LOCALLY RECEIVED AND PROCESSED ATOVS DATA IN THE AUSTRALIAN REGION LAPS DATA ASSIMILATION AND PREDICTION SYSTEM

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LAPS System

- Grid-point primitive equation model
- Horizontal grid spacing of 0.375º (37 km)
- Higher resolution nested mesoscale systems
- 29 sigma levels: 0.9988 to 0.050
- Forecast base-times of 00UTC & 12UTC, forecasts to +72 hr
- Lateral boundary conditions and first guess from GASP

GASP System

- Global spectral model
- TL239 (80 km)
- 29 sigma levels: 0.991 to 0.010
- Forecast base-times of 00UTC & 12UTC, forecasts to +10 days
- OI analysis (both systems)

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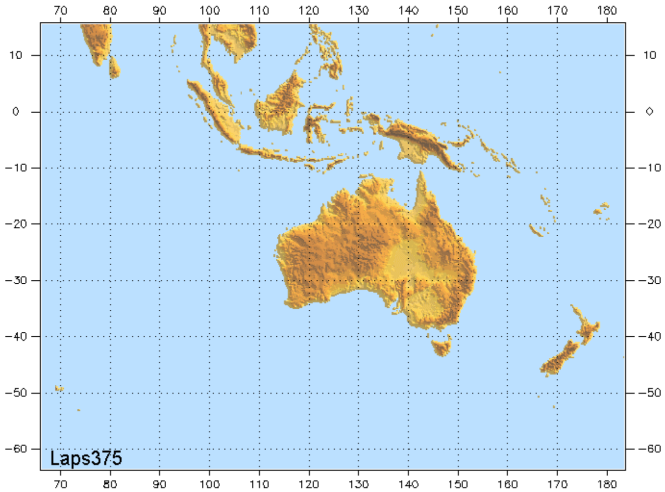
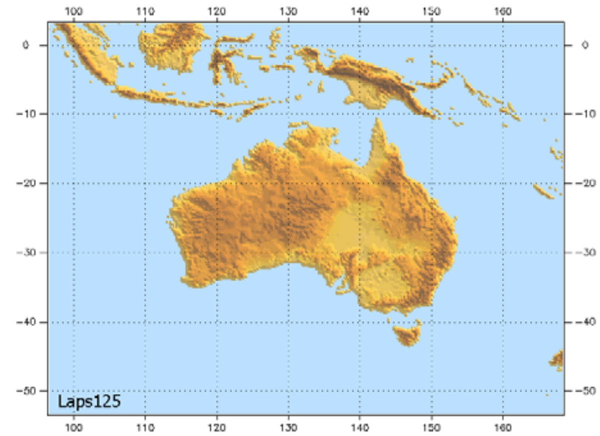


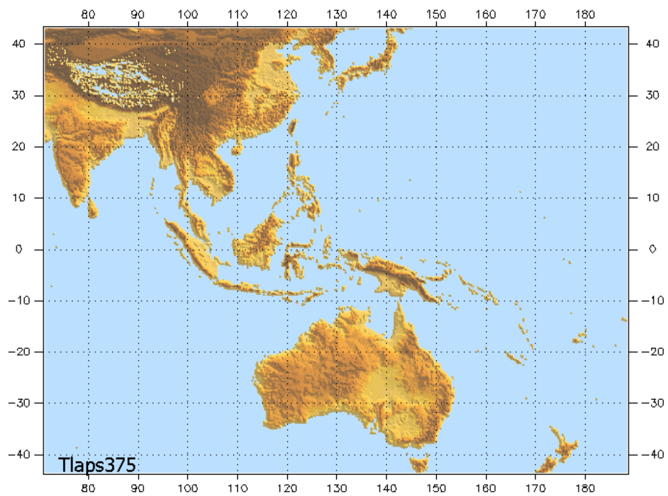
LAPS

0.375º grid

MESOLAPS

0.125º grid

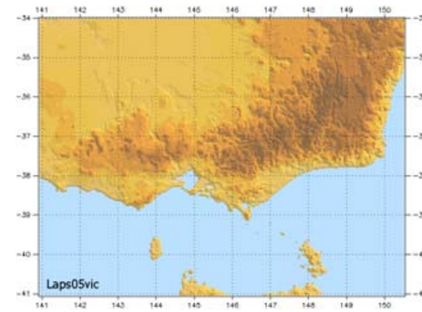


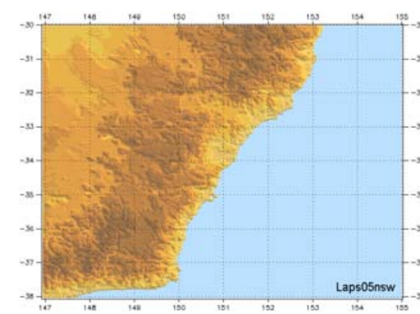


TLAPS

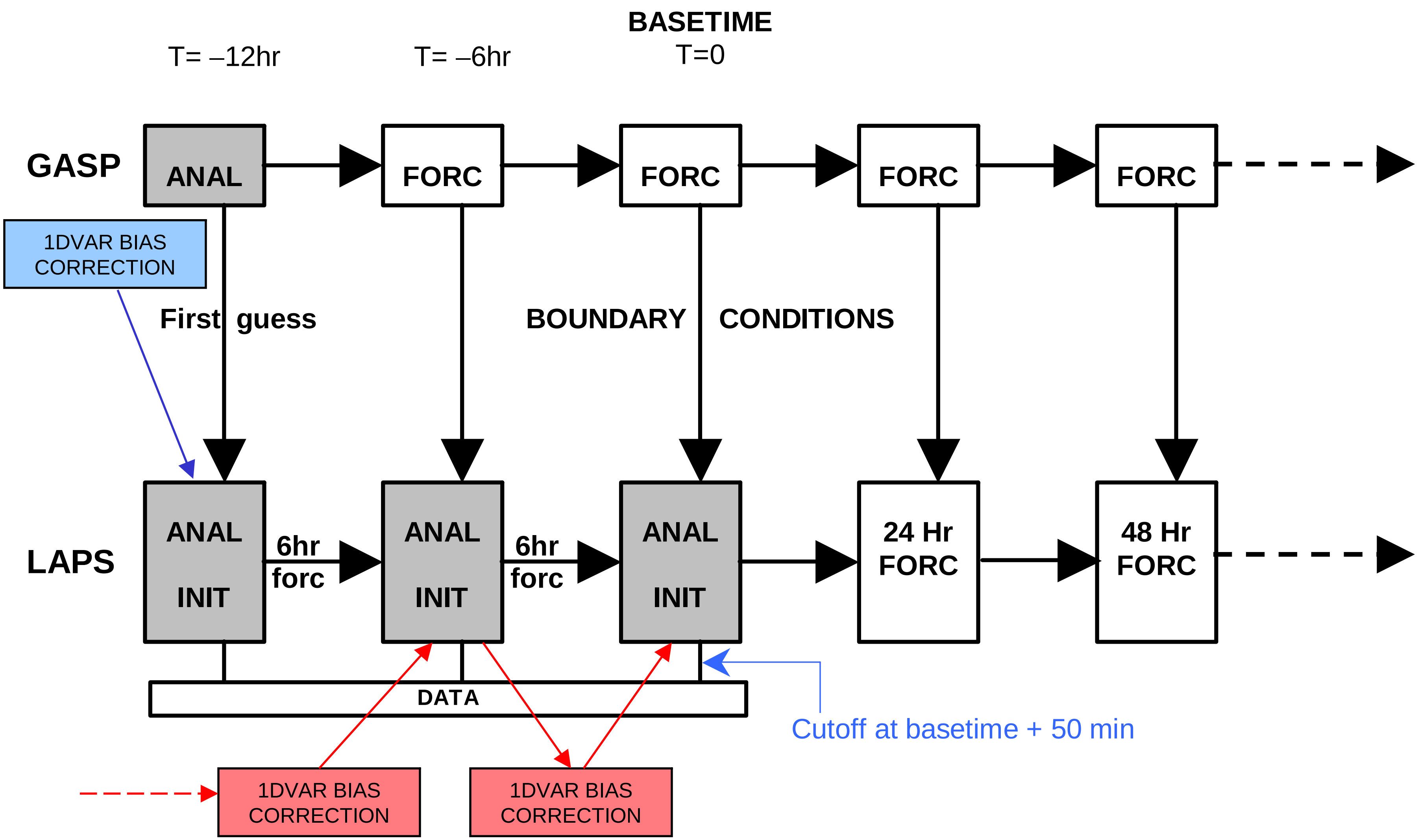
0.375º grid

CITY CENTRED DOMAINS





0.05º grids


BASETIME
T=0
T= –12hr
T= –6hr
GASP
ANAL
FORC
FORC
FORC
FORC
1DVAR BIAS CORRECTION
First guess
BOUNDARY CONDITIONS
LAPS
ANAL INIT
6hr forc
ANAL INIT
6hr forc
ANAL INIT
24 Hr FORC
48 Hr FORC
DATA
Cutoff at basetime + 50 min
1DVAR BIAS CORRECTION
1DVAR BIAS CORRECTION

