LACE Working Group for Data Assimilation: Plans for 2004

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Contents

1 Introduction

This paper discuss the research and development plan for 2004 of the LACE working group for data assimilation. The development work is still grouped the same way as before (plans and report in 2003). In addition, a new feature in 2004 is the research on a possible ensemble prediction system (EPS) of the ALADIN model, which was decided to be coordinated inside the LACE working group for data assimilation too. An other important news for the 2004's research is that a latent heat nudging scheme is going to be implemented in ALADIN, which means again a new direction in the data assimilation developments.

2 Detailed research plan for the year 2004

2.1 Methods: algorithmic aspects

- **Isotropy properties of the B matrix**
  Description: Background error covariances used in ALADIN/3d-var are assumed to be isotropic in the horizontal. However, due to the discretization of this assumption some unrealistic anisotropy is implemented in the horizontal structure functions, especially on rectangular domains.
  Objectives: Experiments have been started last year to make the discretization more realistic and to provide a tool to measure the anisotropy. The experiments will be finished this year and some conclusions are expectable.
  Priority: medium
  Realization: local work
  Risk evaluation: 2
  Estimated efforts: 1 person x months
  Proposed contributors: Gergely Bölöni (HU), Claude Fischer (FR)
  Schedule: January

- **Tuning of the multivariate humidity formulation of the B matrix**
  Description: Earlier 3d-var experiments showed (ATOVS experiments in Budapest) that the impact of multivariate humidity coupling in the ALADIN/3d-var Jb is not straightforwardly advantageous. Namely, the

impact of humidity on mass analysis is positive but not the reverse; the humidity analysis is spoiled due to its multivariate treatment.
Objectives: There is an idea to tune the observation and background errors so, that the positive impact of the multivariate humidity treatment is being expressed and the impact of its drawback is being diminished.
Priority: high
Realization: local work
Risk evaluation: 3
Estimated efforts: 2 person x month
Proposed contributors: Gergely Bölöni (HU), Loik Berre (FR)
Schedule: May, June

- **LH versus NMC statistics**
  Description: The L¨onnberg-Hollingsworth (LH) method is a popular way to estimate the background errors. In its spirit this method is very different from the NMC one (which is presently used in ALADIN). It has been always a question whether our NMC estimation gives errors with realistic magnitudes or not. The comparison of the two independent methods could give some more knowledge about it.
  Objectives: As a first step, input for both LH and NMC statistics computations should be collected for the same period (i.e. the innovation vector for LH and forecast differences for NMC). A prototype program to compute LH statistics has been prepared last year. As a second step it requires some further development, then diagnostics of both (LH and NMC) statistics should be provided for comparison.
  Priority: medium
  Realization: 1.5 m. local work + 1.5 m. stay in Budapest
  Risk evaluation: 2
  Estimated efforts: 3 person x month
  Proposed contributors: Kristian Horvath (CRO), Gergely Bölöni (HU)
  Schedule: September, October

2.2 Methods: cycling

- **BlendVar cycling experiments**

  Description: The BlendVar method (combination of dfi-blending and 3d-var) turned out to be a promising tool for mesoscale assimilation purposes compared to the standard 3d-var setup. On one hand, further investigations of the method will be done using high resolution MAP (Mesoscale Alpine Program) observation data. This is because our general feeling is that the real benefit of BlendVar is not easy to prove using the standard observations network. On the other hand the combination of explicit blending and 3d-var (explicit BlendVar) will be tried, which is a technically simpler alternative of the method.

  Objectives: Interesting MAP cases will be chosen and short cycling experiments will be done to investigate the impact of the extra observations. About explicit BlendVar first the system will be set up. Its validation will be performed mainly in 2 steps, first score comparison with the standard 3d-var setup will be done to verify roughly the reliability of the system, then an extensive study of some interesting cases will be performed.

  Priority: high

  Realization: stay in Prague for MAP, stay in Budapest + local work for the explicit BlendVar

  Risk evaluation: 2

  Estimated efforts: 5 person x month

  Proposed contributors: Dijana Klarić (CRO), Radmila Brožková, Steluta Alexandru (RO), Helga Tóth (HU)

  Schedule: still not precised

2.3 Observations

- **Assimilation of ATOVS and MSG data**

  Description: The impact of AMSU-A ATOVS data has been evaluated in 2003. There are several tuning proposals to improve the system (channel selection, observation error tuning, bias correction modifications). New source of information (AMSU-B) is planned to use in 2004. (Note that AMSU-A and -B are different instrument, A is measuring radiances sensitive

to the temperature, B is measuring radiances sensitive to humidity.) Also, it is planned to use MSG (Meteosat Second Generation) data during 2004.
Objectives: The AMSU-A tunings will be finalised first. About AMSU-B and MSG data the pre-treatment should be worked out at first, then impact studies (scores and cases) will be performed.
Priority: high
Realization: local work
Risk evaluation: 2
Estimated efforts: 6 person x month
Proposed contributors: Roger Randriamampianina (HU), Regina Szot´ak (HU)
Schedule: continuous work

- **Assimilation of radar data**
  Description: An ambitious plan for radar reflectivity assimilation has been prepared. The first step is to develop the ODB software to be able to handle reflectivity data.
  Objectives: The ODB modifications will be done in Toulouse with close harmonisation with ECMWF. Probably LACE contributes to this development in the frame of a stay. It is possible that during the year the idea of other LACE contributions will come up still.
  Priority: high
  Realization: stay in Toulouse + coordination
  Risk evaluation: 2
  Estimated efforts: 3 person x month
  Proposed contributors: Sándor Kertész (HU), Marian Jurasek (SK)
  Schedule: February, April

