

*Regional Cooperation for
Limited Area Modeling in Central Europe*



Appropriate Bmatrix for BlendVar

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Antonín Bučánek



ARSO METEO
Slovenia



- **The BlendVar scheme – wanted properties:**
 - to compensates lack of information on largest scales
 - to preserves results of advanced ARP 4D-Var
 - to analyze scales not resolved by ARP
- **We need special B matrix! Why?**
- **The way we sample the B matrix**
- **Comparison to Ensemble based B matrix**
- **Results of experiments**
- **Conclusion**

- **DF Blending combines a large scale analysis with small scales of LAM background. [2, 3]**

$$\mathbf{x}_a = \mathbf{x}_b + T_{L \rightarrow H} \left\{ \overline{T_{H \rightarrow L}(\mathbf{g}_a)} \right\} - T_{L \rightarrow H} \left\{ \overline{T_{H \rightarrow L}(\mathbf{x}_b)} \right\}, \quad (1)$$

$\mathbf{x}_b, \mathbf{x}_a$ ALADIN background, analysis; \mathbf{g}_a ARPEGE analysis in ALADIN resolution, T denotes change of truncation. Bar is digital filter.

Experimental setup CY38t1tr

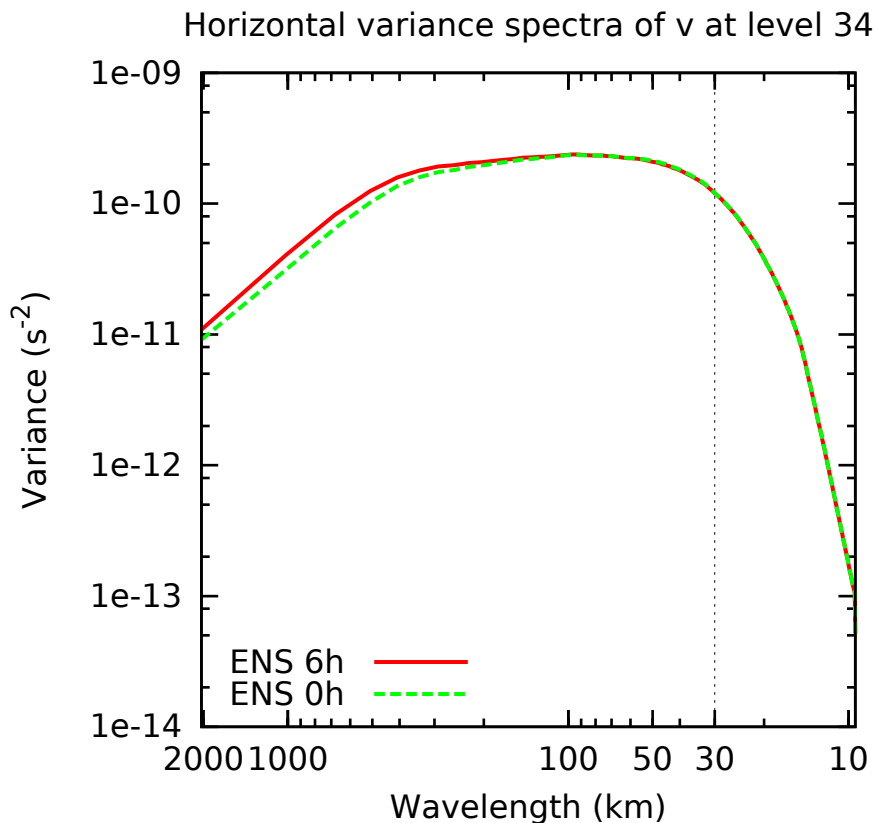
- $\Delta x \sim 4.7\text{km}$, GP 529x421,
- L87, lin. trunc. E269x215,
- $\Delta t = 180$ s, mean orography,
- 3h coupl. interval,
- CANARI (T2m, RH2m)
- ALARO-0 baseline physics [1]

BlendVar for upper air fields

- **DF Blending cutoff $\Delta x \sim 30\text{km}$**
- Obs: SYNOP mslp, TEMP, MSG10 (channels 2, 3, 4, 5, 6), AMV, AMDAR,
- 3h assim. window
- no DFI in 6h assim cycle
- incremental DFI init. in production

Why we need special B matrix?

