ALADIN Newsletter 19

ALATNET Newsletter 2

July - December 2000

http://www.cnrm.meteo.fr/aladin/ & **http://www.cnrm.meteo.fr/alatnet/**

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If needed, please contact : Patricia POTTIER, Météo-France/CNRM/GMAP, 42 av. Coriolis, F-31057 Toulouse Cedex
W **tel: 33 5 61 07 84 74, fax: 33 5 61 07 84 53 (from France, replace 33 by 0), e-mail: patricia.pottier@meteo.fr**

This joined Newsletter presents you the principal events concerning ALADIN or ALATNET during the second half of 2000. The news about work or events are related with informations that you sent.

An electronic ALADIN Newsletter 19 is available on the ALADIN web site and an electronic ALATNET Newsletter 2 can be consulted on the ALATNET web site. These electronic Newsletters are different from this joined "paper" Newsletter as they do not include informations already detailed on the sites (only links instead of summary of these informations).

Please do bring to my notice anything that you would like to be mentioned in the next Newsletter (ALADIN 20 & ALATNET 3) before the 15th July 2001.

Any contribution concerning announcements, scientifical progress, publications, news from the ALADIN versions on workstations or on big computers, verifications results, ... will be welcome.

ALADIN Main events

1. New ALADIN libraries

a) Code changes for AL13/CY22T2:

Mostly general improvements. For ALADIN, a first fully working non-hydrostatic tangent linear and adjoint code and bugfixes to run the simplified physics package developed by Dr. Marta Janiskova for ARPEGE.

b) Code changes for AL14/CY23T1:

The main issue is the switch from CMAFOC to ODB observation file format. This change impacts on all assimilation configurations (CANARI, Screening, 3D-VAR). Note that only the code phasing was prepared, but this cycle was not validated for ODB in ALADIN. Thus, you have to consider it only as a transient cycle, not suitable for operations.

Dynamics however have been validated for the general configurations (hydrostatic, non-hydrostatic, oper-type of conf. 001, 501, 401).

Note also that a reorganization of the code the non-hydrostatic model was performed, at the level of SCAN2M(DM)/CPG.

Finally, a lot of extra Full-Pos diagnostics have entered the cycle, along with namelist cleaning.

c) For AL15/CY24T1,

We anticipate bugfixes for the non-hydrostatic model, and there will be definitely a need for a deeper validation of the assimilation configurations !

The history of the ALADIN cycles has been updated and an history of the phasing teams is now available on the ALADIN website (http://www.cnrm.meteo.fr/aladin/concept/cycles.html).

The multi-tasking option, as well as the shared-memory configuration, will disappear and spectral transforms will enter a new, external library.

2. ALADIN informal meeting in Toulouse

An informal meeting took place after the second day of the 22nd EWGLAM and 7th SRNWP joint meetings (October 9-13, 2000, Toulouse). ALADINers gathered together to debate some technical and scientifical issues. A great part of the main debated points have been already completed.

- Newsletter : the scientific content should be increased with a more detailed description of deported scientific work; a 6-month production frequency is kept with less hardcopies but distribution of CD-ROMs. Let us hope, this Newsletter will obey this !...

- Trombinoscope : a rogues' gallery was asked ... and partly completed (see "Contact").

- Statistics of participation : an automatic system was promised to enable the correspondents to register on-line their contributions; it has been developed and was the opportunity to homogenize contributions, delays, ... (see "Statistics").

- The verification strategy for high-resolution modelling was discussed, the topic of the ALATNET lecture course in 2001 was chosen ("Data Assimilation"), ...

The minutes (and photos) of this informal meeting (and dinner !) are available on the ALADIN website (page Meetings).

3. *9th ALADIN workshop*

The Minutes of the workshop will be available on the ALADIN website, on page "Meetings".

4. *Assembly of Partners*

The 5th Assembly of ALADIN Partners took place in Vienna (Austria) on November 24, 2000. The Minutes have been prepared by our Austrian colleagues and will be available on the ALADIN website as soon as possible. The main conclusions are :

- The MoU is extended for another 6 months : the working group (France, Romania, Slovenia) who received in 1999 the mission to draft the new Memorandum of Understanding will continue its work following the recommendations of the Assembly.

- The signature of the new MoU is expected for the end of May during an intermediate Assembly of Partners, that will be organized jointly with the 2001 celebrations (10 years of ALADIN, 7 years of operations, ...). A working group gathering some directors (Austria, Belgium, Czech, France) will prepare this. This might be also an opportunity to make some publicity for ALADIN (embassies, EU, ...).

- A working group (Belgium, France, Hungary, Romania, Slovenia) was created to harmonize the evaluation of the ALADIN effort in each NMS.

ALATNET Main events

1. Informal meeting of the steering committee of ALATNET, October 12, 2000, Toulouse

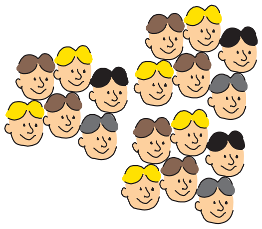
Taking the opportunity of the all ALATNET centers represented in Toulouse at the 22nd EWGLAM & 7th SRNWP joined meetings, an informal ALATNET meeting was organized on October 12, 2000.

Six months after the official start of the ALATNET project, the first evaluation in each center was presented (both scientifical and material aspects). The periods of the next calls for candidatures were decided. Proposals for the ALATNET page in the RTN project report of the EC were discussed.