- **Assimilation of AMDAR data**
  Description: Impact of AMDAR data is has been studied in 2003. In the future the thinning technique used for these data will be studied in details, and experiments with high frequency data will be done.
  Objectives: A newcomer student will study the thinning code, and cycling experiments (scores and case studies) will be run using high frequency AMDAR data available on CD to see the potential benefit of it.
  Priority: high
  Realization: local work
  Risk evaluation: 2

Estimated efforts: 3 person x month
Proposed contributors: Gabriella Csima (HU), Roger Randriamampianina (HU), student (HU)
Schedule: continuous work

- **Assimilation of 10m wind data**
  Description: The impact of 10 m wind data analysed over land has been studied to ARPEGE forecasts in 2003. For data selection a blacklist has been set up. Similar experiments will be done with ALADIN too.
  Objectives: The blacklist for data selection should be defined for ALADIN too (if not the same as used in ARPEGE), then parallel tests should be run for validation and possibly case studies too to see the benefits. This work requires some priory investigations to use non-envelop orography together with the new orographic drag physical parametrisation, in order to have the minimum difference of the real and model orography (working group for physics).
  Priority: high
  Realization: stay in Budapest
  Risk evaluation: 2
  Estimated efforts: 2 person x month
  Proposed contributors: Michail Majek (SK)
  Schedule: summer (not precised)

- **Assimilation of wind profiler data**
  Description: Hungary has invested into two wind profilers in 2003. This new source of information will be tried to assimilate in HMS.
  Objectives: The data will be put into ODB and its impact will be studied.
  Priority: high
  Realization: local work
  Risk evaluation: 3
  Estimated efforts: 2 person x month
  Proposed contributors: Regina Szot´ak (HU)
  Schedule: February to May

2.4 Surface

- **Snow analysis experiments**
  Description: One possible reason for overestimation of 2m temperature is the bad representation of the snow-cover. In 2003 first attempts has been done to use local Canari OI snow analysis. In the future the impact of such local analysis will be studied further. Also there is a possibility to try to use the ECMWF snow analysis in ALADIN.
  Objectives: An interesting case will be selected and all the possibilities of initial snow usage will be compared.
  Priority: high
  Realization: local work
  Risk evaluation: 2
  Estimated efforts: 1 person x month
  Proposed contributors: Helga Tóth (HU)
  Schedule: February

2.5 Nudging

- **Latent heat nudging**
  Description: Latent heat nudging (LHN) is a simple method of precipitation assimilation. It uses nudging of released latent heat from observed precipitation amount - based on radar or satellite. In ALADIN it has never been tried before.
  Objectives: In 2004 we plan to implement the simple version of LHN in the ALADIN model. First with prescribed heat profiles and later maybe using model profiles (this option includes searching for near ”wet” model points and is not straight-forward to implement). Improvements will be looked-for in short-range forecasts of precipitation and in improvement of ISBA related fields.
  Priority: medium
  Realization: local work
  Risk evaluation: 2
  Estimated efforts: 4 person x month
  Proposed contributors: Neva Pristov (SI), Gregor Gregori¡c (SI)
  Schedule: January to May

2.6 LAMEPS

Description: There is a long term plan to run (first experimental, later operational) EPS forecasts with the ALADIN model. The following two topics cover the ALADIN EPS plans for 2004.

- **Optimisation of ARPEGE singular vector perturbations for Central-Europe**
  Objectives: The goal is to define a target domain and integration window for which the ALADIN EPS will be run. The singular vector computations (i.e. the preparation of perturbations) should be optimised for this domain and integration time then.
  Priority: high
  Realization: local work
  Risk evaluation: 2
  Estimated efforts: 6 person x month
  Proposed contributors: Edit Hágel (HU), Gabriella Szépszó (HU)
  Schedule: continuous work

- **ALADIN EPS using PEACE perturbations**
  Objectives: Here the aim is to run ALADIN EPS coupled with the quasi-operational PEACE ensemble members. The PEACE system is run at Météo-France once a day to create a 10 member global ensemble forecast. The coupling domain for the production of coupling files from PEACE should be also defined in the experiments.
  Priority: high
  Realization: local work
  Risk evaluation: 2
  Estimated efforts: 6 person x month
  Proposed contributors: Edit Hágel (HU), Gabriella Szépszó (HU)
  Schedule: continuous work

3 Summary of means

The following table is a short abstract of report above concentrating on the needed manpower for each research topic. The desired LACE support is attached to each item as well.

Topic	**Estimated efforts**	**LACE support**
Isotropy properties of the B matrix	1 p x m	none
Tuning of the multivariate humidity formulation	2 p x m	none
LH versus NMC variances	3 p x m	1.5 p x m
BlendVar cycling experiments	5 p x m	4 p x m (Prague and Budapest)
Assimilation of new observation types: ATOVS and MSG data Radar data AMDAR data	 6 p x m 3 p x m 3 p x m	 none none none
Assimilation of 10m wind data	2 p x m	1.5 p x m
Wind-profiler data	2 p x m	none
Snow analysis experiments	1 p x m	none
Latent heat nudging	4 p x m	none
Optimisation of ARPEGE singular vector computations for Central-Europe	6 p x m	none
ALADIN EPS using PEACE perturbations	6 p x m	none
Total	**44 p x m**	**7 p x m**

Table 1: Estimated means in 2004.