AROME nowcasting - tool based on a convective scale operational system

RC - LACE stay report

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1 Introduction

The basis for hourly AROME nowcasting is the operational 3 hourly AROME 3DVAR RUC model with a horizontal resolution of 2.5 km and 90 vertical levels, which runs 8 times per day. The difference between the two systems consists in the observation window length and the cut-off time (30 minutes). The observations used are available from the OPLACE system (conventional data, satellite radiances) and local database. The radar reflectivities and Doppler radial winds from 4 Austrian radars are assimilated into hourly AROME nowcasting. It is well known the fact, that in order to insert convective structures into model initial conditions, the radar data assimilation is absolutely crucial.
The two systems use the same background error covariances computed using the 16 members of ALADIN LAEF system, ensemble method. Therefore, the 3DVAR technique is applied for the whole area, but for the second system, the integration is done on a smaller domain to reduce numerical costs (Fig.2). Figure 1 shows the operational 3 hourly AROME RUC domain.

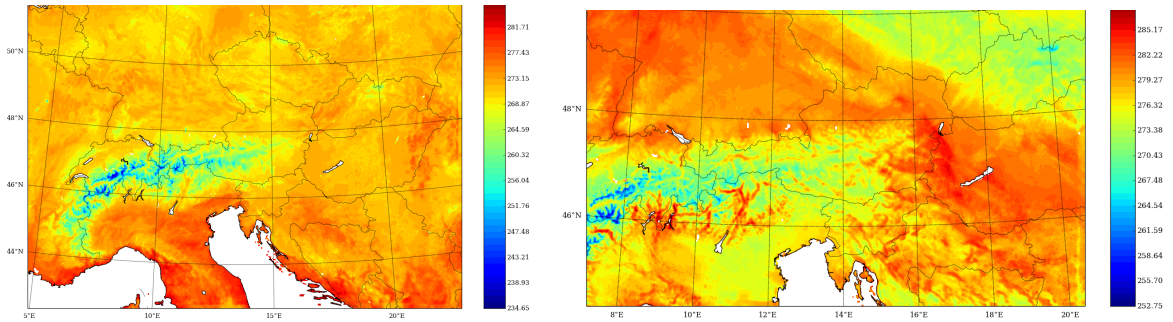

Figure 1: left - AROME 3h RUC operational domain: 600 x 432 grid points, lagged coupled with ECMWF-IFS (3 hourly) and right - AROME nowcasting domain: 432 x 270 grid points, LBC and first-guess file from operational AROME 3 hourly RUC, 12 hours forecast range, the spatial resolution is the same as AROME OPER

2 Configuration set-up

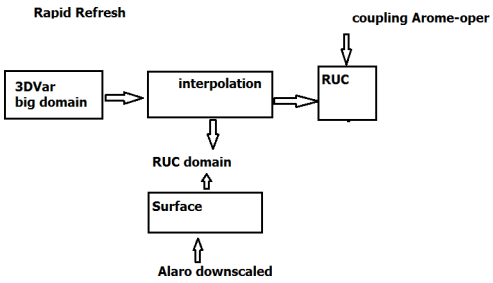

Figure 2: short description of AROME nowcasting system

AROME nowcasting (combining the most recent available observations with the most recent model forecast) is based on the AROME 3 hourly RUC configuration.

3 Impact on forecast

- the aim was to tune proper weights of observations (SIGMAO_COEF) and background forecasts (REDNMC)

For these experiments, the 1st of December 2015 was chosen; for this day the REDNMC coefficient was increased in order to give more weight to observations (default: REDNMC = 1.2).
Several experiments were performed, for REDNMC = 2.2 (EXP1) and REDNMC = 3.2 (EXP2).

Using epygram tool, for several atmospheric fields, the differences between the reference experiment and the two experiments were plotted.

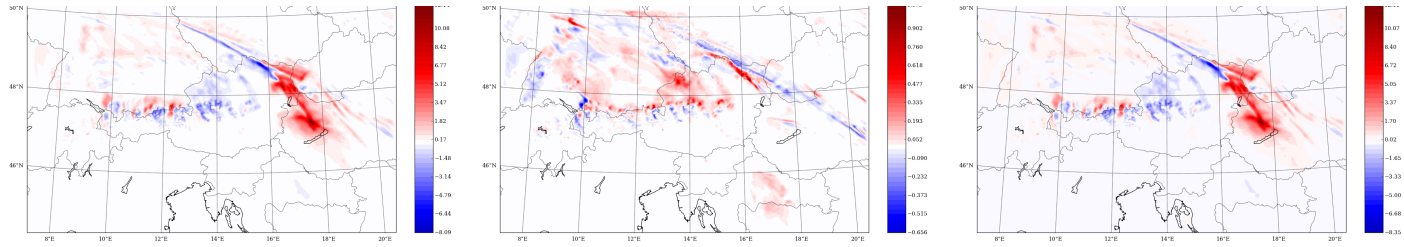

Figure 3: 3h accumulated precipitation AROME nowcasting: left - the difference between REF and EXP1, center: EXP2 - EXP1 and right: REF - EXP2

The observations are more taken into account which means the model will simulate a bigger amount of precipitation (comparing with INCA analysis); it can be observed in figure 3 that the differences between the two experiments are quite small.

