

# Work plan for ALADIN-2 : January 2004 – June 2005

Update of November 2004

## **Introduction**

The reference documents are available on the ALADIN web site, at address : <http://www.cnrm.meteo.fr/aladin/scientific/2004-program.html>.

The source code name is ALARO, whatever the use (scale or research domain). The present version takes into account the results from working groups during the 14th ALADIN workshop and the discussions besides the 9th Assembly of ALADIN partners. The names mentioned are only those of persons likely to work on the various topics from now. Thanks to those who already helped !

## **1. Sub-project INTERFACES**

### **Objective**

To offer the highest level of options while preserving the efficiency and portability of the model. This concept extends beyond the scope of the ALADIN-2 project, towards the ARPEGE-IFS system at least. It will guarantee a smooth convergence of the ALADIN and AROME projects, making validations easier and offering to all the partners any intermediate choice between AROME and the present operational configurations.

#### **a Physics-dynamics interface (upperair) & time-step management**

**COORDINATOR** : J.F. Geleyn

**a1.** Definition of consistent sets of equations and hypotheses compatible with the ALADIN-NH dynamics and the various physical packages likely to be used : focusing on ARPEGE-Climat and HIRLAM physics now.

– Priority level : 2

– Status : **work already performed for the Meso-NH and operational ALADIN physical packages**

– Who : *Y. Bouteloup, B.H Sass*

**a2.** Thorough study of the time-discretization and the organisation of time-stepping.

– Priority level : 1

– Status : **some work performed but reports missing !**

– Who : *P. Termonia, M. Tudor, B. Catry, J.F. Geleyn, Y. Seity, G. Hello ?*

**a3.** Definition of the new physics-dynamics interface, then coding. Once this flexible interface will exist, it will be possible to call various physics in the ALARO framework.

– Priority level : 1

– Status : **still to be done !**

– Who : *B. Catry, M. Tudor, P. Termonia, J.F. Geleyn, B.H. Sass, with help from the participants to the "Prague" workshop*

**a4.** Definition and coding of a set of required diagnostics tools, for all physics (potential impact on the practical implementation of the interface).

– Priority level : 1

– Status : **still to be done !**

– Who : *S. Malardel, J.M. Piriou, T. Kovacic, ?*

### **b Externalisation of the surface**

**COORDINATORS** : P. Le Moigne, E. Martin

**b1.** Training actions

– Priority level : 3

– Status : **significant training effort achieved, tool available by 5 partners**

– Who : *P. Le Moigne as main teacher, B. Ahrens, L. Kullmann, A. Bogatchev at home*

**b2.** Further optimizations and validation of the "externalized surface" package : introduction of the ARPEGE and ALADIN "rotated Mercator" grids, using non-ECOCLIMAP input data (raw or already interpolated fields), consistency of land-sea mask, management of time-varying surface characteristics (update frequency, time-interpolation, ...) to be defined, choice of file formats for I/O, ...

– Priority level : 1

– Status : **interface in the AROME prototype under improvement (vectorization, launching interface), but some options still missing** (see list)

– Who : *P. Le Moigne, E. Martin, J.M. Audoin, M. Pottier, L. Kullmann, A. Bogatchev, B. Ahrens, G. Hello*

**b3.** Definition of the required diagnostics (fitting the needs of all teams) and coding

– Priority level : 1

– Status : **still to be done !**

– Who : *working group to be defined !*

**b4.** Coupling with "upperair" physical packages (except Meso-NH one – already handled in the AROME prototype)

– Priority level : 1

– Status : **starting**

– Who : *P. Termonia , L. Kullmann, P. Marquet, F. Bouyssel, P. Le Moigne*

### **c Assimilation**

**COORDINATOR** : L. Auger

**c1.** “from Diag-Pack to Var-Pack”, or “do we still an O.I. upperair analysis ?”

– Priority level : 2

– Status : **significant progress**

– Who : *L. Auger, L. Taseva, F. Taillefer*

**c2.** Coupling of assimilation with the externalized surface : "surface" observation operators, (O.I.) surface analysis, soil moisture/temperature assimilation, ...