For 2001, the ALATNET support (part "costs linked to networking") will give the opportunity to the ALATNET young researchers to attend different meetings/workshops :

- 23rd EWGLAM meeting : all ALATNET young researchers,
- SRNWP workshop on "Numerical methods" for Christopher SMITH and Jozef VIVODA,
- SRNWP workshop on "Surface processes" for Gianpaolo BALSAMO,
- SRNWP workshop on "Verification methods" for Klaus STADLBACHER,
- participation to an HIRLAM workshop or visit to an HIRLAM NMS for Cornel SOCI,
- ... for new young researchers after the next selections.

Announcements : 2001: a promising year !



Y2K was rich in ALADIN/ALATNET events. The next year will be ... not the same ... but even more !..

Here is a provisional calendar for the only first six months of 2001 :

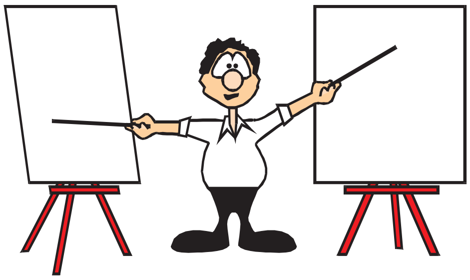
- ALADIN will be 10 years old and the ALADIN effort will reach 3000 person.month, 250 person.year ! This will be duly celebrated, officially by our Directors ... but not only.
- ALATNET will be 1 year old (but this will only be celebrated through all the requested annual reports ...).
- Another call for ALATNET candidates will be proposed in early spring.
- After Ilian (see "Doctor Ilian Gospodinov"), an 8th ALADIN doctor is expected for the end of February.
- A phasing exercise will take place in Toulouse in March-April.
- A new MoU will be signed by an intermediate Assembly of Partners at the end of May (another anniversary : on May 31, 1994, ALADIN begun its quasi-operational life).
- The 10th ALADIN workshop will be organized in Toulouse, proposed dates : June 6-8.
- The ALATNET Seminar on Data Assimilation will take place in Gourdon (near Toulouse, France) on June 11-22,
- ....

1. *Next ALATNET events*

a) ALATNET young researchers

A second call for candidacies was published on December 26, 2000 for the selection of two new candidates : two post-doctoral vacancies are offered to young researchers, one in Brussels (19 months) and one in Budapest (16 months).

A third call will be published in spring 2001 (pre- and post-doctoral positions in the five ALATNET centers).



b) ALATNET Training Course

The next ALATNET training course will be held in Gourdon (near Toulouse, Fr) on 11-22 June 2001.

Its mains topic will be data assimilation.

c) 2nd meeting of the Steering Committee of ALATNET, Brussels (F), 19 March 2001

Main subjects will be :

- ALATNET periodic progress report number 1 (scientifical/financial report of the ALATNET actions after one year)
- Next call for candidatures for ALATNET young researchers in Spring 2001

2. *Next ALADIN workshops/meetings*

a) 10 years ALADIN anniversary

On May 31st, 2001, the 10 years ALADIN anniversay will be officially celebrated (directors, embassies, ... A working group is preparing all details (invitations, programme, nice booklet of the project, ...). Also on May 31st, the new MoU should be signed.

a) The 10th ALADIN Workshop

The 10th ALADIN workshop, dedicated to scientific coordination, will be held in Toulouse (France) next spring. It will be organized just before the next ALATNET training course, as an attempt to reduce travel costs and thus enable a contribution of more partners.

b) The 11th ALADIN workshop

The 11th ALADIN Workshop on "Recent and planned operational exploitation of ALADIN model" will take place in Lisbonn, Portugal in autumn 2001.

3. *Other next events*

a) 23rd EWGLAM & 8th SRNWP joined meetings

The meetings will take place in Cracow, Poland, on October 8-12, 2001, with the usual ALADIN informal meeting to be planned as an evening session.

b) SRNWP workshops

- Workshop of the lead center "Numerical methods", Bratislava, Slovakia, 2-3 July 2001.
- Workshop of the lead center "Surface processes", Madrid, Spain.
- Workshop of the lead center "Verification methods", De Bilt, Netherlands, on April 23-24, 2001 (focal point ben@knmi.nl).
- Workshop of the lead center "High Resolution", Bad Orb, Germany.

