Environnement Canada Environment Canada

Canada

EC's REPS Current Status and Plans

Martin Charron[1], Normand Gagnon[2], Ronald Frenette[3], and Amin Erfani[2]

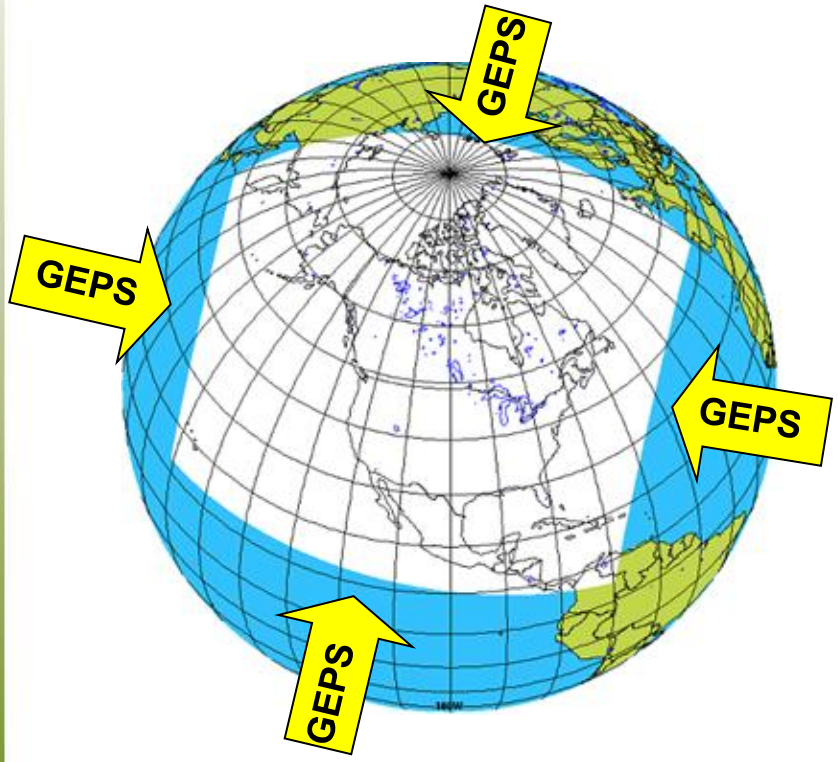
1-S&T, MRD/RPN-A

2-MSC, CMC/CMDN

3-MSC, Nat. Lab. Qc

Current Canadian Regional EPS (REPS)

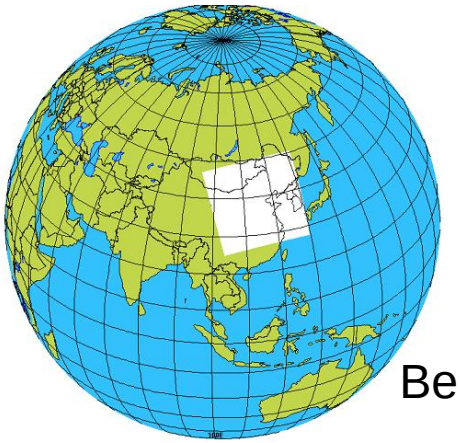
REPS at 33 km L28



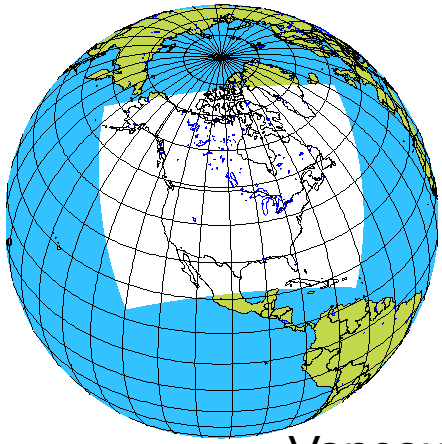
- Dynamical downscaling of the GEPS over North America at 33 km
- Operational since September 2011
- 72 hour forecasts twice daily (00Z and 12Z)

