

Detailed case study of dramatic winter temperature overestimation

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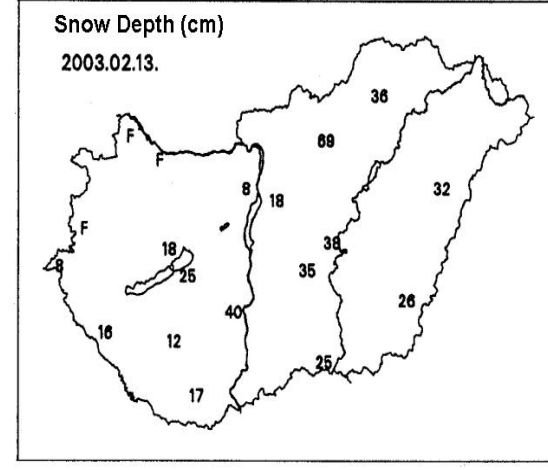
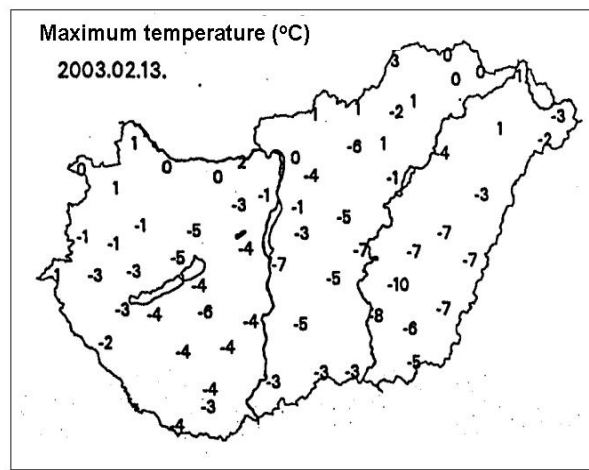
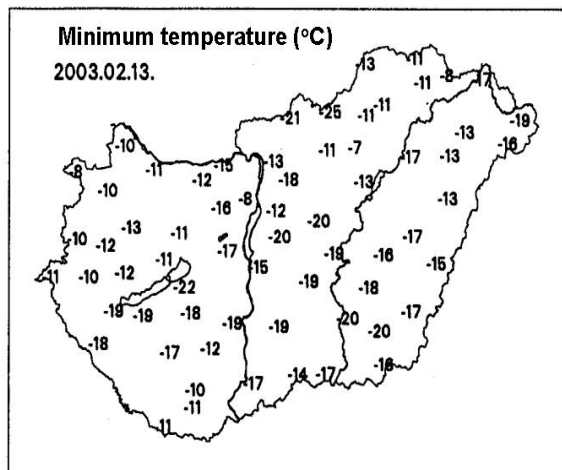
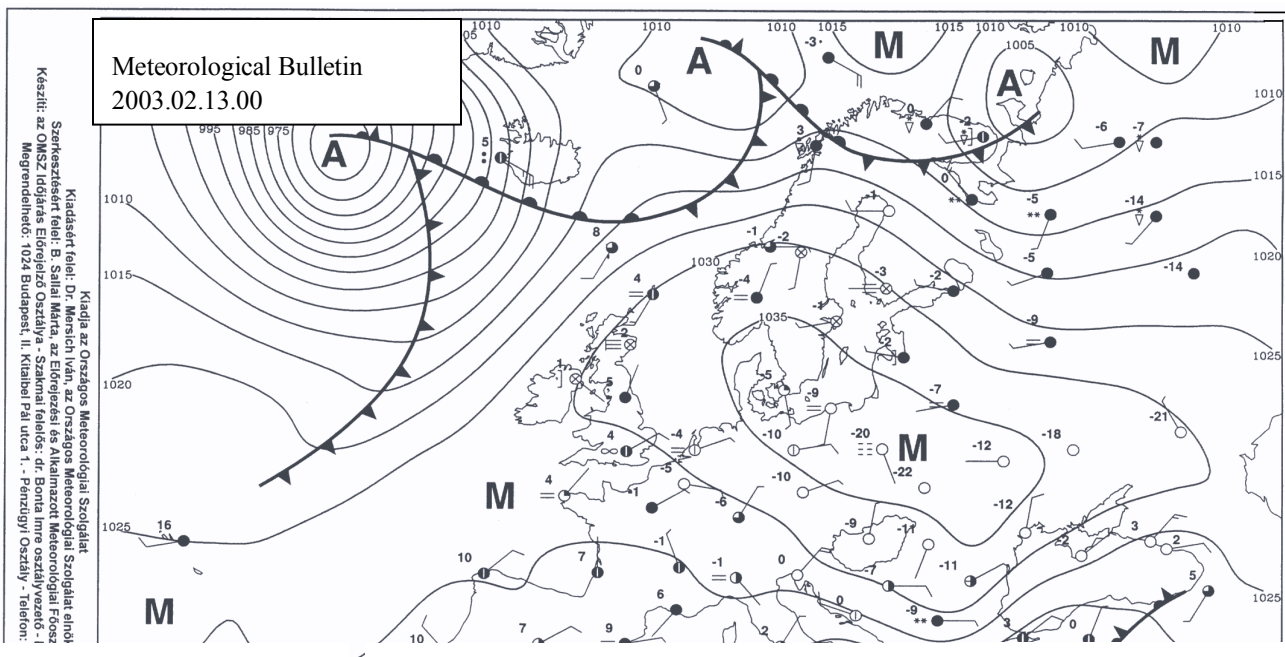


