



Le système expérimental GEM-LAM pour les Jeux Olympiques de Vancouver 2010

J. Mailhot et J. Milbrandt

B. Denis, A. Erfani, A. Giguère, N. McLennan et R. McTaggart-Cowan

Séminaire CMC/RPN - 7 Janvier 2009



Government of Canada

Gouvernement du Canada

Canada



EC activities related to VO2010

Additions to current CMC operational products

- High resolution modeling prototype for Vancouver 2010 (3 components):
 - REPS - Regional Ensemble Prediction System (led by M. Charron)
 - **Limited-area model cascade (15/2.5/1 km) – (led by J. Mailhot)**
 - High-resolution land surface modeling and assimilation system (100 m) – (led by S. Bélair)
- Enhanced monitoring system (OAN – Olympic Autostation Network, advanced monitoring sites including several types of profilers, C-band weather radar) – (led by C. Doyle)
- Nowcasting Research Demonstration Project – (led G. Isaac) – blend of observations and short-term NWP products





Development of VO2010 high-res prototype

- To better address major **challenges** of forecasting for Olympic venues:
 - local features (e.g. valley clouds forming fog at mid-mountain - Harvey's cloud in Whistler);
 - terrain-induced flows and strong wind events (gusty winds, visibility);
 - PCP amounts, phases (rain, freezing rain, snow, pellets), low cloud base, melting level;
- Tailored to fit **users' specific needs** and constraints:
 - thresholds for competitions;
 - forecasters briefing schedules:
 - morning briefing (7h00-8h00 local time) – same day forecasts;
 - late afternoon briefing (15h00-16h00 local time) – evening competitions;
- Availability for winter **2009 Practicum**:
 - forecasters training period on Olympic venues;
 - January to end of March 2009.



Forecasting challenges

- Some of the Olympic events have extremely sensitive thresholds for decision:

(Courtesy of C. Doyle)

Sport and Weather	New Snow (24 hours)	Wind	Visibility	Rain	Low Temp	High Temp	Wind Chill
Downhill, Slalom, Giant Slalom	> 30 cm	Constant above 17 m/s or gusts > 17 m/s	< 20 m on the entire course>	15mm in 6 hours or less			> -25
	> 15 cm and < 30 cm	Constant 11 m/s to 17 m/s <	20 m on portions of the course	Mixed precipitation			
	>5 cm >2 cm within 6h of an event	Gusts above 14 m/s but < 17 m/s>	>20m but <50m on whole or part of the course				