- DF Blending takes large scales from ARPEGE
- 3D-Var reduces **also** the large scale part of BG error
- We need to force 3D-Var to not reanalyze (distort) scales already taken by DF Blending

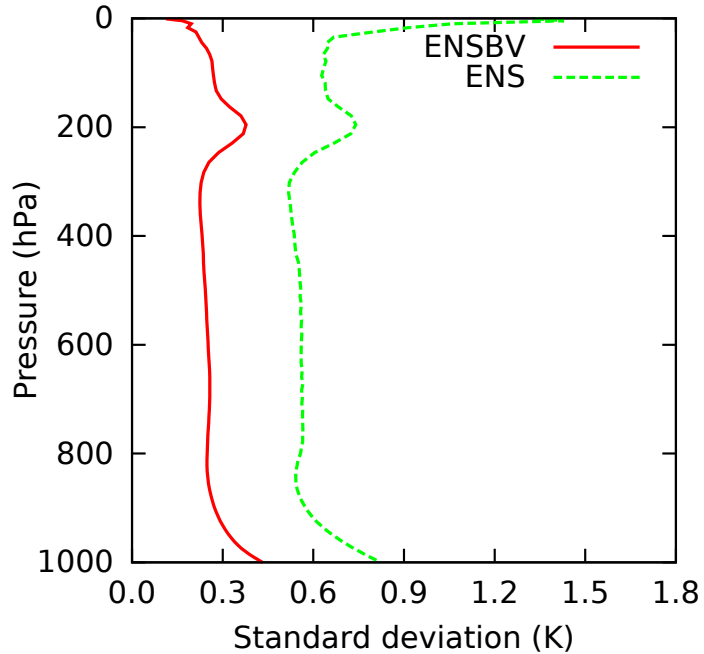


ENS Vorticity var. spectra ~ 500 hPa
Analysis spectra; Background spectra

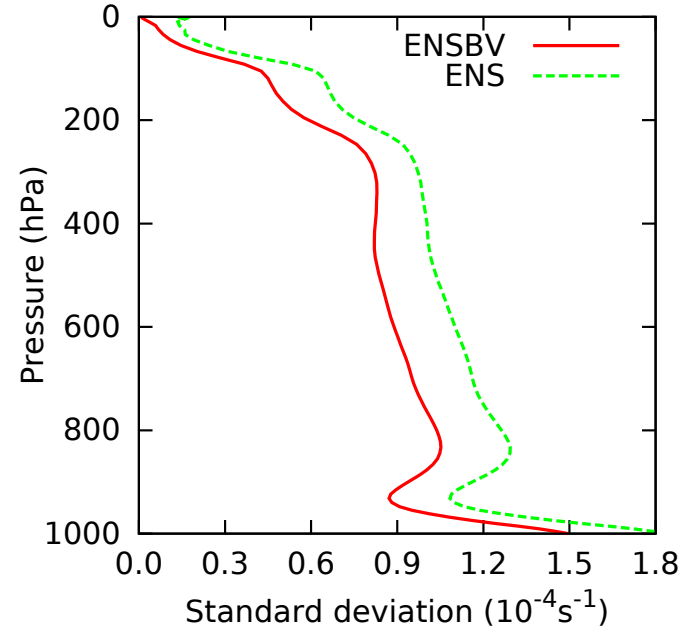
- LAM BlendVar assimilation ensemble with perturbed observations (ENSBV)
- 6h assimilation cycle, coupling to ARPEGE
- Every member is blended with the same ARPEGE analysis
- B matrix is sampled from differences between 6-hour forecast of ensemble members \Rightarrow much lower differences in large scales

Comparison ENSBV x ENS (1)

