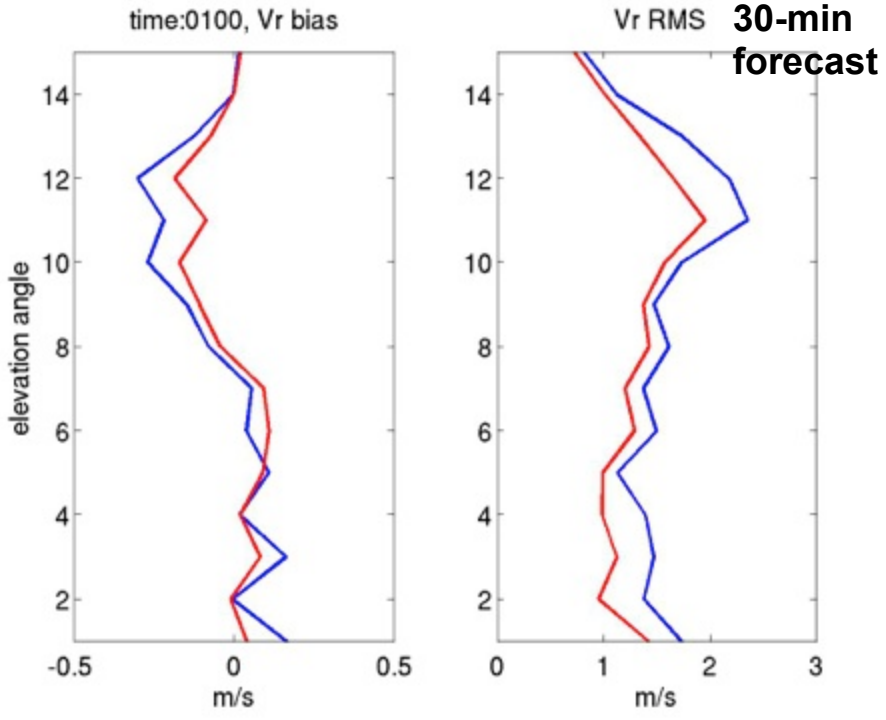


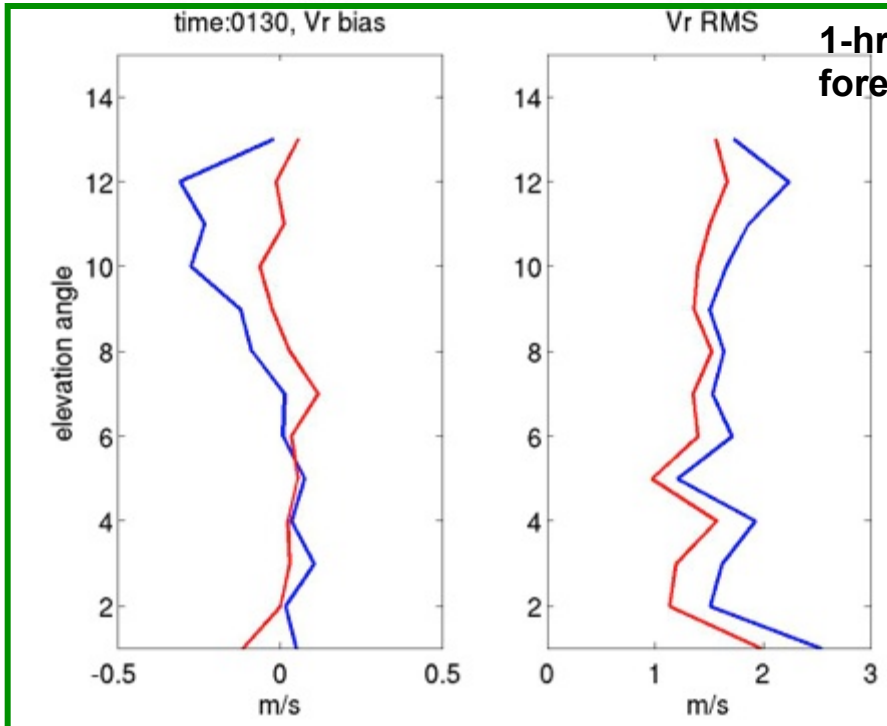
Average and RMS of (O-P) in observation space

