Evaluation of an assimilation cycle in ALADIN on MAP IOP 14

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ALADIN is a limited area model (LAM) developed within international collaboration and coupled to the french global operational model ARPEGE. The ALADIN model used operationally at Météo-France (ALADIN-France) is run at 9.5 km resolution using an initial state corresponding currently to the interpolated ARPEGE analysis on which a digital filter initialization (DFI) is applied. Different strategies for ALADIN initialization have been tested on an intensive observation period (IOP 14) of the Mesoscale Alpine Programme experiment (MAP) which took place in the Alps during the autumn 1999. Between the 2nd and 4th of November 1999 a front crossed eastward Europe giving strong precipitations near Lyon, Barcelone, Gènes and in the south of the Alps. IOP 14 of MAP experiment is a well documented case (SYNOP observations, radar, satellite images, ...), which allows the evaluation of the assimilation techniques described below. The objective of the work is to introduce informations coming from new observations while keeping mesoscale features present in a previous ALADIN forecast.

The DFI-blending technique is a kind of mesoscale assimilation based on DFI, which does not directly use the observations. It combines large-scale features contained in ARPEGE analysis with small and meso-scale features provided by a short range ALADIN forecast. The latter are expected to be more realistic than those obtained by interpolation from the global model. ARPEGE analysis and ALADIN 6h forecast (guess) are first interpolated at low resolution. Then a DFI is applied on these two states before to be interpolated at ALADIN's resolution. The filtered analysis increment (difference between the filtered analysis and the filtered guess) is added to the 6h ALADIN forecast to produce the initial state of ALADIN model.

The experiments performed aim at testing the sensitivity of the forecast to the initial state for a given configuration. The evaluation is done on the 48h forecast starting on 2nd November 1999 at 12h UTC. The reference experiment corresponds to the operational configuration (dynamical adaptation). The blending technique is used with various tunings of the digital filters and various lengths of cycling. The convective activity and the precipitation field are improved with blending initialization. Some rainfall patterns, not simulated by the control run, are well described in the experiments using blending technique like at west of Corsica over sea or in the coastal regions near Nice (Figure 1).

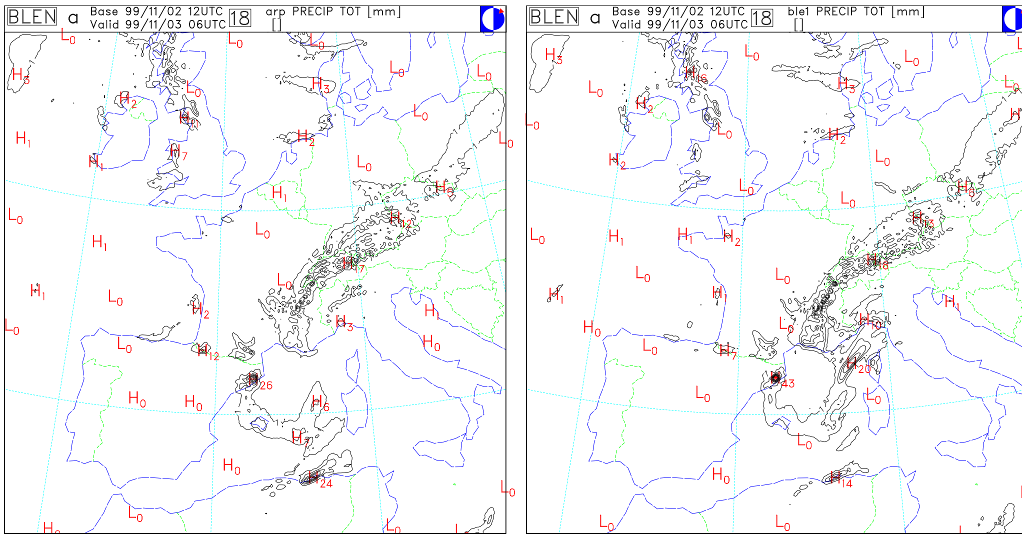

Figure 1: Precipitation cumulated between 00 and 06 UTC on 3rd November for two 18h forecasts corresponding to the control run (left) and a blending cycle (right).

A combination of blending and 3D variational analysis, named "blendvar" is used to introduce directly observations in the ALADIN model. The blended state is used as first guess in the variational analysis. The background error statistics have been obtained through an "NMC lagged" method. The benefits from the observations, shown by the analysis increments (Figure 2), are complementary to those of the blending. The system activity is better described, and the intensity of some patterns are more relevant. To highlight the importance of the blending step, two experiments only using 3D-VAR cycling were performed.

"New" data (i.e. data usually unused in variational analysis) are introduced through a 3D-VAR step. Humidity pseudo-profiles bring information about relative humidity in the troposphere and the initial state is better described. Such data can lead to an improvement of the simulation of precipitations for instance, even beyond 24h forecast.

The initialization step, performed before a 48 hour ALADIN forecast, is also studied. Its impact is compared with that of DFI-blending and that of 3D-VAR. Various kinds of initialization are evaluated and the following conclusions can be drawn : incremental DFI is to be used after a 3D-VAR step; non incremental DFI is to be applied to initialize an interpolated ARPEGE

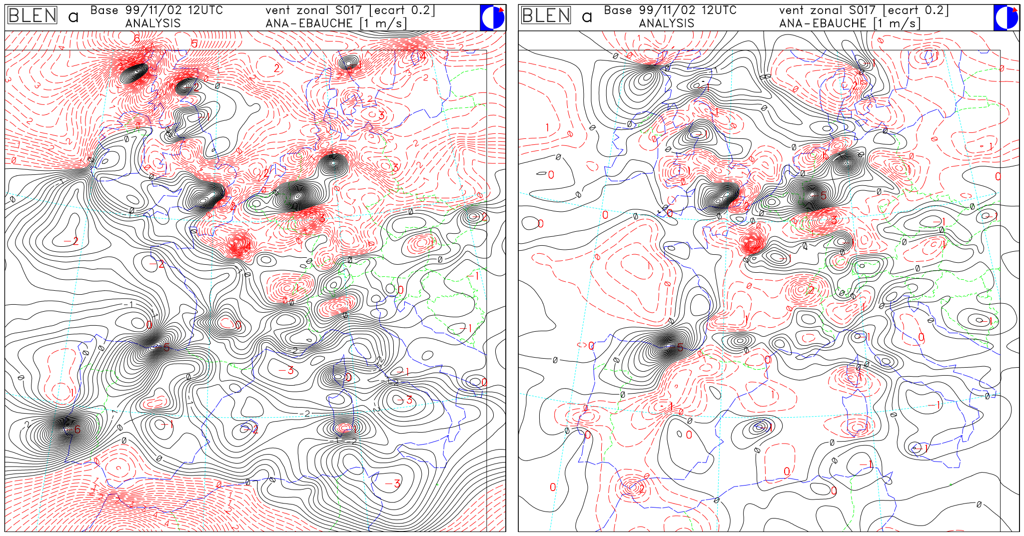

Figure 2: 3D-VAR analysis increments for zonal wind on model level 17 (mid-troposphere) when the first guess is an interpolated ARPEGE analysis (left) or a blended state (right).

analysis, and, less obviously, after a blending step.

The evaluation performed in this particular IOP 14 backgroud leads to very relevant and positive conclusions on blending and blendvar. Small and mesoscale features are taken into account in a good way, and the fields generated with blending have good realism.

References

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