Evolution of dispersion spectra during successive steps of assimilation cycle

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Aladin set up

- ALADIN cycle 36t1ope (ALARO-0 with 3MT)

- LACE domain (309x277 grid points, linear truncation E159x143, Δx~9km)

- 43 vertical levels, mean orography

- time step 360 s, 3h coupling interval

- Ensemble based B matrix

AEARP – Assimilation ensemble ARPEGE

- Only two members of AEARP ensemble are used to build LAM ensemble

- 4DVar, 6h cycling, perturbed observation

- AEARP resolution T399, ~50 km

DFI Blending

$$\mathbf{x}^{i}_{ALD} = \mathbf{x}^{g}_{ALD} + \Psi_{L \to H}\left[\overline{\Psi_{G \to L}\left(\mathbf{x}^{a}_{ARP}\right)}\right] - \Psi_{L \to H}\left[\overline{\Psi_{H \to L}\left(\mathbf{x}^{g}_{ALD}\right)}\right] \quad \text{instead of} \quad \mathbf{x}^{i}_{ALD} = \Psi_{G \to H}\left(\overline{\overline{\mathbf{x}^{a}_{ARP}}}\right)$$

$\mathbf{x}^{i}$: initial state $\qquad$ $\mathbf{x}^{a}$: analysis $\qquad$ $\mathbf{x}^{g}$: guess

$\mathbf{x}_{ALD}$: ALADIN field $\qquad$ $\mathbf{x}_{ARP}$: ARPEGE field

$\Psi_{X \to Y}$: change of geometry (G - ARPEGE, H - ALADIN nominal, L - ALADIN low truncation)
In practice, $\Psi_{G \to L} = \Psi_{H \to L} \circ \Psi_{G \to H}$, since intermediate files are required for coupling. These transformations are achieved using configuration 927 (E927 for $G \to H$, EE927 for $H \leftrightarrow L$).

Bars denote a digital filter initialization :
- simple bar for the internal filter, applied at low spectral resolution,
- double bar for the external filter, applied at full spectral resolution.

Blending low spectral truncation is set to E29x26.

Experiments

Dyn is dynamical adaptation experiment (dfi initialization,
     cold start)

Blend is experiment with dfi blending of upper air fields

Spin-up Blend is experiment where only blending step is
   applied but no cycling

BlendVar   is based on Blend followed by 3DVar and canari
     with perturbed conventional observation

Var   experiment using 3DVar only
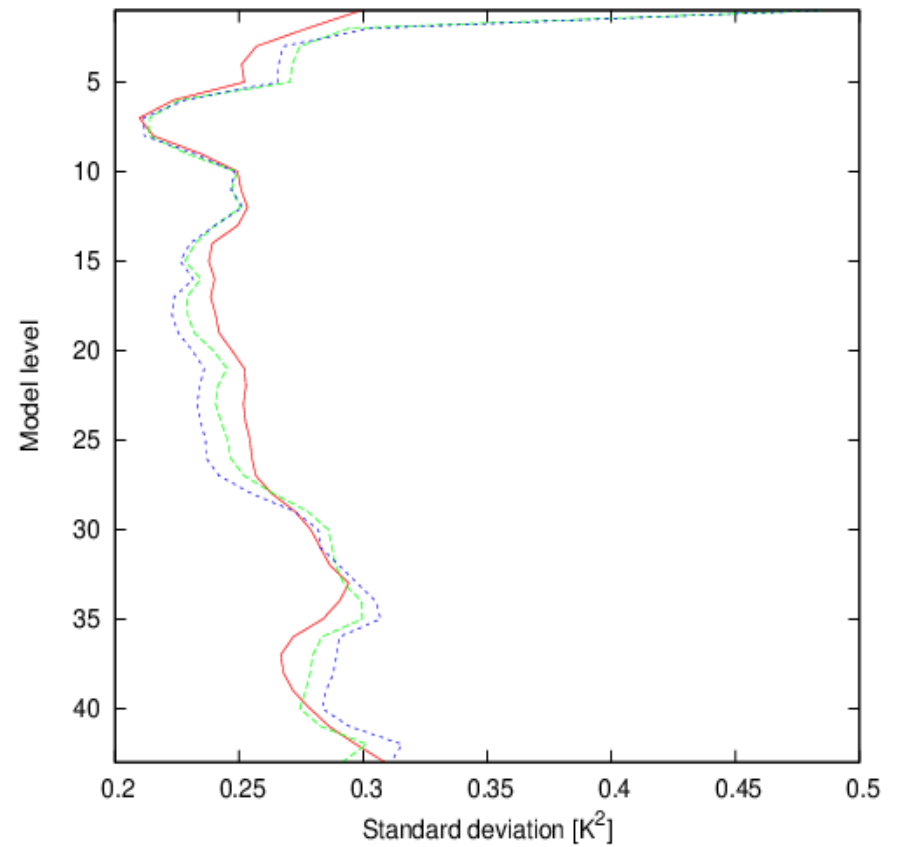
VarBlend   experiment where 3DVar is followed by blending