Forecast after EnKF

Forecast without EnKF

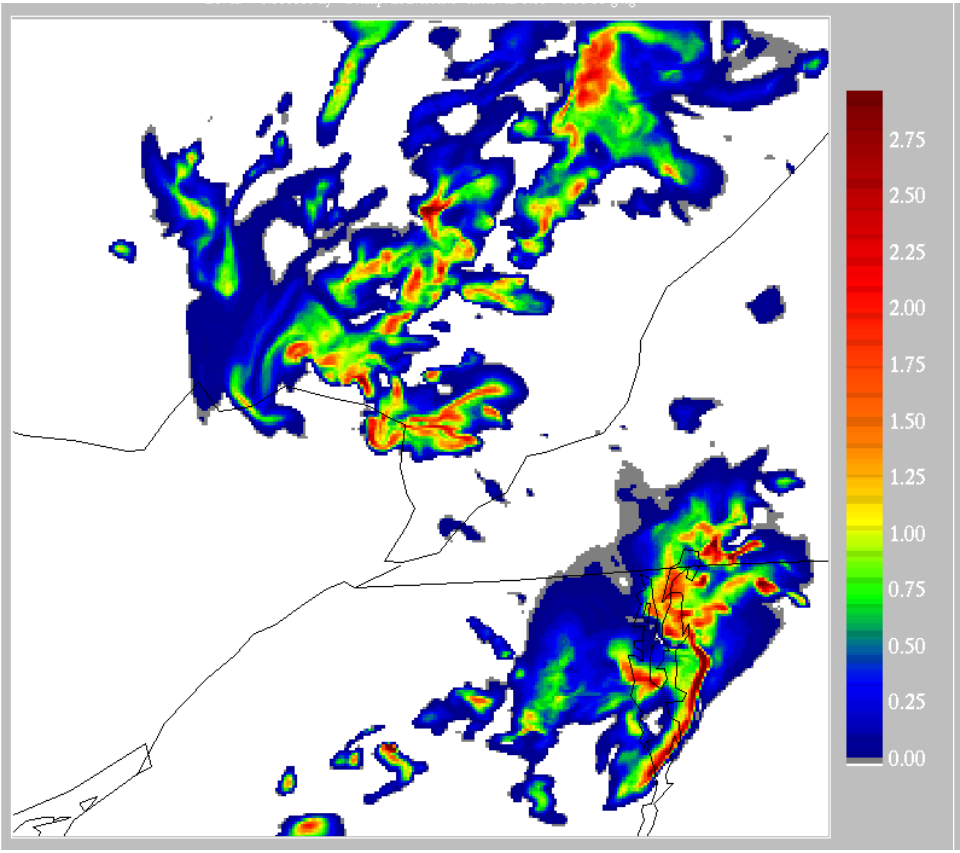




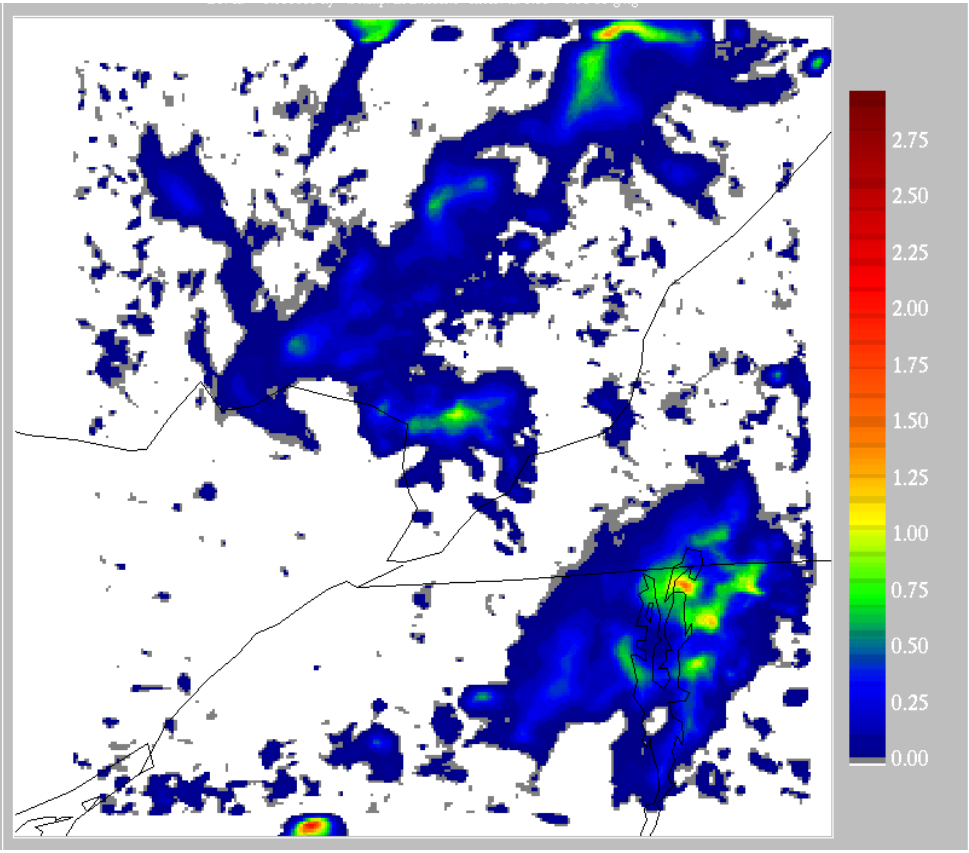


Analysis rain mixing ratio at 2-km height

Control run (no radar assimilation)



