Experiences with the ALADIN-3DVAR system

Andrea Storto (met.no) and Magnus Lindskog (SMHI)

In the frame of the HIRLAM-ALADIN cooperation, the ALADIN-3DVAR suite is being under testing at met.no and SMHI. The first goal of the ALADIN-3DVAR implementation is to evaluate the performances of the ALADIN consortium three-dimensional variational assimilation that uses advanced physics and that is technically ready for assimilating a large numbers of observation types. According to the HARMONIE guidelines, the common platform for the ALADIN-3DVAR experiments is the ECMWF/HPCE IBM supercomputer.

The ALADIN-3DVAR implementation started with the set-up of the forecast model, in order to evaluate the skills of the model, to compute the background error statistics and to prepare a workspace for the evaluation of the ALADIN-3DVAR performances, to be later on compared with the HIRLAM-3DVAR system and the ALADIN forecast in dynamical adaptation mode. At met.no the ALADIN domain has been chosen as close as possible to the operational HIRLAM10 domain (11 Km resolution), although the different geometry adopted by HIRLAM and ALADIN does not allow a perfect matching. At SMHI the domain coincides with the one already used for operational forecast runs (11 Km resolution). Since the Norwegian domain is strongly rotated, the procedure to discard observations outside the LAM domain has been modified. The cycle used for 3DVAR experiments is 30t1, while the forecast model has been lately upgraded to cycle 31t1.

In the original export version, the ALADIN-3DVAR preprocessing system collects observations from the French Database BDM, and populates the observational database (ODB) before performing the background quality check and the cost function minimization. This step has been modified to read observations in BUFR format, for consistency with both HIRVDA and MARS (the ECMWF archiving system). So far, the list of observations correctly read and assimilated includes all the conventional types (SYNOP, TEMP, PILOT and Europrofiler, DRIBU, BUOY) and, recently, also aircraft reports (AMDAR, AIREP, ACAR), Atmospheric Motion Vectors (AMV), and ATOVS data (AMSU-A, AMSU-B). For the latter, bias correction coefficients have still to be tuned.

The B matrix has been computed using the “NMC method” applied to 36hr-12hr differences during a three-months set of forecasts. The forecasts were initialized in dynamical adaptation, by the ECMWF/IFS analysis at met.no and HIRLAM analysis at SMHI. Lateral boundary conditions are provided by IFS forecasts at met.no and HIRLAM forecasts at SMHI. Error statistics agree with the ALADIN literature; moreover, the B matrix computed at met.no and the one computed at SMHI match closely each other. However, a more detailed study of the sensitivity to the B matrix has to be carried on when the data assimilation chain will reach the pre-operational stage. One-observation experiments have been achieved and results show a reasonable pattern of impact of the observation. For an observation close to a lateral boundary, an erroneous impact close to the opposite boundary has been noticed, due to the biperiodicization operator in the extension zone.

At this time only a few cycles of assimilation have been performed and no validation statistics are available. Future plans include the re-computation of the B matrix (via the “NMC method” and subsequently the “ensemble method”), the validation of ALADIN-3DVAR by a cycle of warm-started forecasts, the study of the impact of each type of observations and the computation of the bias of ATOVS data for further assimilation.