Contacts & ... very practical Informations

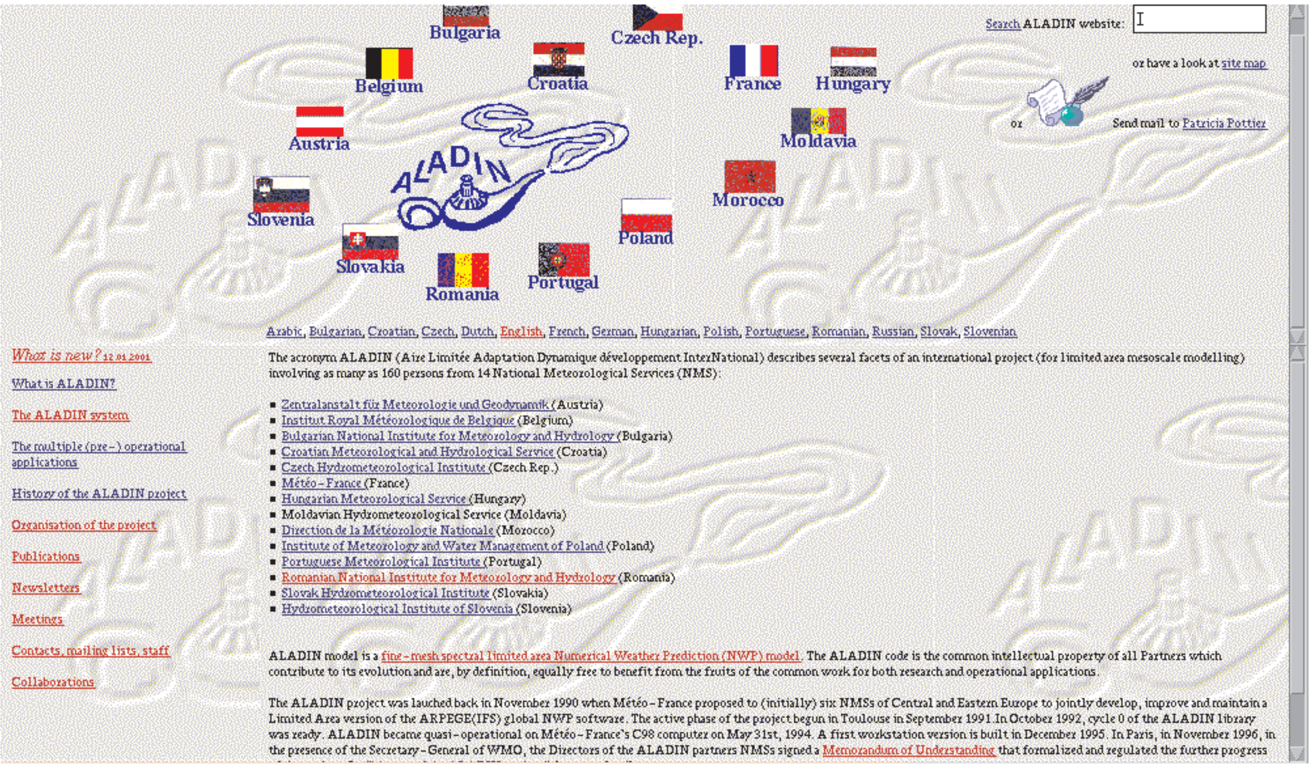
1. ALADIN and ALATNET on the Web

These informations (and many many others ...) are available on the ALADIN usual server:

http://www.cnrm.meteo.fr/aladin/

and on the ALATNET web server : **http://www.cnrm.meteo.fr/alatnet/**

A renewal of the ALADIN web site was performed during the autumn 2000 (many thanks to Method Kozelj). Your access to one of the numerous documents of the site should be now much more easy thanks to the site map and the search engine Method added to the site.



2. Toulouse visitors : some administrative changes

Most of the Toulouse visitors rent a room in the "Résidence" of the French Meteorological School (ENM). A new team is now in charge of the residence management. New rules have been defined for all residence users. After discussion with this team, a simplified procedure has been accepted .

- The key of your room will be available in GMAP a few days before your arrival,
- The GMAP person who will welcome you (at the airport or the station) will give you the usual envelope with access cards, key of your office, papers, ... and the key of your room in the residence.
- In case you arrive by your own:
  * during working hours, please go to GMAP offices and ask for your key,
  * out of working hours, the person at the main entrance will give you, exceptionally, the envelope (please note that the caretakers of the residence have no longer any key). Of course, this is only possible if somebody in GMAP gave him the envelope ... thus, if we know the exact date of your arrival !..
- In order to avoid unnecessary paperwork, the form untitled : "Fiche de Gestion des Etrangers" is now also used by the residence management. It is the only paper you will be asked to fill up at your arrival but it should be filled very quickly and faxed to this team on the first working day after your arrival.

More general informations for (future) persons on stay in Toulouse are available on the ALADIN website "Contact" page.

Last minute !!!! Rules are likely to change again... maybe to become something like the former ones !!! Anyway, please just tell us your exact date/time of arrival and we will solve the key problem.

3. Toulouse visitors : 2001 stays

The organization of the stays in Toulouse for the first 6 months of 2001 was even more complicated than previously, due to so many events in 2001 (see "Announcements") with the more usual constraints for the MAE stays (see "Money").

A compromise was obtained after many e-mails and phone calls. The result, i.e. the provisional planning of the stays (as far as we know it when preparing this Newsletter) is indicated below in the table. Updated versions of this table are quasi-weekly (!) produced and can be found on the page "Contact", under "ALADIN visitors in Toulouse" (planning, offices).

If you are one of the announced visitors, please check everything is OK for you or contact Patricia Pottier to change/complete the planning. If you plan to come in Toulouse during these months and if you cannot find any office indicated for you, please do protest also.