1DVAR in the Bureau of Meteorology

$$\min J = (x - x_b)^T \mathbf{B}^{-1}(x - x_b) + (y_0 + y(x))^T [\mathbf{E} + \mathbf{F}]^{-1}(y_0 - y(x))$$

x_b : background field

y_0 : observed radiances

x : control vector

$\mathbf{B}$: background error covariance matrix

$\mathbf{E} + \mathbf{F}$: Observation and Forward model error covariance

$y(x)$: Forward operator

- Dynamic error scaling (Harris & Steinle 1999)
- Air mass dependent radiance bias predictors & bias monitoring (Harris & Kelly 2001)
- Latitudinally varying scan correction
- Implemented operationally in GASP July 2000, LAPS Sept 2002

Recent Operational Developments

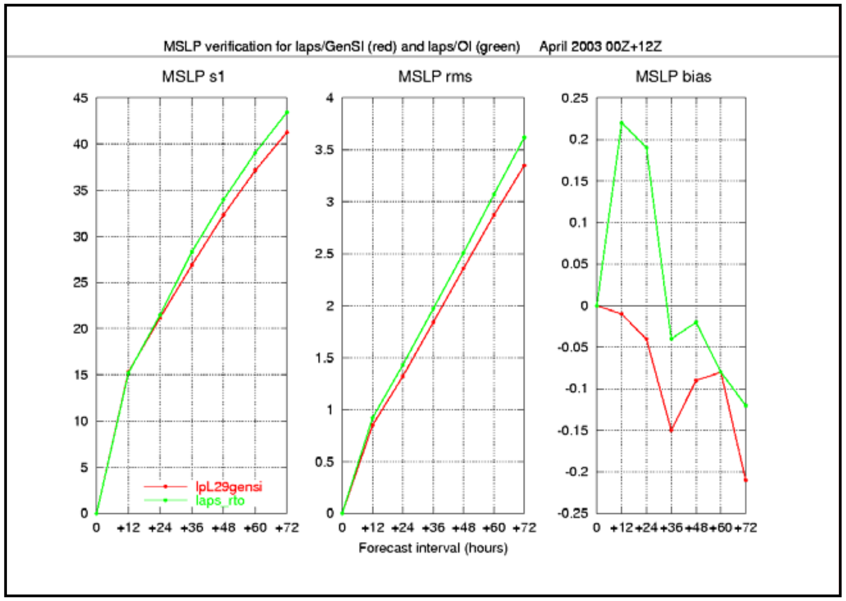
- LAPS: Implementation of 1DVAR assimilation of ATOVS radiances (HIRS and AMSU-A) (September 2002)
  Impact: modest positive impact on forecast skill compared to use of NESDIS retrievals

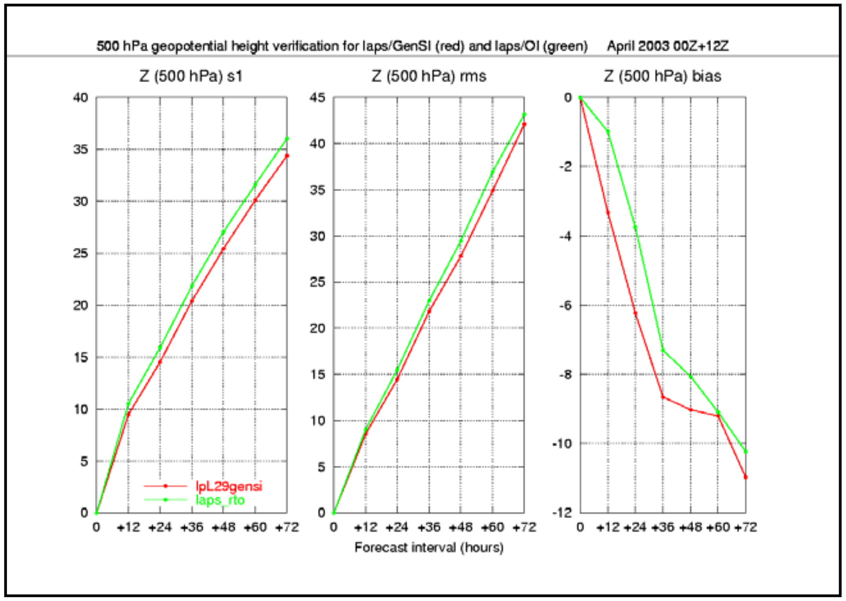
- GASP and LAPS: Implementation of RTTOV-7 and assimilation of NOAA-17 radiances (Feb and June 2003)
  Impact: neutral (NOAA 15 +16 +17 1DVAR compared to NOAA 15 +16 1DVAR)

Current Developments in GASP/LAPS Assimilation

OI → GenSI Analysis

- Analysis equation solved iteratively by a preconditioned conjugate gradient method
- Handles large matrices and simplifies data selection
- Single analysis executable for all NWP systems ⟶ goal of a unified regional/global assimilation system





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DATA TIMELINESS

- NESDIS ATOVS (HIRS + AMSU-A) radiances + retrievals received via GTS

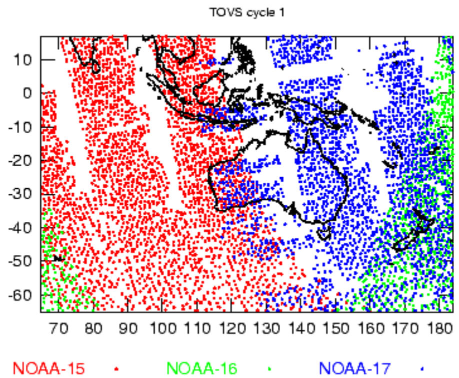
- Early data cut-off for LAPS prevents adequate ATOVS coverage for final (basetime) analysis ….

