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Status of the Operational Global Deterministic Prediction System at Environment Canada

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INTRODUCTION

Many important upgrades to the operational Global Deterministic Prediction System (GDPS) at Environment Canada were implemented during the year 2013.

- Addition of new SSMIS data from DMSP17 and DMSP18
- Addition of GOES-13 and GOES-15
- Addition of RARS (Regional ATOVS Retransmission Service) data from all satellites (except AQUA and METOP-2)
- Reduction of observation bin size in our data assimilation system (4D-VAR) from 45 min to 18 min
- Increase in increment horizontal grid resolution from 240x120 (T108) to 400x200 (T180)
- Use of staggered levels in the vertical coordinate
- Addition of CSR (Clear Sky Radiances) and AMV (Atmospheric Motion Vectors) from MeteoSat10
- Addition of AMSU-A, MHS, GPS-RO, AVHRR polar winds and scatterometer wind retrievals from METOP-1

February 2013

November 2013

INCREASE IN OBSERVATION COUNTS

Average number of observations assimilated in 24-hour period

	January 2013	January 2014	% difference	Explanation
Aircraft	92,458	124,491	34.65%	new data from fleet (no change in assimilation system)
AIRS *	27,682	26,846	-3.02%	
AMV's	90,428	107,895	19.32%	+ METOP-1
AMSU-A *	250,109	322,548	28.96%	+ METOP-1
AMSU-B / MHS *	92,255	130,753	41.73%	+ METOP-1
GeoRad	88,338	212,482	140.53%	+ GEOES13, GOES15,METEOSAT10, MTSAT2
GPS-RO *	2,527	2,856	13.02%	+ METOP-1
IASI *	30,187	31,224	3.44%	
Profilers	106	43	-59.43%	
Scatterometer	35,514	70,442	98.35%	+ METOP-1
RAOBS *	1,237	1,215	-1.78%	
SSMIS *	39,733	85,457	115.08%	+ DMSP17 DMSP18
Surface	28,672	32,047	11.77%	new auto-synop data from December 2013

* = number of profiles

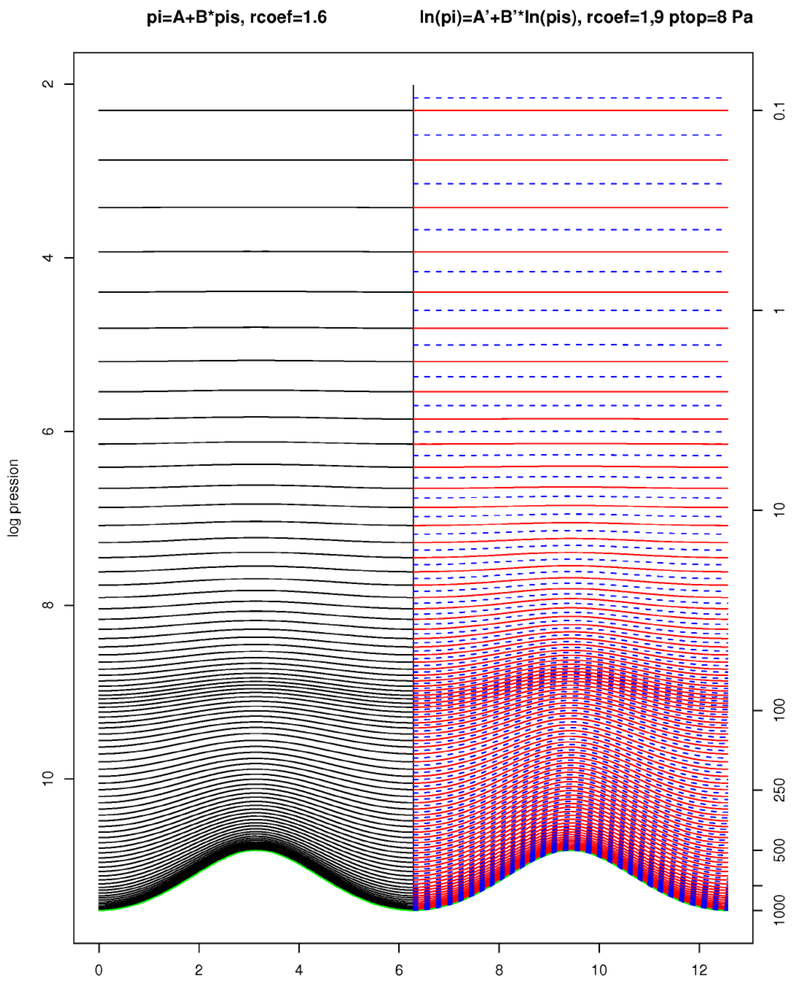
The new binning also increased the number of data assimilated.

The effect of the RARS data is negligible in the GDPS because the cut-off time is long. We use these data as a "backup". However, it makes a difference in the RDPS (Regional Deterministic Prediction System) where the cut-off time is shorter.