Contents

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Motivation

- **Dramatic forecast error of the parameters near the surface in strong inversion situation**
- **A representative example (largest RMSE of 2mT): 12-14th of Febr. 2003. AC developed after a strong cold-advection in the Carpathian-Basin $\Rightarrow$ detailed case study**



ECM snow T 2m (C) 2003-Feb-13 Csüt 00:00 UT (+06)
SYNOP2 Kárpát-medence T (C) 2003-Feb-13 Csüt 00:00 UT

Only 1-2 deg. err.

ECMWF

DYN. AD.

ALHUop T 2m (C) 2003-Feb-13 Csüt 00:00 UT (+06)
SYNOP2 Kárpát-medence T (C) 2003-Feb-13 Csüt 00:00 UT

5-8 deg. overest.

AL3d T 2m (C) 2003-Feb-13 Csüt 00:00 UT (+06)
SYNOP2 Kárpát-medence T (C) 2003-Feb-13 Csüt 00:00 UT

2m Tem
2003. 02

3D-VAR

ECM snow T 2m (C) 2003-Feb-14 Péntek 06:00 UT (+306)
SYNOP2 Kárpát-medence T (C) 2003-Feb-14 Péntek 06:00 UT

ECMWF

DYN. AD.

ALHUop T 2m (C) 2003-Feb-14 Péntek 06:00 UT (+306)
SYNOP2 Kárpát-medence T (C) 2003-Feb-14 Péntek 06:00 UT

**Bad structure of the
part of H.**

AL3d T 2m (C) 2003-Feb-14 Péntek 06:00 UT (+306)
SYNOP2 Kárpát-medence T (C) 2003-Feb-14 Péntek 06:00 UT

10-12 deg. err.

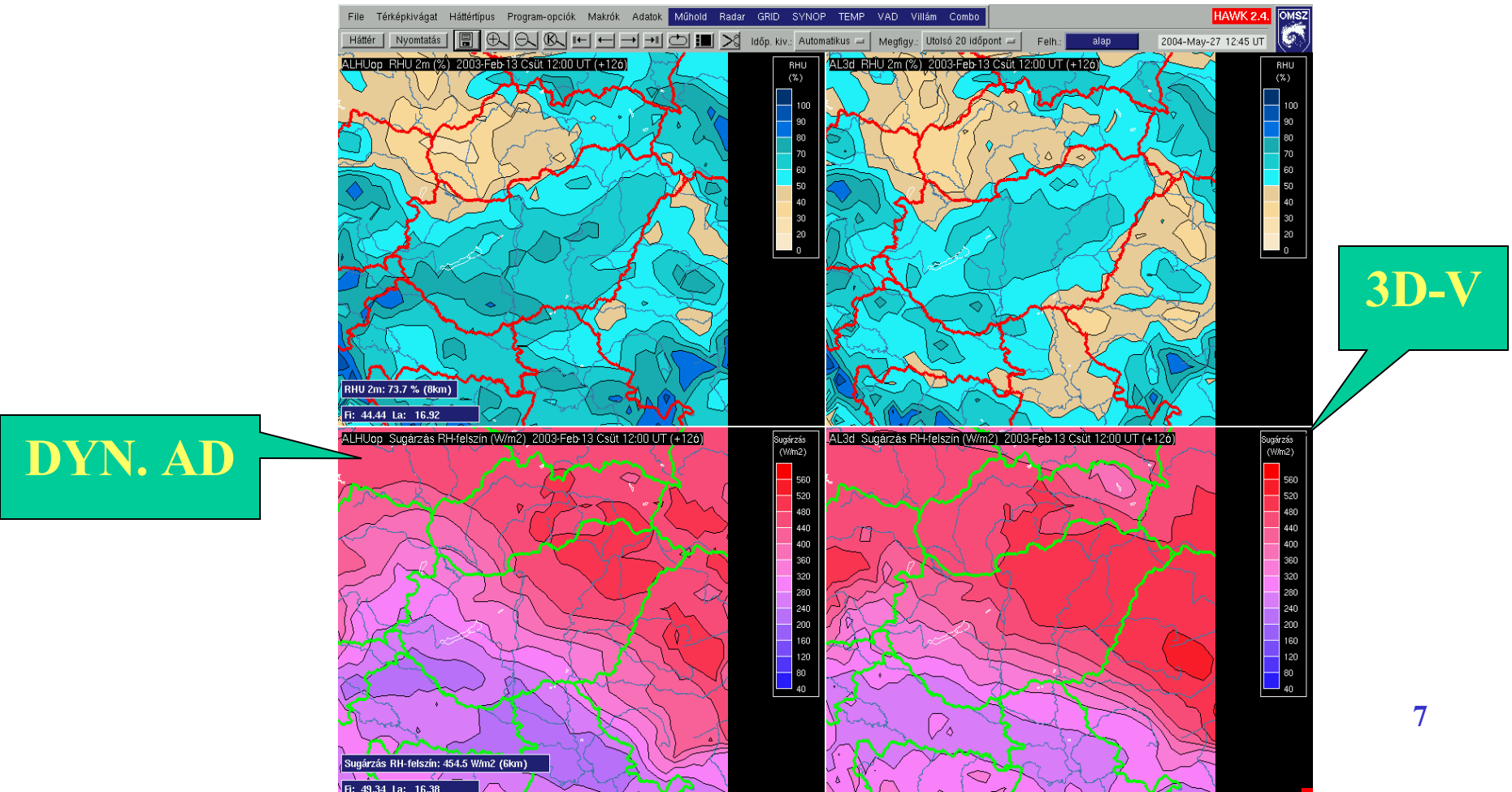
still 10-12. deg. err.