NAME	COUNTRY	BEG.	END	Subject	Mentor(s)
AJJAJI RADI	MOROCCO	2001/05/16	2001/06/30	Incremental approach and simplified physics	BOUYSSEL
ALEXANDRU STELUTA	ROMANIA	2001/01/16	2001/03/15	Optimization of spectral orography considering land-sea mask	GIARD
BALSAMO GIANPAOLO	ITALY	2001/04/01	2001/10/31	Coupling a variational assimilation of gridpoint surface fields with a 4d-Var assimilation of upperair spectral fields	BOUYSSEL GELEYN
DZIEDZIC ADAM	POLAND	2001/05/01	2001/06/30	Combinaison of 3d-Var, initialization and blending	FISCHER
GAYTANDJIEVA LORA	BULGARIA	2001/03/01	2001/04/15	PHASING	FISCHER
GUIDARD VINCENT	FRANCE	2001/01/15	2001/03/02	Singular vectors in ALADIN	FISCHER
IVATEK-SAHDAN STJEPAN	CROATIA	2001/03/01	2001/04/15	PHASING	FISCHER
JANOUSEK MARTIN	CZECH REP	2001/03/01	2001/04/30	PHASING	FISCHER
MASEK JAN	SLOVAKIA	2001/05/01	2001/06/30	Non-hydrostatic dynamics	BENARD
PAYET PIERRE-LUC	FRANCE	2001/01/15	2001/03/02	Singular vectors in ALADIN	FISCHER
RADNOTI GABOR	HUNGARY	2001/03/01	2001/04/30	PHASING and spectral coupling	FISCHER
RANDRIAMAM-PIANINA ROGER	HUNGARY	2001/04/16	2001/08/15	Assimilation of ATOVs radiances from CMS	RABIER
SIMON ANDRE	SLOVAKIA	2001/02/01	2001/03/31	Numerical noise at High Resolution in ARPEGE/ALADIN	PAILLEUX GELEYN
SMOLIKOVA PETRA	CZECH REP	2001/02/01	2001/03/31	New strategies for NH temporal scheme	BENARD
SOCI CORNEL	ROMANIA	2001/05/01	2001/09/01	Sensitivity studies using a limited-area model and its adjoint for the mesoscale range	FISCHER HORANYI
SOUSA DA COSTA VANDA	PORTUGAL	2001/03/16	2001/04/30	PHASING	FISCHER
STEFANESCU SIMONA	ROMANIA	2001/01/16	2001/03/15	Divergence component in Jb for ALADIN	BERRE
SZCZECH MALGORZATA	POLAND	2001/03/01	2001/04/15	PHASING	FISCHER
SZCZECH MALGORZATA	POLAND	2001/04/14	2001/06/15	Coupling an emissivity model with ALADIN	BOUYSSEL RABIER
VUKELIC BLAZENKA	CROATIA	2001/01/16	2001/03/15	1d model and boundary layer parametrization	PIRIOU

ALADIN/ALATNET Toulouse visitors : preliminary document for 2001, updated on 19.02.2001

4. *Toulouse visitors : what about "euro" ?*

An operational switch to euro money is planned for the beginning of 2002 ... with far little chance of being delayed than an ALADIN cycle !.

From mid-February 2002, French money (as most of the other E.U. money) could no longer be used. Some of you went to Toulouse and may be have kept some French money. If this money is on a bank or post account, no problem: it will be automatically changed into euros.

But, if you have kept franc notes, you have 3 solutions :

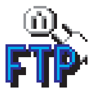
- to come in France before February 2002 and change the notes,
- to give it to one of your colleague who will go to France before the deadline,
- to keep the notes as "souvenirs" ...

After the deadline, it will be still possible to change the notes but only in Banque de France. Thus, try to find a solution before ! "NO CHANGE" in GMAP !...

5. *First ALADIN "trombinoscope"*

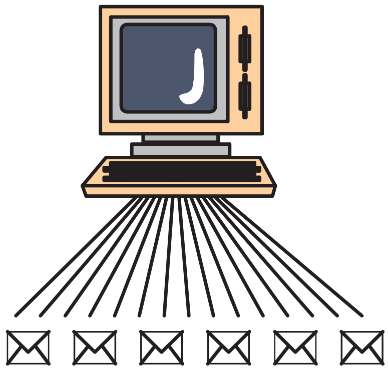
A rogues' gallery was produced by Jean-Daniel Gril with photos mainly taken during and after EWGLAM. If you don't find yours (see "Contact" on the ALADIN website), please send a numerical or paper (scanned then returned) photo to him and you will appear on the new "trombinoscope".

6. *Public ftp*



A public ftp is available since November 1995. Until 2000, it has been used to give ALADIN general informations. Now, the informations which can be found on the ALADIN website no longer appear on the public ftp. However, this public ftp can still be used for selective exchanges (ftp : ***cnrm-ftp.meteo.fr***, on user anonymous, under the directory ***/pub-aladin)***.

7. *Mailing lists*



Some mailing lists also exist to make our correspondence smoother :

The public lists :

- a general list has been recently updated : aladin@meteo.fr . It can be used for exchanges of general interest about the ALADIN project. It contains address of ALADINers at home.
- An e-mail list has been created : alatnet@meteo.fr . It can be used for exchanges of general interest about the ALATNET project. It contains address of people involved in the ALATNET project (ALATNET Young Researchers, mentors, co-ordinators).
- the stagmap@meteo.fr list contains the list of the ALADIN international Toulouse team : this very variable list (updated at the arrival or the departure of every visitor) permits to contact all visitors in GMAP,
- the AWOC list : awoc@meteo.fr, list for ALADIN WOrkstation Coordination,
- the list for questions and/or problems encountered with the ALADIN software : alabobo@meteo.fr,

More "private lists" :

- a list with correspondents for operational questions related to the Toulouse centre : operala@meteo.fr ,
- a list with correspondents for verification questions : verifala@meteo.fr , following the 1999 Assembly of ALADIN Partners' recommendations, each country has entrusted one person as the correspondent for the verification project.
- a list around the exchange of applications in the ALADIN's world : exchala@meteo.fr .

8. *Remote access to Météo-France machines*

Many of you have a remote access to Météo-France machines. Authorizations for such access must be renewed yearly. Eric Escalière (eric.escaliere@meteo.fr) is your contact point for this.

ALADIN documentation

A list of ALADIN publications (papers, reports, ...) is available on the ALADIN website and updated twice a year : papers in NWP specialized international journals with a reviewing committee, technical reports, extended abstracts and publications in other journals and the ALADINthèque contents (ALADIN reports).

