Data Assimilation at CHMI

progress report from February 2009

Alena Trojáková

Czech Hydrometeorological Institute
Na Šabatce 17, 143 06 Prague 4

Contents

1 IDFI

Following experiment was dedicated to impact study of initialization procedure used in production cycle, where Incremental Digital Filter Initialization (IDFI) is used (Please remind, that in assimilation cycle there is no initialization before +6h integration). An impact was examined in very simple way and in experiment **Z12** IDFI was suppressed. As this modification is independent of assimilation cycle, only relevant productions were recomputed.

1.1 Verification against observation

On following figures VERAL scores (against SYNOP and TEMP observation), were can be seen mainly very small improvement for analysis time in upper-air and degradation for temperature and humidity in 2m.

- **Z09** - BlendVar
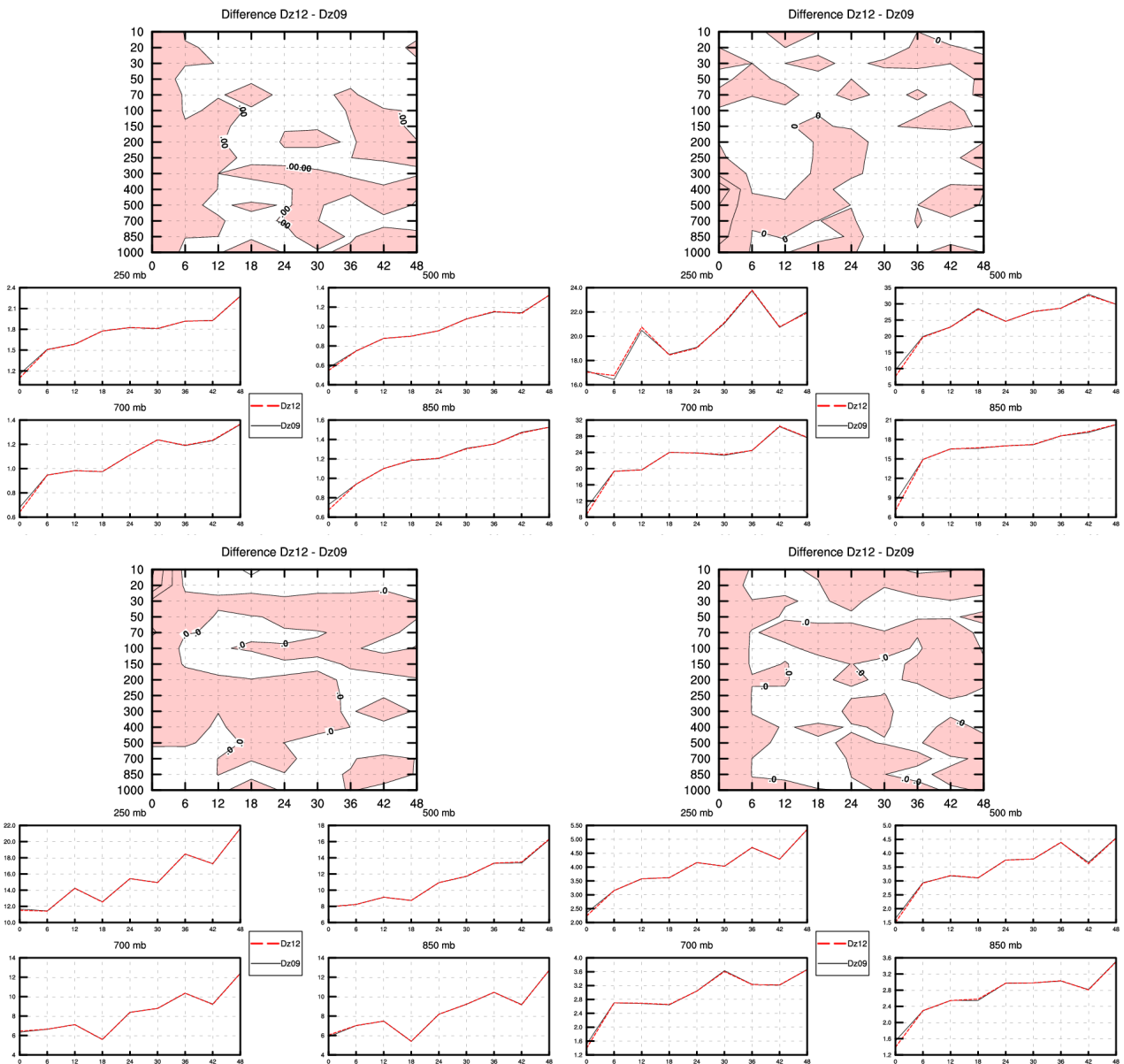- **Z12** - BlendVar without IDFI of short cut-off production analysis