Too warm

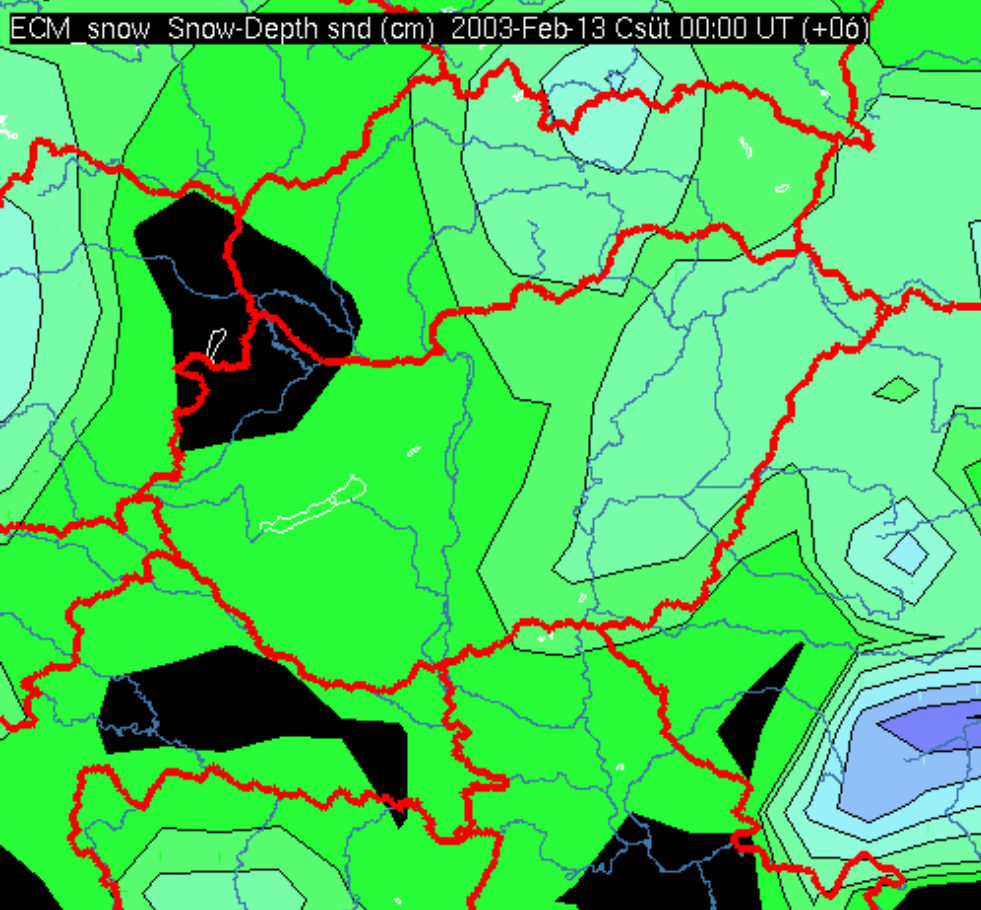
3D-VAR

**2m temp
2003. 02.**

- 3D-VAR forecast became worse in time
- 2mRhu is too dry $\Rightarrow$ short wave radiation is bigger $\Rightarrow$ 2mT is higher