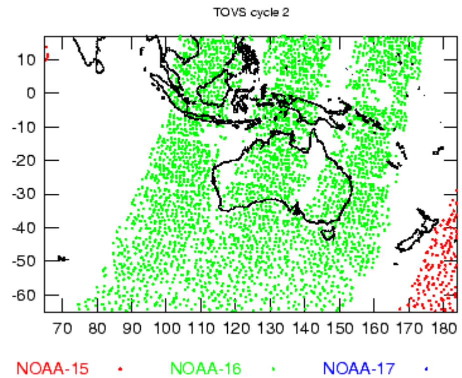
LAPS 20030226.00 satids: 15 16 17

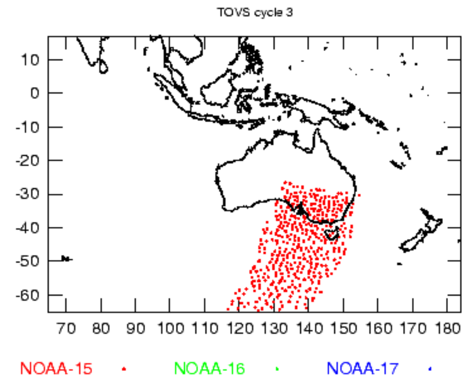
00 UTC

LAPS

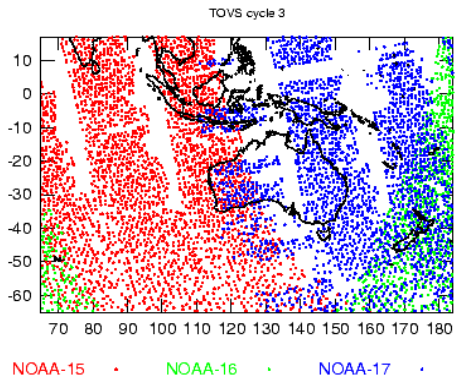
-12 hr **-6 hr** **basetime**

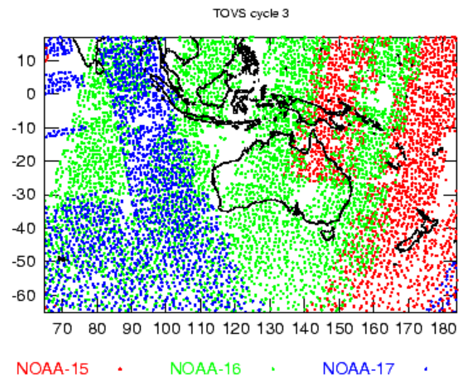


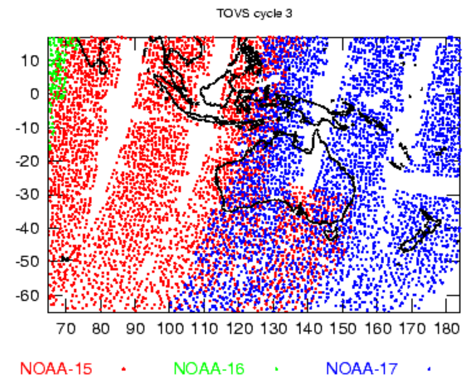




GASP



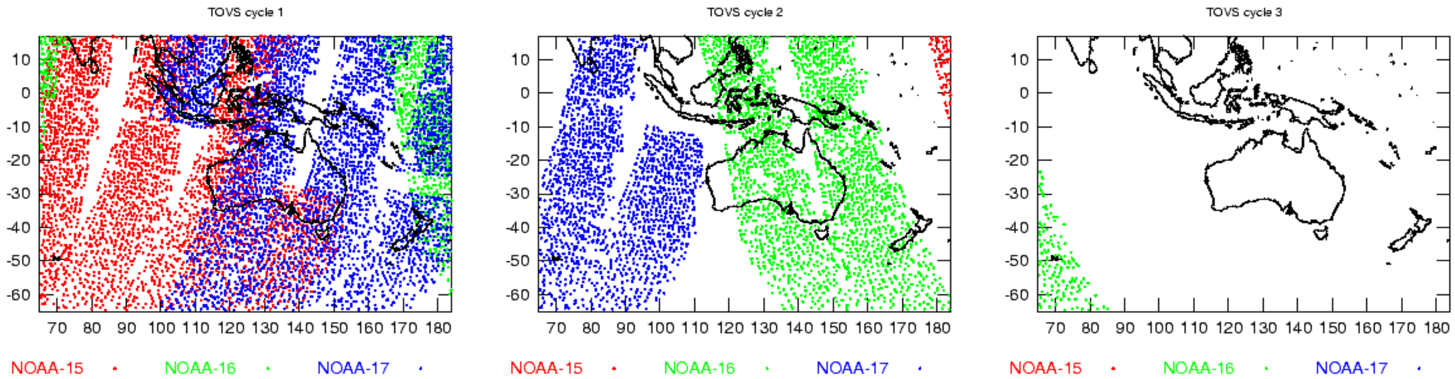




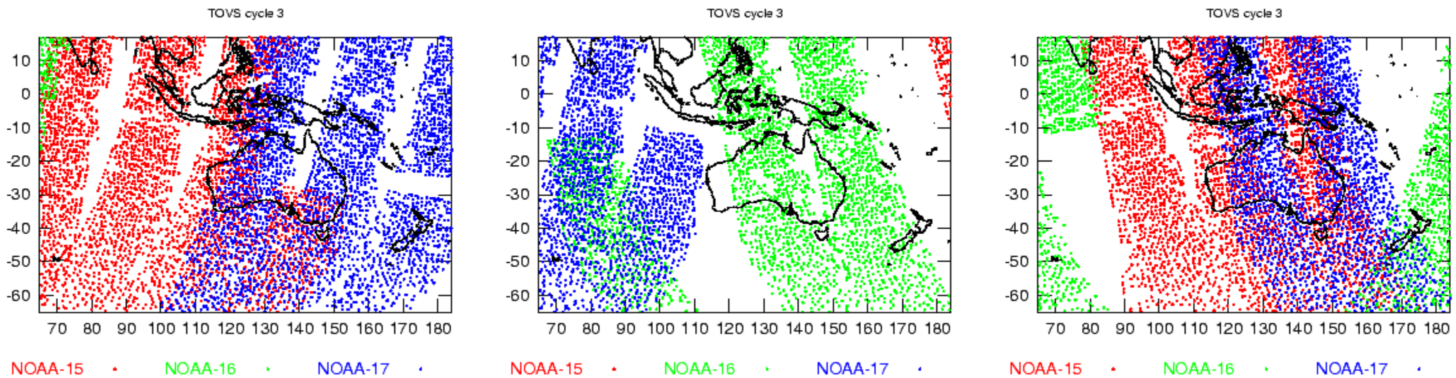
LAPS 20030226.12 satids: 15 16 17

12 UTC

LAPS -12 hr -6 hr basetime



GASP



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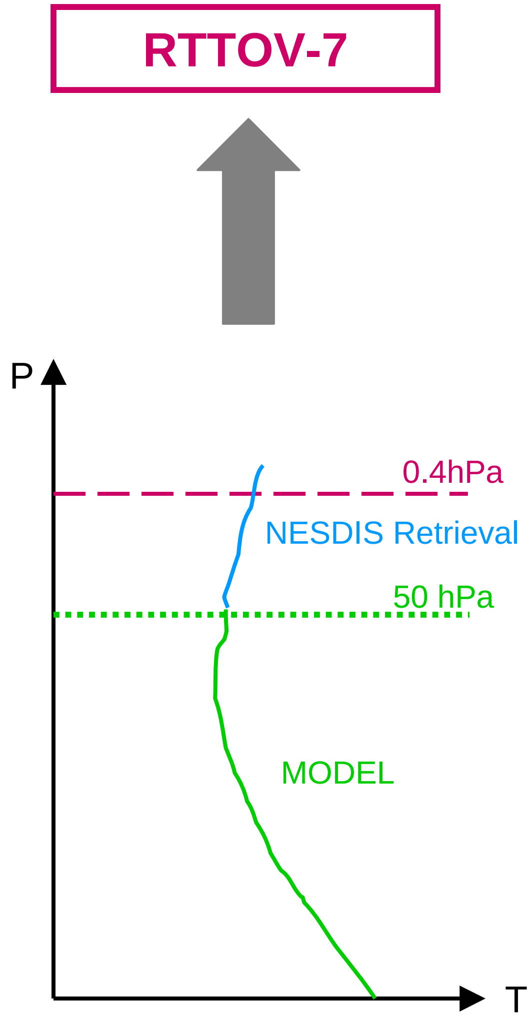