Fig. 11: RMSE of T (upper-left), RH (upper-right), ϕ (bottom-left) and wind speed (bottom-right). Red areas denote positive impact of no IDFI, isolines every 0.1 K, 1%, 0.2 $dynm$ and 0.2 m/s.
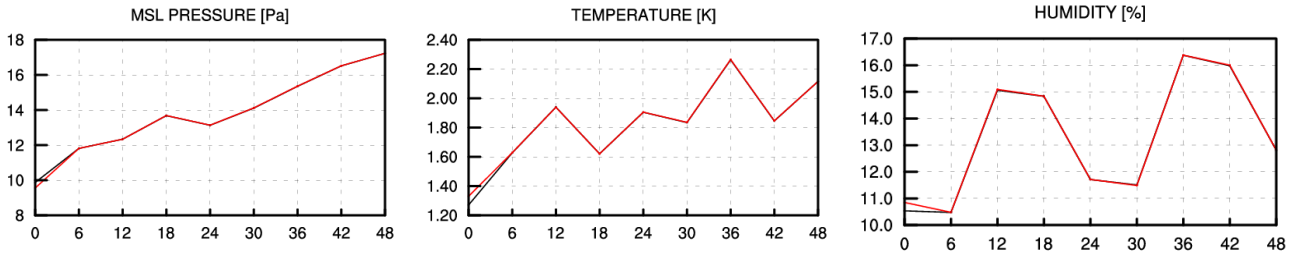
3

Fig. 12: RMSE of $MSLP$ (left), $T2m$ (middle) and $RH2m$ (right) from 20080330 till 20080419 of 00 UTC runs. BlendVar without IDFI in red and reference BlendVar experiment in black color.