Ensemble based estimation of error stde and variance spectra
Experimental period: 2.-28. 2. 2011, 4 forecasts a day, sample
contains 108 "forecasts"

Vertical profile of standard deviation for v

Vertical profile of standard deviation for t

Compare ALADIN, AEARP

Horizontal variance spectra of v at level 29
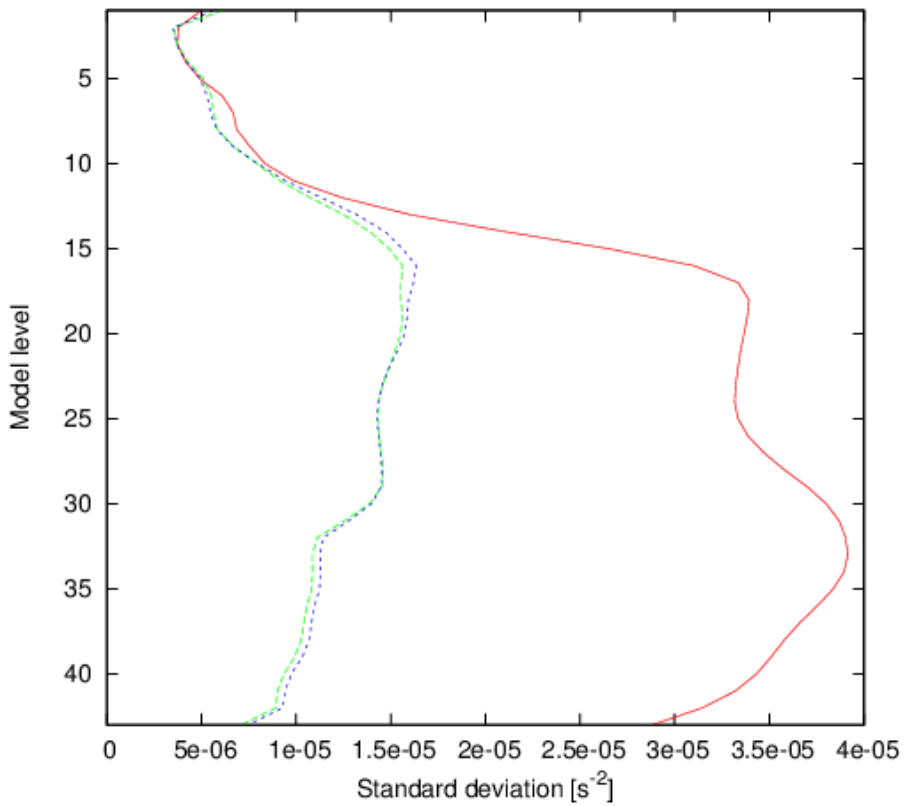
Dyn, guess-ala
Dyn, anal-arp
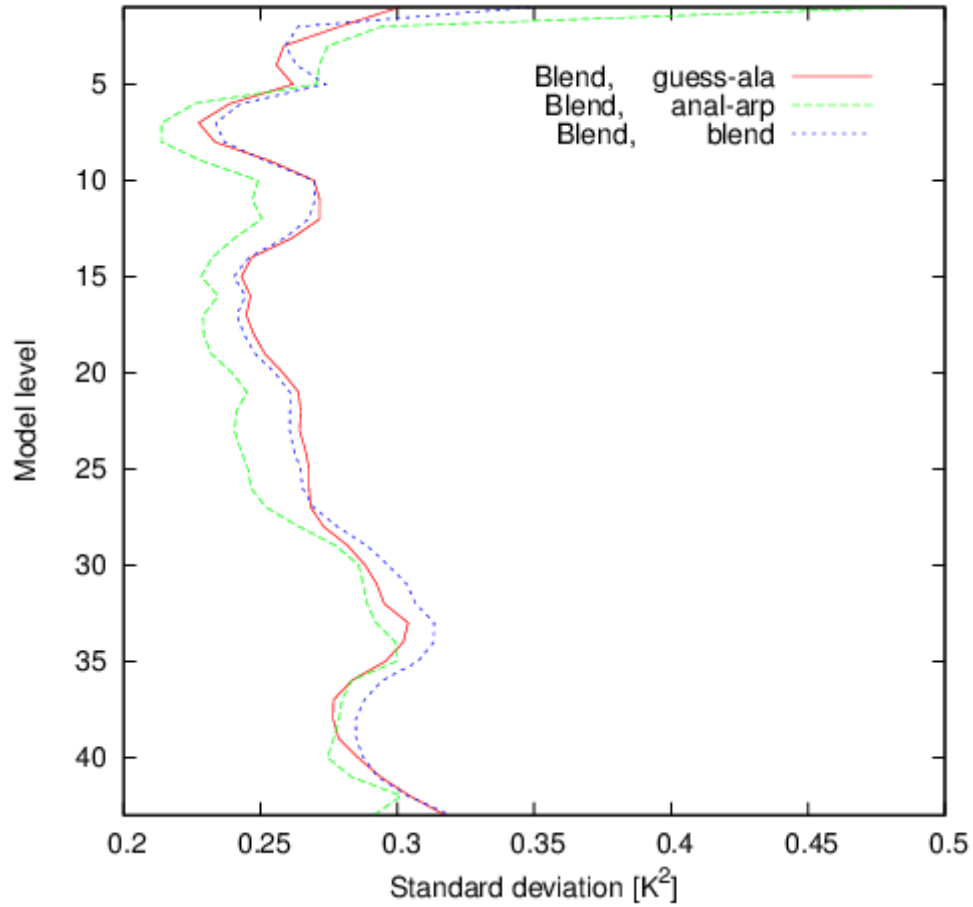Dyn, guess-arp