– Priority level : 2

– Status : **not yet started**

– Who : *L. Auger, L. Taseva, F. Taillefer ?*

### **d Efficiency and Portability**

**COORDINATOR** : R. El Khatib

**d1.** Further improvement of the xrd library and of the consistency of tools

– Priority level : 1

– Status : **huge cleaning started !**

– Who : *O. Spaniel, J.D. Gril, M. Pottier, R. El Khatib, A. Bogatchev, N. Bouzouita, ?*

**d2.** Management of the extension zone (avoiding calling physics there)

– Priority level : 2

– Status : **detailed proposal written by Ryad**

– Who : *R. El Khatib, R. Brozkova*

**d3.** Further externalizations : FA-LFI, biperiodization, Full-Pos, O.I., ?

– Priority level : 2

– Status : **not yet started, order of priorities revised**

– Who : *see d1, S. Buarque*

**d4.** New file structure for AROME

– Priority level : 3

– Status : **some discussions, no decision**

– Who : *J.M. Audoin, R. El Khatib, J. Clochard, J.F. Estrade, G. Cats, M. Derkova, ?*

### e Validation / verification tools

**COORDINATOR** : J. Stein

**e1.** Development or refinement of validation / verification tools using e.g. radar and satellite data, or new methods (e.g. probabilistic scoring of precipitation, improved use of regional observing networks).

– Priority level : 2

– Who : *J. Stein, Hungarian team, J.M. Piriou, T. Kovacic, S. Sbi, JP Chaboureau, E. Wattrelot, ??*

## **2. Sub-project ALARO – 2 km**

### Objective

This is the "model" part of the AROME project : improving (*ALADIN*) NH dynamics and (*Meso-NH*) physics at very high resolution, assessing day-one meteorological quality, optimizing computational efficiency. Work can be performed using the ALADIN model (dynamics), the externalized surface package, the 1d version of AROME or the first version of the 3d prototype (in Toulouse for the period considered ?).

### a Dynamics

**COORDINATORS** : P. Bénard, R. Brozkova

**a1.** Code maintenance, cleaning and optimization, validation aspects (including more case studies) : introducing the latest developments in ICI.

– Priority level : 2

– Status : **clean version now available**

– Who : *J. Vivoda, J. Masek, P. Bénard, G. Hello, Y. Seity, R. Brozkova*

**a2.** Lower Boundary Condition (consistency between the formulations of SI and spectral horizontal diffusion or SL advection, advection of vertical velocity).

– Priority level : 2

– Status : **problems identified but not solved**

– Who : *J. Masek, R. Brozkova, P. Bénard*

**a3.** Upper Boundary Condition : radiative condition, adaptation to variable  $d4$ , fo finite-elements discretization, ....

– Priority level : 2

- Status : **waiting**
- Who : *M. Janousek, J. Masek, P. Bénard*

**a4.** Diabatic forcing : coding in the 3d model and validation.

- Priority level : 3 unless proved of major importance for the physics-dynamics interface
- Status : **preliminary academic tests successful, coding nearly achieved**
- Who : *A. Trojakova, P. Bénard, B. Catry*

**a5.** SLHD for NH dynamics.

- Priority level : 2
- Status : **experimentation is starting now, with focus on diffusive chimneys**
- Who : *F. Vana, M. Voros*

**a6.** Theoretical studies, towards higher resolution (vertical discretization, link between NH and finite elements, problems due to the “terrain-following” coordinate, SRNWP challenges).

- Priority level : 3
- Status : **started (vertical discretization)**
- Who : *J. Masek, M. Zagar, K. Yessad, P. Bénard, R. Brozkova*

### **b Physics -1 : surface**

**COORDINATOR** : E. Martin ?

**b1.** Introduction of the operational snow scheme in the externalized surface package.

- Priority level : 1
- Status : **started**
- Who : *A. Bogatchev, P. Le Moigne, E. Bazile*

**b2.** Documentation and upgrade of the externalized surface package.

- Priority level : 1
- Status : **starting**
- Who : *E. Martin, P. Le Moigne*

**b3.** Test and optimization of the ISBA-dif model (with several vertical layers).

- Priority level : 3
- Status : **starting**

– Who : *L. Kullmann, B. Ahrens* ?