There is noticeable BIAS for particular parameter and level, which disappears after the first 6H of forecast. This feature will be demonstrated on scores evolutions only for surface parameters
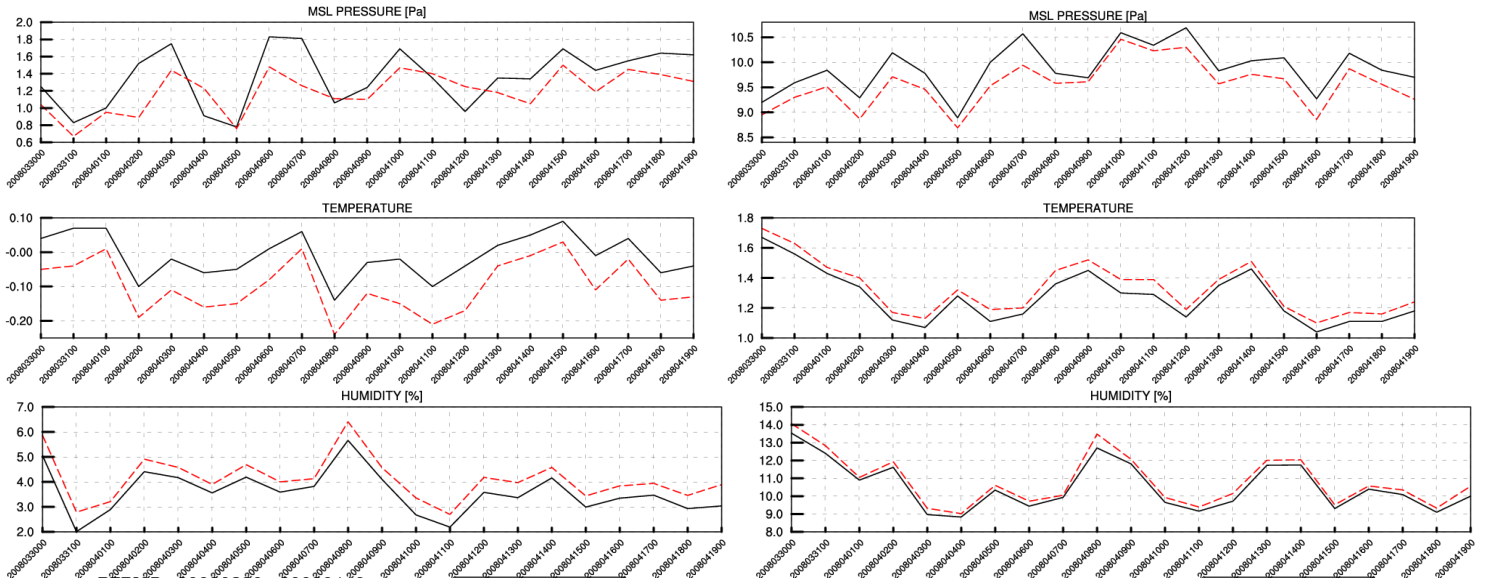

Fig. 13: Time evolution of BIAS (left) and RMSE (right) for $MSLP, T2m$ and $RH2m$ at time of analysis (+0H). BlendVar without IDFI in red and reference BlendVar experiment in black color.
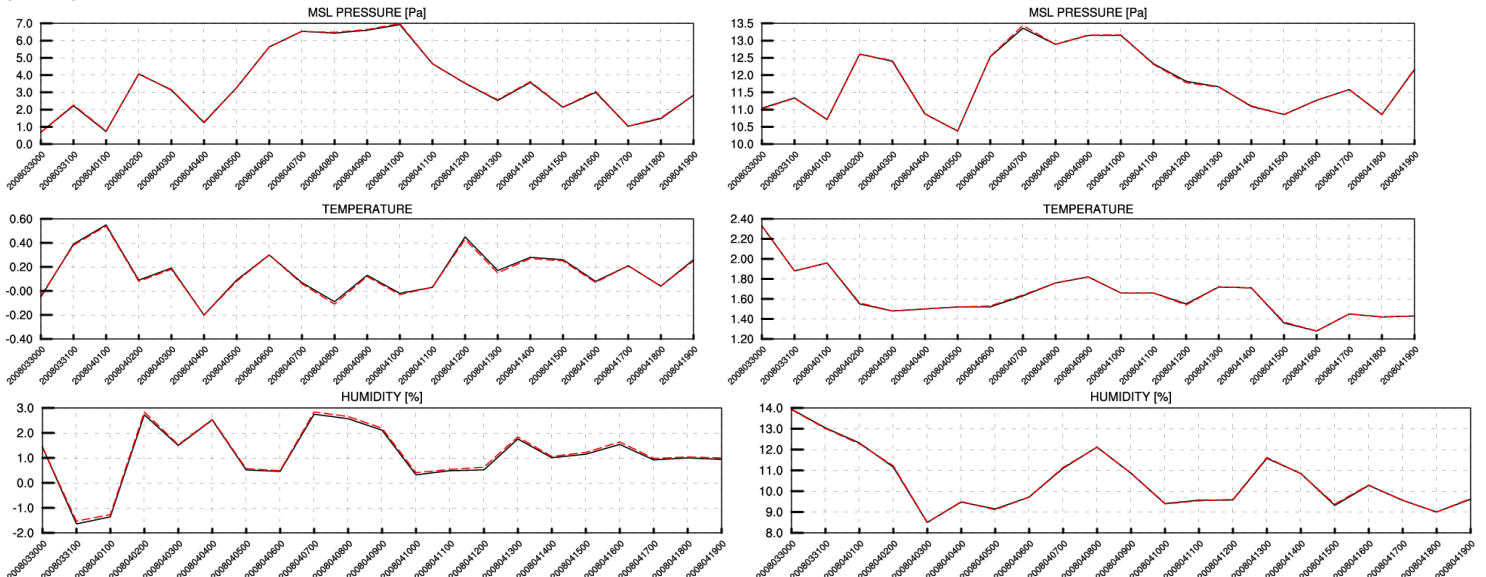