Compare ALADIN, AEARP

Horizontal variance spectra of logarithm of surface pressure
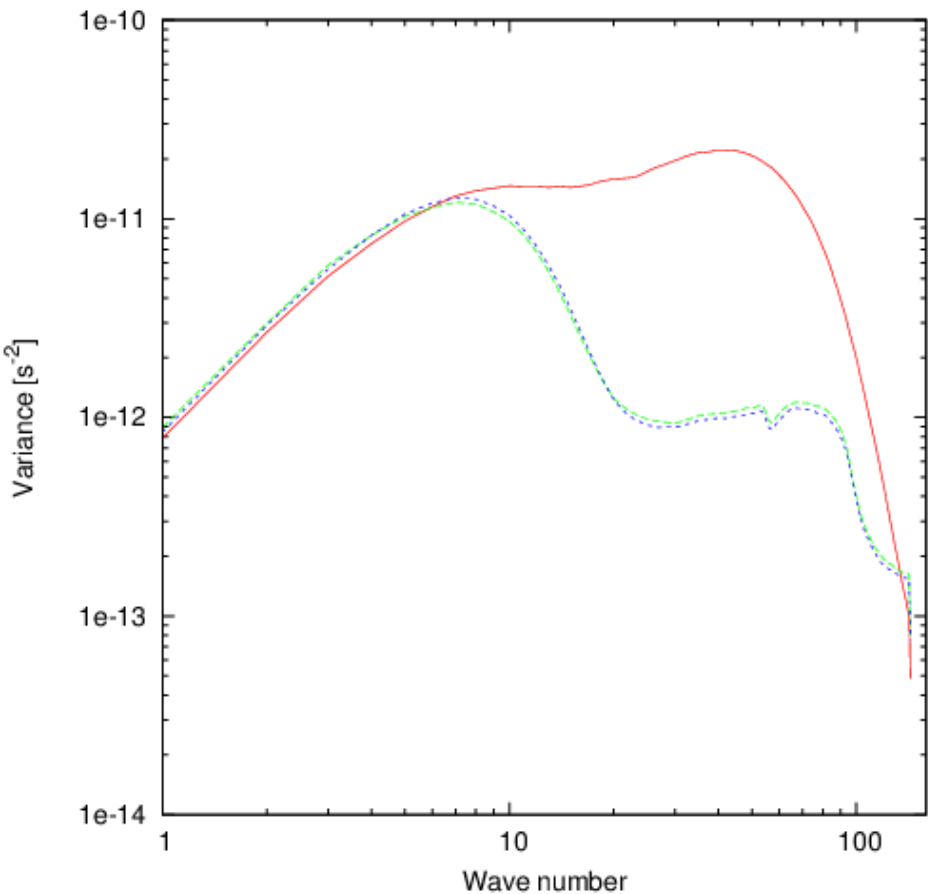
AEARP dispersion spectra for wave numbers larger than 28 is introduced only by interpolation
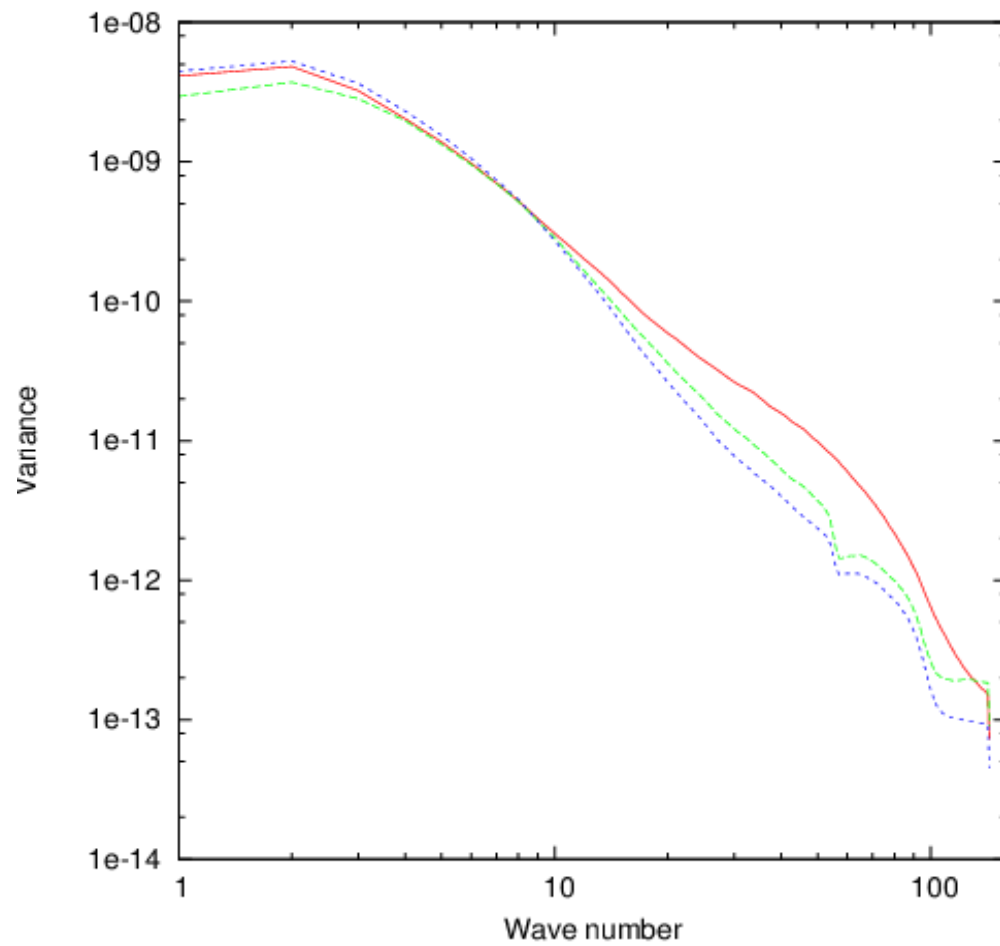
Blending cycle