For the time being, only a short summary (2/3 lines) of each publication is available. It would be useful to provide also full articles ... as far as possible. Thus, if you are the author of one of the referenced publications and if you still have the .ps of your article (or .html, .aw, .txt), please contact eric.escaliere@meteo.fr.

Of course, do tell us if you have some ALADIN publications not referenced.

Money Funding asked for some cooperations based on the ALADIN project

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

All the stays on 2000 support have to be completed before the end of June 2001 and are mostly already planned.

As a justification for 2001 demands, the Ministère des Affaires Etrangères asked for *a report on the 10 last years of cooperation* (progress, benefits for each part), for the partners benefiting from this support. Dominique Giard did the compilation of the personalized and detailed inputs about the history of ALADIN in each ALADIN country. This exceptionally good documenting effort surely helped Francois Duvernet and Sylvie Rivals to defend our ALADIN case at the Ministry (in not so easy circumstances) by convincing the COCOP of the seriousness of our activity. The COCOP of our Ministry of Foreign Affairs fully validated the demand for "soutien au programme de cooperation de Météo-France avec l'Europe Centrale et Orientale".

The demand to the embassies for the support to non-ECO countries in 2001 are being examined.

More details can be asked to Sylvie Rivals (Météo-France/D2I/INT, ***sylvie.rivals@meteo.f***).

2. *Bilateral supporting grants*

AMADEUS, BALATON, BARRANDE, PROTEUS are bilateral programs who can support short visits for both sides.

The 2000 exchanges (BALATON, BARRANDE) have been completed during autumn 2000.

For the first time, ALADIN will benefit of an AMADEUS program. It will focus on the improvement of the description of precipitations on mountain areas (parametrization, analysis, verification).

The former programs (BALATON, BARRANDE and PROTEUS) won't continue in 2001 (no new demand or demands refused).

More details can be asked to Dominique Giard (***dominique.giard@meteo.fr***).

3. *Météo-France support for maintenance, ...*

The Météo-France support to the maintenance of ALADIN in 2001 will be distributed among 20 stays and 30 person.month. It is a little less than in 2000 as it will support only 2 phasing exercises with 8 persons invited each time, and some additional stays (part of maintenance is expected to be deported from this year).

4. *ALATNET funding*

- On 25 May 2000, Météo-France received the initial advance from the Commission (30% of the total).
- On 5 June 2000, the advance was allocated to each participants in accordance with the article 3 of the ALATNET contract.

This money is to be mainly used for young researchers employment in the 5 ALATNET centers (salaries or grants, social charges, relocation costs, travel costs). A smaller part will be dedicated to the Networking of the research work associated with ALATNET. All details can be found in the ALATNET contract and its Annex 2.

The operational ALADIN models

1. *Status report of the operational ALADIN versions*

ALADIN runs operationally on a wide range of computers, from single workstations to vector computers in shared or distributed memory, and on a cluster of workstations under Linux. 12 operational (and 1 pre-operational) ALADIN suites are presently running in various NMS. Coupling files for 7 domains are produced operationally at Météo-France, for 1 in Prague.

2. *Operational version at Austrian Meteorological Service*

(more details wang@zamg.ac.at)

Implementation of MANDALAY

In order to be able to use DIAGPACK for analyzing surface parameters like surface pressure, wind, visibility, precipitations, ..., the tool MANDALAY was installed at ZAMG as the first step for implementing DIAGPACK. Some technical investigations on the adaptation of data from the ZAMG database to the data format needed by MANDALAY were also done.

Implementation of 500 hPa geopotential verification of ALADIN

A 500 hPa geopotential verification routine for ALADIN-VIENNA was developed. This routine calculates bias, mean absolute error, rms error, standard deviation, and anomaly correlation for the 500 hPa geopotential each day. The verification procedure will be used for monitoring purposes, e.g. when the model cycle is changed.

3. *Operational implementation of ALADIN-Belgium*

(more details luc.gerard@oma.be)

Main operational work :

- Installation of AL12/CY22T1/XR22 under MPI on a HP 9000/800 system: this work required the modification of about 290 auxiliary routines, and some corrections in ALADIN routines
- Installation of AL12/CY22T1/XR22/Cycorabis under MPI and Linux on PCs.
- Installation of all (locally developed) operational ALADIN tools on a PC under Linux.

Development

- CANARI assimilation
- Implementation of a parallel run including a data assimilation suite based on CANARI and cycle AL11T2. Unfortunately, the scores are not much better.
- Implementation and test of a new database for vegetation and soil data.

4. Operational version at Bulgarian Meteorological Service

(more details valery.spiridonov@meteo.bg or andrey.bogatchev@meteo.bg)

Last news in Newsletter 18.

5. Pre-Operational version at Croatian Meteorological Service

The 3rd quarter of the year has been devoted to the organization and preparation of the pre-operational version of ALADIN-HRVATSKA. Preparation steps:

- porting the AL11T2 version from Ljubljana
- parallel processing tests on 10 processors (three 2xPIII 800 MHz 256 Mb RAM and two 2xPIII 667 MHz 256 Mb RAM)
- used software: OS Linux RedHat 6.2, MPICH1.2, F90 Fujitsu compiler
- use of Slovenian configuration
- switch to the AL12 version
- writing or adapting scripts
- post processing and visualization
- quasi operational run
- defining Croatian domain: number of points 108x90 (SE corner 41.86, 22.16; NE corner 49.55, 15.00), 31 vertical levels, resolution 11 km, time step 450 sec
- operational cycle AL12T2 (since September)
- visualization using Vis5d

We would like to thank our Slovenian colleagues Neva Pristov and Jure Jerman for help and support.