Fig. 14: Time evolution of BIAS (left) and RMSE (right) for $MSLP, T2m$ and $RH2m$ after +6H. BlendVar without IDFI in red and reference BlendVar experiment in black color.

The results of significance test are summarized in Fig 15, where the list of parameters and forecast ranges where BlendVar without IDFI performs better/worse in terms of RMSE scores against observation with significance 90 % two side confidence interval significance test.

4

	00	06	12	18	24	30	36	42	48
250	+								
300	+								
400	+								
500	+								
700	+								
850	+								
1000	+								
surf	-								

temperature

	00	06	12	18	24	30	36	42	48
250	-								
300	+								
400	+								
500	+								
700	+								
850	+								
1000	+						-		
surf	-								

relative humidity

	00	06	12	18	24	30	36	42	48
250	+								
300	+								
400									
500									
700	-								
850	-								
1000	-								
surf	+								

geopotential

	00	06	12	18	24	30	36	42	48
250	+								
300	+								
400	+								
500	+								
700	+								
850	+								
1000	+								
surf	+								

wind speed

Fig. 15: List of parameters and forecast ranges where BlendVar without IDFI performs better (in green)/worse (in red) than BlendVar with IDFI in terms of RMSE scores against observation with significance 90 % two side confidence interval significance test.

Summary: The differences in scores are very small and significant mostly for analysis time. But I'm not sure whether such results are sufficient for removal of IDFI or further diagnostics as Echkevo or similar could demonstrate need of IDFI more clearly?

2 Impact of updated B matrix

This test was dedicated to the impact study of B matrix. A new B matrix was computed following the lagged NMC method from model outputs based on forecast including ALARO physics and from period of March - May 2008. Note, that period covers also "future" (May) with respect to testing period (March-April) and as is can't be used in reality! So the test was attempt to the best simulation of B matrix.

2.1 Verification against observation

There are very small differences in RMSE scores due to updated B matrix, as can be seen on following figures.

- **Z02** - reference (Blending)
- **Z09** - BlendVar - B matrix was computed following the lagged NMC method (from period of October - December 2006) with "ALAROminus3MT"
- **Z13** - BlendVar - B matrix was computed following the lagged NMC method (from period of March - May 2008) with "ALARO"
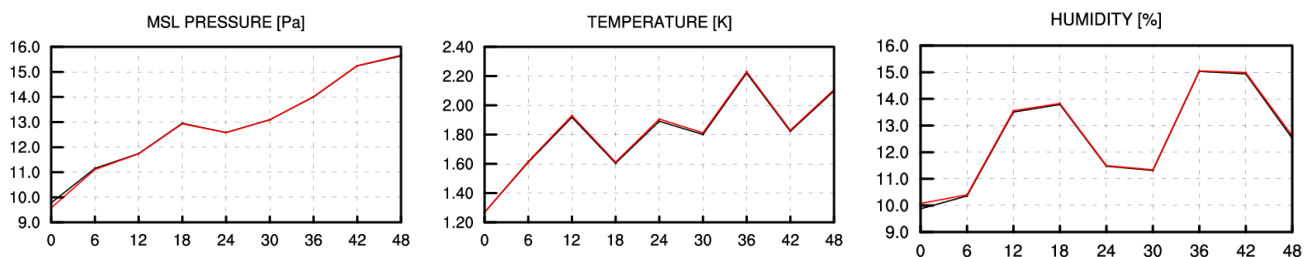