- Perturbations from :
  - Different initial conditions from the global EnKF
  - Different lateral boundary conditions from the GEPS
  - Stochastic perturbations of physical tendencies

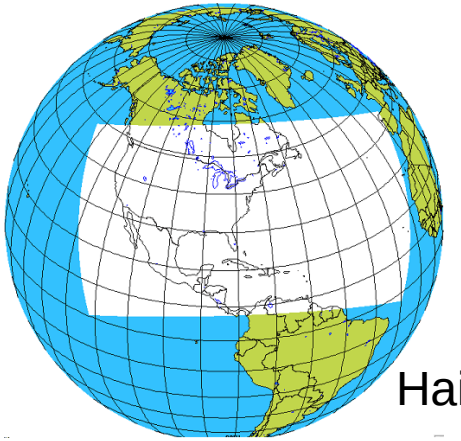
The different domains over the years



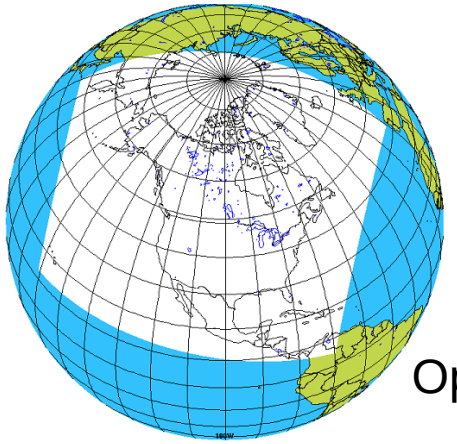
Beijing 2008



Vancouver 2010



Haiti 2010-11



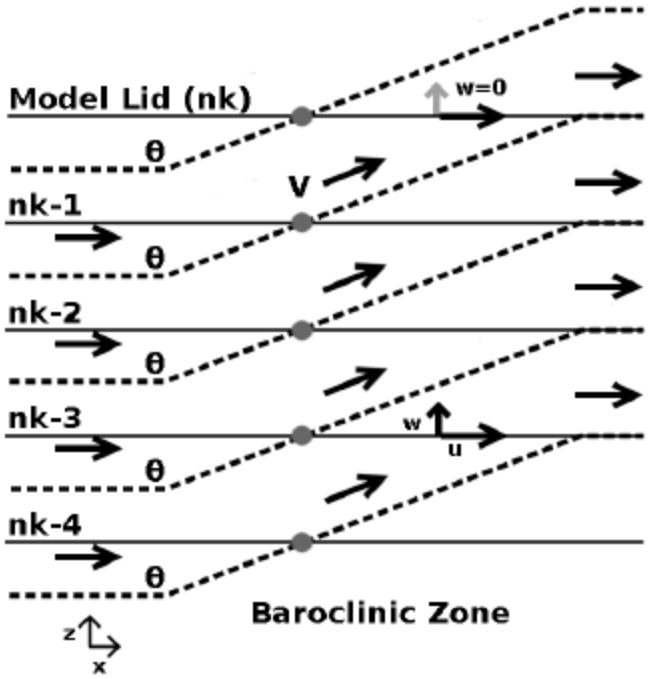
Oper.

System Description

- Based on GEM 4.2 (vertical staggering)
- Physics almost identical to deterministic global system. Differences are :
  - no sponge in REPS
  - no methane oxidation
  - no non-orographic gravity wave drag
- Resolution: 0.3° x 0.3° (280 x 287 x L28 grid points)
- Use lid nesting technique