Blending cycle

Relative plots are made according to $\dfrac{a}{ref} - 1$
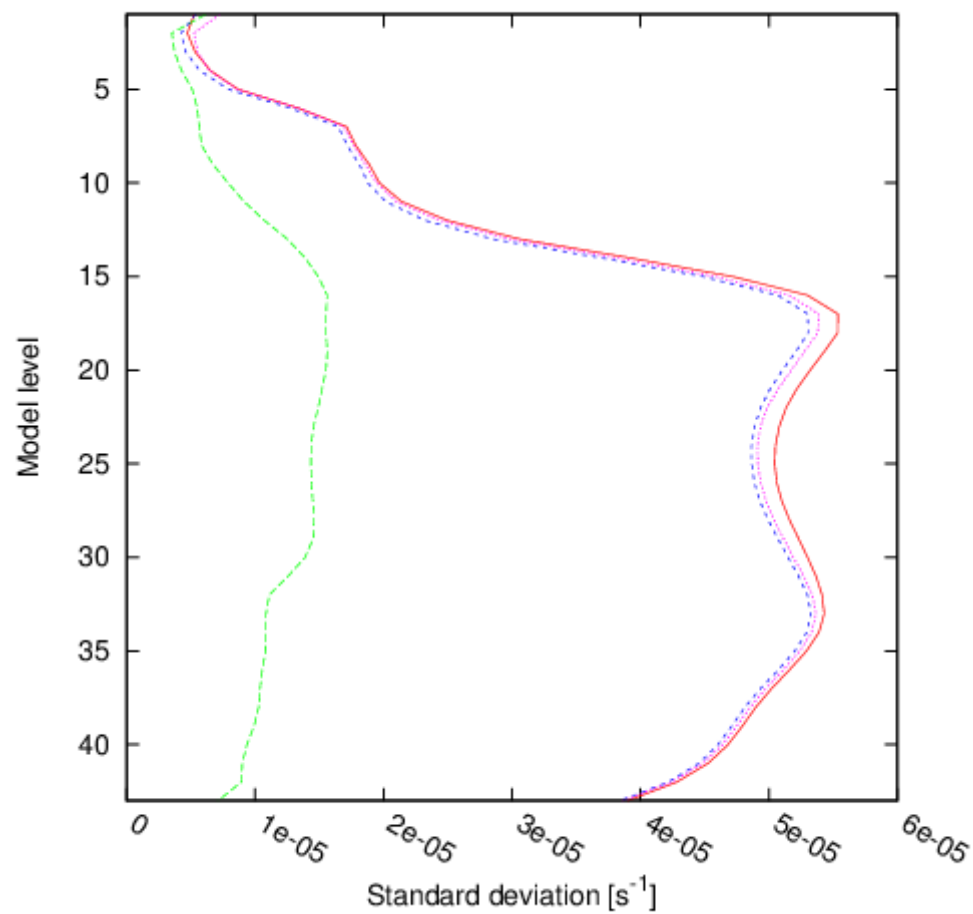
BlendVar cycle