Fig. 16: RMSE of $MSLP$ (left), $T2m$ (middle) and $RH2m$ (right) from 20080330 till 20080419 of 00 UTC runs. BlendVar with new B matrix in red and reference BlendVar experiment in black color.
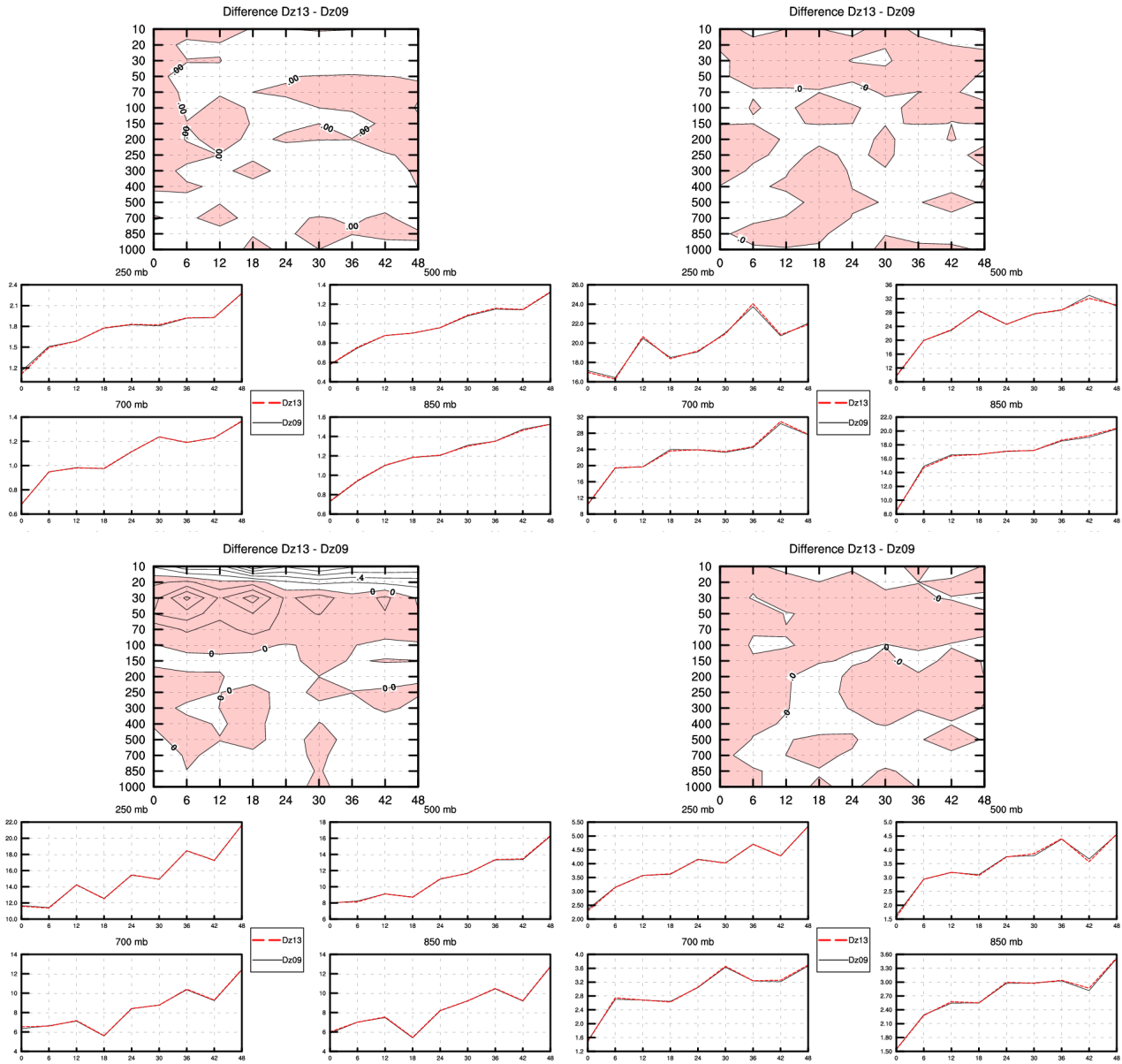
Fig. 17: RMSE of T (upper-left), RH (upper-right), ϕ (bottom-left) and wind speed (bottom-right). Red areas denote positive impact of new B matrix, isolines every 0.1 K, 1%, 0.2 $dynm$ and 0.2 m/s.

