Austria Belgium Bulgaria Croatia Czech Republic France Moldavia Morocco Poland Hungary Portugal Romania Slovakia Slovenia

ALADIN

Newsletter

Number 13 **October 1998 - December 1998**

This Newsletter presents you the principal events concerning ALADIN during the quarter of year mentioned above. The news about work or events outside Toulouse are related with informations that you sent (for disponibility constraints, the "deported" work deals with the previous quarter).

So, reading this Newsletter, you will know everything about ALADIN activities (more precisely everything I was told about) between October 1998 and December 1998 (except for the work realized outside Toulouse : between July 1998 and September 1998).

Please do bring to my notice anything that you would like to be mentioned in the next Newsletter (number 13) before the 25th of April 1999.

Any contribution concerning announcements, publications, news from the ALADIN versions on workstations or on big computers, verifications results, ... will be welcome. This deadline is particularly important for the report of the deported work each representative should sent every quarter.

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Many thanks for all of you who have sent me most of the informations reported here.

Contents

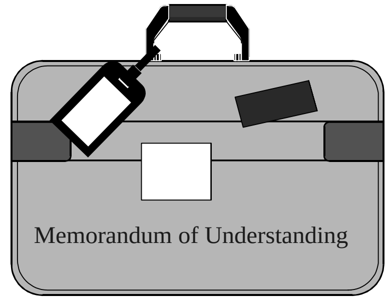
Main events

1. A new Memorandum of Understanding

During the last Assembly of ALADIN Partners, some amendments to the ALADIN MoU were proposed. All minor amendments were approved by the Assembly. Others were discussed and the directors chose between a few possible options. Main accepted modifications are :

- regarding the access to ALADIN code for institutions which were neither ALADIN participating Partners, nor from an ECMWF Member, nor from an ECMWF Co-operating country, it was decided : no rule of exception but regulation of new problems by the amended mechanism for full adhesion;
- the case of code benchmarks was specifically added to the non-dissemination and restricted-use rules;
- regarding the "Commitment and monitoring of manpower associated to the ALADIN Project" : a third category of work for reporting ("Prague-LACE" in addition to "Toulouse" and "at Home") and applying of strict deadline and using single contact points were agreed upon.

The modified version of the MoU is currently visiting all ALADIN countries to be signed. Countries are visited in an alphabetic order which is certainly not the order I would have chosen in case I would have the opportunity to travel with it.



The trip of the MoU is illustrated by the map below:

- in red : parts of the trip already completed, i.e. countries that have already signed the MoU and sent it to the following country (from Austria to Moldavia);
- in green : parts of the trip still to be completed, i.e. countries that will receive soon the MoU to sign (from Morocco to Slovenia).

This new MoU is available on our public ftp (MoUnew.ps).

2. Agreement between ECMWF and Météo-France for the access and use of the jointly developed and maintained NWP software "IFS/ARPEGE"

This Agreement has been approved by ECMWF Council and is expecting to be signed any day now. Once signed, the text will be available on our public ftp.

The work of the ALADIN community is officially recognized by ECMWF who considers "the advantage as IFS/ARPEGE partners to profit from the ALADIN community's contributions on outstanding NWP issues that may be beneficial both for synoptic- and meso-scales".

This Agreement is linked to the ALADIN MoU since it regulates an access to those countries which are neither full nor associated Members of ECMWF to the ECMWF-born parts of the ALADIN software.

A draft of this agreement was presented during the last Assembly of Partners who decided to declare the agreement of ALADIN Partners with the presented document.

3. Second medium-term (1999-2001) research plan for ALADIN

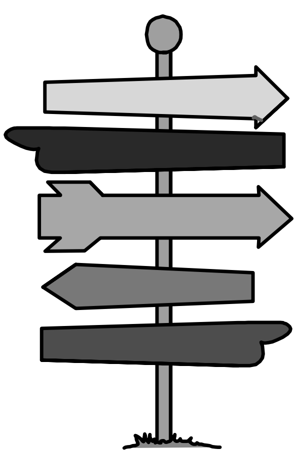
This document has been approved (for its purely scientific part and accordingly edited) at the third Assembly of Partners. It is available on our public ftp (plan2001.ps).

It was the second exercise of this type in the history of ALADIN, both plans coinciding with important events in the life of the project : the quasi-operational start of ALADIN-PECO in 1994 (first plan), and now the operational or pre-operational status of ALADIN by most of the NMS involved in the project.

This new plan has been constructed starting from a few basic assumptions :

- sufficient means will be allocated to cover strong burden of code maintenance resulting, for the IFS/ARPEGE/ALADIN software, from a more and more distributed research effort;
- the different operational applications of ALADIN will not generate any unnecessary diverging tendencies inside the overall ALADIN community for what concerns the links between research and operations.

Three main topics are discussed in the plan :



- operations : the code maintenance is a key for all operational versions but it is equally important for the common research and development work. Co-ordinators have been proposed for dynamics, physics and observation handling topics and orientations are defined.
- applications : this part of the document deals with the application of the model itself and its products for further use and for other special applications. Two topics and their co-ordinators have been proposed : modelling problems and production related problems.
- investment : in this part, orientations for the research for tomorrow's numerical weather prediction are given once divided in two main topics : data assimilation and high resolution dynamics.

Please consult the complete document for details.

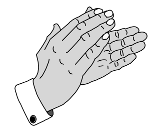
4. *Attention : major change with free-source format and implicit none statement*

The next IFS/ARPEGE cycle 21 is an automatic processing of cycle 20 introducing a strong typing (through the IMPLICIT NONE usage) and the FORTRAN 90 free format. This automatic processing will introduce the definition of KIND parameters, dedicated macros for declaration of integers and reals, and macros to replace superstar real constants.

Free format, which means that there is no more specific positions on a FORTRAN line, should drive us to more flexibility and legibility of the source code.

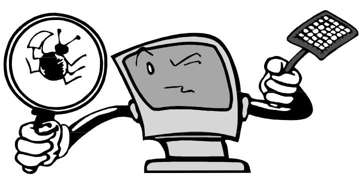
See more details in annex in this Newsletter.

5. *Success in a coordinate change*



On November the 19th, the second coordinate change of the clim files used by all ARPEGE and ALADIN operational suites was successfully completed. It allowed a better description of vegetation, especially over Eastern and Northern Europe.