**b4.** Introduction of a 1d lake-model (from HIRLAM or COSMO).

– Priority level : 3

– Status : **not started, but models found** ?

– Who : *M. Caian* ?

**b5.** Further test and validation of the 1d urban model for AROME (then upscaling ?).

– Priority level : 3

– Status : **not started**

– Who : *V. Masson* ?

**b6.** Validation and improvement of sea fluxes.

– Priority level : 3

– Status : **not started**

– Who : *C. Le Baupin, G. Casagrande* ?

### **c Physics -2 : upperair**

**CONTACT POINTS** : G. Hello, S. Malardel

**c1.** Training on Meso-NH physics, making documentation and the 1d model easily available.

– Priority level : 1

– Status : **started**

– Who : *S. Malardel, C. Lac, M. Tudor, S. Sbi, contribution from LA* ?

**c2.** Inter-comparison experiments of the various physical packages using 1d models.

– Priority level : 1

– Status : **started**

– Who : *M. Tudor, S. Sbi, S. Malardel, D. Banciu, ?*

**c3.** Validation and improvement of fog forecast (1d model, then AROME prototype).

– Priority level : 3

– Status : **not started**

– Who : ?

**c4.** Further research and development on the 1d turbulent scheme

- Priority level : 2
- Status : **no news**
- Who ? : *GMME team*

**c5.** Validation and improvement of a new shallow-convection scheme (1d model, then AROME prototype).

- Priority level : 1
- Status : **just launched**
- Who : *V. Masson, S. Malardel, J.M. Piriou, Portuguese team*

#### **d Model validation**

**d1.** Introduction of the AROME prototype in an official library.

- Priority level : 1
- Status : **scheduled for spring 2005**
- Who : *Y. Seity, G. Hello, L. Kullmann*

**d2.** Evaluation of the stability and accuracy of AROME physics with long time-steps, control of the robustness of parameterizations.

- Priority level : 1
- Status : **not started** (because of late training actions)
- Who : *M. Tudor, Y. Seity*

**d3.** Intensive validation using the 3d AROME prototype.

- Priority level : 1
- Status : **started**
- Who : *Y. Seity, S. Malardel, G. Hello, L. Kullmann, M. Voros, ALADIN visitors in Toulouse ?*

**d4.** Feed-back from algorithmic developments in ALARO-10.

- Priority level : 2
- Status : **just launched**
- Who : *Y. Seity, S. Malardel, G. Hello, GMME team*

### 3. Sub-project ALARO - 5 km

#### Objective

To possibly solve the problems inherent to the so-called “grey zone”, mainly that convection is partly explicit but not fully resolved, but other parameterizations may also required attention. It has to be stressed here that, first “grey-zone” problems appear only in the domain of physical parameterizations, second Météo-France does not want to be involved in this sub-project. The support for experiments is the ALADIN model at the beginning. There will be strong interactions with the ALAD1 and ALARO-10 km sub-projects.

Significant progress has already been achieved on the problem of orographic forcing. But, due to the necessary reorientation of ALARO-10, further work on ALARO-5 must be delayed (hence changes in priorities).

*COORDINATORS* : L. Gerard, T. Haiden

#### a Deep convection

**a1.** Enter grey zone (more comparison experiments on 7 km, 4 km, and 2.5 km), maybe it is not as “bad” as anticipated)

– Priority level : 1

– Status : **first experiments started**

– Who : *T. Haiden, L. Gerard, J. Cedilnik, D. Banciu, G. Pistotnik, ?*

**a2.** Prognostic scheme of Luc Gerard.

– Priority level : 1

– Status : **improving**

– Who : *L. Gerard*

**a3.** Study of the triggering and development stage of deep convection, using radar and satellite data.

– Priority level : 2

– Status : ?