System Description

- Idea behind the lid nesting approach



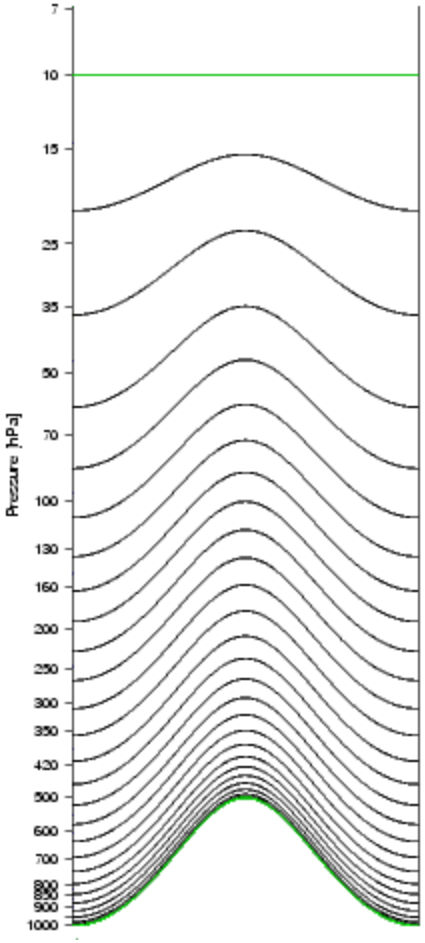
Schematic of air parcel (grey dots) movements across a baroclinic zone near the top of the model.

Courtesy of
Ron McTaggart-Cowan, RPN

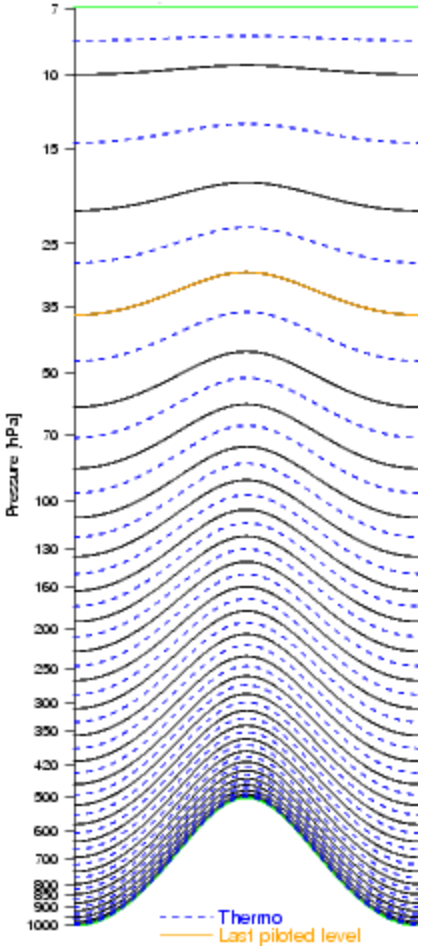
System description

- REPS model lid near 10 hPa
  - piloting between 10 and 35 hPa (3 levels)
  - blending between 35 and 100 hPa (3 levels)
- Piloted by the operational GEPS every 3 hours
  - GEPS has lid at 2 hPa