Vertical profile of standard deviation for t

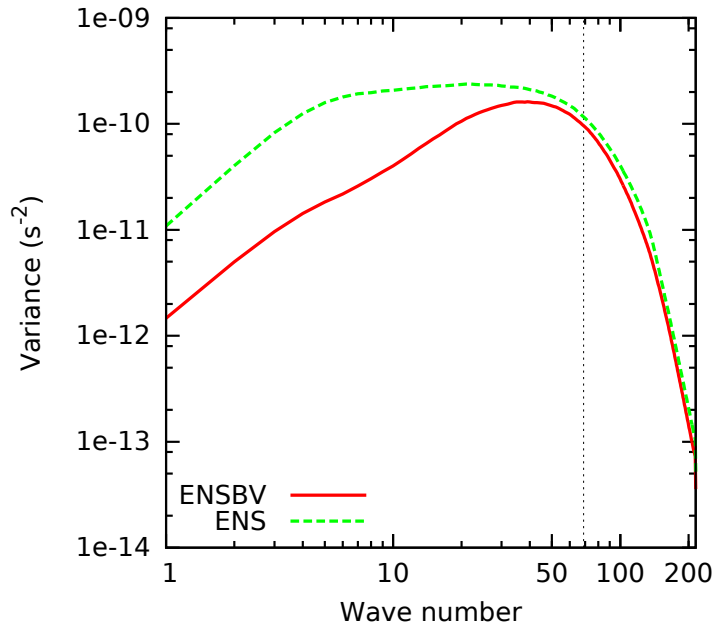


Vertical profile of standard deviation for d

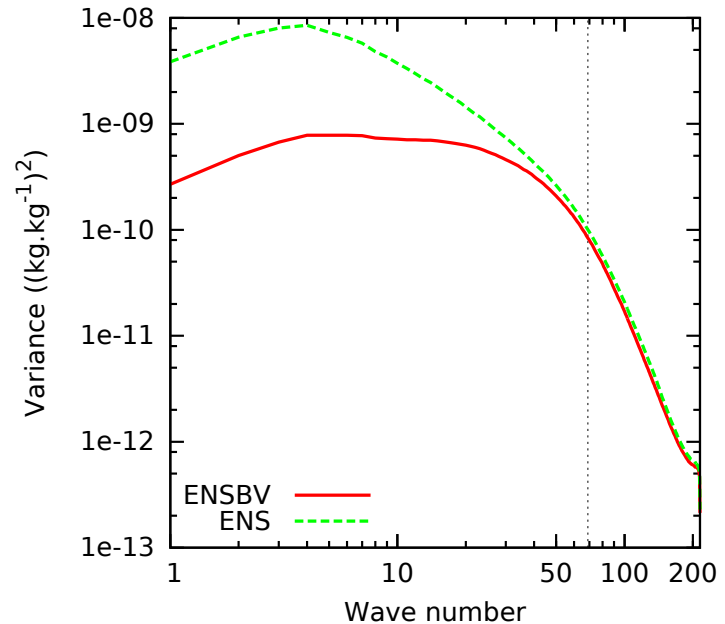


Comparison ENSBV x ENS (2)

Horizontal variance spectra of v at level 34

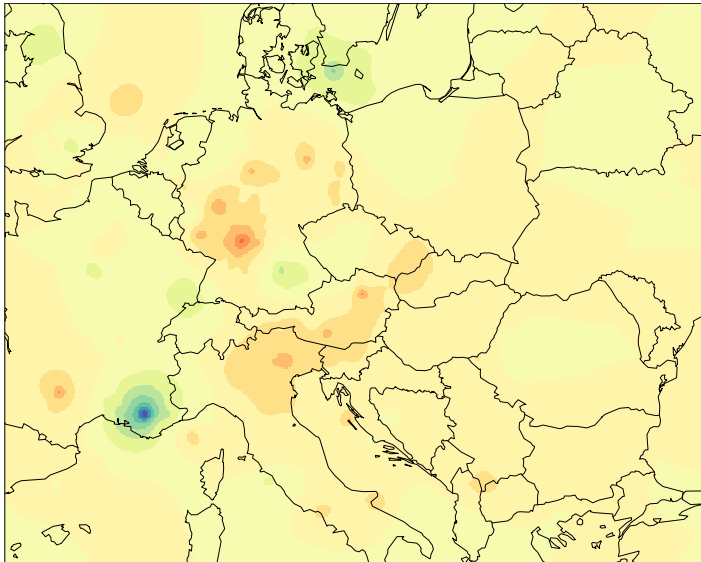


Horizontal variance spectra of q at level 34

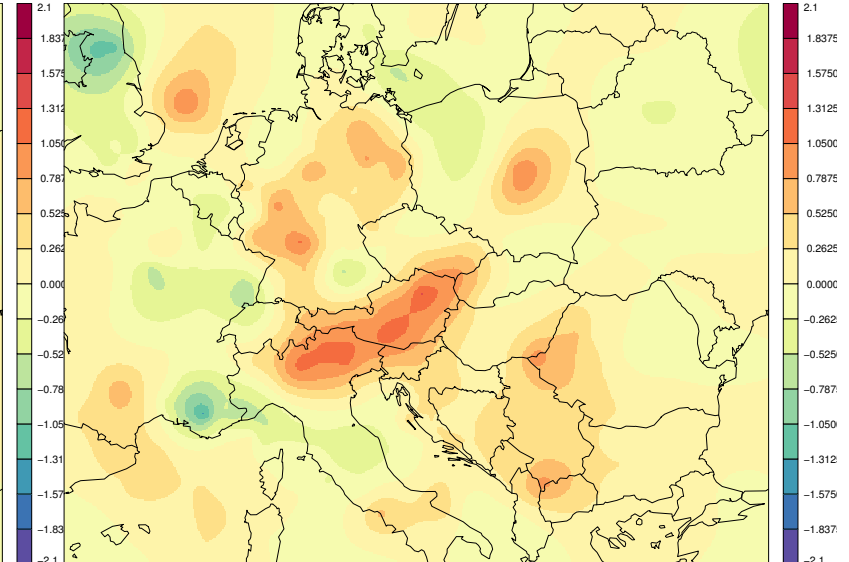


Comparison ENSBV x ENS (3)