– Who : *F. Wimmer, M. Bellus, T. Kovacic*

#### b Shallow convection and low cloudiness

**b1.** Convergence between Xu-Randall and Seidl-Kann schemes, 3d tunings.

– Priority level : 2

– Status : **improved scheme available**

– Who : *A. Kann, R. Brozkova, Czech team*

**b2.** Other experiments on inversion formation and sustenance (if required).

– Priority level : 2

– Status : **no news**

– Who : *A. Kann, L. Kullmann, G. Bölöni*

**b3.** Requirements for vertical diffusion and vertical resolution to simulate formation of sharp inversions.

– Priority level : 2

– Status : **no news**

– Who : *T. Haiden (1d), A. Simon (3d)*

**b4.** Validation and improvement of a new shallow-convection scheme : cf ALARO-2

### **c Orographic drag and envelope**

**c1.** Validation of wind forecasts at high mountain stations.

– Priority level : 2

– Status : **no news**

– Who : *K. Stadlbacher*

### **d Prognostic cloud water**

**d1.** Sensitivity studies on orographic precipitation cases.

– Priority level : 2

– Status : **waiting for the implementation of cycle 28T\***

– Who : *C. Wittmann*

**d2.** Interaction with other developments (Meso-NH microphysics, “Functional Boxes”, data assimilation, ...)

– Priority level : 2

– Who : *D. Banciu*

## 4. Sub-project ALARO-10 km

### **Objective**

To ensure that developments designed for smaller scales will improve forecast skill at the current operational ones without too much loss of numerical efficiency.

Revised strategy! (cf documents from the 9th Assembly of partners)

*COORDINATORS* : J.F. Geleyn, N. Pristov

### **a Further evaluation of the ALARO-10 km prototype, with a "raw" import of Meso-NH physics**

**a1.** Trying to better understand the failure.

– Priority level : 1

– Status : **started**

– Who : *T. Kovacic, J. Cedilnik, G. Hello*

### **b Improvement of ALADIN parameterizations**

**b1.** Further work on "mixed" radiation schemes.

– Priority level : 1

– Status : **significant work already done**

– Who : *J.F. Geleyn, N. Pristov, G. Hello, A. Trojakova, Y. Bouteloup, ?*

**b2.** Triggering of convection

– Priority level : 1

– Status : **starting**

– Who : *T. Haiden, M. Bellus, J.M. Piriou, T. Kovacic, L. Gerard*

### **c Adaptation of Meso-NH parameterizations**

**c1.** TKE parameterization.

– Priority level : 1

– Status : **not yet started**

– Who : *J.F. Geleyn, M. Tudor, J. Cedilnik, F. Vana*

**c2.** Micro-physics.

– Priority level : 1

– Status : **not yet started**

– Who : *J.F. Geleyn, M. Derkova, Austrian team*

**c3.** Validation and improvement of a new shallow-convection scheme : cf ALARO-2 & ALARO-5

**c4.** Algorithmic aspects (robustness, efficiency, ...).

– Priority level : 1

– Status : **waiting**

– Who : *J.F. Geleyn, P. Termonia, M. Tudor, ?*

**c5.** Interfacing.

– Priority level : 1

– Status : **waiting**

– Who : *J.F. Geleyn, ?*

## 5. Sub-project ALAROPAC

### Objective

To continue research on issues that concern all scales, roughly as scheduled. Only the main lines are given for data assimilation and predictability. A close cooperation with HIRLAM is expected here.

#### a Data assimilation

**COORDINATORS** : C. Fischer, G. Bölöni

**a1.** Algorithmic aspects

- General maintenance (phasing and validation, evaluation of a new humidity variable)

- Moving to 3d-FGAT

– Priority level : 1

– Who : *C. Fischer, G. Bölöni, L. Berre, C. Soci, K. Yessad, G. Desroziers, B. Chapnik*

- Implementation and evaluation of a variational quality control

- Update and evaluation of the TL/AD models
  - Priority level : 2
  - Who : *C. Fischer, P. Moll, C. Soci, K. Yessad, A. Simon, B. Chapnik*
- Model imbalances, initialization and the “Jc-dilemma” (watch)
  - Priority level : 3
  - Who ? : *Claude Fischer, Dominique Giard*