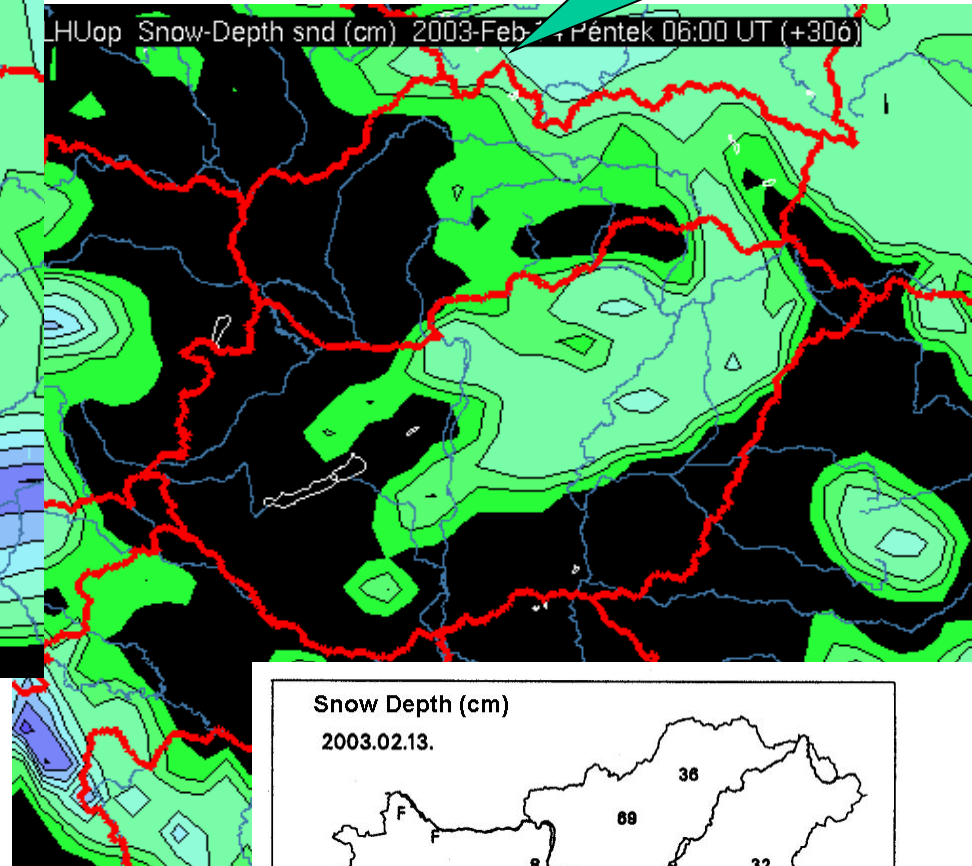
ECM snow Snow-Depth snd (cm) 2003-Feb-13 Csüt 00:00 UT (+06)



ECMWF

DYN. AD.

HUop Snow-Depth snd (cm) 2003-Feb-13 Péntek 06:00 UT (+306)

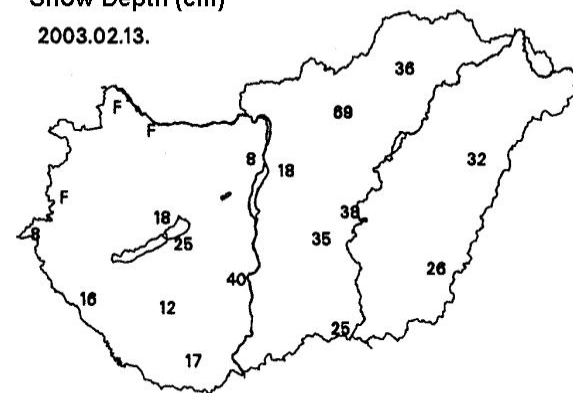


Reason of the bad forecast:

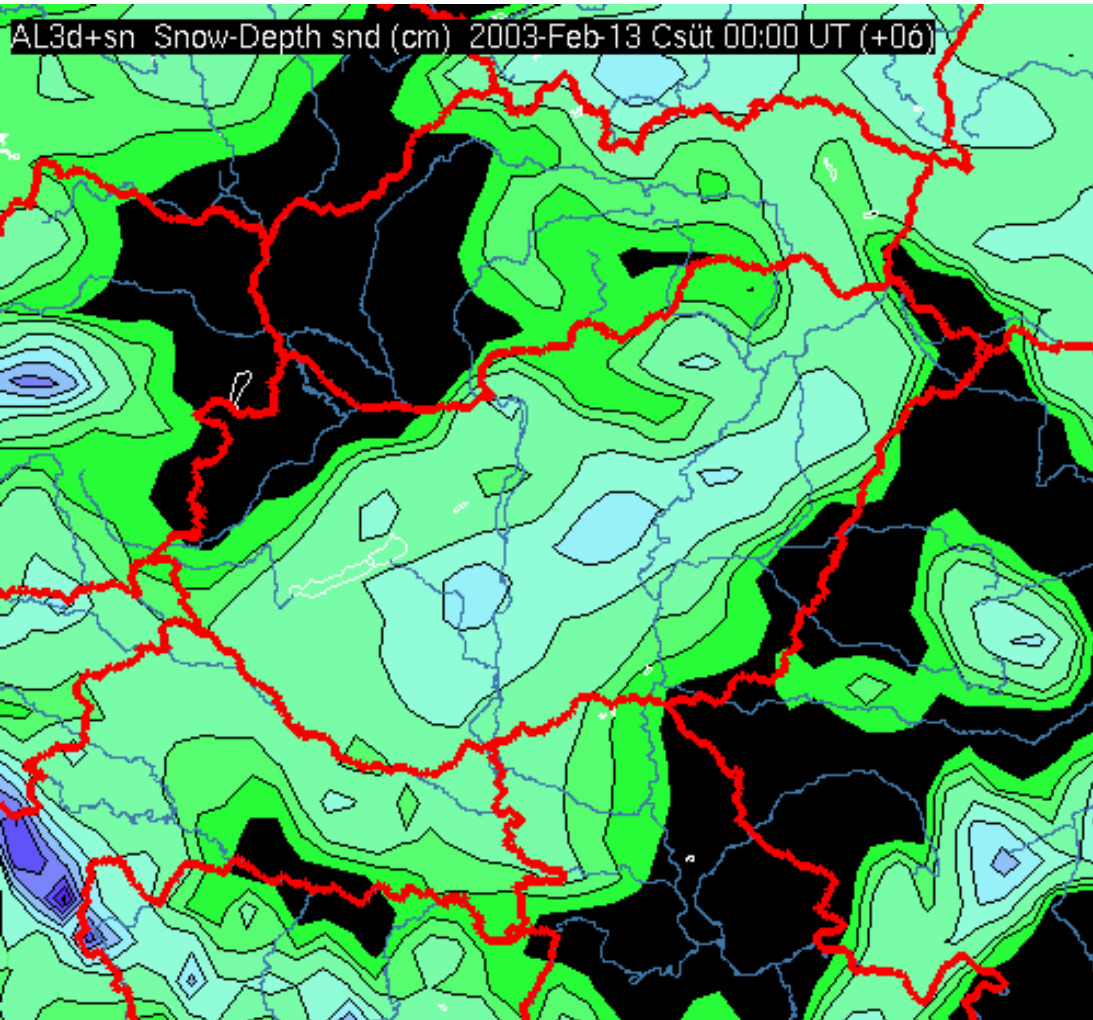
**1. No Snow analysis,
2003. 02. 13. 00 UTC**