Vertical profile of standard deviation for t
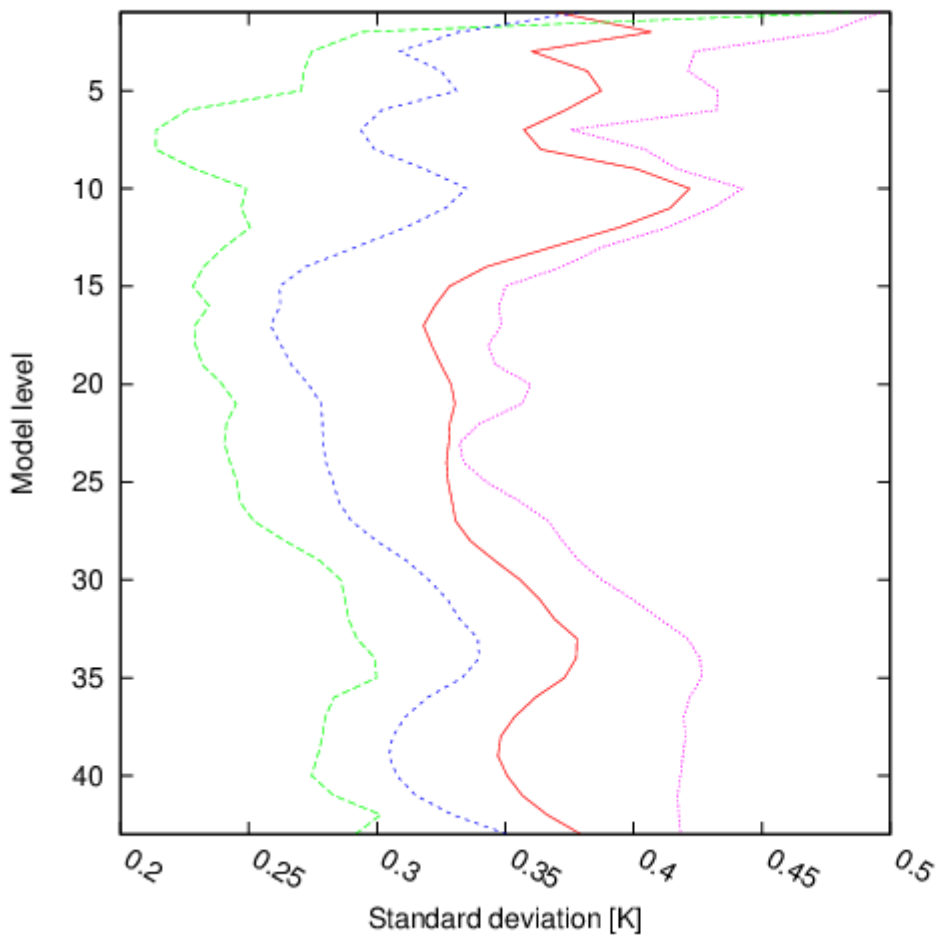
BlendVar, guess-ala
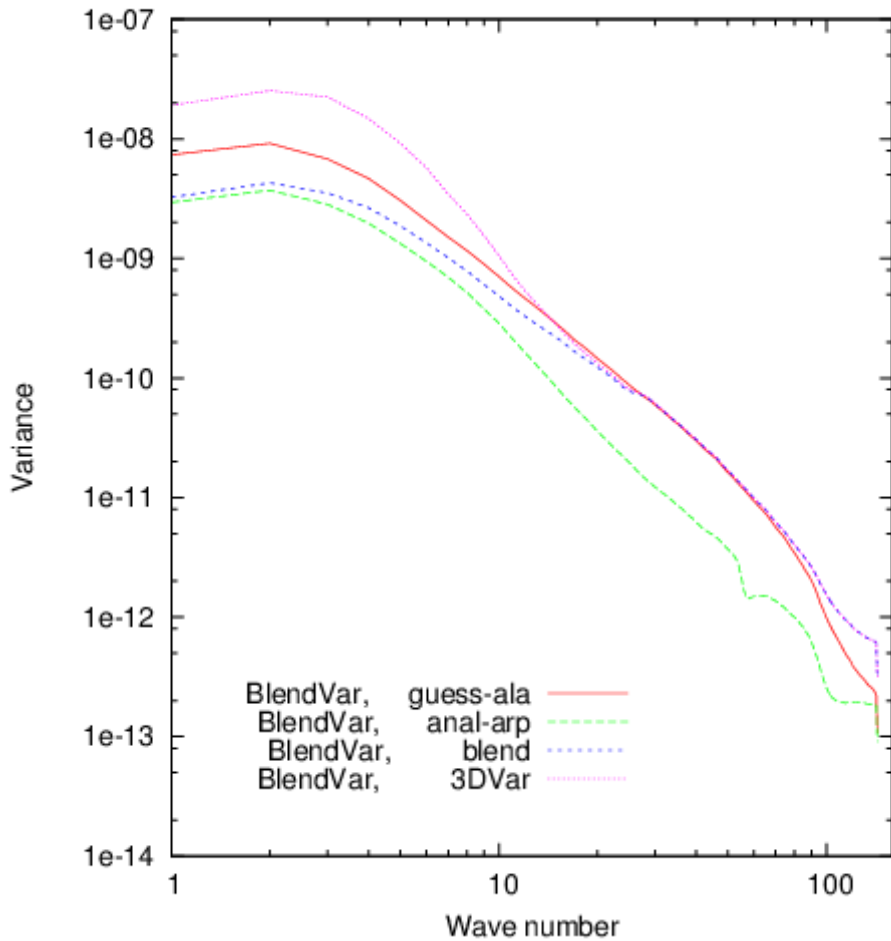BlendVar, anal-arp
BlendVar, blend
BlendVar, 3DVar