Government of Canada

Gouvernement du Canada

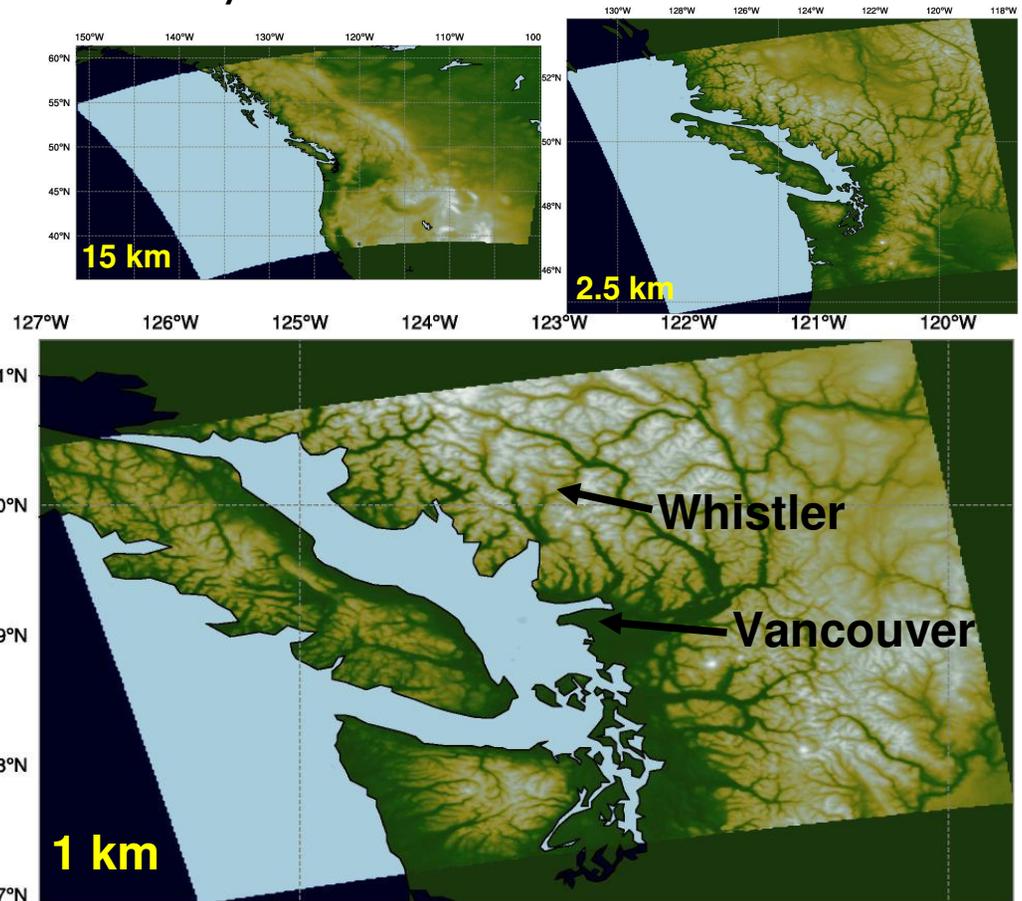
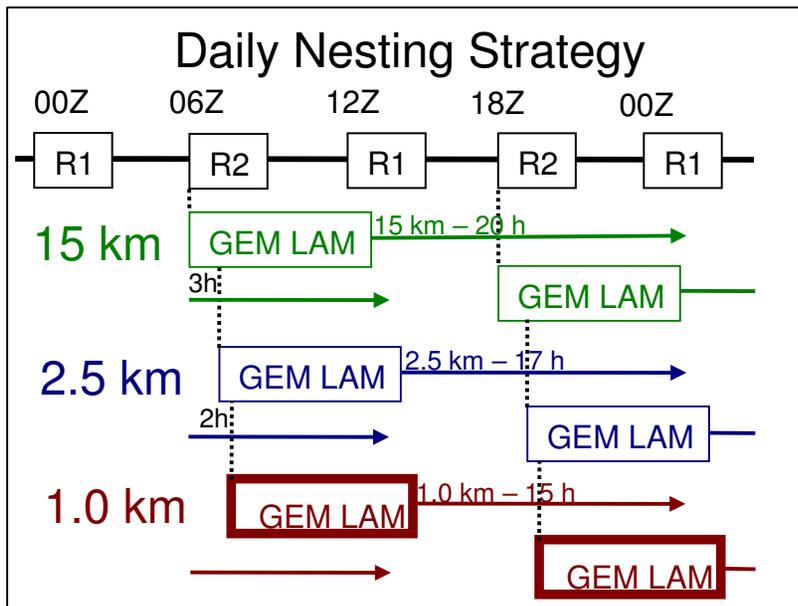
2010 Sports/Weather Threshold matrix;
 Red text = Critical Decision point
 Orange text = Significant decision point
 Green text = Factor to consider





Production of high-resolution forecast

- 3 self-nested LAM integrations twice daily from 0600 and 1800 UTC
- GEM Regional forecasts:
 - LAM-15km → 2.5km → 1km