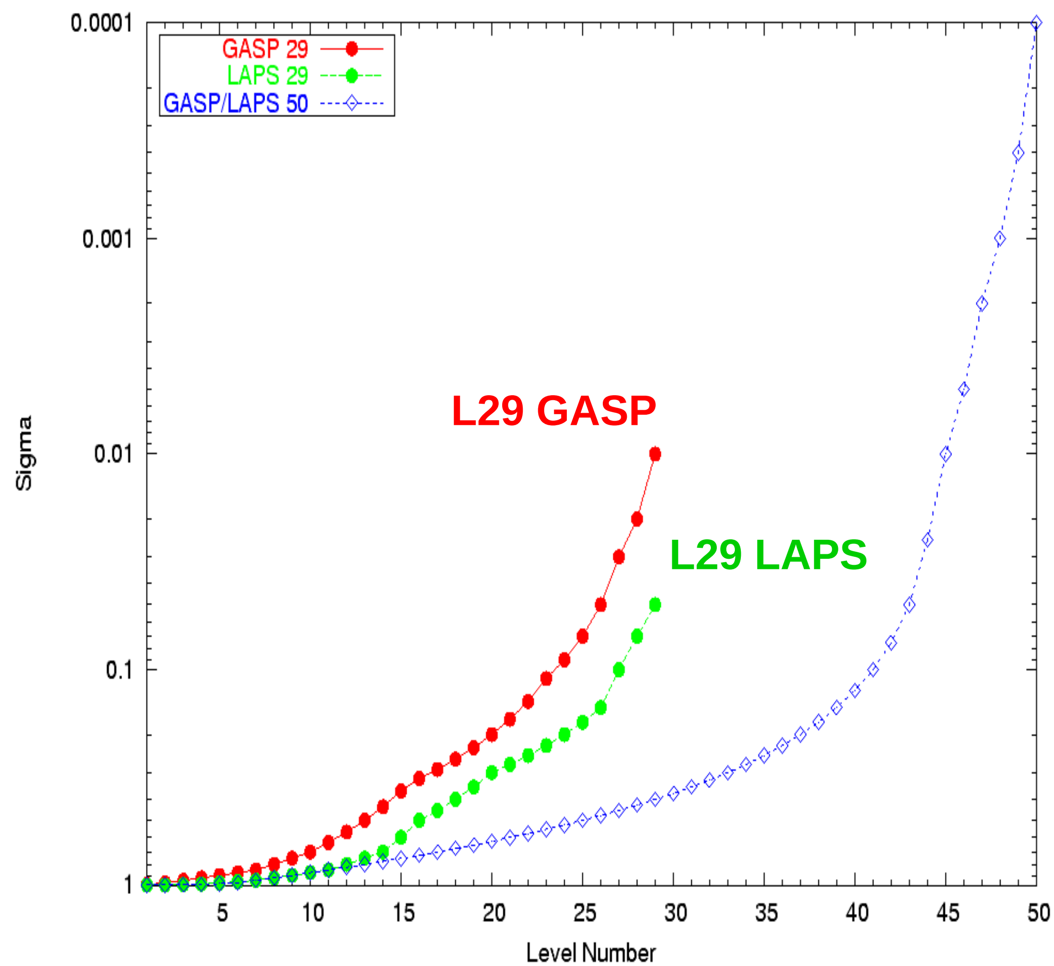

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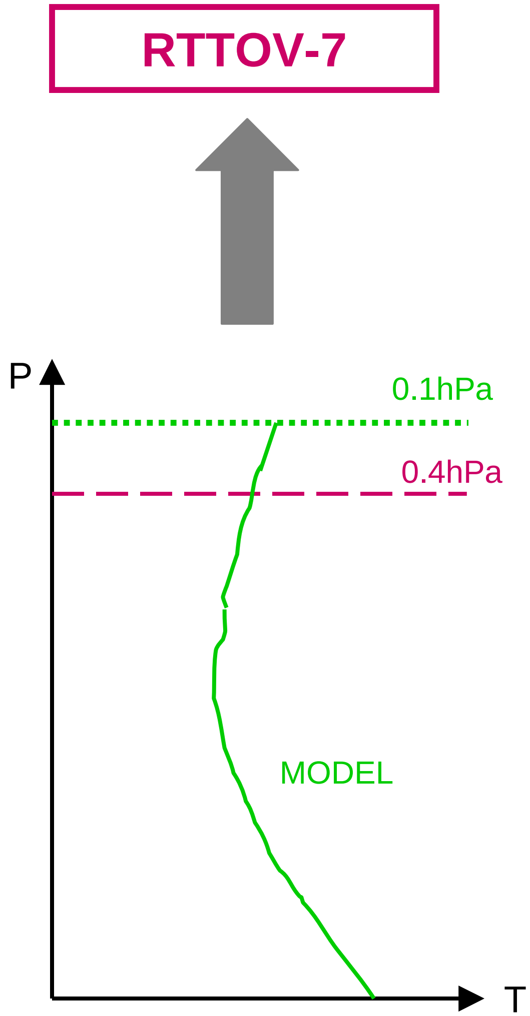

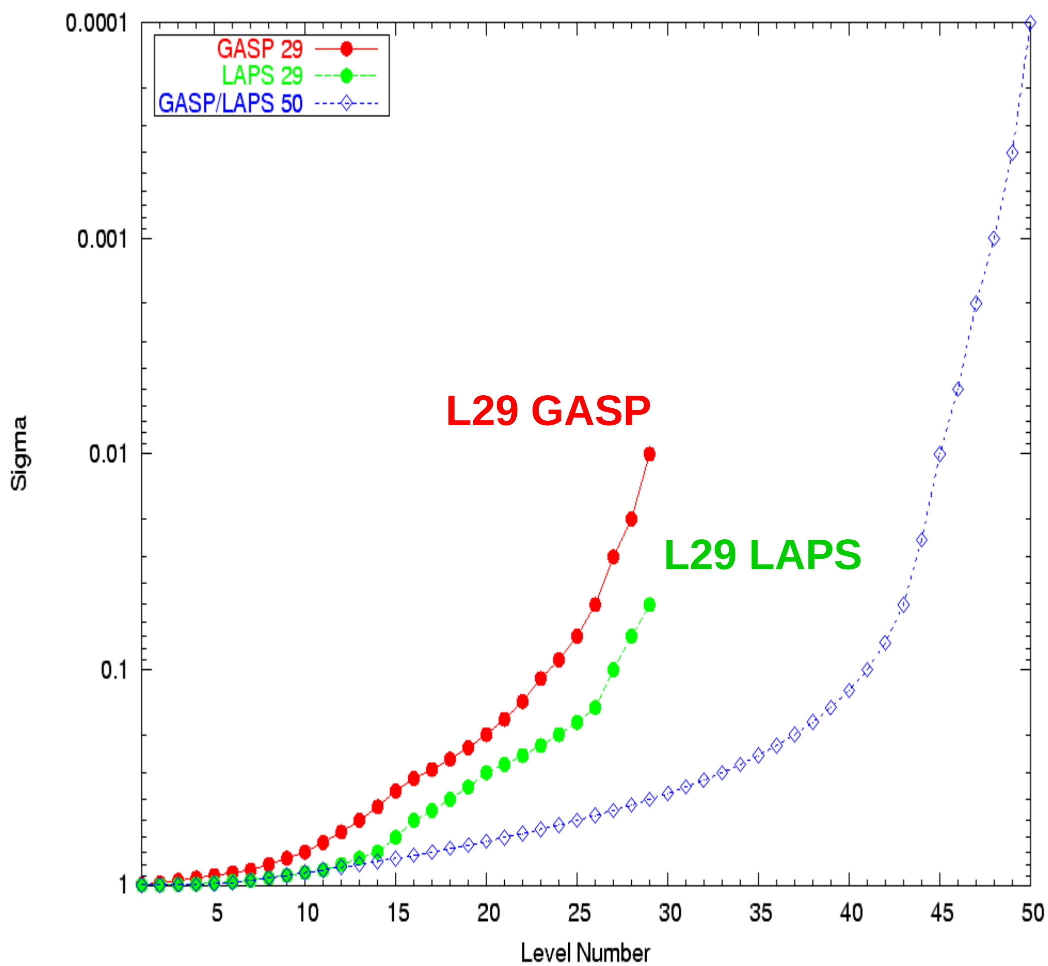

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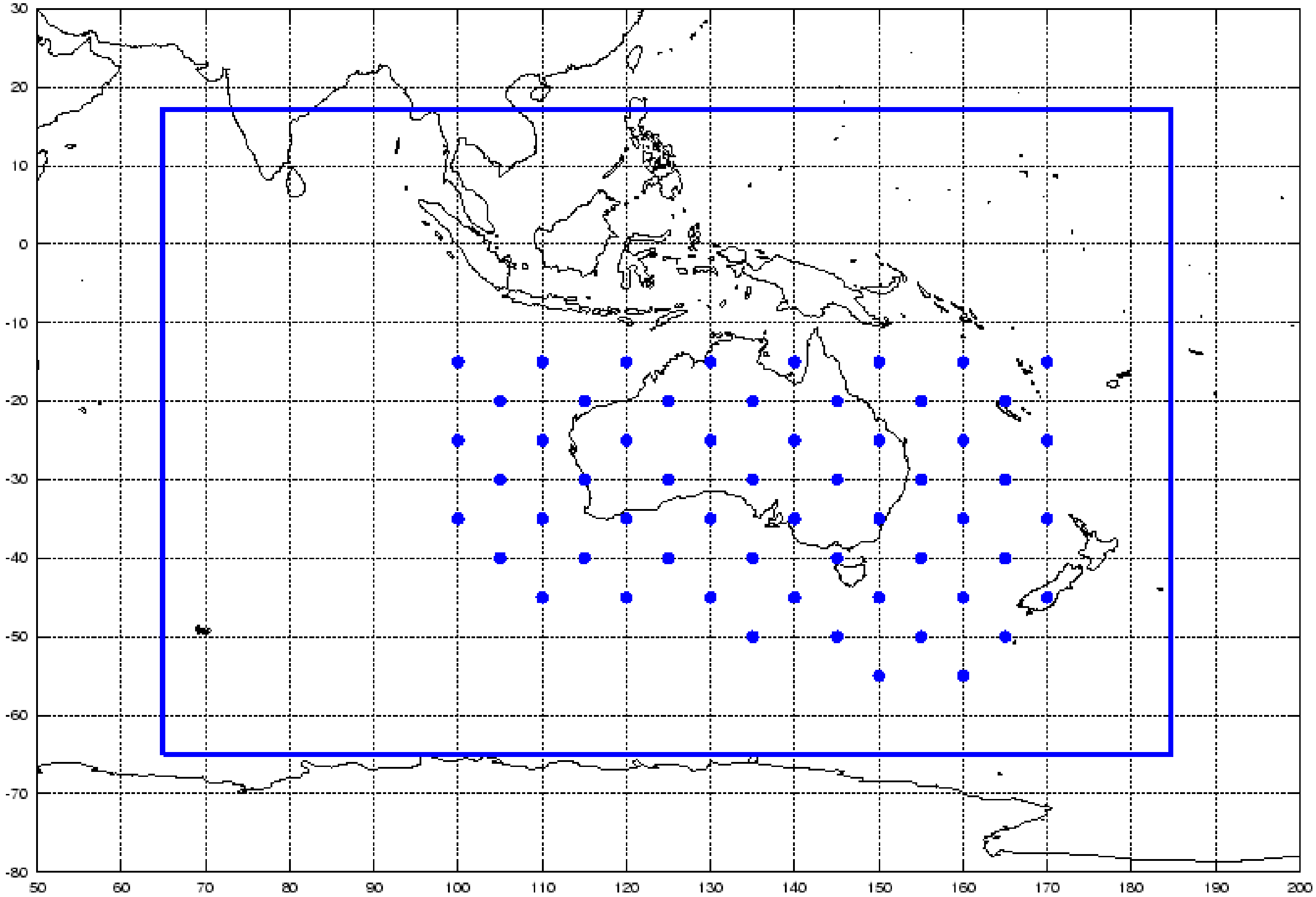
STANDARD LAPS VERIFICATION GRID