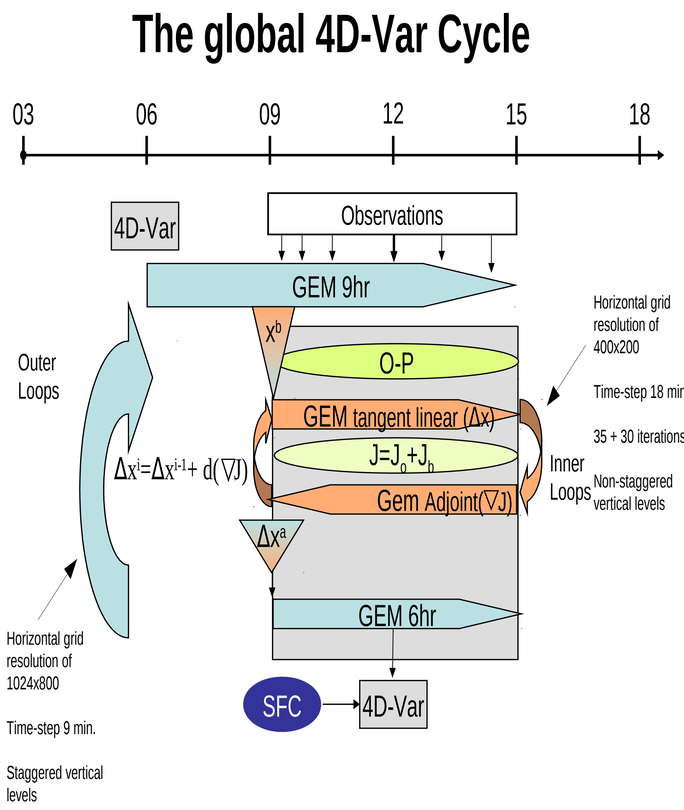
SETUP AND RESULTS

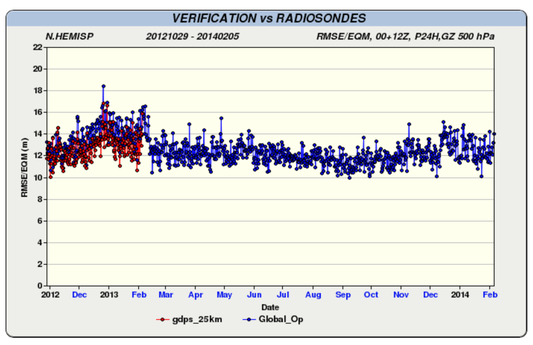
Characteristics of the forecast model (GEM):

- 80 levels with model top at 0.1 hPa (63km)
- 25km resolution (1024x800)
- Staggered vertical levels
- 12 min. time step



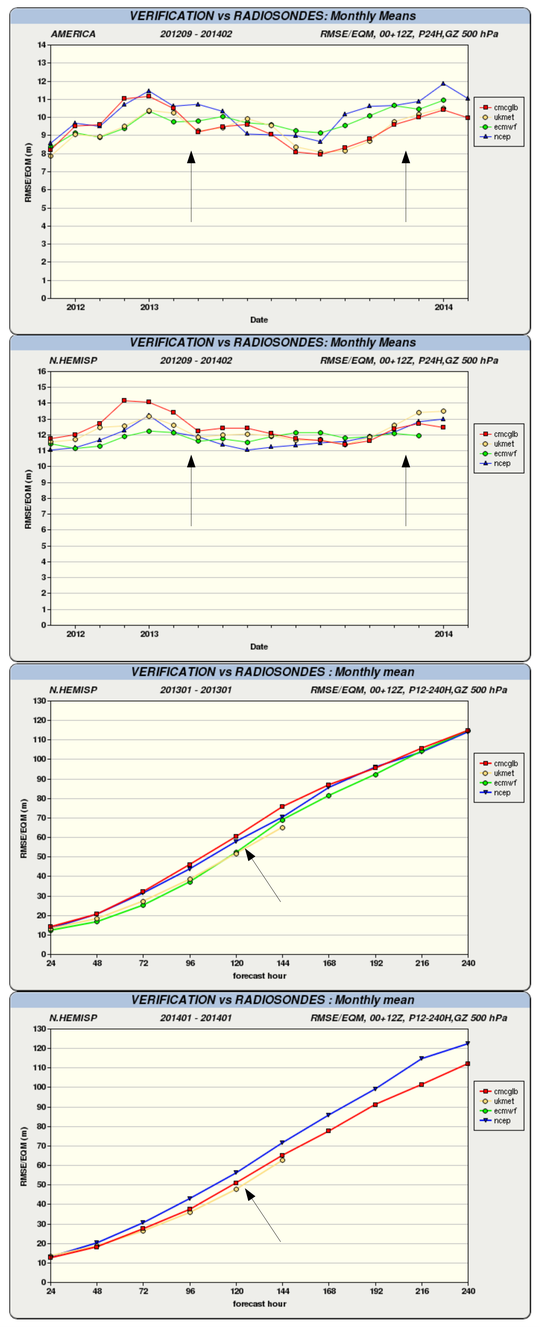
Laprise-Girard hybrid vertical levels (left) and new staggered vertical levels (right). The Red solid lines depict momentum levels (where u, v lie) while the blue dashed lines depict thermodynamic levels (where T, q, w and scalars lie).





Verification against radiosonde data of parallel run with new 4D-Var and model setup (in red) and operational run (in blue). After February, the parallel run became operational. RMSE of the parallel run is lower than the operational run.

Comparison with other centers



Verifications of the 24h forecast of GZ 500mb over the Northern Hemisphere and North America show an impact for both implementations at our center. The arrows correspond to the months of February and November 2013.

At a lead time of 5 days (120h, see arrows):

Jan. 2013: RMSE = 60.4m (upper plot)
Jan. 2014: RMSE = 51.0m (lower plot)

This represents about a 14-h gain in the forecast skill

FUTURE PLANS:

Inclusion of additional IASI channels
Inclusion of ATMS data

REFERENCES:

Girard, C., A. Plante, M. Desgagné, R. McTaggart-Cowan, J. Côté, M. Charron, et al. 2013: Staggered Vertical Discretization of the Canadian Environmental Multiscale (GEM) model using a coordinate of the log-hydrostatic-pressure type. Mon. Wea. Rev. doi:10.1175/MWR-D-13-00255.1, in press.

EC monitoring web site (login and password available upon request) http://collaboration.cmc.ec.gc.ca/cmc/data_monitoring/

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