#### **a2.** Cycling

- Analysis-only : further work on 3d-var in ALADIN-HU, first version of 3d-var in ALADIN-France and ALADIN-Roumanie
- Large scale update : DFI-blending in ALADIN-CE, explicit spectral blending in ALADIN-HU, and comparison with Blendvar, Blendvar in ALADIN-NORAF, variational control via the Jk cost-function
  - Priority level : 2
  - Who : *Hungarian, French, Moroccan, Romanian, Czech, Slovak ... teams*

#### **a3.** Background error covariance description

- Sampling : Ensemble versus NMC methods
- Tunings : ALADIN-France B statistics, a posteriori diagnostics and retunings, comparison with a Loennberg -Hollingsworth approach
- Structure functions : bi-periodic increments, compactly supported correlations, isotropy and off-diagonal terms in B, multivariate humidity analysis, wavelet basis, evaluation via single-obs experiments, ...
  - Priority level : 1
  - Who ? : *L. Berre, S. Stefanescu, T. Montmerle, B. Chapnik, G. Bölöni, K. Horvath, C. Fischer, R. Randriamampianina, A. Deckmyn*

#### **a4.** Observations and observation operators

- Radar (reflectivity)
  - Priority level : 1
  - Who ? : *M. Jurasek, P. Moll, E. Wattrelot, E. Bazile, O. Caumont, V. Ducrocq, C. Fischer, F. Bouttier*
- ATOVS (AMSU-A, AMSU-B, HIRS, SSM/I(S))
- MSG
- Screen-level data
- Wind profiler data
- AMDAR data
- QUICKSCAT data

– **Priority level : 1** (mainly continuation of the present work or adaptation to ALADIN)

– Who ? : *E. Gérard, R. Randriamampianina, G. Bölöni, Z. Sahlaoui, T. Montmerle, M. Dahoui, M. Szczech, F. Rabier, P. Moll, M. Majek*

- AIRS

- Humidity "bogus"

- Ground GPS

  - Priority level : 3

  - Who ? : *V. Ducrocq, M. Nuret, H. Brenot*

#### **a5.** Surface analysis

- adaptation of recent improvements in ARPEGE to ALADIN.

- improvement of the initialization of soil moisture in 927 (soil wetness indices in Full-Pos)

- cooperation with HIRLAM on the analysis of 2m temperature and humidity (structure functions) and of snow cover (adaptation ?)

- simplified 2d-var / dynamical optimal interpolation for mean soil moisture (further validation, use of infra-red brightness temperatures), and mean soil temperature

- extraction of high resolution products and impact studies : SST, snow, albedo, ice

- use of snow analysis for T2m forecast, comparison of several snow products

  - Priority level : 3 (apart from the interaction with the externalization of surface, 1c2)

  - Who : *F. Bouyssel, F. Taillefer, K. Bergaoui, L. Taseva,, ??*

### **b Predictability**

**COORDINATOR** : A. Horanyi

#### **b1.** ALADIN-France EPS

- **Priority level : 2**

- Status :

- Who : ??

#### **b2.** EPS at ZAMG : breeding method then use of ETKF to improve breeding vectors

- **Priority level : 2**

- Status : **started** (breeding)

- Who : *Y. Wang, A. Kann, Slovak team*

**b3.** ALADIN-Hungary EPS : optimize global singular vectors (SV) to initialise the LAMEPS, force LAMEPS by perturbations from the French PEACE, evaluate local LAM SVs, develop and/or install diagnostic and performance products

- Priority level : 2
- Status : **significant work already performed**
- Who : *E. Hagel, G. Szepszo, S. Kertesz, A. Horanyi*

**b4.** ALADIN-NORAF EPS

- Priority level : 2
- Status :
- Who : *R. El Ouaraini*

other contributions : *M. Caian, J. Nemeghaire, GMAP/RECYF team (Alain Joly and co), ?*