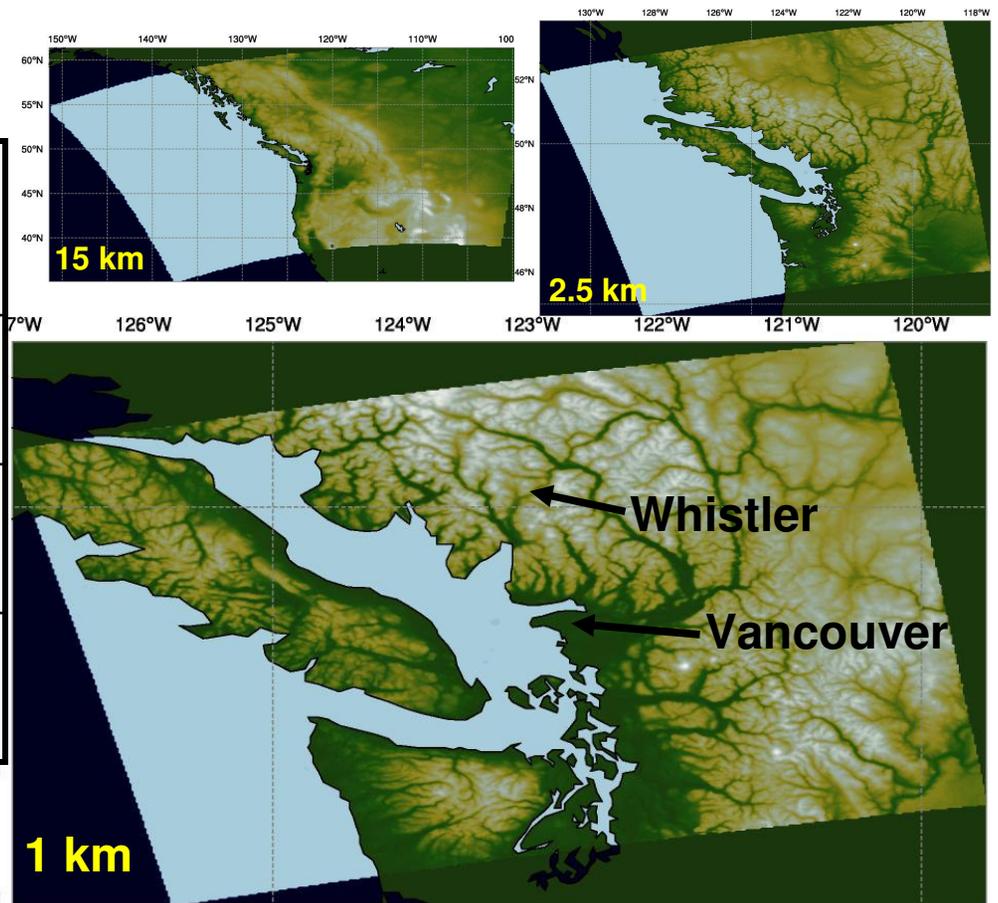




Production of high-resolution forecast

- Cascade runs done twice daily:
 - LAM-15km → 2.5km → 1km

LAM	run	# grid points	exec. CPUs	exec. time (min)
15 km	20h	261 x 260	128	3
2.5 km	17h	344 x 349	256	20
1 km	15h	456 x 379	320	35



- Cascade needs about 1h+ execution time:
- to be run by Operations for timely delivery to Practicum forecasters



New features and products

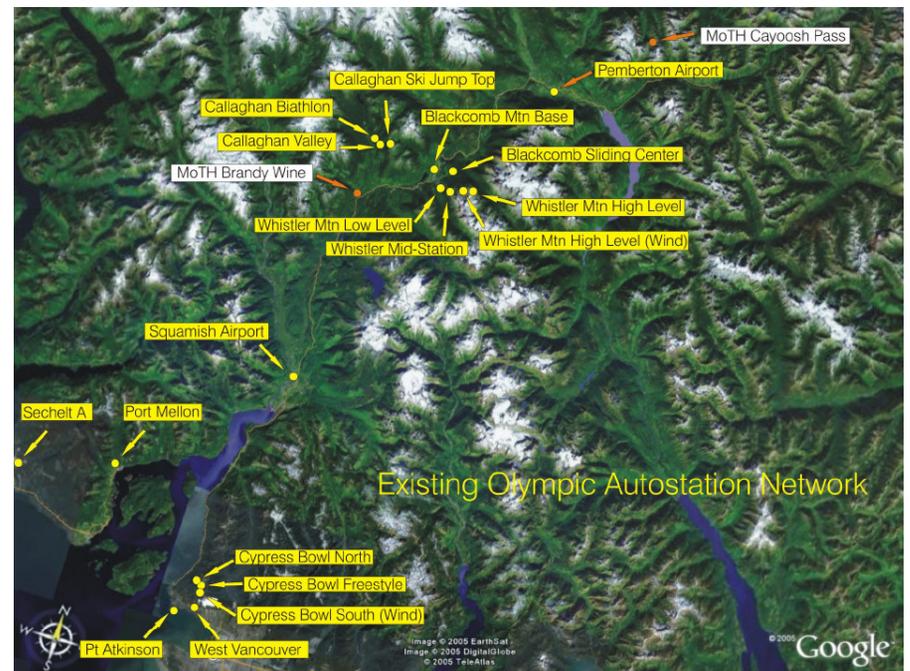
- New features: evaluation in 3 steps
 1. geophysical fields (orography, surface roughness,...) using GenPhysX and new database at 90-m res;
 2. CCCmarad radiation scheme;
 3. Milbrandt-Yau double-moment bulk microphysics (with a prognostic snow/liquid ratio for snow density);
 - first 2 steps presented and accepted by CPOP in December;
 - last step to be proposed at tomorrow's CPOP;
- New model diagnostic outputs:
 - visibility reduction due to hydrometeors (fog, rain, and snow);
 - cloud base, melting level, snow base;
 - solid-to-liquid ratio for snow density;
 - diagnostics of surface wind gusts and wind variance;
- Customized output package:
 - based on Olympic forecasters feedback (products, display format,...);
 - comprehensive list of 2D maps, time series at stations, vertical soundings and cross-sections;
 - easy display (jpeg images with MetViewer).