System Description



Previously used levels – GEM 3



Currently used levels – GEM 4

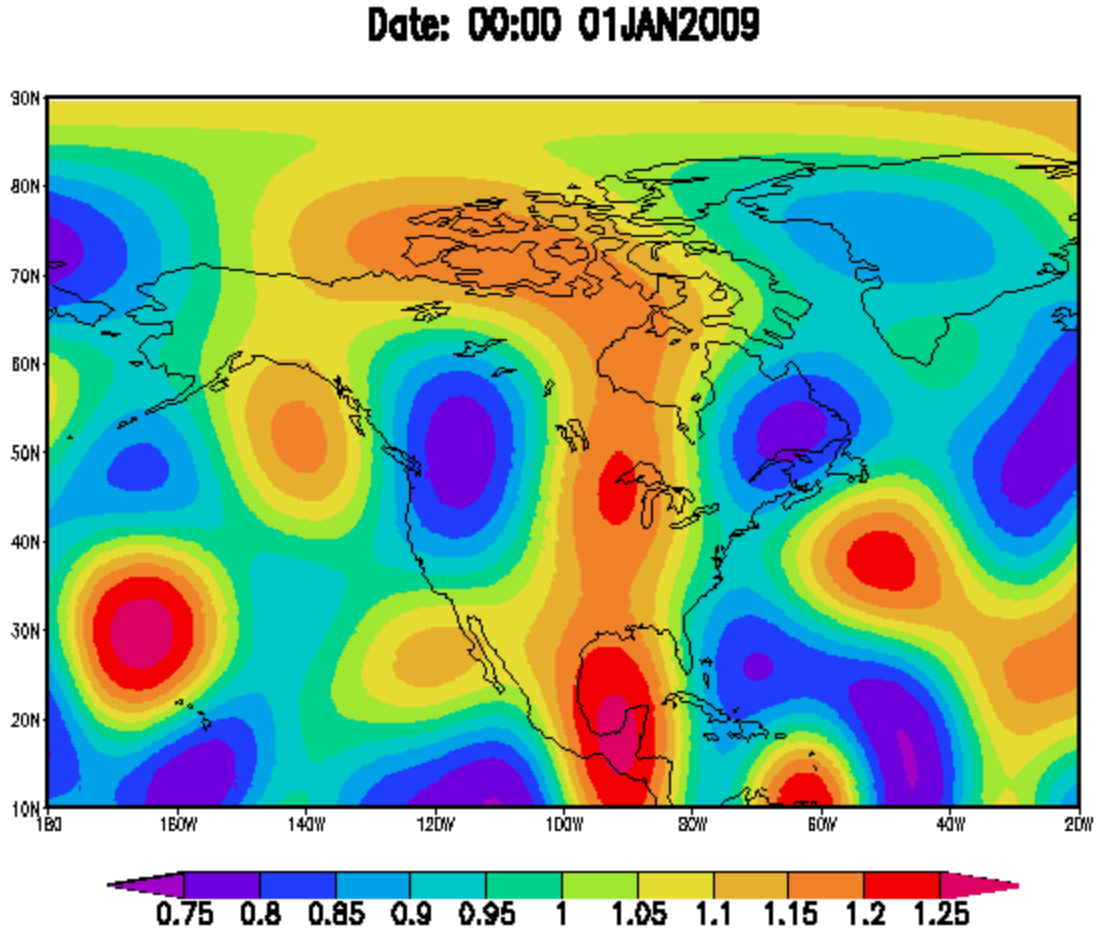
Physics Perturbations with Markov Chains

$$f(\lambda,\phi,t) = \mu + \sum_{l=L_{min}}^{L_{max}} \sum_{m=-l}^{l} a_{lm}(t) Y_{lm}(\lambda,\phi)$$