6. *BUG AL09 !!!!*



A major bug in ALADIN 09 has been discovered by the Prague/LACE team. It concerned AL09/CY19T1 : the bug was active in the forecast mode in the case you had more than 7 coupling files. The 8th file was the fatal one : it was not read and the previous one was kept. For example, for ALADIN/FRANCE that is coupled every 3 hours, the 8th file was valid for +21h. Coupling was realized with +15h instead of +21h. Results were false at +21h. This error had still an influence at +24h even though the coupling was right at that range. The coupling sequence was : ... +15h, +18h, +15h, +24h ... . For ALADIN/LACE that is coupled every 6 hours, the fatal file was for +42h.

The regular examination of ALADIN-France scores (realized only every 6 hour !...) have not shown any spectacular break corresponding to the bug.

The problem has been corrected. The ALADIN09 export version number 5 is OK. In case you use ALADIN09, please make sure that every coupling files has been used (check in the job listings).

7. *Phasing in work*

Last December, ALADIN source code has been phased with a preliminary ARPEGE library preCY20. Phasers are now validating CY20/AL10 code... and they are doing their best to avoid such a big bug as the one introduced in cycle 9. This will be completed by the end of February. Validations on CRAY and on workstation (SUN) will be performed afterwards in Belgium and in France respectively.

Then, a cleaning cycle (CY21/AL11) will be performed with free-source format and IMPLICIT NONE statement. Please contact us in case of bad experience with local compiler and free-source format.

8. *A new ALADIN doctor*

As you can see on the 8 pages below, Marta Janiskova successfully defended her PhD on the 9th of November 1998 in Brastislava.

GEOFYZIKÁLNY ÚSTAV SLOVENSKEJ AKADÉMIE VIED
V BRATISLAVE

UNIVERSITE PAUL SABATIER DE TOULOUSE

THESE EN CO-TUTELLE

pour obtenir le grade de

DOCTEUR DE L'UNIVERSITE PAUL SABATIER DE TOULOUSE

Discipline: Océan, Atmosphère et Biosphère

présentée et soutenue publiquement
par

Marta Janisková

le 9 novembre 1998 à Bratislava

Titre:

Realization of a simplified, differentiable and realistic physical parametrization for incremental four-dimensional variational data assimilation

Réalisation d'une physique simplifiée, différentiable et réaliste pour une assimilation variationnelle quadri-dimensionelle incrémentale

Directeurs de thèse:

M. Robert ROSSET
M. Ferdinand HESEK

JURY:

M.	Dušan ZÁVODSKÝ	Président du Jury
M.	Olivier THUAL	Co-président du Jury
M.	Olivier TALAGRAND	Rapporteur
M.	Jean-François MAHFOUF	Rapporteur
Mme.	Radmila BUBNOVÁ	Rapporteur
M.	Milan LAPIN	Rapporteur
M.	Jan BEDNÁŘ	Examinateur
M.	Štefan ŠKULEC	Examinateur
M.	Ján TOMLAIN	Examinateur
M.	František Matejka	Examinateur
M.	Jean-François GELEYN	Examinateur
M.	Jean-Noël THÉPAUT	Examinateur

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ACKNOWLEDGEMENTS

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Many thanks belong to Jean-Noël Thépaut and Jean-François Geleyn for introducing me to the "mysteries" of the data assimilation and the physical parametrizations, helping me with their fruitful advices and instructive suggestions. I appreciated a lot their patience and "scientific charm". At the same time I would like to thank them that they were able to find a way to "press" me to do the work which I would never suppose I was able to do.

My Slovak supervisor Ferdinand Hesek and the French one Robert Rosset are also acknowledged for readiness to help me whenever I needed their help.

I also would like to thank all colleagues who have been developing the ARPEGE/IFS system and without whom this work would not have been possible. The help of the French colleagues as well as the colleagues of the whole ALADIN community is gratefully appreciated.

The spectral transforms, used for radiation coefficients in this study, were developed by Karim Yessad without a word (even of protest) and his help is gratefully acknowledged.

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I am grateful to Gérald Desroziers and Béatrice Pouponneau for the constructive discussions and some common 4D-Var experimentations for FASTEX situations.

Special thanks go to Patricia Pottier for her kidness and permanent help in arranging everything concerning my stays at Météo-France.

I would like to thank Doina Banciu not only for her special French lessons, but especially for her real friendship helping me always to find a new energy to carry on my work. My thanks belongs also to Patrick Moll for his sense of special humor at the right time and the hospitality offered in his user Id.

Since there is still a lot of such people, who helped me generously, but their list would be quite long, I would like to express my sincere common thanks to everybody who is concerned.

I am grateful to all reviewers of my thesis (Olivier Talagrand, Jean-François Mahfouf, Radmila Bubnová, Milan Lapin and Jan Bednář) for their comments and instructive suggestions.

My study has been made possible thanks to the research scholarships provided by the French "Ministère de l'Education Nationale, de l'Enseignement Supérieur et de la Recherche" and "Ministère des Affaires Etrangères".

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Marta Janisková: Realization of a simplified, differentiable and realistic physical parametrization for incremental four-dimensional variational data assimilation

The thesis was successfully defended on 9 November 1998 in Bratislava, in Slovakia. Its extended abstract follows.

- All the developments and evaluations done during the thesis were motivated by the fact that a large part of forecasting deficiencies is connected with the imperfect assimilation of available data in the numerical prediction process. It means that to produce a good forecast requires to have a good description of the initial conditions.
- Most of the operational assimilation schemes (OI, 3D-Var) are affected by various spin-up effects, all due to the fact that the analysis is carried out without full consistency with the model equations. Using a better assimilating model and 4D-Var, which allows a consistent use of the observations and the dynamics of the model, a better analysis and the subsequent forecast can be obtained.
- However using more sophisticated assimilating model, with an inclusion of the physical parametrizations, makes the computations required for 4D-Var more difficult due to the fact that the physical processes are highly nonlinear and often discontinuous.
- 4D-Var consists in minimizing the distance between a model trajectory and observations spread over a given time interval (this is a variational problem), the results of this "optimal" trajectory being used as initial conditions for a numerical forecast.
- A 4D-Var system has been developed at ECMWF in collaboration with Météo-France. Its formulation in terms of increments (Courtier et al. 1994) can reduce the computational time. In this approach, the atmospheric state remains transported in time at hight resolution and with the complete model, while the "errors" (perturbations around trajectory) are transported with a simplified linear model. This linear model does not need to be the exact tangent linear version of the full model. It allows to use different resolution, different geometry and also different physics. Then one has plenty degree of freedom to develop simplified, differentiable physical parametrizations for a gradual improvement of the linearized model used in 4D-Var.
- There are several reasons why to investigate the problem of including the physical processes in the assimilating model:
  - The use of an adiabatic linear model can be critical especially in the tropics, the planetary boundary layer and the stratosphere where the description of the atmospheric processes is controlled by the physics rather than the dynamics.
  - Missing physical processes in the assimilation systems can lead to the so-called spin-up problem due to an imbalance between the model equations and the initial state.
  - Using the adjoint of various physical processes should provide an initial atmospheric state for NWP models which is more consistent with the physical processes and producing a better agreement between the model and data.
  - On top of that, an iclusion of the physics in the assimilating model is a necessary step towards the use of the observations directly related to the model physics, such as precipitation, cloudiness, etc.