Verifications for VO2010

- Olympic Autostation Network (OAN) consists of:
 - about 40 standard and special surface observing sites (hourly or synop available on GTS);
 - (relatively) large number of surface stations,
 - concentrated in small region;
- verifications based on a set of 10 cases (winter 208);
 - representative of "bad" weather conditions for the area;
 - frontal passages, heavy snow, change of PCP phases, valley clouds, strong wind gusts,...



Contrôles: EQM et Biais

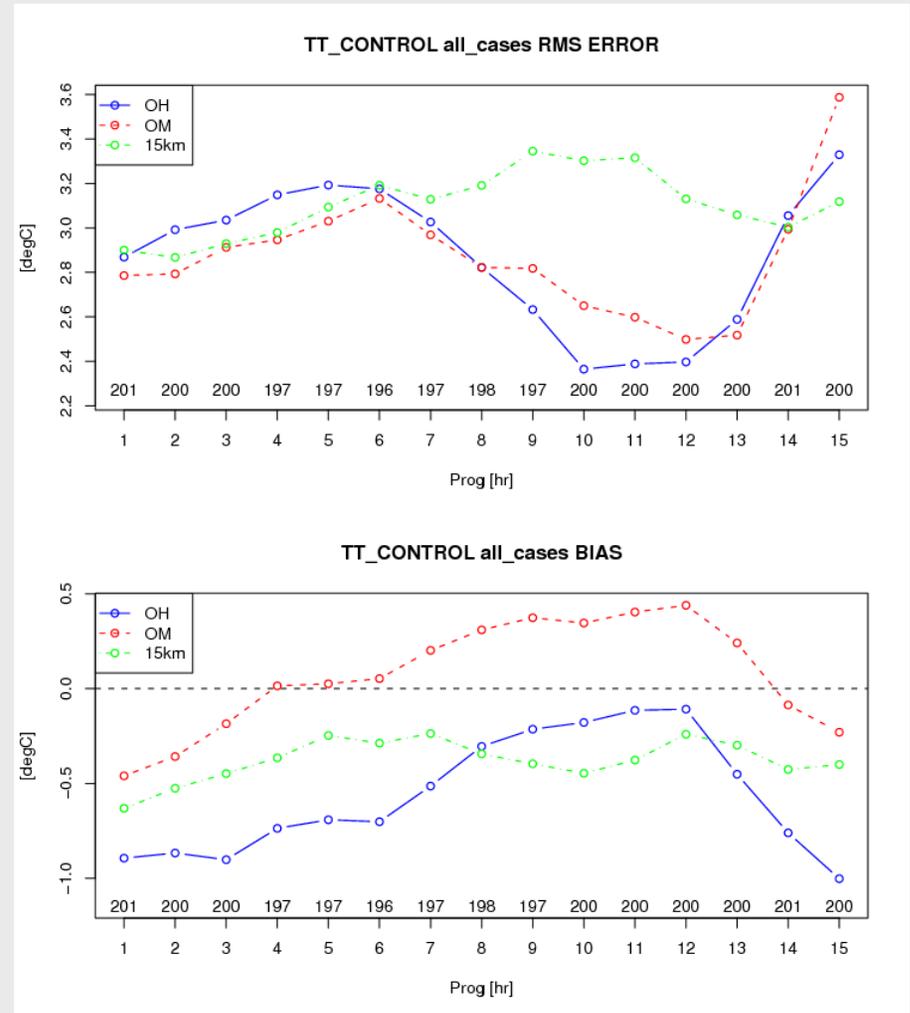
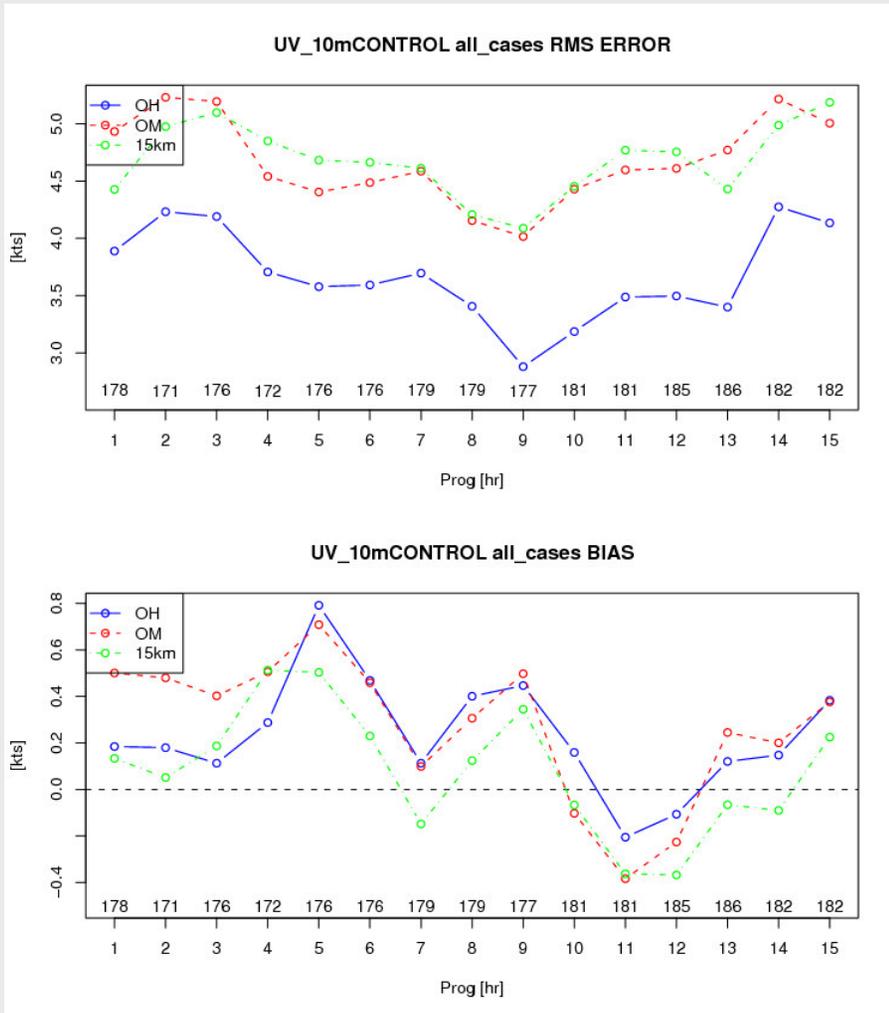
15km=GEM-REG