$$a_{lm}(t+\Delta t) = e^{-\Delta t/\tau} a_{lm}(t) + R(t)$$

L_{min} = 1
L_{max} = 14
τ = 24 h
μ = 1

Physics Perturbations with Markov Chains

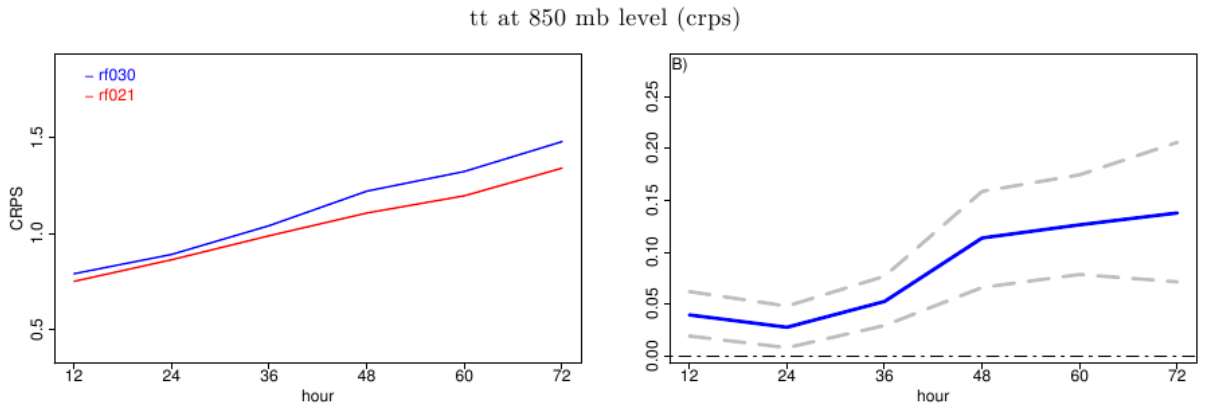


Main differences with global EPS physics

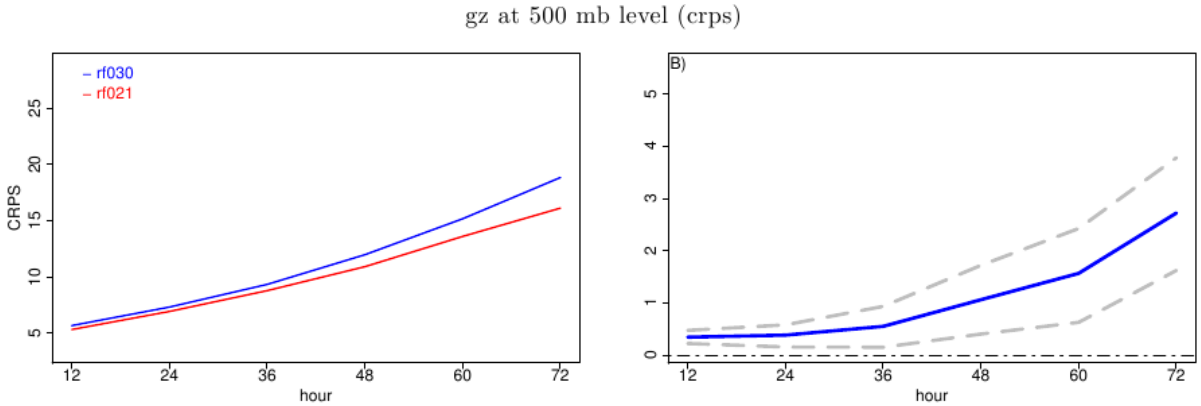
	REPS	GEPS
Radiation	Li and Barker	Li and Barker
Surface	ISBA	ISBA and Force-restore
Deep convection	Kain-Fritsch	Kain-Fritsch, Kuo
Gravity wave drag	One parameter	Multi-parameter
Mixing length	Bougeault	Bougeault, Blackadar
SKEB	No	Yes
Physical tendency perturbations	[0.7 , 1.3]	[0.5 , 1.5]
Grid spacing	33 km	66 km

Verification against Radiosondes
REPS (GEM 4.2, red) vs REPS (GEM 3.2, blue)