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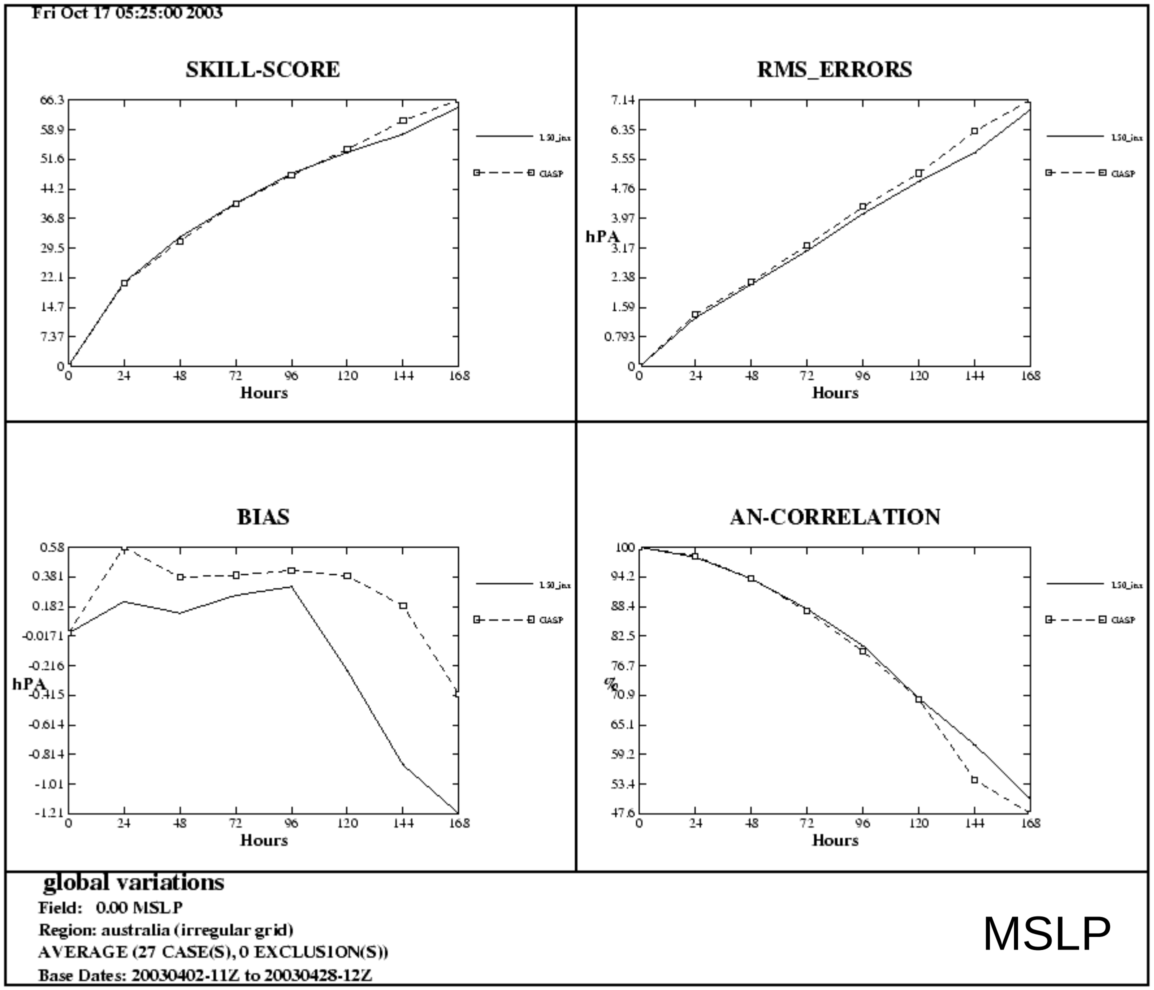
GASP L50

- GenSI assimilation
- Introduce Rayleigh friction ($1x10^{-6}$ s^{-1}) above 10 hPa to dissipate stratospheric noise
- One month run with forecasts generated every 24 hours



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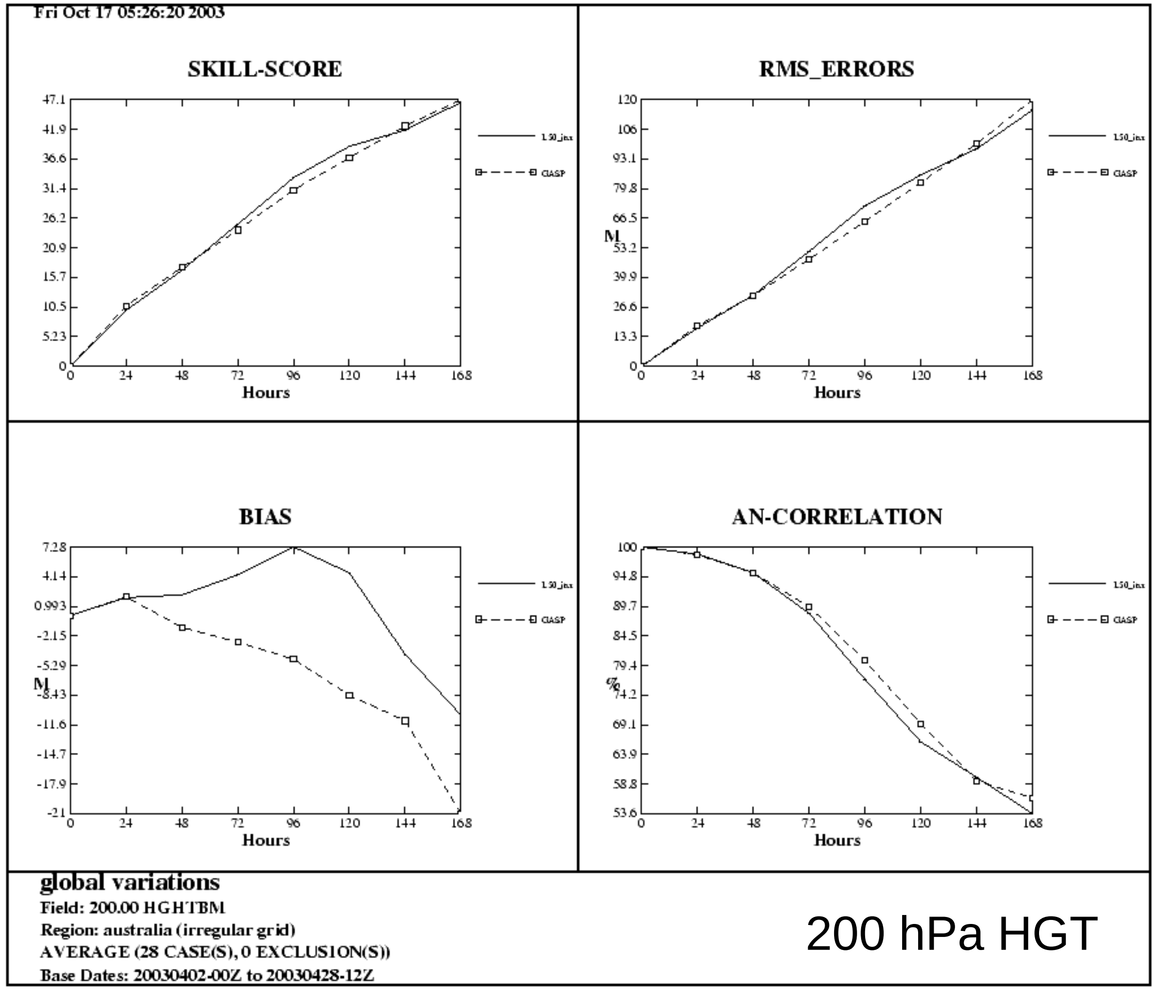
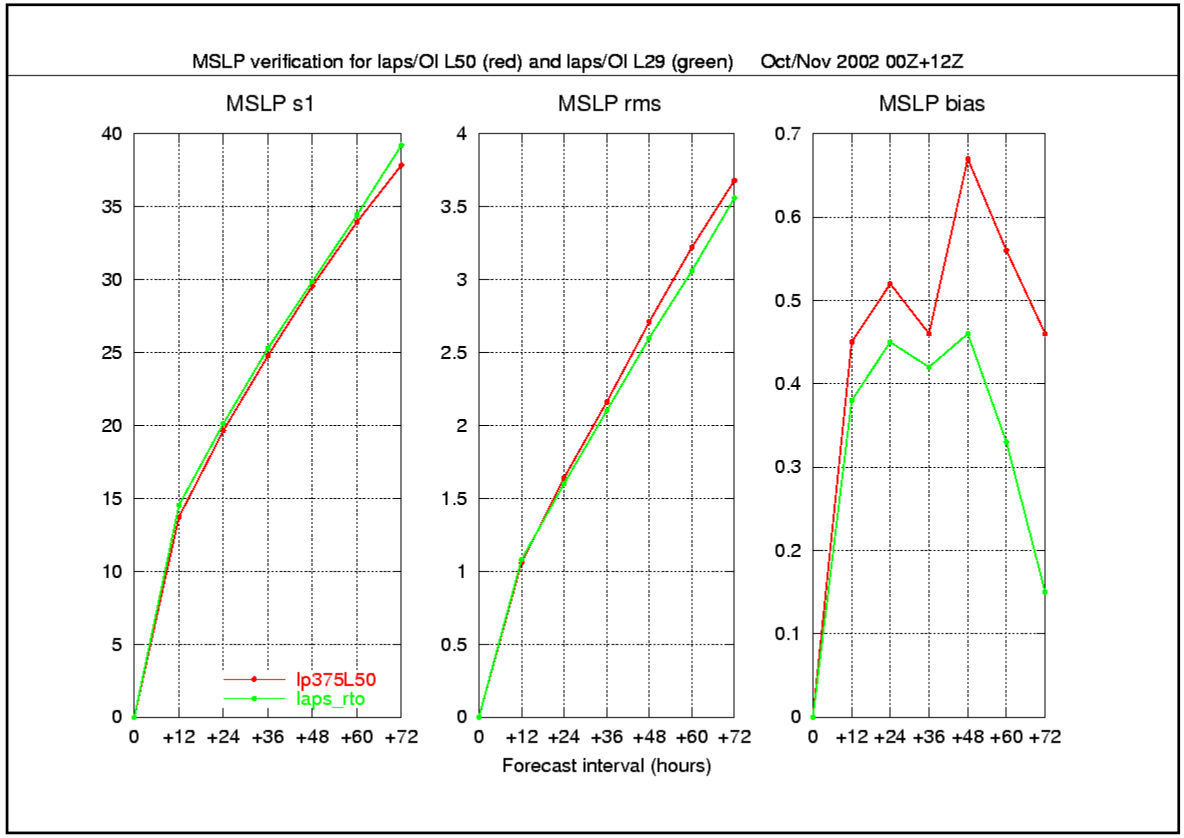

