An Experiment with the ETKF Transformation Matrix at HMS

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1 Introduction

At the Hungarian Meteorological Service the Ensemble Transform Kalman Filter technique is being developed mainly to make the background error covariance matrix, P_f, flow dependent. Petra Csomós [1] has written the script that computes the transformation matrix (T) and the analysis dispersions ($z_{a,j} \quad j = 1, \ldots, k$).

2 Experiment

We obtained the input files for our experiment, the forecast ensemble as first guesses to ETKF, from ALADIN EPS (the singular vector based EPS system of the ARPEGE global model -PEARP - downscaled by the ALADIN model). The ensemble included 1 control forecast ($x_{f,1}$) and 10 perturbed forecasts ($x_{f,2}, \ldots, x_{f,11}$), so the ensemble size (k) was 11. Our aim was to test the transformation matrix T, so we wanted to see in what extent T represents the 11 analysis. We compared the analysis perturbations (Z_a) we got using ETKF (Figure 1) with the analysis perturbations (Z'_a) we got when running 11 assimilations (shown in Figure 2).

3 Conclusions

We found that all 22 perturbations are very similar in space (the examples are shown on Figure 3 and 4), but the amplitude of perturbations are rather different: the 'ETKF-perturbations' are 100-1000 times smaller than '11assim-perturbations'. We found it also, there was a frontal zone, where large gradients appear in the perturbations. We think, all this means that transformation works well, but the use of inflation factor is essential for getting perturbations of correct size.

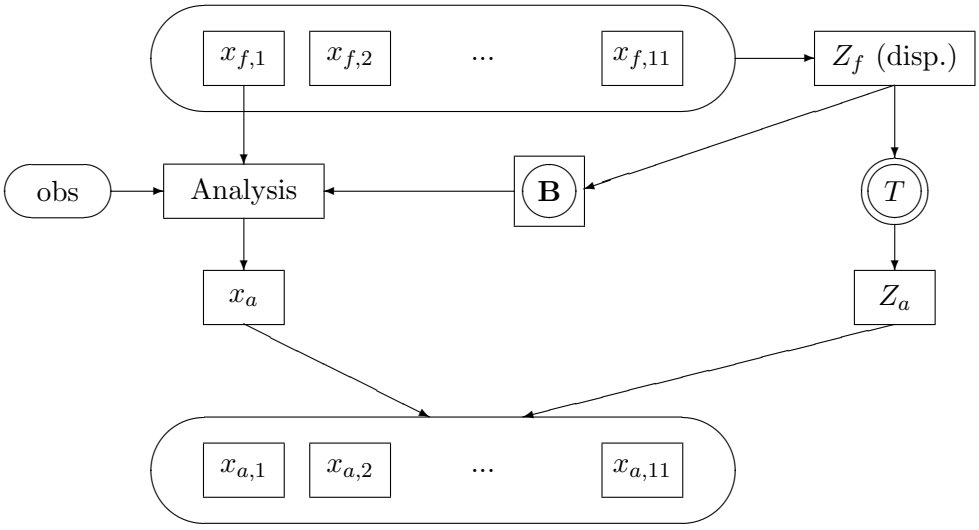


Figure 1: Algorithm of the computation of one transformation matrix and perturbations we add to analysis x_a.

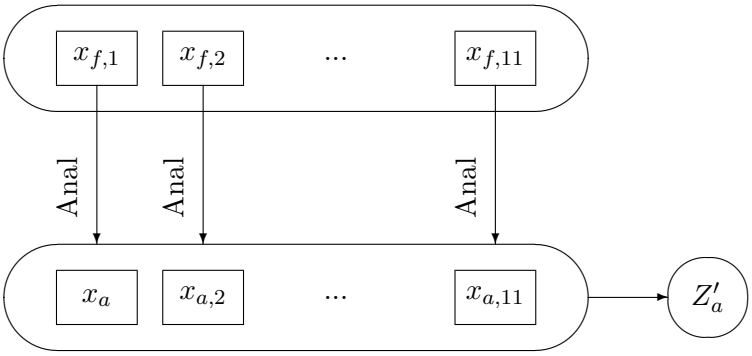


Figure 2: The 11 assimilations we run, the perturbations are obtained by subtracting analysis x_a from each $x_{a,i}$.