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- However, for avoiding strong non-linearities and thresholds in the physical processes (which may cause serious problems in 4D-Var which is based on a linearization of the model equations), the physical parametrizations used for 4D-Var should be simple, regular and at the same time realistic enough for keeping the description of atmospheric processes physically sound.

- A complete set of the simplified physical parametrizations has been developed for incremental 4D-Var assimilation (Janisková et al. 1999). It contains a simplified computation of radiative fluxes, vertical turbulent diffusion, orographic gravity waves, deep convection and stratiform precipitation fluxes.

- In our approach the surface processes are not treated. Then for the simplified physics we suppose that the surface variables (surface temperature T_s, surface humidity q_s, roughness length z_0, snow depth) are constant for a given time step and taken from a model trajectory run with the full physical package.

- While in the original version of the ARPEGE stratiform precipitation scheme (Geleyn et al., 1995) the computation of fall speed depending rates of evaporation in unsaturated air (Kessler-type formula) and melting/freezing have to be done, in the simplified version, it is supposed that all supersaturation is immediately removed from the system on one hand, and everything is evaporated when the given sub-cloud layer is unsaturated on the other hand. The distinction between solid and liquid type of precipitation is done according temperature (if $T \geq 0^o$ C, then the precipitation is liquid).

- The gravity wave drag scheme, which is used in ARPEGE, is a modified version of the scheme of Boer et al. (1984) where during the computation of the linear deposition rate the flux is only assumed to be saturated at the surface and it is described by the same condition during the upward propagation of the wave. An important additional feature of the scheme is blocking of the low level flow, when the effective height of the sub-grid scale orography is high enough. The effect of anisotropy is kept as in the original scheme. The simplified version contains only the linear part of the computation of orographic gravity-waves breaking effects on momentum.

- The exchange coefficients for heat and momentum are computed according to Louis et al. (1981). The shallow convection is parametrized with a slightly modified version of Geleyn (1987). For the simplified physics the adopted assumption of piecewise time-constant values for surface temperature and surface humidity allows a simplification of the original vertical diffusion scheme (Geleyn et al., 1995) and the use of two independent matrices for the computation of turbulent fluxes for specific humidity and dry static energy, as it is usually done for the computation of turbulent fluxes for momentum.

- The simplified convection scheme is a mass-flux type scheme with the closure assumption of Kuo-type. Similarly as in the Bougeault scheme (1985), there is parametrization of the liquid water resp. ice in the cloud ascent computation.

  In principle, it is supposed that the convective process at some level appears when there is conditional instability and a non-zero mass flux. This condition of instability is modified by forcing no-triggering moist convection when there is dry convection at the cloud base.

  There are other differences with the full Bougeault scheme:

- detrainment is not assumed constant with height but depends on the variations of the mass flux,
- an entrainment rate is used consistently with the detrainment,
- the vertical turbulent fluxes of dry static energy and specific humidity are treated separately for diffusion and convection.

- The proposed radiation scheme is built up under the assumption that the local effects of gasses are constant in time (this is probably acceptable up to 24 hours).

  For thermal radiation, the simplification consists in calling the complete ARPEGE radiation routine only for recovering the thermal radiation coefficients in clear sky conditions. Then the coefficients of this matrix are recomputed as a function of cloudiness in the simplified physical parametrization. The thermal radiation flux is obtained by using the Stefan-Boltzmann law multiplied by this matrix.

- The solar radiation coefficients, which represent the properties of absorption and multiple scattering, are also computed during one time step integration of full radiation scheme for a mean solar angle (for clear sky and cloudy conditions). The dependency of the coefficients on actual cloudiness is recomputed during the integration of the simplified model and the solar fluxes are obtained using the basic flux equations.

- The validation of the whole direct simplified physical package has been done by comparing forecasts (performed up to 24 hours) using the model with the complete physics and the model where particular physical parametrizations of the full model were gradually replaced by simplified physical parametrizations. Such comparisons allowed to evaluate the behaviour of each simplified physical parametrization itself. To conclude the results from this validation, let us recall that these schemes were developed to be as much differentiable as possible, for adjoint purposes, i.e. several simplification assumptions had to be adopted, while trying to catch nevertheless the main tendencies in atmospheric evolution. It seems that this basic aim was achieved though these new parametrization schemes still require some tuning. The experiments suggest that the emphasis should be put on improving convection and cloudiness for radiation, in particular.

- To include the described simplified physical parametrizations into assimilating model, their tangent linear and adjoint have been developed. The adjoint is a powerful tool for many studies that require an estimation of sensitivity of model output with respect to input. The adjoint operates backward in time in the sence that it determines a gradient with respect to input from a gradient with respect to output.

- The verification of the correctness of the tangent linear model was first done through the classical Taylor formula:

$$\lim_{\lambda \to 0} \frac{M(\mathbf{x} + \lambda \delta \mathbf{x}) - M(\mathbf{x})}{M'(\lambda \delta \mathbf{x})} = 1$$

  where M describing the time evolution of the model state $\mathbf{x}(t)$ is a model such as

$$\mathbf{x}(t_{i+1}) = M[\mathbf{x}(t_i)]$$

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and M' is the tangent linear model of M:

$$\delta \mathbf{x}(t_{i+1}) \quad = \quad M'[\mathbf{x}(t_i)]\delta \mathbf{x}(t_i) = \frac{\partial M[\mathbf{x}(t_i)]}{\partial \mathbf{x}} \delta \mathbf{x}(t_i)$$

- After this standard validation, the accuracy of the linearization of the simplified physical parametrization has been investigated. Comparisons have then been done between on one hand the evolution over 6 and 12 hours of a perturbation (of the order of magnitude of analysis increments) with the simplified tangent linear model $M'(\delta\mathbf{x})$ and on the other hand the finite differences between two nonlinear forecasts using the full physical parametrizations, one from a basic state ($\mathbf{x}$) and the other one from a perturbed state ($\mathbf{x} + \delta\mathbf{x}$).