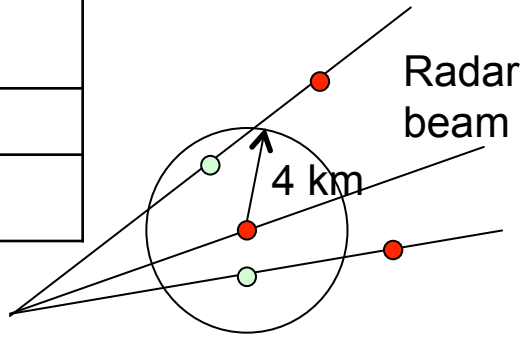
EnKF (6 cycles) mean analysis



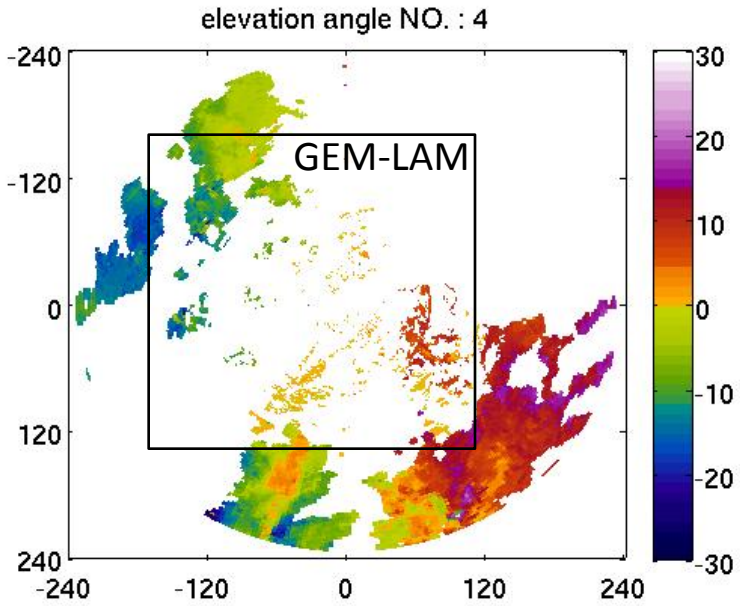
0030 UTC

HRENKF Radar Data Assimilation

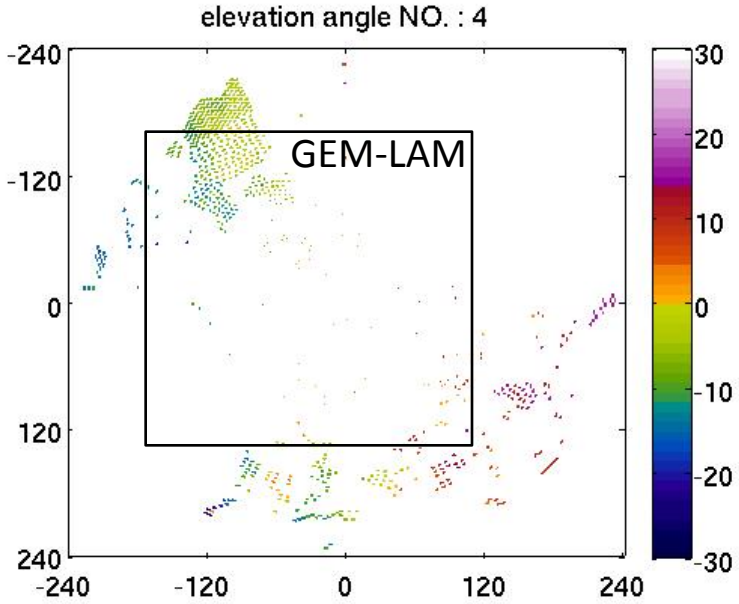
Radial wind (VR)	Total number of observations	Percentage
All data	~15000	100%
4 km Data thinning	~5000	~30%



- **Doppler winds from McGill Radar**



Thinning



2010 July 22, 0000 UTC