ALADIN Workshop 2004, Innsbr

Snow Depth (cm)
2003.02.13.



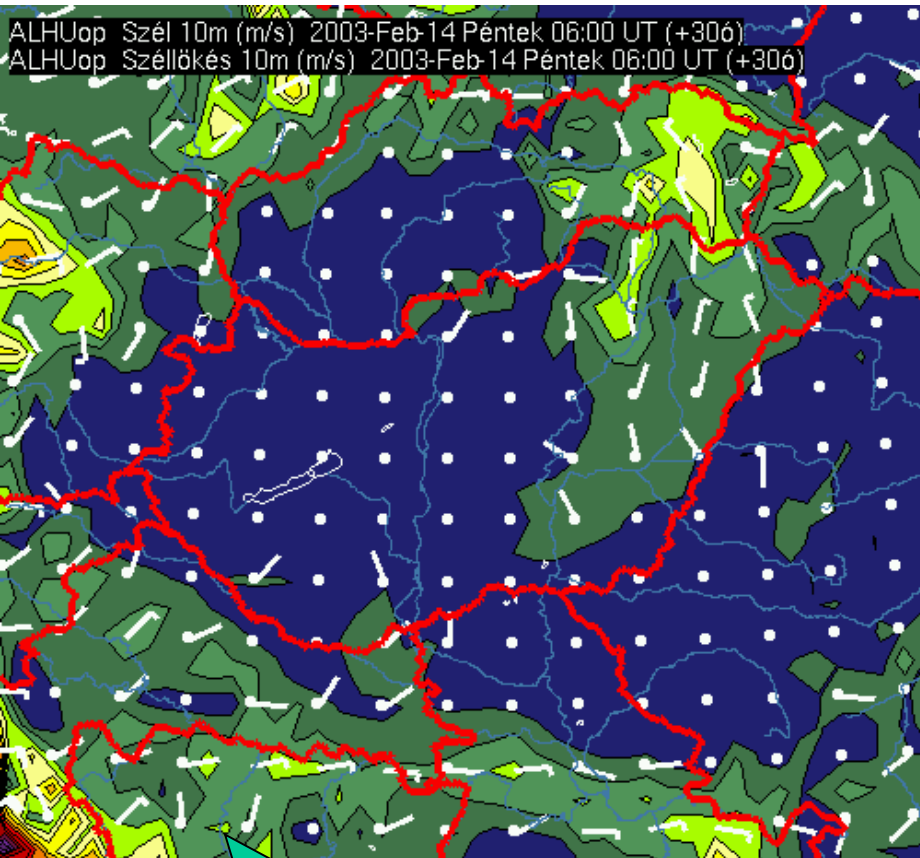
- **Test with 3D-VAR+CANARI snow anal**



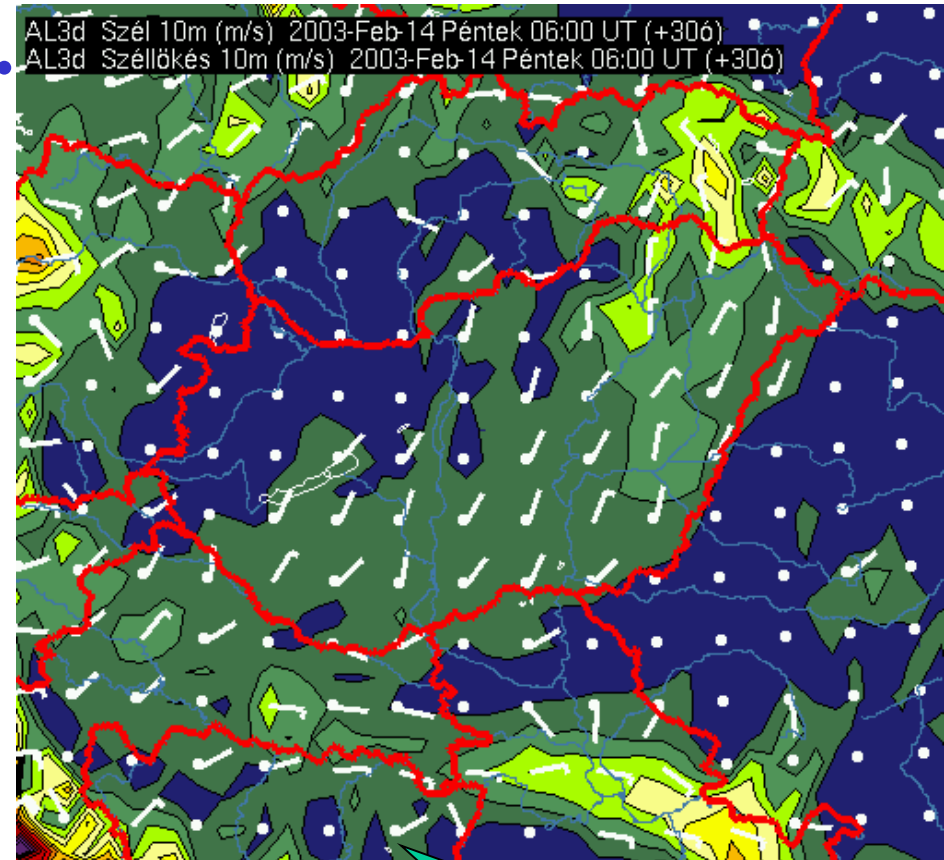
**- The snow analysis is not good enough
⇒ some measurements are not taken into account well (big diff. between the obs. and guess)**

- A little bit better T2m field after a time, but still have 8-10 degree errors

- 2 problem: too strong 10 m wind and gust in 3D-VAR fcst.



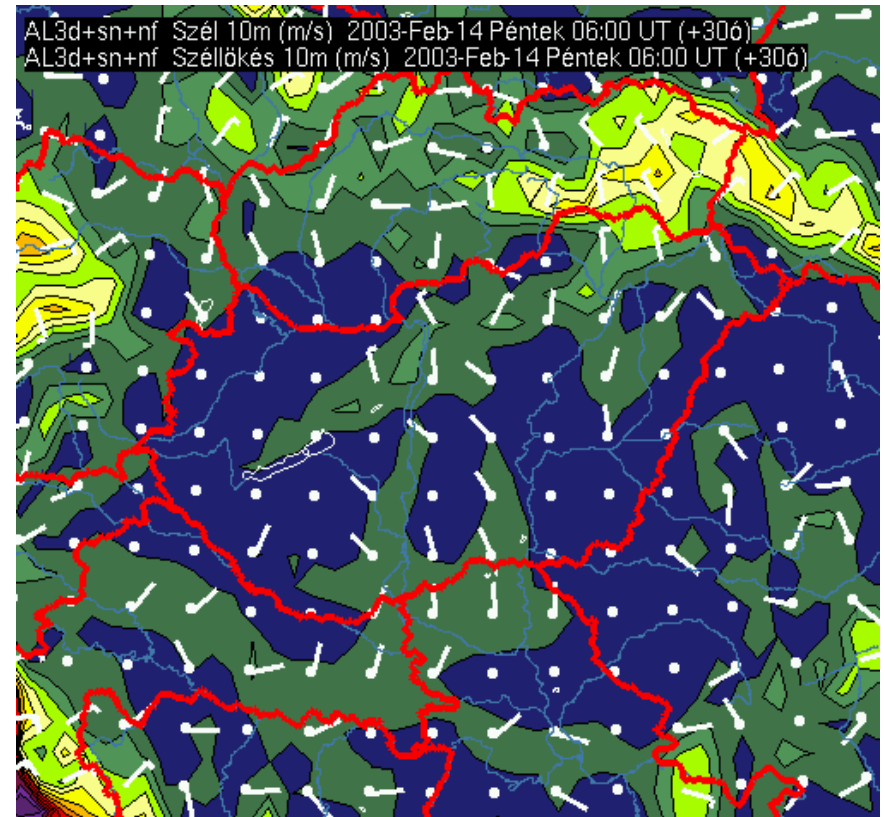
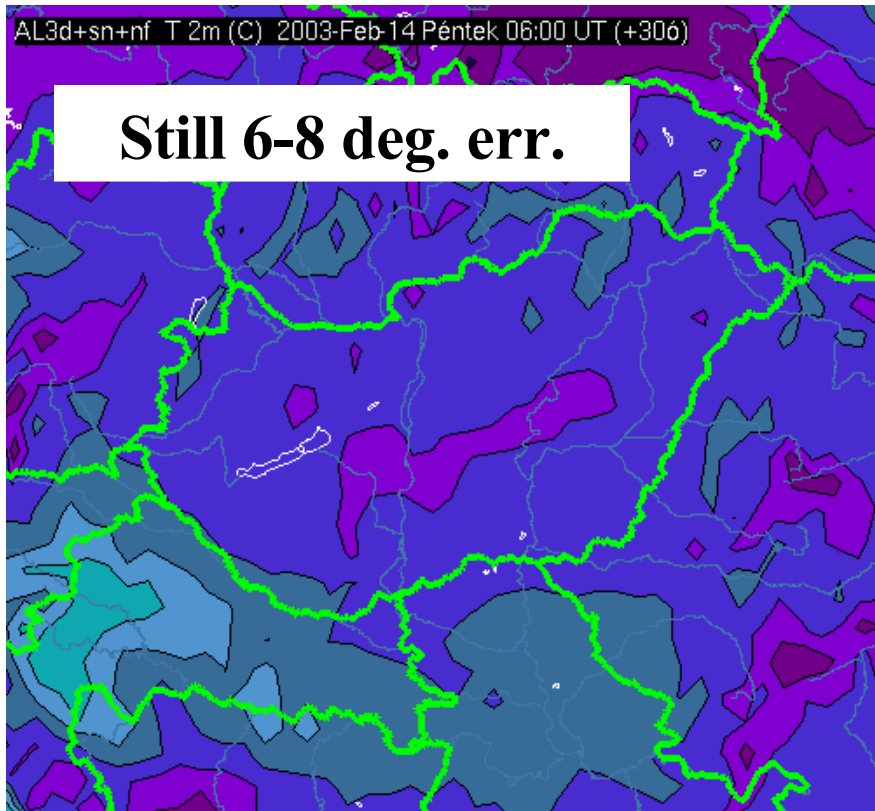
DYN. AD.