Fri Oct 17 05:26:20 2003
SKILL-SCORE
RMS_ERRORS
BIAS
AN-CORRELATION
Hours
M
%
global variations
Field: 200.00 HGHTBM
Region: australia (irregular grid)
AVERAGE (28 CASE(S), 0 EXCLUSION(S))
Base Dates: 20030402-00Z to 20030428-12Z
200 hPa HGT

Forecast skill comparison between L29 LAPS and L50 LAPS with OI analysis

Forecasts run twice daily (00UTC and 12UTC) for 1 month

L50 system shows modest gain in S1 skill at most levels



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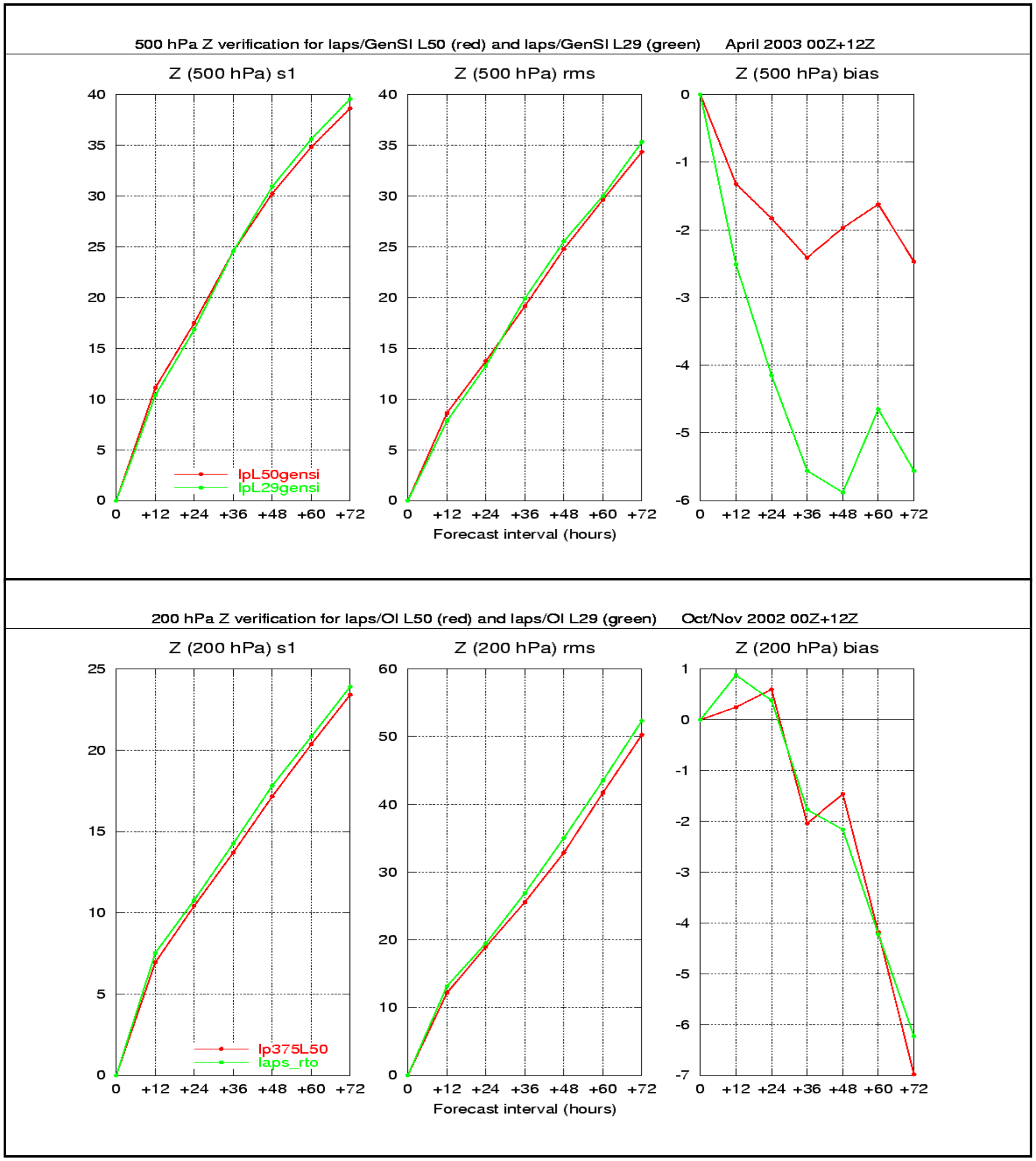

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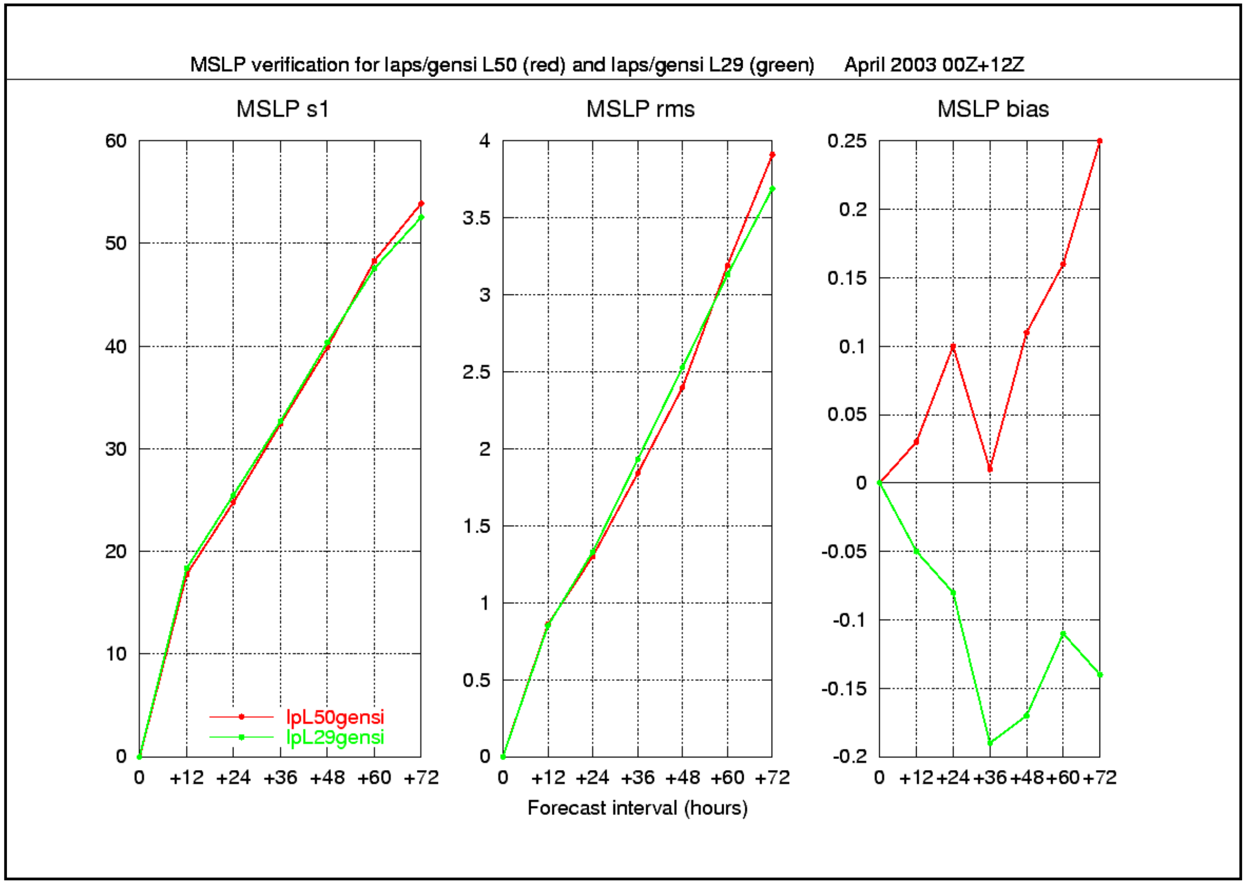
Forecast skill comparison between L29 LAPS and L50 LAPS with genSI analysis