### **c Coupling**

**CONTACT POINTS** : P. Bénard, P. Termonia

**c1.** Spectral coupling

- Priority level : 1
- Who : *R. Radu*

**c2.** Transparent boundary conditions in a spectral model (esp. problem of the extension zone)

- Priority level : 1
- Who : *F. Voitus, P. Bénard*

**c3.** Update and validation whenever new fields are introduced

- Priority level : 2
- Who ? : *J.M. Audoin, R. El Khatib, those who introduce the fields !*

**c4.** Two-way nesting in a spectral model

- Priority level : 3
- Who ? :

**c5.** Definition of a coupling strategy for AROME (gridpoint and/or spectral, transparent boundary conditions or not, resolution ratios, ...); Impact of the above choices on the format of coupling files; Physical and political aspects of coupling for AROME

- Priority level : 3 (prospective)
- Who ? :

## 6. Sub-project ALAD1

### Objective

To further improve the skill of the operational suites, including progress in verification and maintenance / update of the source code.

#### **a Update of the operational suites (all of them !)**

**CONTACT POINTS** : M. Derkova, D. Giard, B. Lacroix

**a1.** Update of the source code library : a move directly up to cycle 28T1-3 is strongly suggested.

– Priority level : 1

– Who : *all ALADIN teams*

**a2.** First update of the operational namelists : checkings for dynamics, move to a more recent version of physics, local retunings (including the verification of orography description).

– Priority level : 1

– Who : *all ALADIN teams*

**a3.** Update of the operational suites considering the outcome from research both in ALARO and in ARPEGE (both up- and down-scaling)

– Priority level : 2 (unless major improvements come rapidly)

– Who : *M. Derkova, and all ALADIN teams*

**a4.** First test : new coupling files !

– Priority level : 2

– Who : *M. Derkova, F. Bouyssel, R. El Khatib, GCO, and all ALADIN teams*

#### **b Changes in coupling files**

**CONTACT POINTS** : M. Derkova, D. Giard

**b1.** Moving to 4 runs per day

– Priority level : 2

– Who : *all ALADIN teams*

**b2.** Enhanced compression of coupling files (for surface fields, for all fields)

– Priority level : 1

– Who : *R. El Khatib, M. Derkova, GCO, + all ALADIN teams*

**b3.** Implementation in ARPEGE of a monitoring of coupling files production (warning index).

– Priority level : 1

– Who : *P. Termonia, K. Yessad, R. El Khatib, M. Derkova, GCO, + all ALADIN teams*

### **c Verification**

**COORDINATORS** : J. Jerman, J. Stein, Y. Wang

**c1.** Operational implementation of the “objective verification project”

– Priority level : 1

– Who : *Slovenian team, helped by all ALADIN teams*

**c2.** Definition and use of new verification methods

– Priority level : 2

– Who : *all ALADIN teams*

**c3.** MAP actions, using ALADIN et al.

– Priority level : 3

– Who : *Y. Wang, S. Ivatek-Sahdan, J. Cedilnik, B. Ahrens, D. Klaric, M. Derkova, ?*

**c4.** Case studies, analysis of forecast failures or success

– Priority level : 2

– Who : *all ALADIN teams*

### **d Source code maintenance**

**COORDINATOR** : C. Fischer

**d1.** Phasings : CY29T1, CY29T2, CY30

– Priority level : 1

– Who : *F. Vana, S. Ivatek-Sahdan, A. Deckmyn, J. Vivoda, A. Dziedzic, ...*

**d2.** Optimization of Full-Pos

– Priority level : 1

– Who : *R. El Khatib*

**d3.** Update and cleaning of configuration 923

– Priority level : 2

– Who : *D. Giard, F. Taillefer, P. Saez, S. Ivatek-Sahdan*

**d4.** Update of diagnostics for physics in ALADIN (DDH, physical tendencies in DM, model to satellite)

– Priority level : 1

– Who : *Y. Bouteloup*

**d5.** Documentation (pursuing the efforts : writing / reorganization of the web sites )

– Priority level : 2

– Who : *French team, with any other contribution welcome*

**e Improvement of the operational version of ARPEGE**

**COORDINATOR** : A. Joly