3D-V

- **Test with 3D-VAR+CANARI snow analysis + modified stability parameters (*USURID*, ... etc)**
 - **Test with 3D-VAR+CANARI snow analysis + modified physics package:**
 - **Xu-Randall cloudiness**
 - **EWS radiation**
 - **deep convection**
 - **vertical turbulence transport + modified stability parameters**
-

- **Nicer results with 3D-VAR+CANARI+the new physics package**



3. Test: Go back to the snow analysis to be more correct

- increase the guess error (more obs. to be considered)**
- increase the radius of obs. influence**

This was not obvious because of the deficiency of the OI and post-processed snow quantity calculation

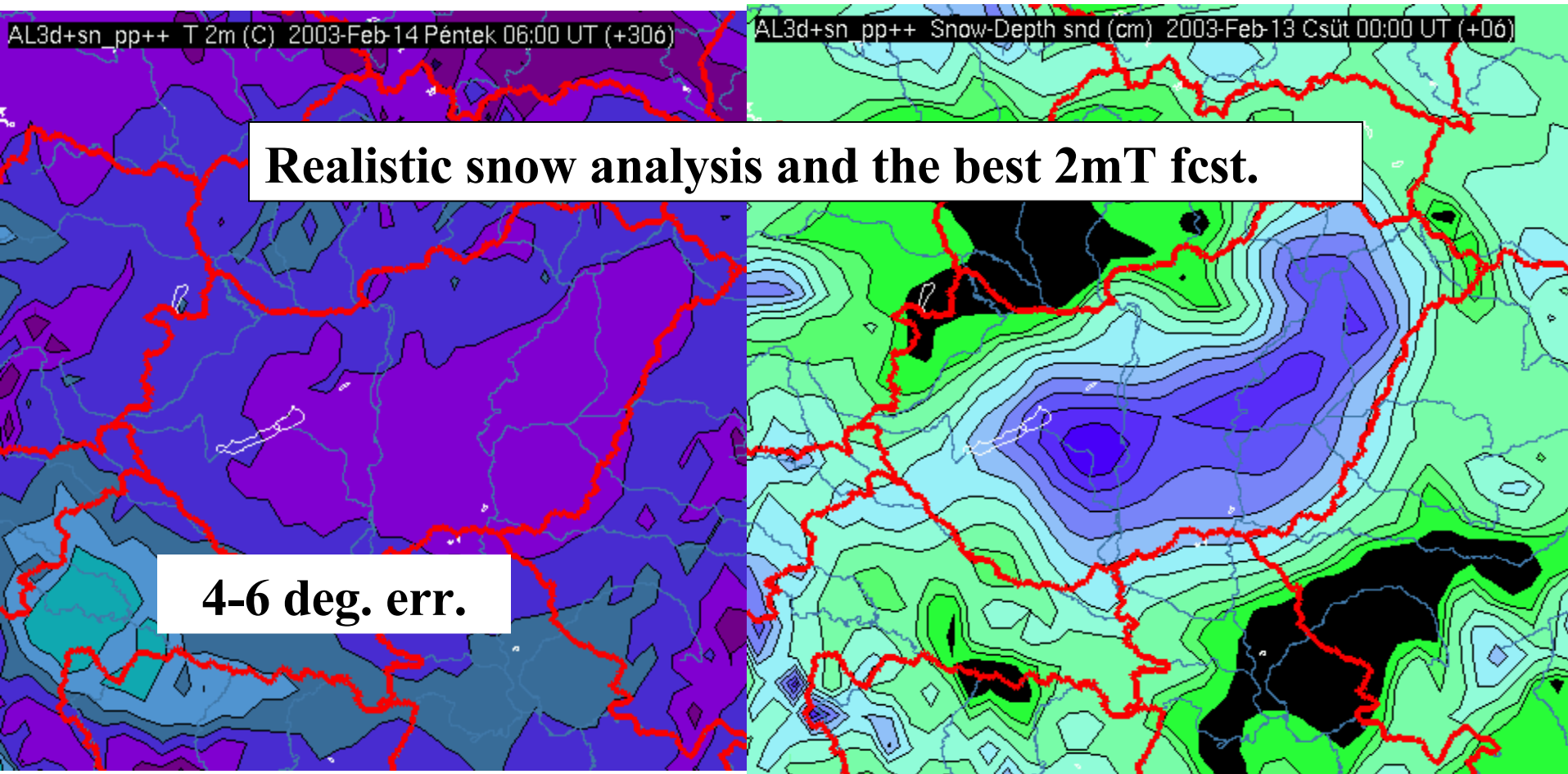
- **Post-processed snow analysis:**

$$S_n = \frac{1}{2}(276 - T_{\text{clim}}) + \frac{1}{3}(276 - T_{\text{obs}})(S_{n_{\text{mod}}} - S_{n_{\text{clim}}})$$