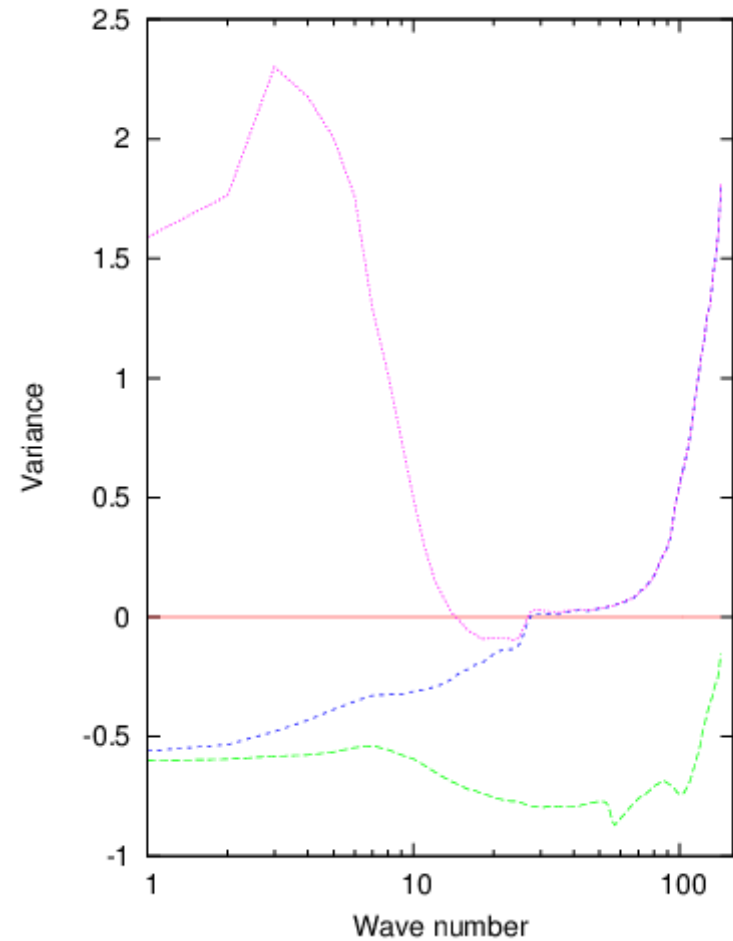Vertical profile of standard deviation for v

BlendVar cycle

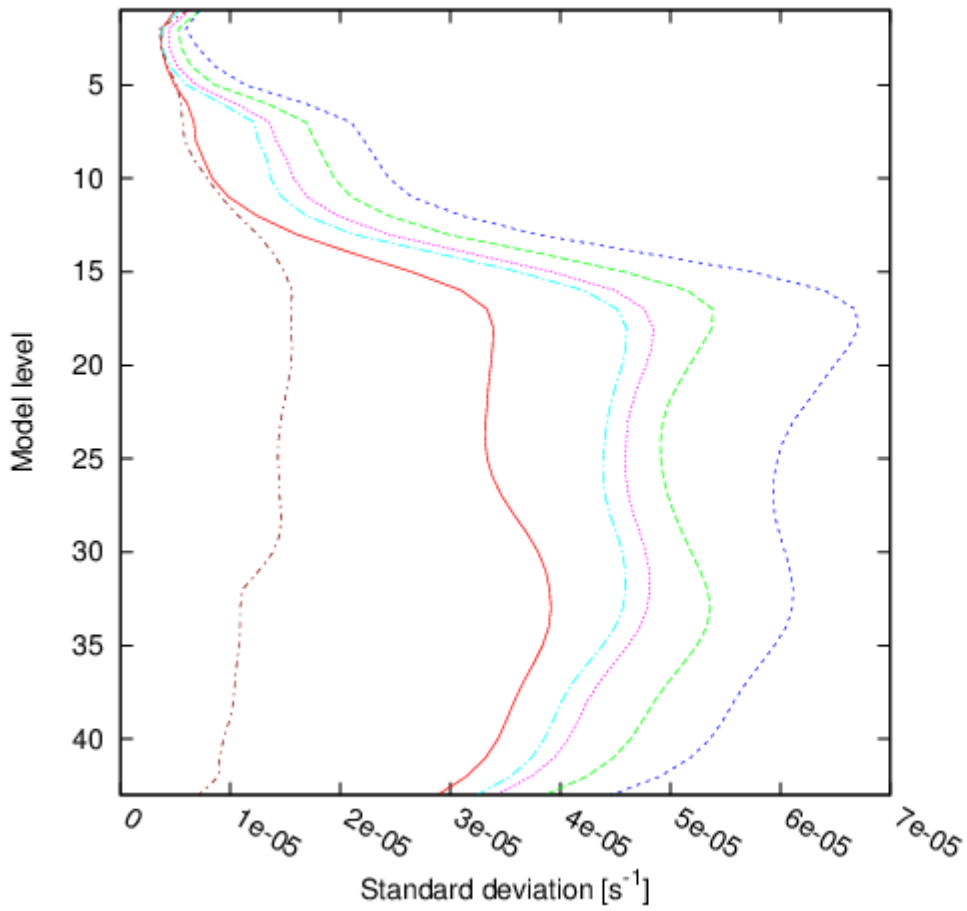Horizontal variance spectra of logarithm of surface pressure