Fig. 18: List of parameters and forecast ranges where BlendVar with new B matrix performs better (in green)/worse (in red) than reference BlendVar in terms of RMSE scores against observation with significance 90 % two side confidence interval significance test.

On following figures the performance with respect to blending is displayed. The impact is almost the same as in experiment **Z09** with former B matrix.
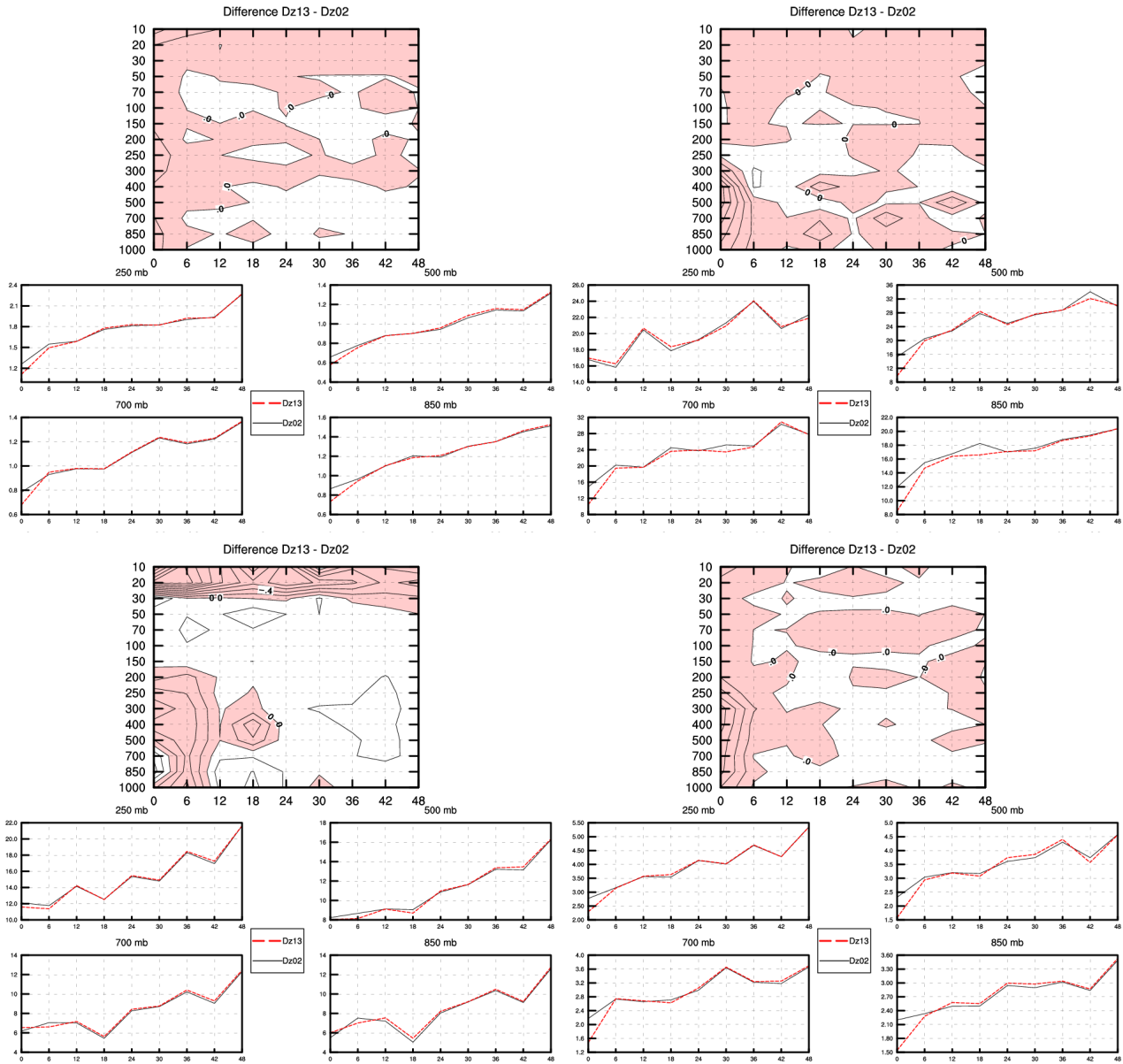