6. Operational ALADIN-FRANCE in Météo-France

(more details bruno.lacroix@meteo.fr)

ALADIN-France e-suite on SYNERGIE display

The last upgrade performed on SYNERGIE server has been done last year. It is now possible to look at ALADIN-France test suite as well as the ARPEGE one. This tool is helpful to validate the behavior of any new scheme, in particular for all the features not controlled by classical scores. For instance, the present test suite is about modifications on CYCORA physics for both ARPEGE and ALADIN, and a slight increase of horizontal resolution for ALADIN-France (9.9 to 9.5km in grid point). The impact on surface temperature of the new resolution is quite visible on this pictures (figure 1), directly printed from SYNERGIE. The Belle-Ile temperature is much better now. The problem here was similar to that encountered on Lake Balaton (paper of S. Kertesz in the last Newsletter). The island was ignored by the model but present on the finer post-processing grid. The increase in the model resolution solved the problem here.

Such an easy way to look at the model fields open new perspective for verification. A forecaster in the PREVI/COMPAS team looks regularly now on both operational and test suites to detect any anomalies.

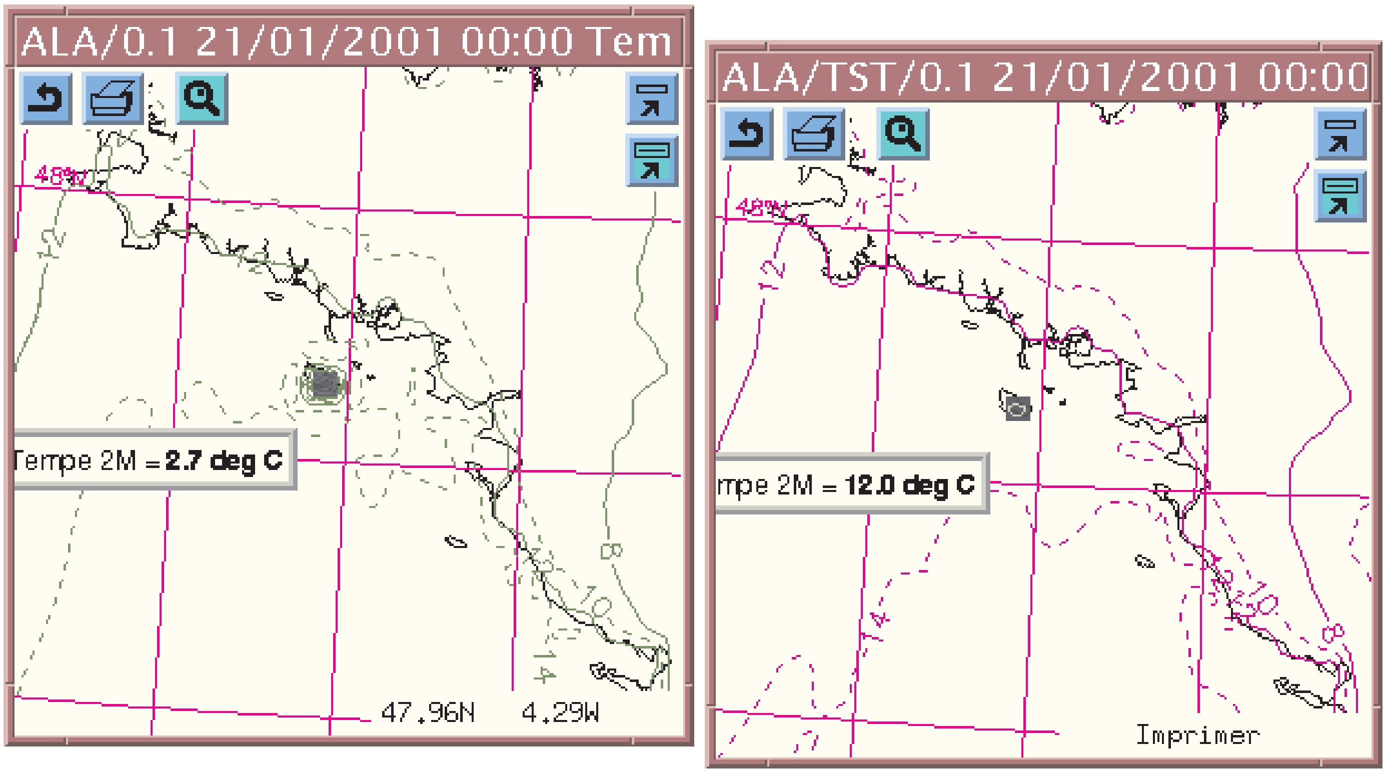


Figure 1: ALADIN-France 2m temperature forecasts, operational (left) and test (right) suite as seen with SYNERGIE software.

7. *Workstation version at French Meteorological Service*

(more details jean-marc.audoin@meteo.fr)

Last news in Newsletter 18.

8. *Operational version at Hungarian Meteorological Service*

(more details horanyi@met.hu)

During the period several tools were adapted and installed in Budapest, which on the one hand helps on the development work and on the other hand extends the available products based on the ALADIN model. The following tools were adapted (the work had been started during the stay of Neva Pristov in Budapest):

- Adaptation of e923 in Budapest in order to be able to create climatological files locally for any domain over Europe. This facility gives more flexibility while creating any kind of new ALADIN domain.
- Adaptation of ascs software in order to visualize vertical cross sections over the ALADIN domain. The software was also extended using the products of the ECMWF model. Ascs was put into operations during the summer.
- Further dynamical adaptation (dada) of the wind field over Hungary. A domain with high resolution (around 2,5 km mesh) was defined covering Hungary and the forecasted wind fields were

adapted to the high resolution climatological data base. Dada became operational at the end of summer.