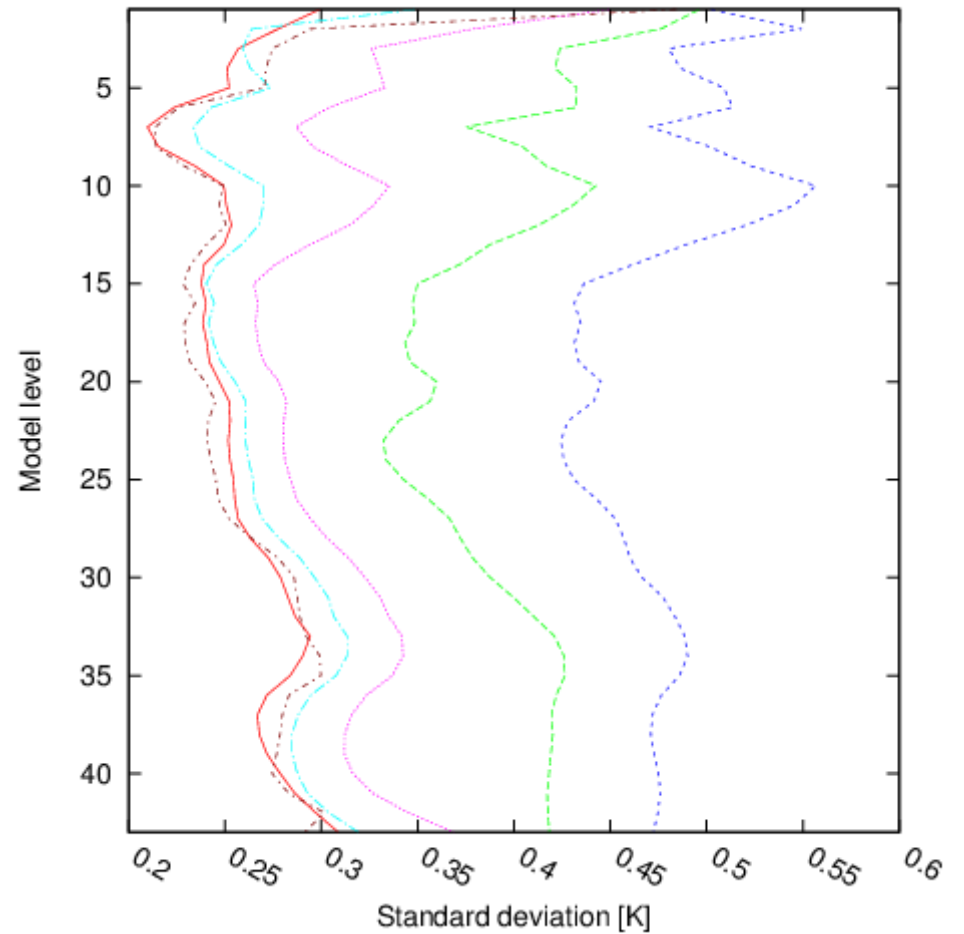Relative horizontal variance spectra of logarithm of surface pressure

Reference BlendVar, guess-ala
BlendVar, anal-arp
BlendVar, blend
BlendVar, 3DVar

BlendVar, guess-ala
BlendVar, anal-arp
BlendVar, blend
BlendVar, 3DVar

Vertical profile of standard deviation for v

Dyn,	guess-ala
BlendVar,	3DVar
Var,	3DVar
VarBlend,	blend
Blend,	blend
Dyn,	anal-arp

