Combined use of 3d-var and DFI-blending on MAP IOP 14

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ALADIN is a limited area model (LAM) coupled to the global model ARPEGE. A key step of a LAM initialization is the introduction of ARPEGE large scales into ALADIN. The DFI-blending technique is a kind of mesoscale assimilation, which does not directly use the observations, based on digital-filter initialization (DFI). 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.

The MAP (Mesoscale Alpine Programme) experiment took place in the Alps during the autumn 1999. Its 14th intensive observation period (POI 14) is the meteorological background to this study. It is a well documented case (SYNOP observations, radar, satellite images, etc ...), which allows the evaluation of the assimilation techniques described below.

The experiments performed here aim at testing the sensitivity of the forecast to the initial state for a given network. The blending technique is used with various tunings of the digital filters and various lengths of cycling. An evaluation is applied on the forecasts performed from these initial states and from the nominal run. This evaluation is based on a comparison to the observations and a diagnostic of the initial spin-up of the model. Thanks to the blending, the simulation of the convective activity and of the precipitation field are improved. Some rainfall patterns, not simulated by the control run, are well described in the experiments using the blending technique (Fig. 1).

Blendvar, which is a combination of blending and 3d variational analysis, directly introduces the observations in the ALADIN model. The benefits from the observations, shown by the analysis increments (Fig. 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.

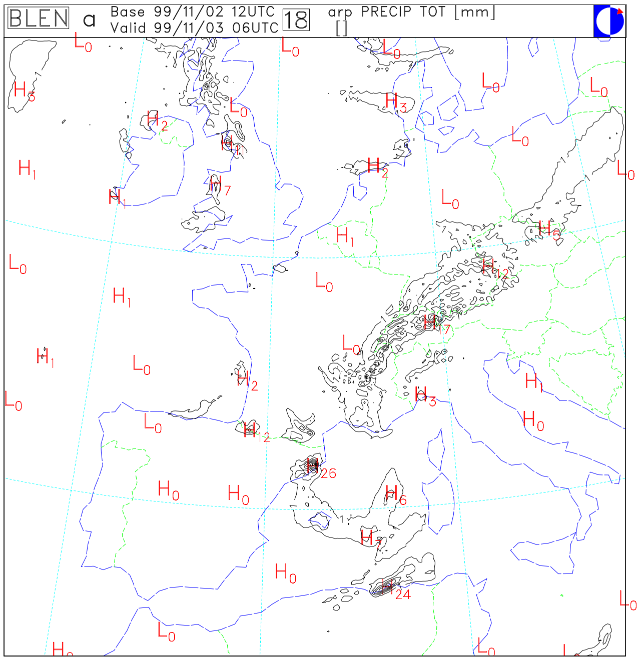
"New" data (i.e. data usually unused in variational analysis) are introduced through a 3d-var step. Humidity pseudo-profiles bring information about relative humidity in the troposphere and the initial state is better described. Such data can lead to an improvement of the simulation of precipitations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

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

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

Figure 1: Precipitation cumulated between 00 and 06 UTC on November, 3rd

+18 forecast for the control run



+18 forecast using blending cycling

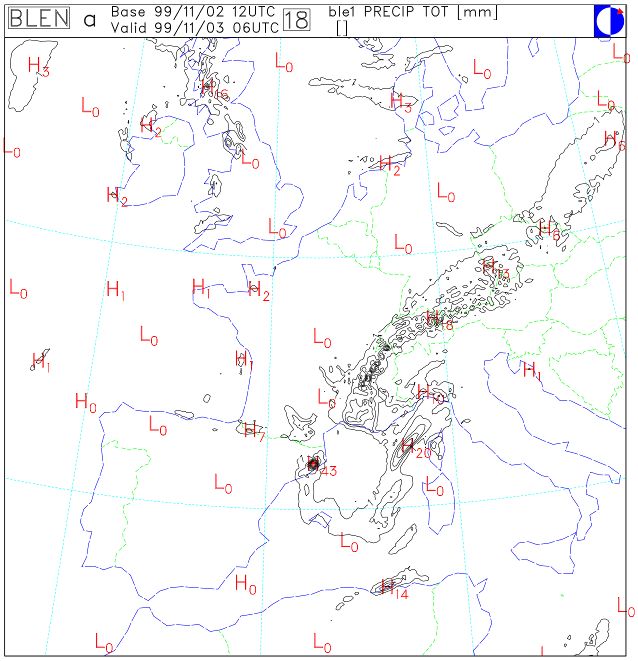
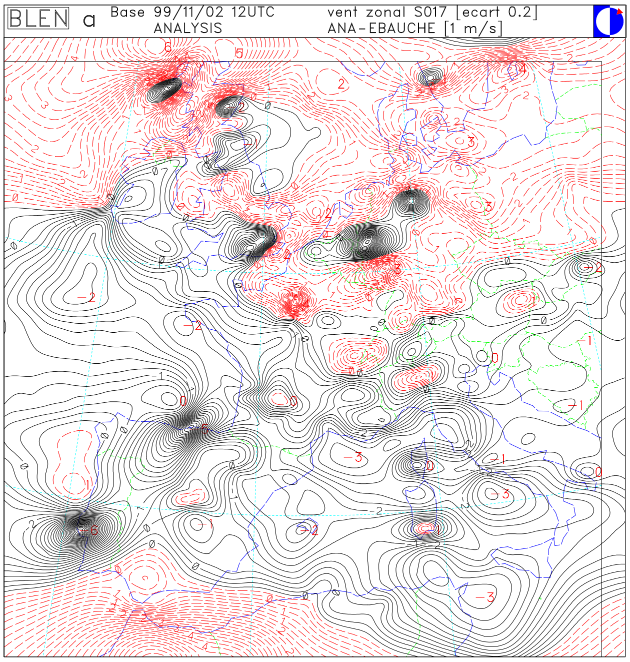


Figure 2: 3d-var analysis increments for zonal wind on model level 17

First guess is an interpolated ARPEGE analysis



First guess is a blended state