Temperature at 850 hPa



Geopotential Height at 500 hPa



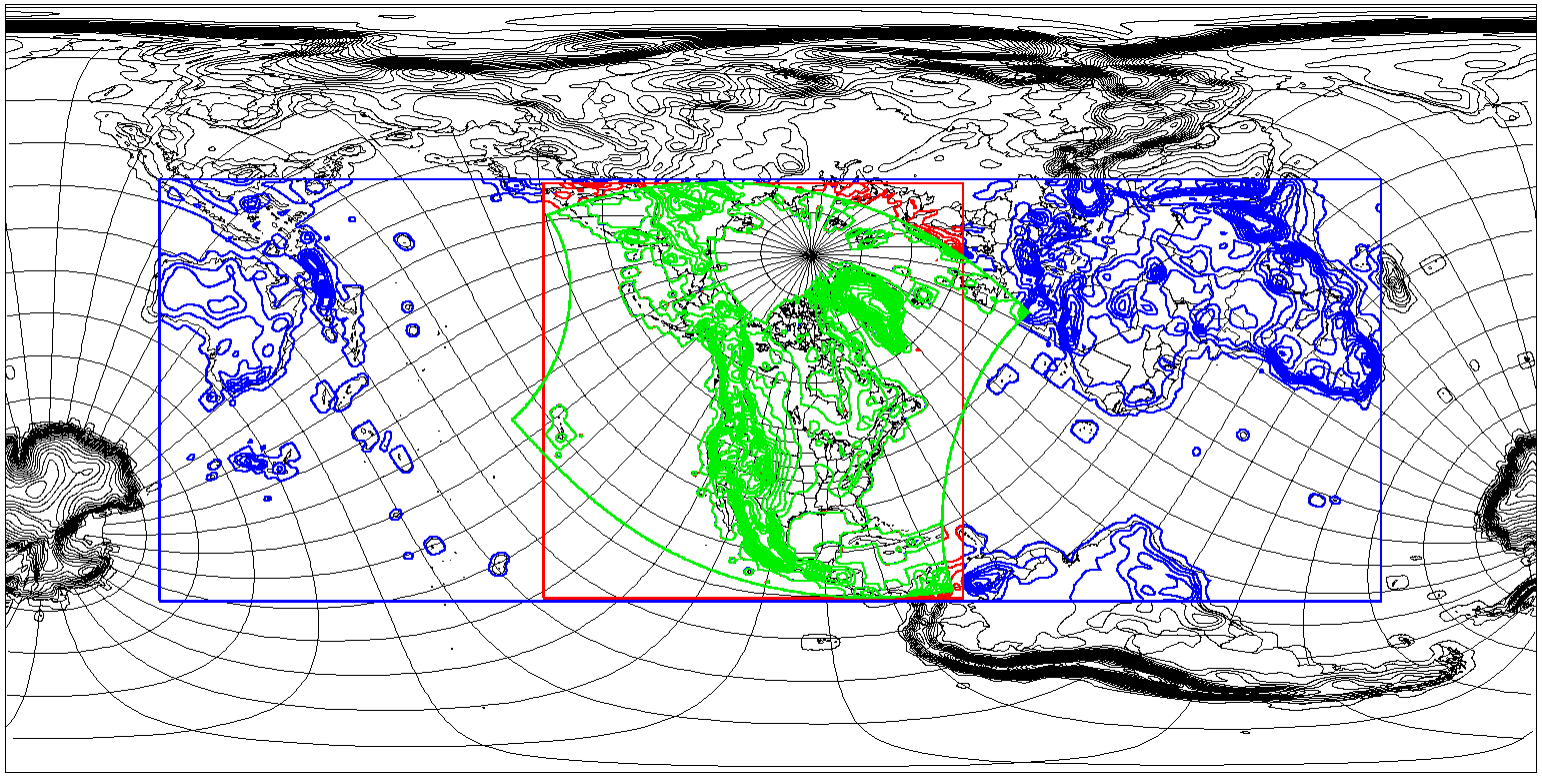
CRPS (left) and CRPS difference (with 90% confidence intervals, right) between the previous experimental REPS (blue) and operational REPS (red).

The Canadian Regional EPS in Fall 2012...

- The Canadian regional EPS will consist of
  - Assimilation component
    - Same initial condition as the global EPS
  - Forecast component
    - Grid spacing at 15 km
    - Lead time : 3 days
    - Forecast frequency : twice daily (00Z and 12Z)
    - Same physical parameterizations as the global deterministic prediction system
    - Stochastic physical tendency perturbations
    - Lateral and upper boundary conditions from global EPS

The Canadian Regional EPS in 2013...

- New domain following the adoption of the Yin-Yang grid by the GEPS



The Regional EPS in 2014-2015...

- The Canadian regional EPS will consist of
  - Assimilation component
    - Regional ensemble Kalman filter
      - A major milestone for the regional EPS
      - Background at 10-15 km grid spacing
  - Forecast component
    - Lead time at 4-5 days?
    - 4x per day?
    - Stochastic convection
    - Grid spacing : 10 km
    - Better surface and near-surface model error representation by perturbing uncertain parameters and fields related to the surface scheme