Vertical profile of standard deviation for t
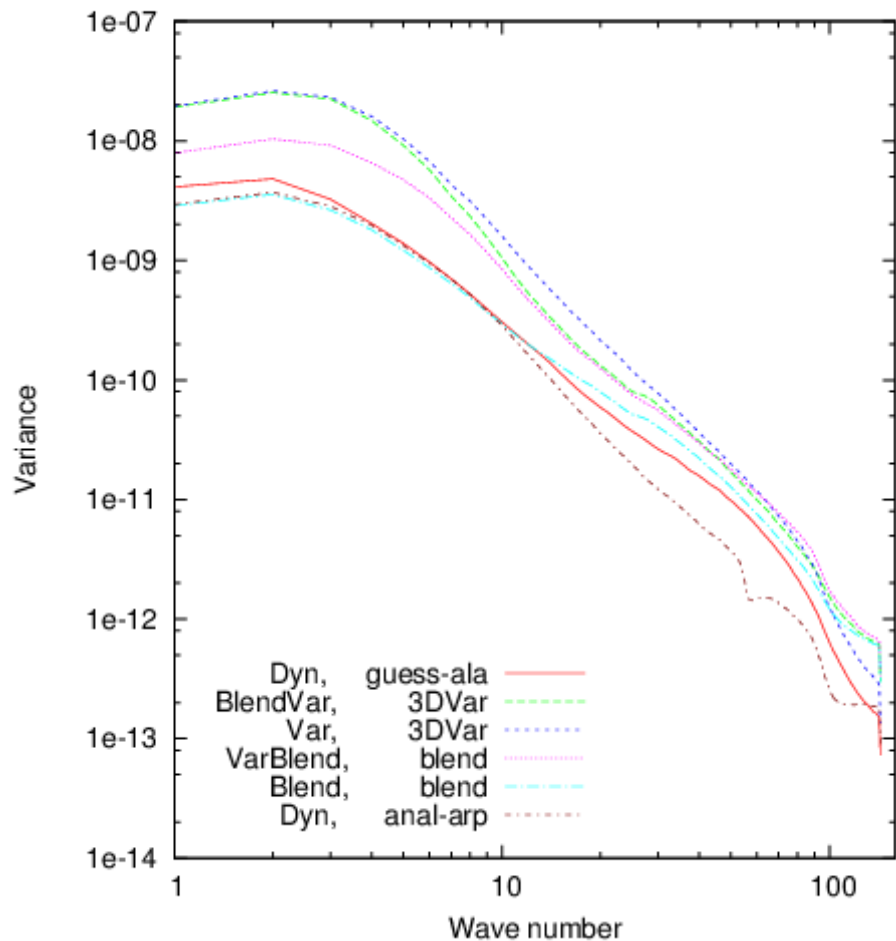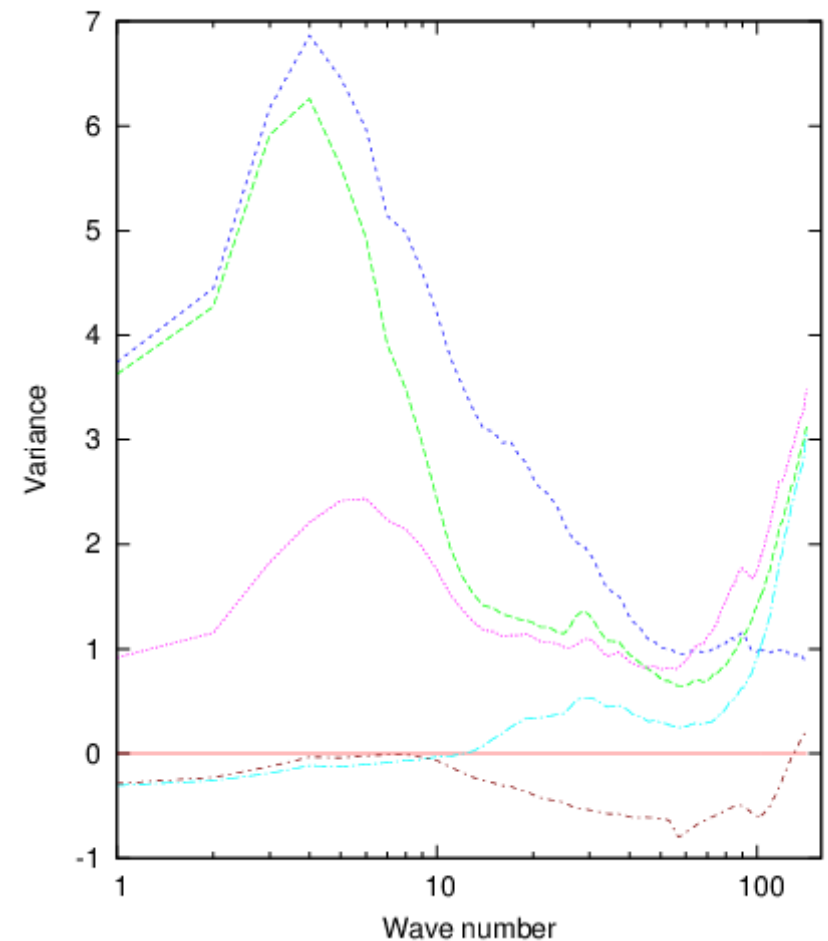
Comparison of analyses from all experiments

Comparison of analyses
from all experiments

Reference Dyn,   guess-ala
BlendVar,   3DVar
Var,   3DVar
VarBlend,   blend
Blend,   blend
Dyn,   anal-arp

Horizontal variance spectra of logarithm of surface pressure

Dyn,   guess-ala
BlendVar,   3DVar
Var,   3DVar
VarBlend,   blend
Blend,   blend
Dyn,   anal-arp

Variance

Wave number

Relative horizontal variance spectra of logarithm of surface pressure

Variance

Wave number

Conclusion

Possible reasons for observed behaviour 3D-Var:

- Observations are projected to large scales

- Not proper accounting model errors

- Too small amount of observations, only SYNOP, TEMP observations were assimilated (45; 12)