Forecasts run twice daily (00UTC and 12UTC) for 10 days (ongoing)

So far, L50 system shows modest gain in S1 skill for upper levels



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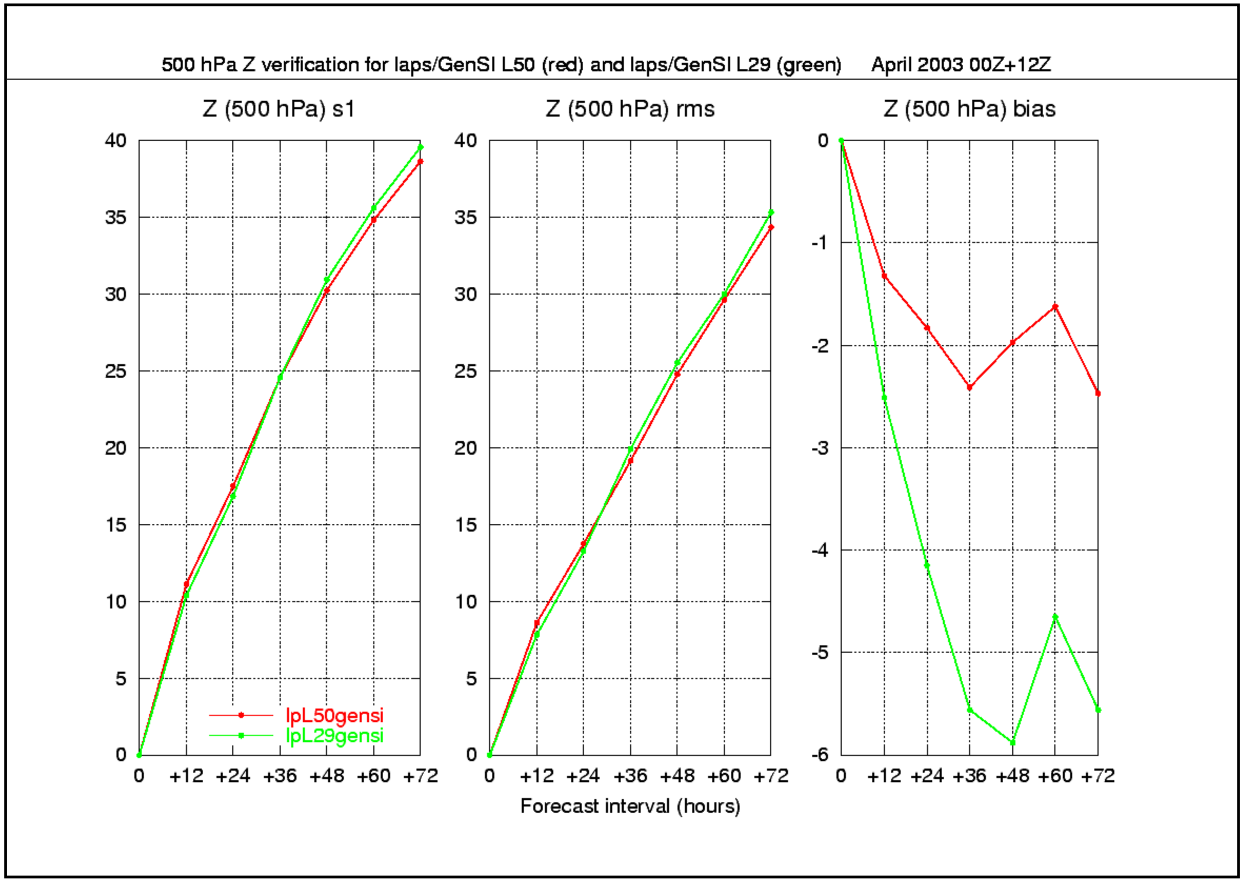
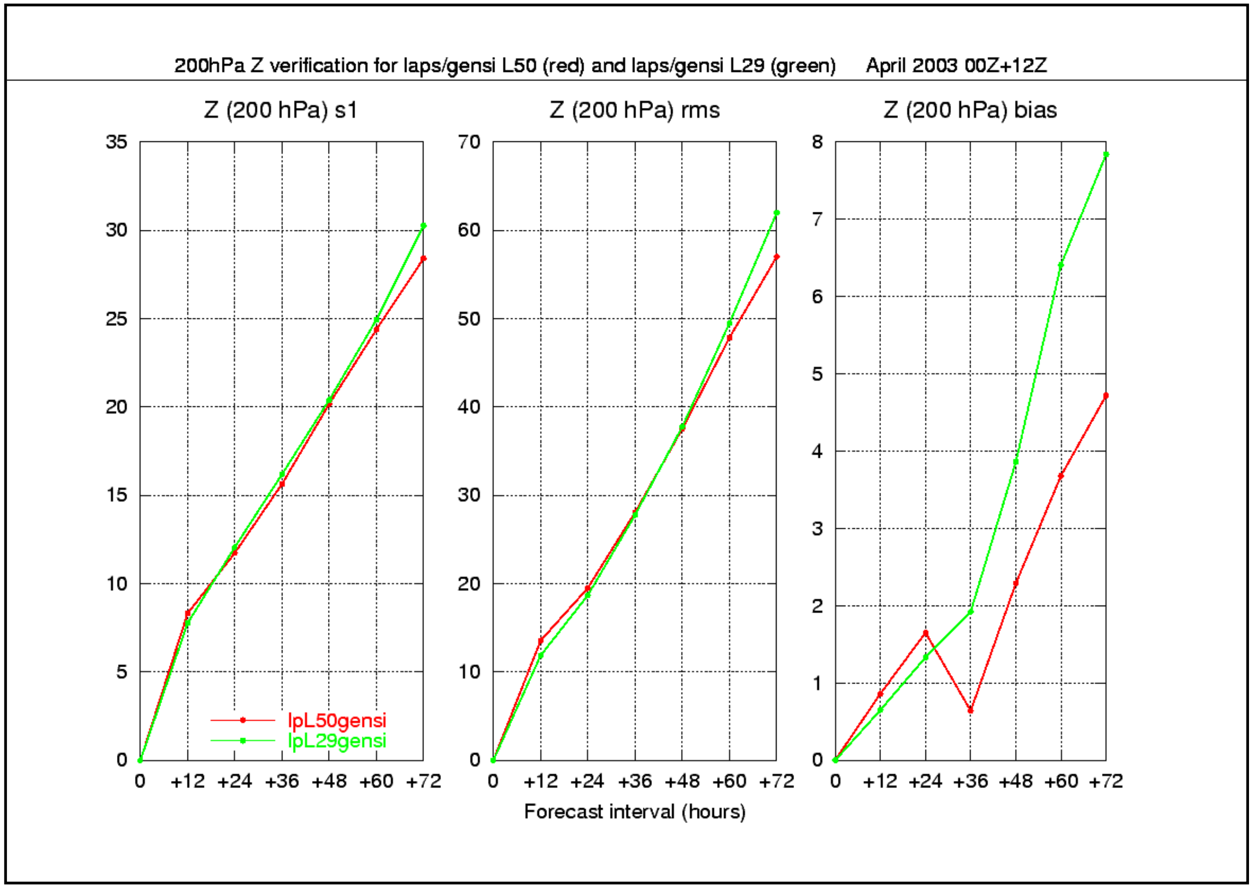


500 hPa Z verification for laps/GenSI L50 (red) and laps/GenSI L29 (green) April 2003 00Z+12Z
Z (500 hPa) s1
Z (500 hPa) rms
Z (500 hPa) bias
lpL50gensi
lpL29gensi
Forecast interval (hours)


200hPa Z verification for laps/gensi L50 (red) and laps/gensi L29 (green)   April 2003 00Z+12Z
Z (200 hPa) s1
Z (200 hPa) rms
Z (200 hPa) bias
lpL50gensi
lpL29gensi
0 +12 +24 +36 +48 +60 +72
Forecast interval (hours)

What's next ?