- The physical processes are characterized by the threshold processes, such as discontinuities of some functions themselves describing the physical processes - some on/off processes (for instance produced by supersaturation, changes between liquid and solid phase), some discontinuities of the derivative of a continuous function (i.e. the derivative can go towards infinity in some points) or some strong non-linearities (for instance created by the transition from unstable to stable regimes in the PBL). In each of these situations an estimation of the derivative close to the discontinuity point will be different between the non-linear model (in finite differences) and the tangent linear model.

- All of this makes the tangent linear approximation less valid for the model with included physical parametrizations than the adiabatic version. This was proved during the validation of the tangent linear model with simplified physical processes. The importance of regularization, i.e. smoothing modifications of the parametrized discontinuities arose. Aware of this problem from the beginning, we have tried to develop a set of simplified physical parametrizations as much differentiable as possible. But it is quite difficult to find a tradeoff between a physically sound description of atmospheric processes and a linear physical parametrization.

- The principal problems which were necessary to be solved were connected with the regularization of the tangent linear radiation and convection schemes.

- Since the simplified radiation scheme is linear itself it is clear that the noise in this scheme can only come from the parametrization of cloudiness. There are two possible solutions to solve this problem. First one is to try to find a smoother transition between non-cloudy and cloudy state of atmosphere which is not so trivial due to plenty of possible thresholds in this type of schemes and probably goes against reality. The second solution is to use the assumption that the cloudiness is constant in a particular time step (this means that the perturbation of cloudiness is zero). We have chosen this second approach.

- Most of the problems were expected from the linearization of the convection scheme and this is why the scheme was developed with the aim to avoid as much threshold processes as possible, with the risk of degrading the quality of the scheme. Some deteriorating the quality of the convergence in the Taylor test had to be accepted in order to remove the noise in the evolution of a perturbation (created by the tangent linear convection scheme compared to the finite differences between two nonlinear forecasts using full physical parametrization). Then no other significant problem connected with the tangent linear convection scheme itself was encountered. On the contrary, adding the tangent linear radiation and convection schemes to the set of simplified physical parametrization schemes usually helped to modify the perturbation in the right direction.

- The problem of spurious noise, coming from the vertical diffusion scheme and created by a function of the Richardson number $f(Ri)$ describing the transition from unstable to stable regime, was solved by modifications of $f(Ri)$ in order to ensure its smaller derivative around the point of singularity (neutral state of the atmosphere where $Ri = 0$).

- The regularization in the large scale precipitation scheme with several potential threshold processes (the thermodynamical properties of condensated water in mixed phase, condensation, rainfall evaporation, snow melting) was applied to the stratiform precipitation fluxes themselves after completing the vertical loop of the computation of those fluxes.

- The proposed regularizations helped to remove the most of important threshold processes in physical parametrizations without significant change of the description of atmospheric processes. After solving the threshold problems, the results indicate a clear advantage of the diabatic tangent linear evolution of errors compared to the adiabatic evolution. The tangent linear model with simplified physical parametrization is able to fit the finite differences better than adiabatic or adiabsvd TL model. This suggests that the inclusion of the physical parametrizations in 4D-Var should improve the simplified linear model.

- Some tests have been done using incremental 4D-Var assimilation with the global forecast model ARPEGE. The full model (high resolution model, T95 and 27 levels) is a stretched (stretching factor c=3.5) and rotated model. It contains complete physical parametrization. The simplified linear model is non-stretched version of the model with 27 levels but with the lower horizontal resolution T63. It can be adiabatic or it can contain a set of simplified physical parametrizations.

- FASTEX (Fronts and Atlantic Track Storm Experiments) have been selected as test cases. The aim of FASTEX was the study of the evolution of atmospheric depressions in Atlantic ocean during January - February 1997. Following situations have been studied:

IOP3	:	assimilation from 13/1/97 to 14/1/97
IOP17	:	assimilation from 17/2/97 to 18/2/97

- In our experiments 24-hour (4 times 6-hour) assimilation cycle was used. The same quality control as in the former operational OI system has been performed. The background term $\mathcal{J}^b$ is identical to the one used in the French operational 3D-Var scheme. The forecasts from produced initial conditions were performed up to 72 hours.

- For each evaluated situation, the general abilities of the system to create the initial conditions for numerical forecast corresponding well to the analysed situation qualitatively (ability to catch some specific features of atmospheric development) and quantitatively (the differences between the analysis and the forecast in terms of bias, rms) were investigated. When looking at the mean sea level pressure fields and geopotential fields on the different levels, it was usually observed that using 4D-Var leads to the correction of position of the cyclone compared to OI and 3D-Var. Using physics in 4D-Var usually helped to improve the position of the cyclone as well as the value of low. But in some cases it was realized the tendency to deepen the cyclone when using 4D-Var with the simplified physics, but to localized it better than in the case of adiabatic 4D-Var.

- For detailed study of the situations the vertical cross-sections for relative humidity, pseudo-wet bulb potential temperature and vertical velocity over the line crossing the fronts in the domain of the FASTEX cyclone development were driven. Such evaluation showed that the structure of the followed fields is better represented by using 4D-Var with simplified physical parametrization than 3D-Var and adiabatic 4D-Var.

- For a more objective evaluation of the quality and the stability of the assimilation systems, one of the experiments starting from 13 January 1997 was prolongated to 20 January 1997. One week assimilation cycles were done using 3D-Var, 4D-Var adiabatic and 4D-Var with the whole set of simplified physical parametrization. The forecasts were performed up to 72 hours twice a day, from 00UTC and 12UTC. The range of 72-hour forecasts in 12-hour intervals were verified against the OI analysis and some comparisons have been done as well against observations.

- The verification of the forecast against analyses showed a general improvement of the forecast in Europe-Atlantic domain and a degradation in the low troposphere of the tropics when using 4D-Var. The inclusion of the physics marginally improved the scores.