OM=LAM2.5km

OH=LAM1.0km

VENTS 10m

Températures 2m



CCCMARAD: EQM et Biais

15km=GEM-REG

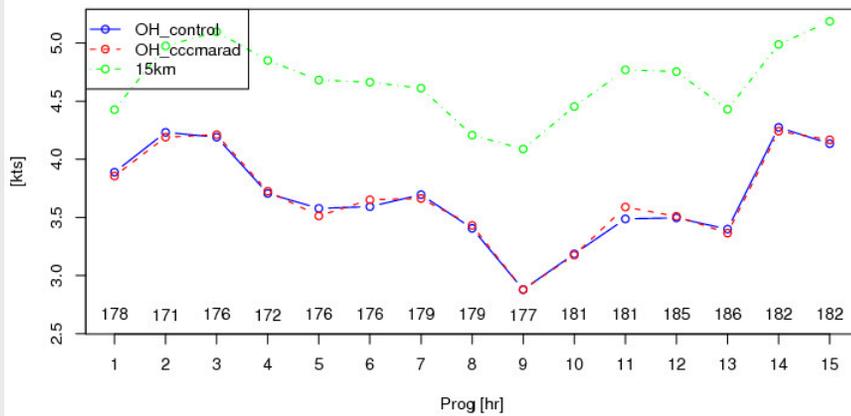
OH_CCCMARAD (LAM 1.0km)

OH_Control (LAM1.0km)