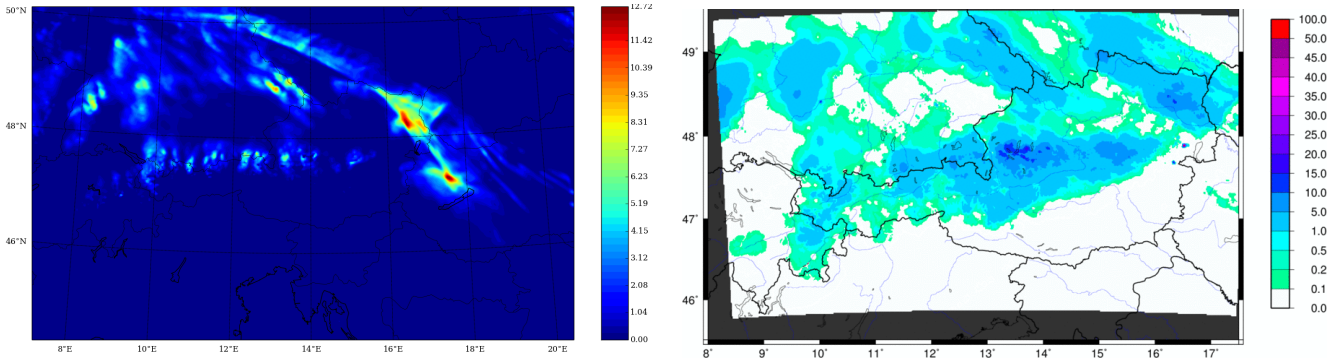

Figure 4: 3h accumulated precipitation: left - AROME nowcasting and right - INCA analysis

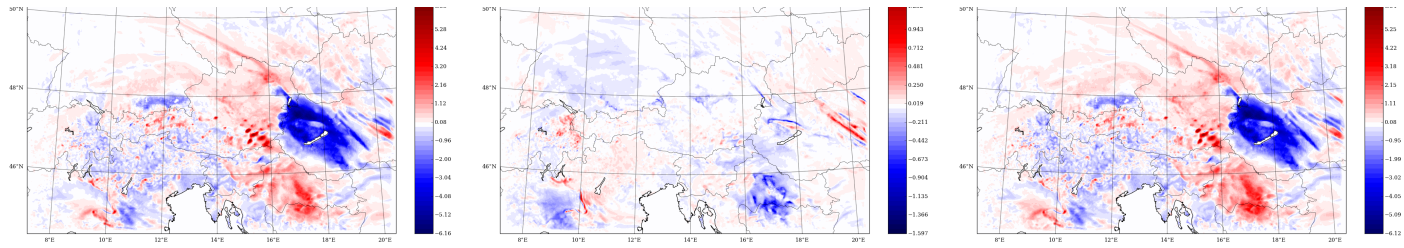

Figure 5: 2m temperature: left - the difference between REF and EXP1, center: EXP2 - EXP1 and right: REF - EXP2

For the 2m temperature (figure 5), the positive values of the differences between REF and EXP1 (EXP2) show that when the weight given to observations is bigger, the simulated values for 2m temperature are smaller than the ones obtained in the experiments.

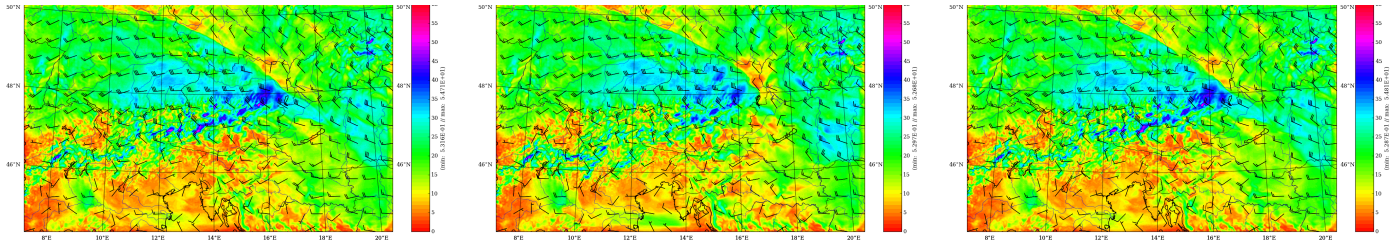

Figure 6: 10m wind: left - EXP1, center: REF and right: EXP2

For 10m wind (figure 6), the differences between the two experiments are quite small, but comparing with the reference, the values are slightly bigger.

Coupling hydrometeors

- new fullpos 2 was used and the hydrometeors are taken into account

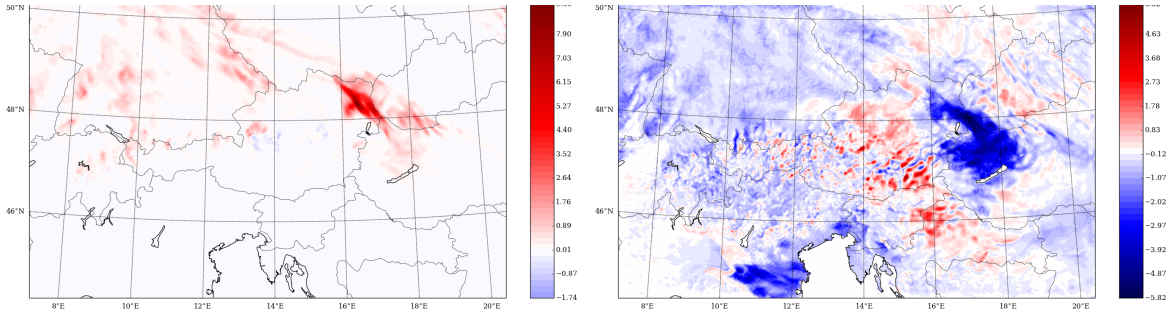

Figure 7: difference between fp2 and fp1: left - precipitation, right - 2m temperature

4 Outlook

- optimisation of the AROME nowcasting configuration;
- to asses the behaviour of AROME-nowcasting compared with INCA system valid at the same time, using both objective scores and subjective validation.

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References

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