- The fit of the initial conditions to the observations for the whole period was evaluated as well. The comparisons against observations showed an improvement in the case of 4D-Var, but there are really slight differences when using 4D-Var adiabatic and 4D-Var with simplified physics. Comapring the forecasts against OI analysis for different areas showed mostly improvement (except the tropics) of the scores of 4D-Var over 3D-Var and even some additional improvement when using the simplified physics in 4D-Var. In the tropics the results are worse in the lower part of the atmosphere. There is just improvement in the troposphere in this case.

- The study of how the assimilation systems are able to deal with the spin-up effect showed that this is a common problem of both 4D-Var systems (adiabatic or with the simplified physics). In the tropics some improvement was achieved when using 4D-Var with the whole set of simplified physics compared to 4D-Var adiabatic.

- The first 4D-Var assimilation experiments using simplified physical parametrization schemes, which have been performed, showed that 4D-Var with simplified physics is able to represent cyclogenesis over North Atlantic better than 3D-Var or 4D-Var adiabatic. But generally the impact of the physics in 4D-Var is weak. One reason may be the short assimilation window (6 hours) or not using enough data especially in the tropics (where using more information about humidity when using the physics is wishable). In the tropics, the results are not satisfactory when using 4D-Var compared to 3D-Var.

- Despite the developments which are still necessary for improving this 4D-Var system with simplified physics, it seems that the combination of the incremental method and the inclusion of the simplified and regular physics in the assimilating model is the way to improve the future operational data assimilation system at Météo-France.

- The problem which will still require some investigation is the definition of the "optimal" 4D-Var set-up (the number of updates and iterations between these trajectory refreshments, using the iterations run adiabatically and run with the simplified physics), which is likely to be meteorological situation dependent. Though a plenty of experiments have been done to define used scenario, but the number of possible combinations is huge.
- Another question is whether using the DFI initialization, especially in the tropics when the simplified physics is used in 4D-Var, does not remove some useful information about the atmospheric state. Therefore the impact of the initialization of the increments should be also studied.
- Future experiments should be done in order to study if the effects of physics become really more important as the duration of the assimilation window is longer.
- The advantage of including the physics in 4D-Var should be the possibility to use some additional data related to the model physics (cloudiness, precipitation data, liqued water contents). The impact of using such data will be studied as well.
- The inclusion of the tangent linear and adjoint of the simplified physical parametrizations should be extended to the limited area model ALADIN in the future.

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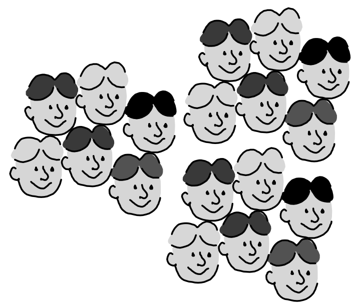
Geleyn, J.F., Basile, E., Bougeault, P., Déqué,M., Ivanovici, V., Joly, A., Labbé, L., Piédelièvre, J.P., Piriou, J.M. and Royer, J.F., 1995: Atmospheric parametrization schemes in Météo-France's ARPEGE N.W.P. model. In the Proceedings of the 1994 ECMWF seminar on physical parametrizations in numerical models, ECMWF Reading, 385-402.

Janisková, M., Thépaut, J.-N. and Geleyn, J.-F., 1999: Simplified and regular physical parametrizations for incremental four-dimensional variational assimilation. *Mon. Wea. Rev.*, **127**, 26-45.

Louis, J.F., 1979: A parametric model of vertical eddy fluxes in the atmosphere. *Bound.-Layer Meteor.*, **17**, 187-202.

Conferences/Workshops/Announcements

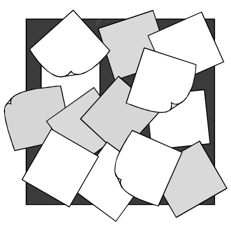
1. EWGLAM/SRNWP held in Copenhagen on October 5-9th, 1998, next meeting, next workshops



Organized by the Danish Meteorological Institute, the 1998 combined EWGLAM/SRNWP meetings took place in Copenhagen.

As usual, during the EWGLAM meeting (5-7th October), the participants could attend international projects presentations (ALADIN, DWD, HIRLAM, UKMO, ECMWF), national presentations and scientific presentations. The special topic was "Experiences with very high resolution models using a grid point distance below 10 km".

Then, during the SRNWP meeting (8-9th October), reports from the Lead centres were presented :

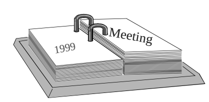


- Variational data-assimilation (UKMO),
- Surface processes and assimilation (HIRLAM, Spain/Sweden/Norway),
- Non-hydrostatic models (DWD),
- Semi-Lagrangian schemes (Météo-France),

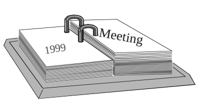
Decision was taken to transform the topic "Semi-Lagrangian schemes" into "Numerical methods", a more general topic including problems of dynamical/physical discretization and representation, interaction between dynamics and physics, etc ...

During the SRNWP issues, J. Quiby has been designated as SRNWP coordinator.

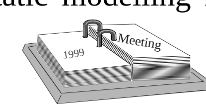
The next EWGLAM/SRNWP meetings will take place in Bratislava on October 11-15th, 1999.



Two SRNWP workshops are planned within this year :



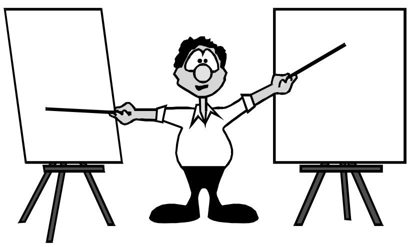
- a SRNWP Workshop on "Numerical methods" in Prague (26-27th of April, 1999).
- the third International SRNWP Workshop on Non-Hydrostatic modelling in Offenbach (25-27th of October, 1999) focusing on "Data assimilation for fine mesh models". Please contact jsteppeler@dwd.d400.de.



2. *The 3rd Assembly of ALADIN Partners held in Prague on November 6th, 1999, next Assembly*

The participants to this Assembly attended some lectures on :

- the history, the current status and the prospect for ALADIN-LACE application,

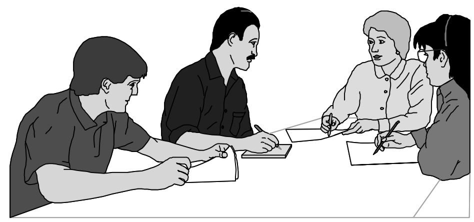


- presentation of the status of the new telecommunication network RMDCN,

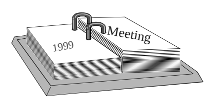
and on scientific topics :

- high-resolution dynamics,
- how to trigger and harmonize ALADIN-based applications,
- data assimilation.