During the last quarter of 2000 the following main activities were performed around the workstation version of ALADIN:

- Introduction of new post-processed variables in the operational suite. The most interesting new variables in use are potential vorticity, total precipitable water and short wave radiation on the surface.

- During the stay of Ryad El Khatib in Budapest some tests were carried out on the formulation of the post-processed wind gusts. According to some case studies it was found that the turbulent wind gust seems a better option than the PBL gust formulation.

- At the end of the year the ARPEGE/ALADIN source code browser was installed.

- A one week visit of Metod Kozelj was devoted to the demo installation of SMS (Supervision Monitor Scheduler) in Budapest. Some operational scripts were considered and modified in order to demonstrate the applicability of SMS.

- The adaptation of the Kalman filter software package (originally written by Jozef Vivoda) was continued but not yet finished.

9. Operational ALADIN-LACE in CHMI

(more details can be asked to Project Leader or Prague Team Leader)

1. Evolution of the ALADIN/LACE application.

The new operational suite of ALADIN/LACE based on SMS (Scheduler-Monitor-Supervisor tool ©ECMWF) started on:

- 22/08/2000 for 12 UTC network time: afternoon suite starts to run under SMS

- 25/08/2000 for 00 UTC network time: complete switch to SMS

After quite a complex testing, the technical organization of the operational suite was completely changed. The suite is now handled by SMS running on a SUN server. The advantages of this technical change are the following:

- better supervision of individual suite tasks by the system and also by the operator, having a comprehensive suite diagram on the screen at any instant;

- easy operator's intervention (like reload of individual tasks) in case of problem;

- optimisation of the long distance telecommunication I/O operations, when both download and upload of data via EQUANT network is moved from NEC/SX4 to a more appropriate SUN server;

- easy incorporation of any new element of the suite (blending-suite, data assimilation type of suite, more frequent runs, etc.).

The operational switch went smoothly. The blending modules are ready by now and may be activated whenever needed.

2. Parallel Suites & Code Maintenance

The Prague Team launched the following parallel tests to assess the impact of different modifications:

- **Blending suite, running in its assimilation cycle mode (without regular production runs).** A modification was ported to the surface part of blending, allowing to blend just land points. This modification was necessary to avoid even stronger drift of surface lake temperature than it is witnessed in the e927/ee927 procedures. Files from the blending assimilation cycle are used both for specific validation tests and for R & D purposes. The standard scores of the blending suite production brought improvements of bias in the initial state conditions and also weak improvements of RMSE scores. On the other hand there is yet an unexplained worse bias of mean-sea level pressure for the network time at 12h. See, please, ALATNET Newsletter for further details on blending. As a whole, blending suite was judged to have either neutral or slightly positive impact. The scores are not presented on the web pages (the production parallel test was launched manually) but they are available on request.

- **Linear grid suite *aba***. It consists in using a linear grid type of spectral truncation for all variables but orography. The orography remains the same like it is when using the quadratic grid, in order to avoid $2\Delta x$ waves to get excited because of the orographic forcing. This suite reflects recent results brought by the quasi-academic experiment SCANIA. The results of *aba* suite are slightly positive. However the introduction of this modification was reported to a later stage when a more efficient data packing would take place in order not to charge the telecommunication lines and archive by voluminous history files (foreseen library AL12_op6).

- **AL12_op3 library suite validation.** It was intended to prepare this library for an operational switch in order to profit from new products: CAPE, moisture convergence, height of PBL and wind gusts. Unfortunately, the problems of archiving server in CHMI disabled to finish correctly the evaluation of this parallel test as well as a new trial to test ALADIN/LACE 37 levels coupled with ARPEGE 41 levels parallel test. Due to a complete collapse of the archiving server the Prague Team was forced to restrict parallel tests and to devote the remaining free space on various computers to the R&D tasks of Prague Team visitors.
  The situation with archive server has been treated together by CHMI and by the provider. It was an interesting lesson: when a bug appears in ARPEGE/ALADIN it is quite quickly fixed, unlike in case of some software companies which are not able within two years to provide a stable version of the software they have charged money for. The new archiving server is now under testing.
  Two new parallel tests were started on December 1st. Meanwhile the parallel test plan was redefined, mainly due to the evolution of ARPEGE parallel test.

- **AL12_op6 library and CYCORA-bis tests.** Since ARPEGE parallel test library evolved to incorporate CYCORA-bis modifications and more sophisticated diagnostics of wind gusts, Prague Team decided to abandon the level of op3 library and to switch to the op6 library directly. Future operational library of ALADIN/LACE is then AL12_op6. On the same library the new package of physics shall be tested (CYCORA bis). However, for the moment we stick to 31 levels taking a lesson from a few bad surprises of ARPEGE 41 levels parallel test. Hence the modified physical package is to be tested first and to enter the operational suite as soon as possible (pending the scores, of course) since it is supposed that the improved physics will behave better in winter situations, namely it should not make such an erosion of inversion layers.

The results of parallel tests may be consulted on www.chmi.cz/meteo/ov/lace/aladin_lace/partests/ pages.