Analysis increment BlendVar_ENSBV
TEMPERATURE ~500hPa

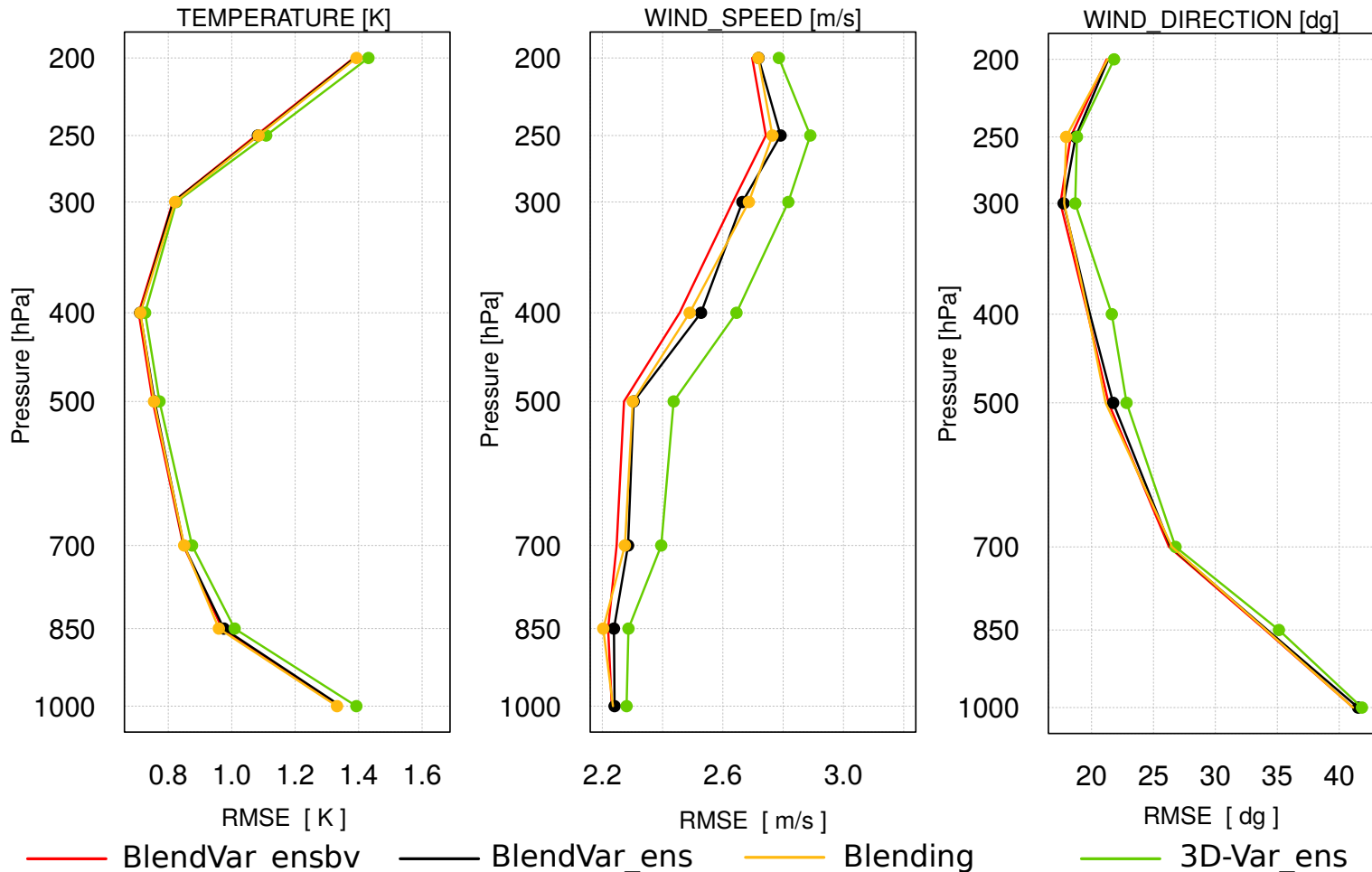


Analysis increment 3Dvar_ENS
TEMPERATURE ~500hPa



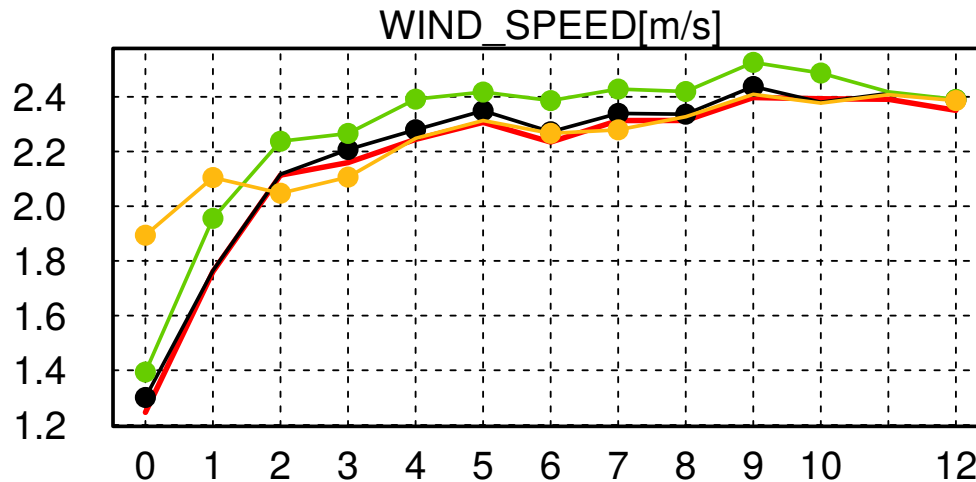
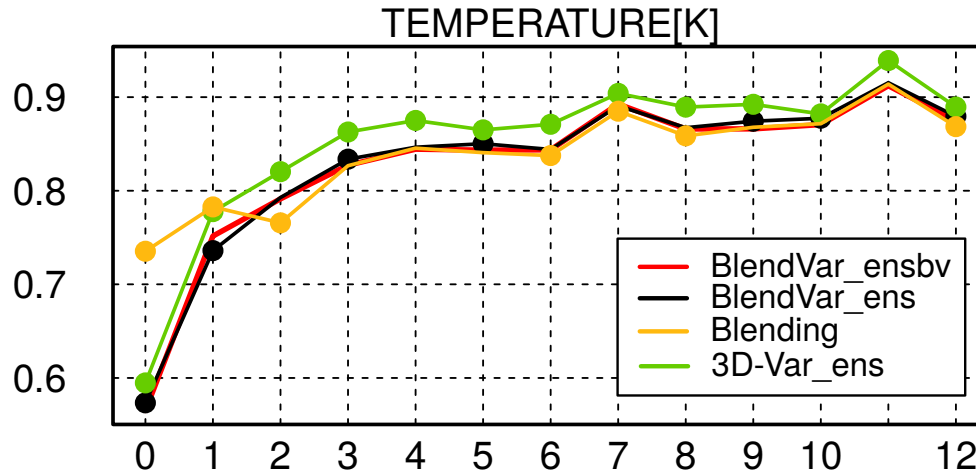
Results of experiments (1)

- RMSE fc +6h assim cycle, against TEMP, AMDAR, 6/2013



Results of experiments (2)

- RMSE 700hPa production 00,12 utc, against AMDAR, 6/2013



- **DF Blending based schemes clearly outperformed 3D-Var alone**
- **Appropriate B matrix for BlendVar gives better results than standard ENS.**
- **The newly sampled B should be used only in BlendVar scheme**
- **There is space for improving the B matrix for BlendVar since the first derivation in ENSBV was using standard ensemble based B matrix. (second derivation using bg errors of ENSBV)**

Thank You for Your attention !

- [1] R Brožková. A general description of the “alaro” concept and its realisation. 2014. http://www.rclace.eu/File/ALARO/ALARO_description_Jan2014.pdf.
- [2] R Brožková, D Klaric, S Ivatek-Sahdan, J-F Geleyn, V Cassé, M Siroka, G Radnóti, M Janousek, K Stadlbacher, and H Seidl. Dfi blending: An alternative tool for preparation of the initial conditions for lam. *WORLD METEOROLOGICAL ORGANIZATION-PUBLICATIONS-WMO TD*, pages 1–7, 2001.
- [3] M. Derková and M. Belluš. Various applications of the blending by digital filter technique in the ALADIN numerical weather prediction system. *Meteorol. časopis*, 10(1):27–36, 2007.