Discussions were mainly about :



- assessment of the 1998 scientific program,
- draft ECMWF/Météo-France agreement for the IFS/ARPEGE/ALADIN software protection,
- amendments to ALADIN Memorandum of Understanding,
- technical overview of the project at the end of 1998 and 1999 perspective,
- the scientific plan and its implications (Second medium-term (1999-2001) research plan for ALADIN).



Discussions about maintenance and training problems were delayed to the next Assembly.

The representative of Portugal kindly offered that the next Assembly would take place in the end of November or beginning of December 1999 in Lisbon.

The Minutes of the Assembly are available on our public ftp (minutes_assembly.ps).The production of printed proceeding is under way.

3. *IFS/ARPEGE coordination meeting for cycle 20 held at Météo-France on January 18th, 1999*

The preparation of ARPEGE cycle 20 took longer than expected. ALADIN code has been phased with a pre-cycle 20 prepared by Météo-France. After full validation at Météo-France this pre-cycle will be sent to ECMWF where the recently written adjoint of the semi-Lagrangian code will be included in order to release cycle 20. This is expected to be completed by the end of February.

Cycle 21 will be made automatically about 2 weeks after cycle 20 is ready : It will include some cleaning, free source code format, and the implicit none statement everywhere.

The Minutes of this IFS/ARPEGE coordination meeting are available on our public ftp (minutes_ifsarp.ps).

Progress and plans at Météo-France, at ECMWF, and about the observational data base and general code issues are summarized in the Minutes. ALADIN partners are mainly concerned by the conclusions about the "Free source format" and the agreement between ECMWF and Météo-France on the access and the use of the IFS/ARPEGE software.

The observational database (ODB) will replace CMAFOC files from ARPEGE cyle 23 (planned for spring 2000). A tool will be developed to transform ODB into CMAFOC data. One could go on using CMAFOC. For ALADIN models, this change will only have an impact for those using CANARI, verif.pack, diag.pack or 3D-VAR. For more details, please contact vincent.casse@meteo.fr.

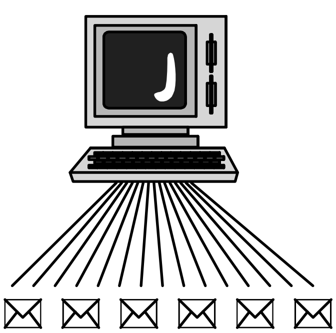
4. Sixth ALADIN Workshop held in Bucarest on February 15-17th, 1999

This Sixth ALADIN Workshop took place at the National Institute of Meteorology and Hydrology in Bucarest and was entitled "Scientific development and new applications of the numerical weather prediction model ALADIN". More details in Newsletter 14.

Contacts & Informations

These informations (and others, please see the list of the documents in annex) are available on a public ftp : ***cnrm-ftp.meteo.fr***, under the directory ***/pub-aladin***. Please connect on user anonymous and use you e-mail address as your password.

Some mailing lists also exist to make our correspondence smoother; for example :



- the general list : ***aladin@meteo.fr***,
- the RC LACE list : ***lace_talk@chmi.cz***,
- the AWOC list : ***awoc@meteo.fr***,
- the list for questions and/or problems encountered with ALADIN : ***alabobo@meteo.fr***,
- ...

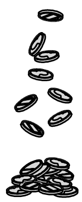
Many of you have a remote access to Météo-France machines. Eric Escalière (*eric.escaliere@meteo.fr*) is now your only point of contact for these access.

There was no answer to the previous call to update the list of the contact points for operations !

Money Funding asked for some cooperations based on the ALADIN project

1. *INCO-COPERNICUS keep-in-touch, so-called ''ALADIN-KIT''*

ALADIN-KIT is finished but please do Keep-In-Touch !...

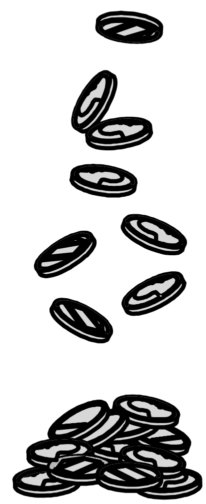


The final report has been sent to the EU and the project review took place in Bruxelles on the 22nd of February 1999.

This funding was concerning the 6 Central or Oriental European countries involved in the previous PECO action (i.e. Bulgaria, Czech Republic, Hungary, Romania, Poland and Slovakia) and two Western European countries (Denmark and France). It covered organisation expenses fee and some travels to 4 meetings during 1997/1998.

The final report is available on our public ftp (kit.ps).

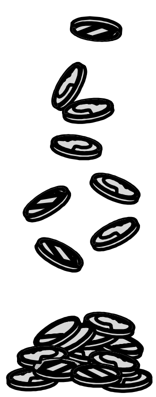
2. *French "Ministère des Affaires Etrangères" support (MAE)*



Demands for Embassy support for 1999 have been expressed to the Ministery last October. Rules are the same as 1998 ones with a probable reduction of the total amount of the support. We should know more about what has been given at the beginning of March. As soon as we receive informations, your representatives will be contacted and we will plan the stays benefiting from this support.

More details can be asked to Arlette Rigaud (Météo-France/DGS/IE, arlette.rigaud@meteo.fr).

3. *Bilateral supporting grants*

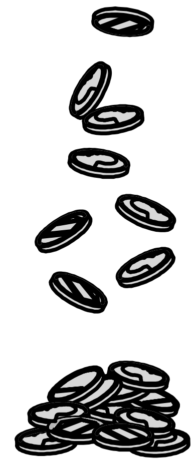


Balaton, Barrande, Proteus, Portugal are famous names of ... bilateral programs who can support short visits in both sides. All submitted demands have been successful even though we have not obtained all what has been requested. The countries involved in these programs can easily be guessed considering the programs names.

The French fundings are used to pay the per-diem (in France) of the visitors and to pay the travel of French people to your NMS, and vice-versa.

4. *Météo-France support for maintenance*

The GMAP demand to Météo-France for funding to support maintenance actions in the ALADIN project has been successful, with an increase in available credits. Part of this support is being used for the current phasing. We still have to find volunteers for the next one...