Figure 3: The 5th perturbation from the 11 Analysis

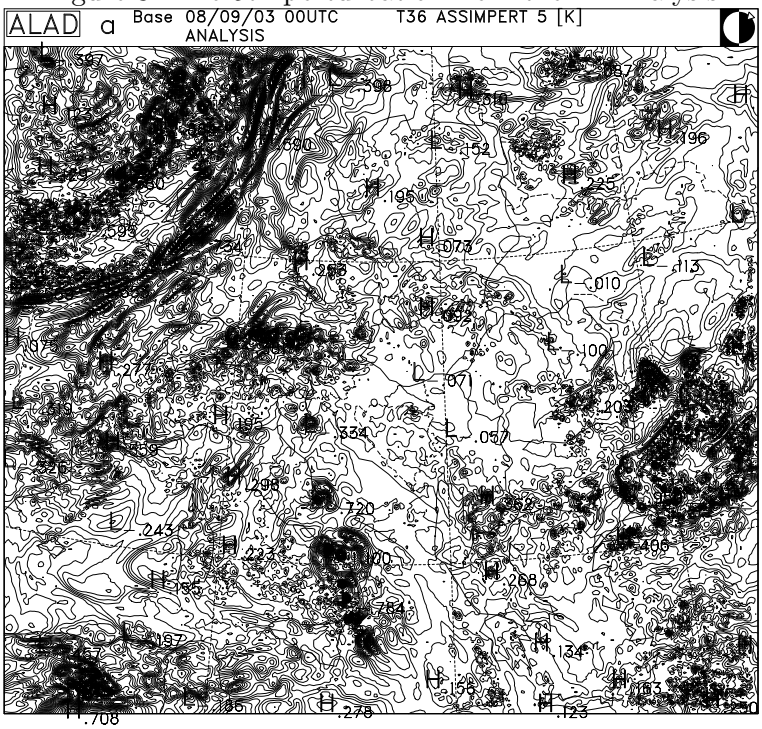


Figure 4: The 5th perturbation from ETKF

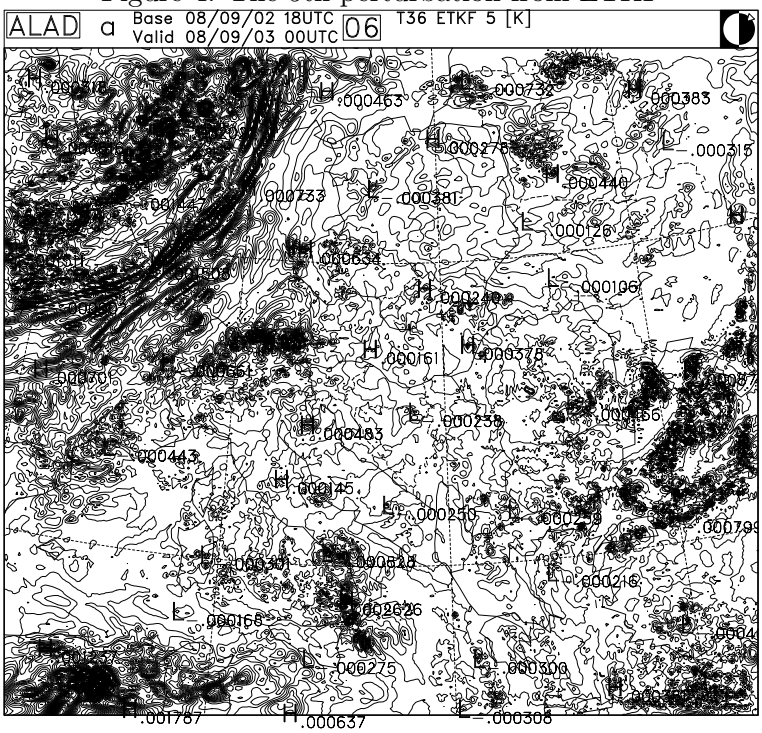
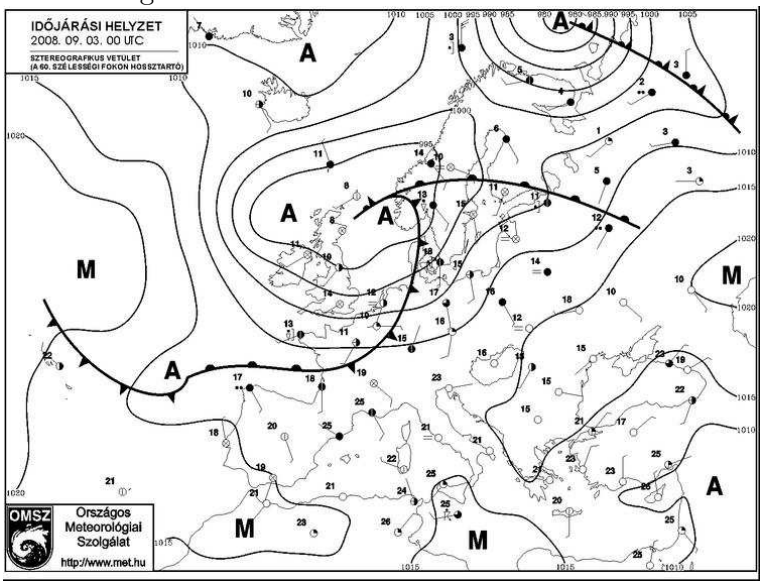


Figure 5: The weather situation that time



References

[1] Petra Csomós and Gergely Bölöni, First steps towards the application of the Ensemble Transform Kalman Filter technique at the Hungarian Meteorological Service, *HIRLAM Newsletter* **no. 54.** (www.hirlam.org)