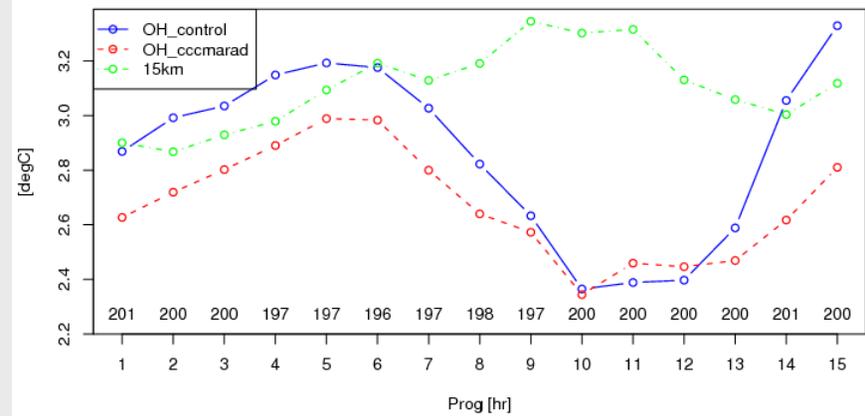
VENTS 10m

Températures 2m

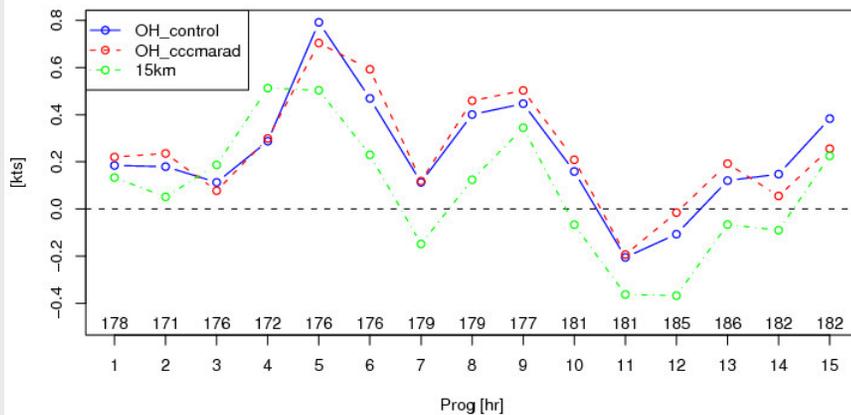
UV_10mCCCMARAD_OH all_cases RMS ERROR



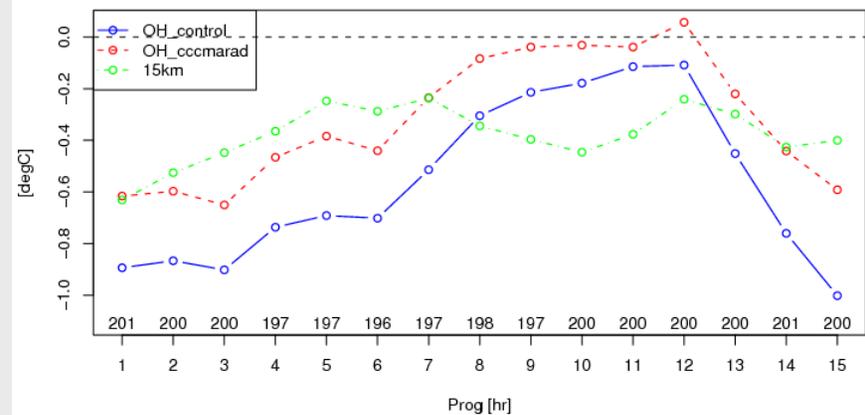
TT_CCCMARAD_OH all_cases RMS ERROR



UV_10mCCCMARAD_OH all_cases BIAS



TT_CCCMARAD_OH all_cases BIAS





Vancouver 2010 Olympics Prototype

Status of project

- First version of Olympic prototype has been running during winter 2008 Practicum (ran in personal user account – availability problems with model outputs);
- More final version now completed (improved physics, customized output package);
- Assessment and verification against VO2010 observation network is underway (+ subjective verification and feedback from Practicum forecasters);
- Need to run prototype in Operations for timely availability of products;
- Testbed for next upgrade of LAM-2.5 West (Fall 2009): then addition of LAM-1km cascade only;





Vancouver 2010 Olympics Prototype

Outlook

- Potential for experimental system:
 - more advanced schemes;
 - unique opportunity for final testing of prototype with the Practicum;
- Verifications:
 - small data set (problem common to all high-resolution models);
 - but no evident problems so far;
 - continuous verification (obj + subj) over 3-month period of the Practicum.