A small experiment on the www

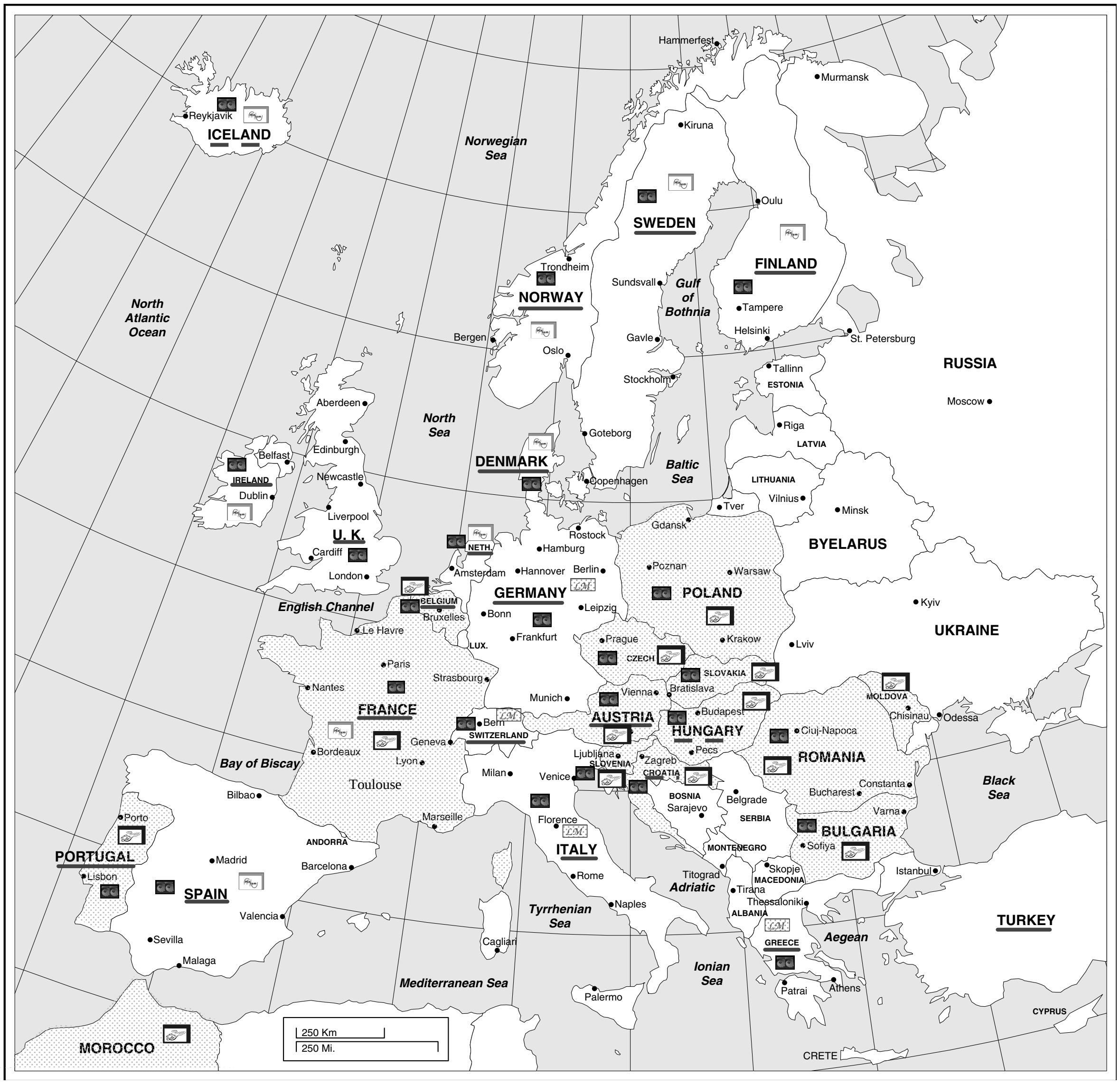
Have you ever try to find informations about ALADIN on the www ? ALADIN appears as :

- a shared-library catalog for universities in the U.S. States,
- a water and amusement park in Pakistan,
- an editor of music from Magreb,
- an interactive software sky atlas referenced as "the ALADIN project",
- Advanced LAnguage Device for INteraction Project with a magic lamp as a logo !...,
- a famous casino in Las Vegas,
- a great number of restaurants,
- ... and so many other things.

Very persevering Internet surfers can succeed in finding a few pages about our ALADIN. Other international projects in NWP (see the maps below for localization and examples) do not have the same problem. You can directly obtain informations about them on the Internet but ... they do not have a so famous (and consequently) so used name ... and they have a general server that presents their project with links to local pages of the NMS cooperating in the project.

Let us take up this easy challenge for a magic project such as ALADIN : to make a web page about our ALADIN project appear in the www search engines. All ideas or contributions can be sent to patricia.pottier@meteo.fr or eric.escaliere@meteo.fr.

The ALADIN Project within the European collaborations in Numerical Forecast



ALADIN : Aire Limitée Adaptation dynamique Développement InterNational

* Belgium, France, Morocco, Poland, Portugal

* LACE : Limited Area for Central Europe :
Austria, Croatia, Czech Rep., Hungary, Slovakia, Slovenia

* SELAM : South Est Limited Area Model : Bulgaria, Romania, (Moldovia)

ECMWF : European Center for Medium Range Weather Forecasts :

Members : Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Switzerland, Spain, Sweden, Turkey, United Kingdom

Associated Members : Croatia, Hungary, Iceland, Slovenia

HIRLAM : High Resolution Limited Area Modelling :
Denmark, Finland, Island, Ireland, Netherlands, Norway, Sweden

Local Model : Germany, Greece, Italy, Switzerland

SRNWP : Short Range Numerical Weather Prediction "network" countries ( ) :
Austria, Belgium, Bulgaria, Croatia, Czech Rep., Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom

EUMETNET : the Network of European Meteorological Service (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom

EWGLAM : European Working Group for Limited Area Modelling

EUMETNET

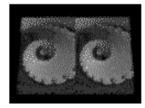
The Network of European Meteorological Services

The Network of
18 National Meteorological Services

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom

EUMETNET is a network grouping 18 European National Meteorological Services. EUMETNET provides a framework to organise co-operative programmes between the Members in the various fields of basic meteorological activities such as observing systems, data processing, basic forecasting products, research and development, training. Through EUMETNET Programmes, the Members intend to develop their collective capability to serve environment management and climate monitoring and to bring to all European users the best available quality of meteorological information. They will use EUMETNET to make more efficient the management of their collective resources.

http://www.eumenet.eu.org



The SRNWP Working Group was established in 1993 by ICWED (Informal Conference of Western Europe Directors of NMSs). Since then it has been " organising the competition " between the different teams active in Europe for the development of numerical weather prediction models.