- Model stability

  Find optimum horizontal diffusion, Rayleigh friction settings in GASP and LAPS

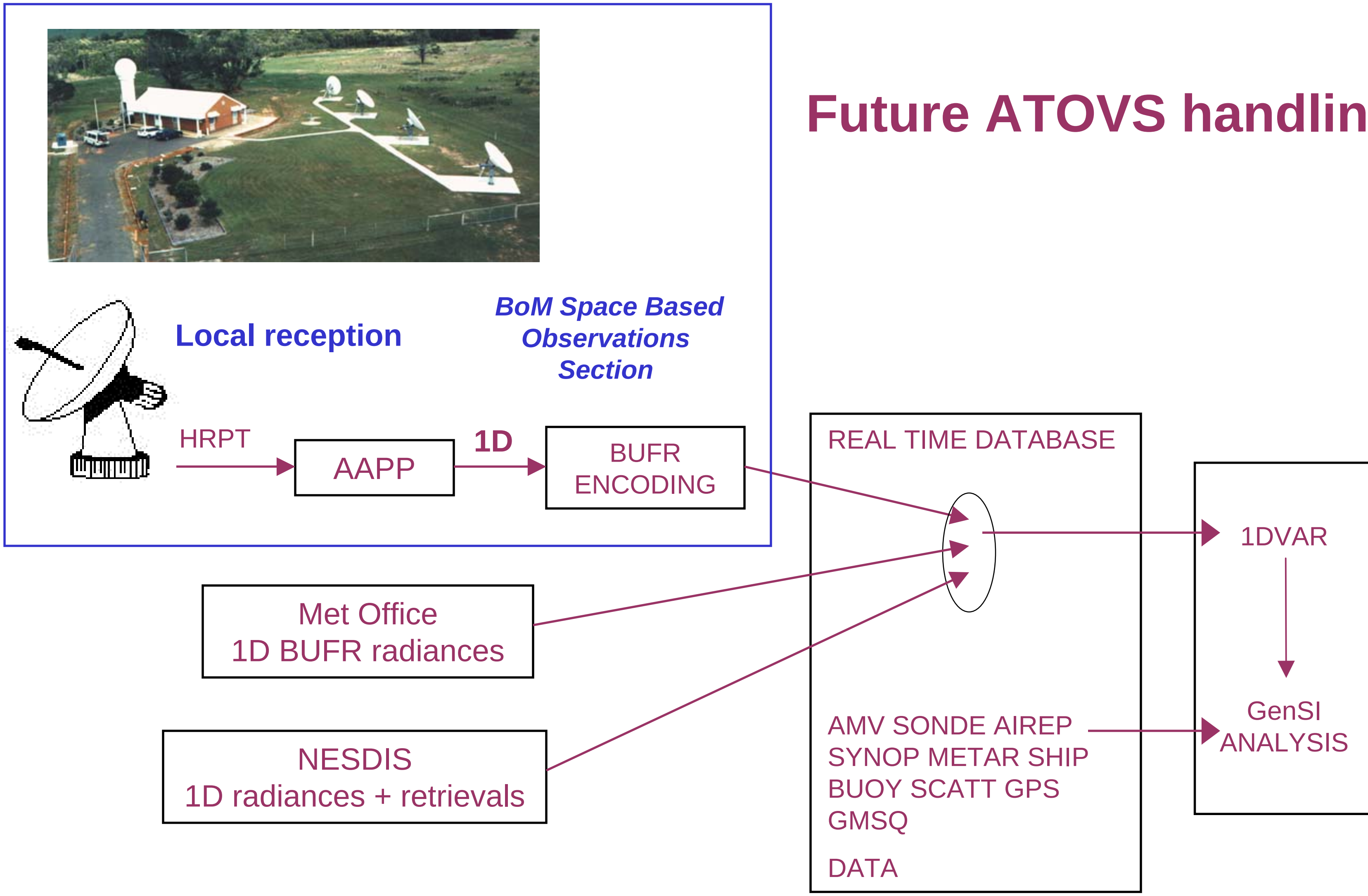
- Model physics

  LAPS Bulk Explicit Microphysics (BEM) cloud scheme retuned to work with 50 levels
  Fine tune radiation ?

- Complete the implementation of local AAPP processing

- Begin trials of assimilation of local radiances in L50 models

Future ATOVS handling



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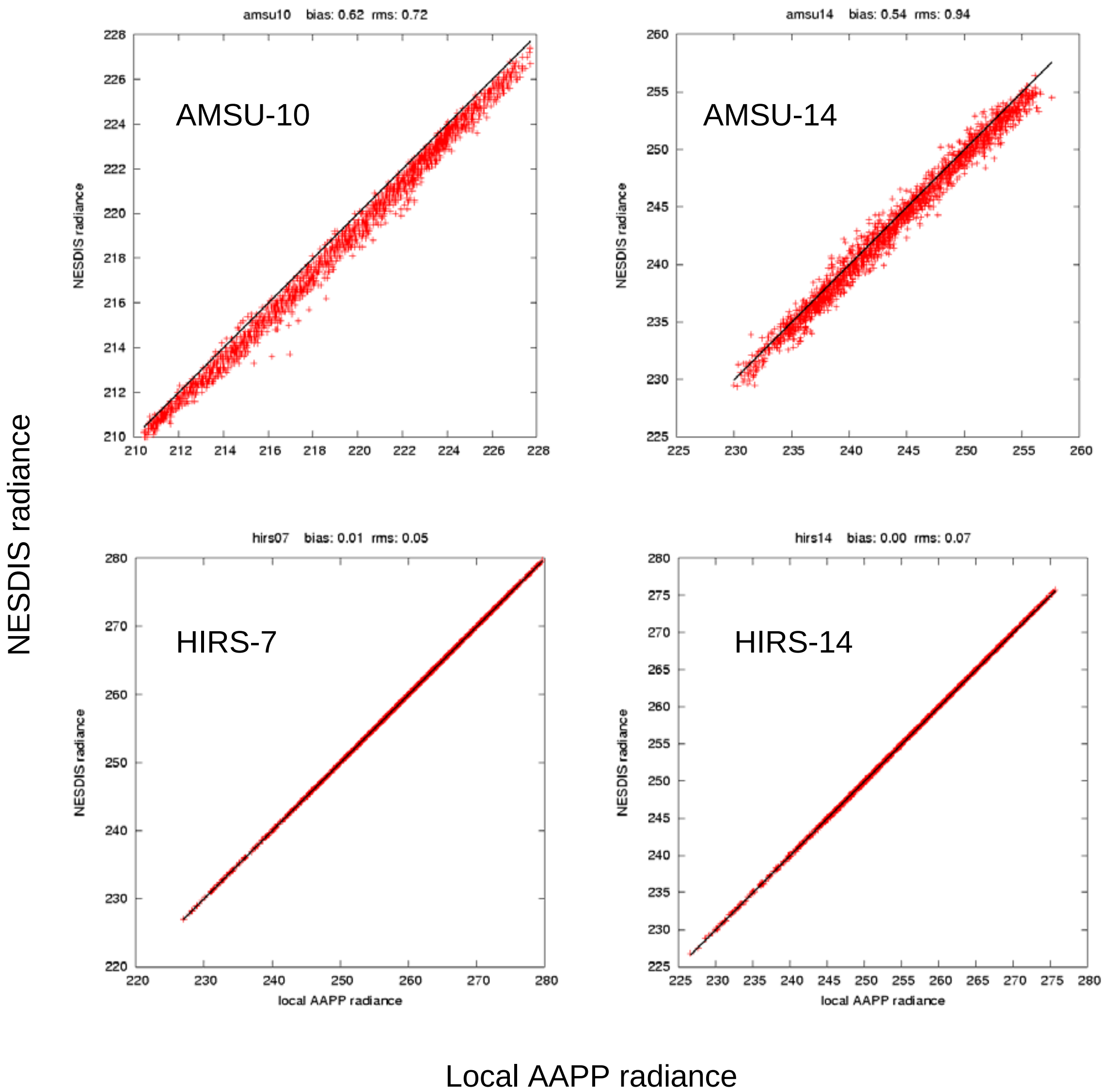

Comparison of locally received and processed (AAPP) NOAA-17 1D radiances with corresponding NESDIS values

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International TOVS Study Conference, 13th, TOVS-13, Sainte Adele, Quebec, Canada, 29 October-4 November 2003. Madison, WI, University of Wisconsin-Madison, Space Science and Engineering Center, Cooperative Institute for Meteorological Satellite Studies, 2003.