Fig. 19: RMSE of T (upper-left), RH (upper-right), ϕ (bottom-left) and wind speed (bottom-right). Red areas denote positive impact of new B matrix with respect to Blending, isolines every 0.1 K, 1%, 0.2 $dynm$ and 0.2 m/s.
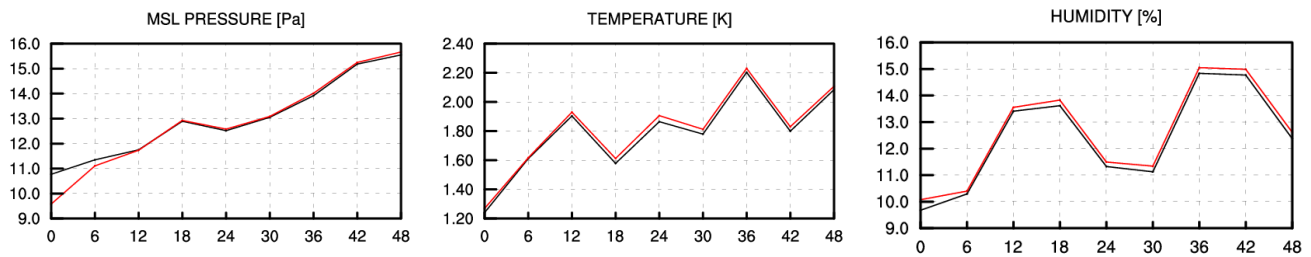

Fig. 20: RMSE of $MSLP$ (left), $T2m$ (middle) and $RH2m$ (right) from 20080330 till 20080419 of 00 UTC runs. BlendVar with new B matrix in red and Blending experiment in black color.
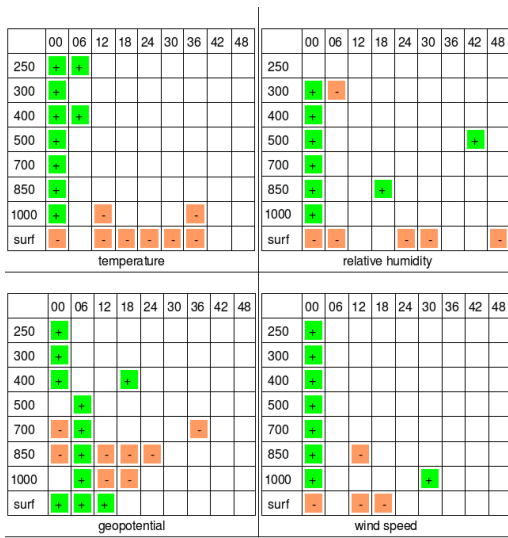
Fig. 21: List of parameters and forecast ranges where BlendVar with new B matrix performs better (in green)/worse (in red) than Blending in terms of RMSE scores against observation with significance 90 % two side confidence interval significance test.

Summary: An update of B matrix didn't show any notable improvement.