Lead Centres are selected by the group for different topics. The Lead Centres have the responsibility to organise intercomparisons, and workshops and to ensure the flow of information between participants.

The currently active topics are :

- surface processes (lead centre HIRLAM)
- semi-lagrangian schemes (lead centre Météo-France)
- variational assimilation (lead centre UKMO)
- non-hydrostatic modelling (lead centre DWD)

Traditionally, the SRNWP group meet once a year in October, in a meeting combined with the EWGLAM (European Working Group on Limited Area Modelling) annual meeting.

http://www.eumenet.eu.org/contsrnwp.html

European Centre for Medium-Range Weather Forecasts (ECMWF)

ECMWF is an international organisation supported by 18 European Member States. The Centre has three working languages - English, French and German.

The European Centre for Medium-Range Weather Forecasts (ECMWF, the Centre) is an international organisation supported by eighteen European States:

Belgium, Denmark, Federal Republic of Germany, Spain, France, Greece, Ireland, Italy, Yugoslavia*, the Netherlands, Norway, Austria, Portugal, Switzerland, Finland, Sweden, Turkey, United Kingdom.

* inactive since 5 June 1992

The Centre has concluded co-operation agreements with **Croatia**, **Iceland**, **Hungary**, and **Slovenia**, and has working arrangements with the **World Meteorological Organisation (WMO)**, the **European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)**, and the **African Centre for Meteorological Applications for Development (ACMAD)**.

Originally a COST (European Cooperation in Science and Technology) project, the Centre was established in 1973 by a Convention.

The first real-time medium-range forecasts were made in June 1979. The Centre has been producing operational medium-range weather forecasts since 1 August 1979.

http://www.ecmwf.int

The principal objectives of the Centre are:

- the development of numerical methods for medium-range weather forecasting;
- the preparation, on a regular basis, of medium-range weather forecasts for distribution to the meteorological services of the Member States;
- scientific and technical research directed to the improvement of these forecasts;
- collection and storage of appropriate meteorological data.

In addition, the Centre:

- makes available a proportion of its computing facilities to its Member States for their research;
- assists in implementing the programmes of the World Meteorological Organisation;
- provides advanced training to the scientific staff of the Member States in the field of numerical weather prediction;
- makes the data in its extensive archives available to outside bodies.

RC LACE

http://www.chmi.cz/meteo/ov

Regional Centre for Limited Area Modelling in Central Europe

Mission

Regional Centre for Limited Area Modelling for Central Europe (RC LACE) is an international non-governmental organisation of six Central-European National (Hydro) Meteorological Services. Its main objective is to develop and operate numerical weather prediction systems for short-range weather forecast in Central Europe.

History

RC LACE was established in December, 1994 with the signature of its Statute (some kind of constitution). The members of this joint action are Austria, Croatia, Czech Republic, Hungary, Slovakia and Slovenia with close relationship with its numerical weather prediction partner Meteo France.
The next milestone of the project was at the end of 1995, when a Contract was negotiated and signed with Meteo France for using their J916/12 CRAY computer for operational and development purposes for RC LACE. Based on this Contract the ALADIN/LACE model has been operationally launched in Toulouse since 1 July, 1996 for a domain around the LACE Member States.
At that time RC LACE Telecommunication and Archiving Centre (TelArC) was established in ZAMG, Vienna, with the mission to serve as a centre for product dissemination and archiving.
In July 1998 the main ALADIN/LACE operational application was moved to the new supercomputer NEC SX4 installed at CHMI, Prague.

Structure

With the signature of the **Statute** of RC LACE some LACE decision making bodies were defined as it is for ECMWF. The project is led by the Project Leader. Three **advisory committees** exist: scientific, technical and financial ones. These committees provide some expertise and proposals for consideration of the **Council** of RC LACE, where the principal representatives of the Members are represented. Beside these bodies at every Member State **Decentralized Research Units** (DRU) were created focusing on the processing of model products and further ALADIN-related local research and development.
The main model operations are secured by the Prague Operational Team, consisting of Prague Team Leader, his/her Deputy, and other visiting scientists and technicians.

World Meteorological Organization

A United Nations Specialized Agency
Weather, Climate, Water, Atmosphere.

http://www.wmo.ch

ALADIN

Belgium, Austria, Bulgaria, Czech Republic, France, Hungary, Croatia, Moldavia, Slovenia, Slovakia, Morocco, Poland, Romania, Portugal

http://www.???

http://www.knmi.nl/hirlam/

High Resolution Hirlam Limited Area Model

The international HIRLAM project is a cooperation of the following meteorological institutes:

- Danish Meteorological Institute (DMI) (Denmark)
- Finnish Meteorological Institute (FMI) (Finland)
- Icelandic Meteorological Office (VI) (Iceland)
- Irish Meteorological Service (IMS) (Ireland)
- Royal Netherlands Meteorological Institute (KNMI) (The Netherlands)
- The Norwegian Meteorological Institute (DNMI) (Norway)
- Spanish Meteorological Institute (INM) (Spain)
- Swedish Meteorological and Hydrological Institute (SMHI) (Sweden)

There is a research cooperation with Météo-France (France).

The aim of the project is to develop and maintain a numerical short-range weather forecasting system for operational use by the participating institutes. The project has started in 1985. Since 1 January 1997 the project is in its fourth phase, HIRLAM-4. The HIRLAM-4 system, which to a large extent was built on the research results of the third phase of HIRLAM, is now used in routine weather forecasting by DMI, FMI, IMS, KNMI, INM, and SMHI. The HIRLAM project is controlled by the HIRLAM council, which consists of the directors of the participating institutes. The project is managed by the management group consisting of:

- Peter Lynch, project leader
- Nils Gustafsson, deputy project leader for data assimilation
- Bent Hansen Sass, deputy project leader for the forecast model
- Gerard Cats, system manager

Terms of reference describe the duties of the project leader, and those of the system manager.
The management group is advised by a Scientific and Technical Advisory Committee.