- the expr. is called two times (obs. depar. before the analysis and calc. the diff. obs-an)
- If the diff. in the expr. are too big $\Rightarrow$ the snow obs. are avoid
- Instead of the mentioned formula:

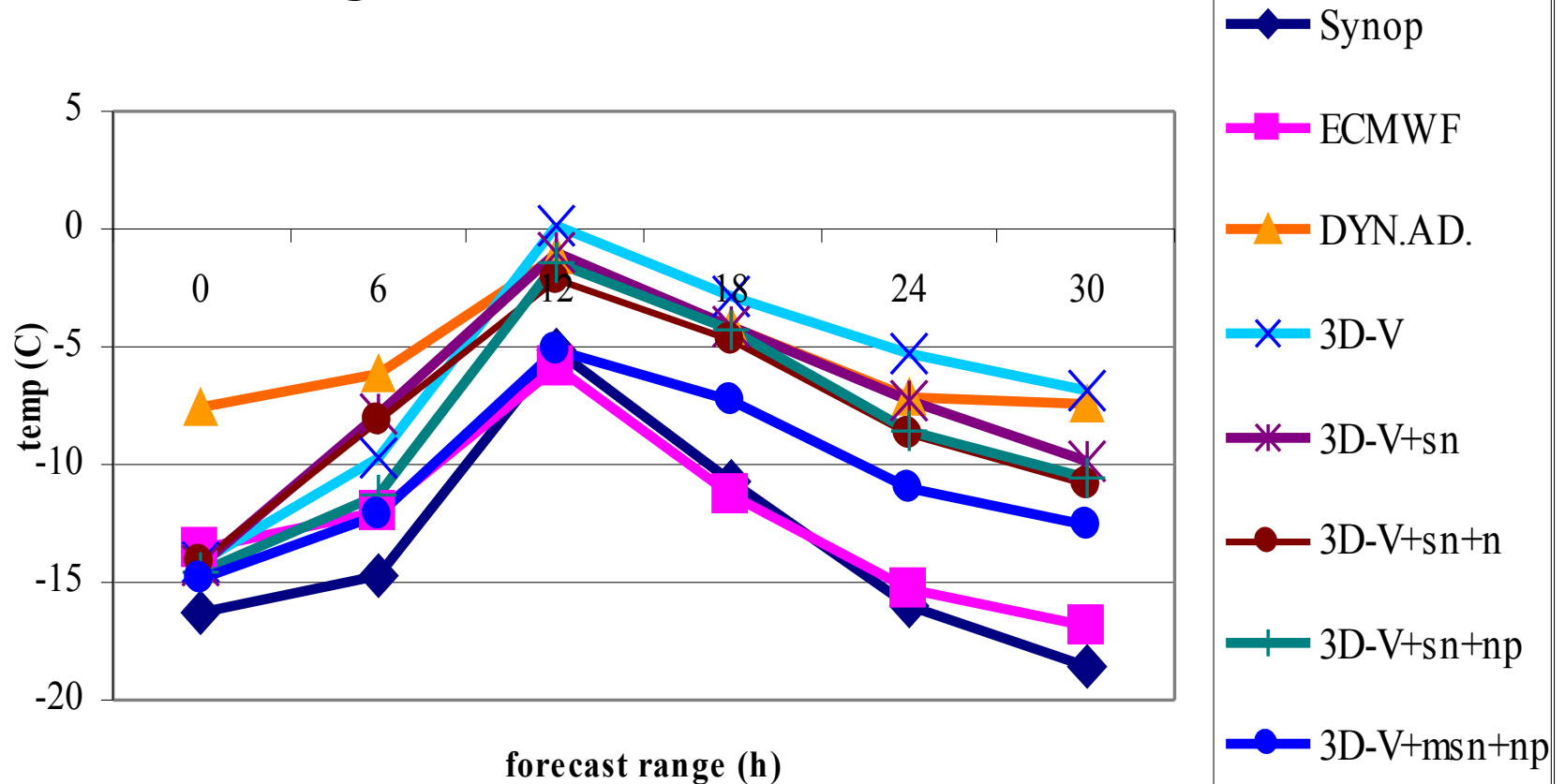
$$S_n = S_{n_{\text{mod}}}$$

4. Test: 3D-VAR+mod. CANARI snow anal +new physics package



Summary

Szeged 2003. 02. 13. 00 UTC forecast



Conclusion

- **The main reasons of the misforecast weather situation are the absence of the snow analysis and the problems of the physics**
- **Plan: to do some test with artificial physics**