3. ARPEGE back-up special event.

Since last year autumn Prague center has got a task to ensure the initial and lateral boundary conditions for all ALADIN applications in case of some major accident in Toulouse. This task resumes to receive a pre-processed observation data file from ECMWF, to run ARPEGE 3DVAR assimilation cycle (4 long cut-off times), to make ARPEGE production forecast up to 60 hours (due to 12h lagged coupling in some ALADIN applications) based on the short cut-off analysis (twice a day) and finally to compute all the LBC files for all ALADIN domains not forgetting to run the LACE suite behind all this. It can be easily understood that all the above mentioned pieces needed a lot of preparation, starting from small details such as verifying all national e-927 namelists and climatological files and ending with more tricky problems on how to properly vectorise and multitask the Canari configuration using the Japanese way of tasks numbering. Though the Prague Team has been more or less continuously working on the issue, November strike-menacing events in Lautrec came something like one week too early (or too late) to get combined with a long weekend (of course!) due to the celebration of the victorious fight for democracy in the country of Vaclav, following thus Murphy's law "à la lettre". Despite the enormous efforts the Prague Team managed to run safely under SMS just the long cut-off ARPEGE assimilation cycle before the above mentioned long weekend and happily enough the real intervention of Prague was not needed before the weekend got over. The remaining suite pieces were fixed the following Monday and the vitality of ARPEGE back-up was proved (in terms of still useful timeliness of ALADIN forecasts as also confirmed by SELAM colleagues). The event, ended by corks flying in RC LACE chiefs' office, was quite an useful exercise for the Prague Team to lively experience the pressure of having to handle an operational suite of data assimilation (yet just technically and without a real worry about the observation pre-processing). To say the truth, the ARPEGE back-up suite is never going to be a story of a simple pressing of the button, for example the supply by the observations from the whole of globe is still quite a vulnerable point.

10. Operational ALADIN-MAROC in MAROC-Météo

(more details Radi Ajjaji, mrpa650@andante.meteo.fr)

Since July 2000, Aladin/Morocco is running Canari analysis part using AL11T2 (CY21T2) version. The forecast part has been performed with AL11T2 since February 2000.

This new Upgrade was possible after the tuning of CANARI structure functions for both altitude and surface parameters in the assimilation mode.

The validation has been done on a 10 days parallel suite; and the results obtained with this new version affected especially the surface fields analysis. Altitudes fields still have the same behaviour. A report of this work has been written and is present at GMAP.

So, for the time being, Aladin/Morocco is operational with AL11T2 in both assimilation and forecast modes.

The parallel version of Aladin has been tested on CRAY J90 plate-forme using either PVM and MPICH ; this tests were successful with use of PVM, but the mode LMESSP=.TRUE and NPROCA=4 is very expensive in terme of memory and CPU time compared to the operational mode LMLTSK=.TRUE. and NTASKS=4.

Finally, MAROC-METEO decided last November to buy a new computation machine, an IBM Super Scalar POWER III machine, a shared memory one with 48 GFLOPS of power (32 procs).

Now we plan to run Aladin/Morocco with less than 10km resolution for 60 hours forecast range twice a day. All our futur efforts will then focus on implementing a 3DVAR assimilation suite.

11. Operational version at Polish Meteorological Service

(more details zijerczy@cyf-kr.edu.pl)

In the second half of 2000 most efforts made by Cracow Aladin team focused on shifting the operational work from IBM RS/6000 to SGI 2800 machines. New, much more enhanced model environment was prepared to reach the aim. Here are some details of current operational suite:

- machine: SGI~2800 (128 CPU's, 40 GB RAM, 190 GB HDD)

- resources devoted to operational runs: 8 CPU's, 2 GB RAM, 4 GB HDD
- model version: ALADIN AL09.3
- operational modes: ee927, e001, Full-Pos
- mesh size: 180x180 (169x169 without E zone)
- number of levels: 31
- spatial resolution: 13.5 km
- domain: 2270 km x 2270 km
- time step: 450 sec.
- forecast range: 48 hours
- coupling: Arpege, every 6 hours
- initialisation: DFI
- post-processing: Full-Pos on-line
- frequency: twice per day

Some other efforts focused on the creation of preliminary versions of two new systems. First one is designed for NWP data storage and access: operational database was built on a basis of RDBMS PostgreSQL and datastored in it are made available via HTML/PHP3 pages. The second system is devoted for qualified forecast preparation support and it is also based on WWW technology: forecaster can get numerical prediction data for given locations placed in interactive form, data can be modified and then preparation of some forecast products can be initialized.

12. *Operational version at the Portuguese Meteorological Service*

(more details christina.madeira@meteo.pt)

The e923 configuration was implemented on workstation with operational ALADIN cycle (AL11T2) following N. Pristov documentation. We are now testing the two cost functions - Jercynzsky (LNEWORO2 = T) and Bouteloup (LNEWORO = T) - in order to verify which one represents better the orography of ALADIN/Portugal domain.

In order to run OI/CANARI with local observations some steps have already be done:

- extraction of TEMP/TEMPSHIP and SYNOP/SHIP observations from our national database;
- installation of the code to produce the ASCII files used by MANDALAY to create the CMAFOC file, which was provided by our hungarian colleagues;
- implementation of MANDALAY itself.

13. *Operational version at the Romanian Meteorological Service)*

(more details banciu@meteo.inmh.ro)

No change since the report in Newsletter 18.

14. *Operational version at Slovak Meteorological Service*

(more details olda.spaniel@mail.shmu.sk)

- computer:

DEC Alpha Xp1000 (Compaq), EV6 processor DIGITAL UNIX V4.OD
Digital F90 compiler 640 MB memory
12 GB HDD

- model characteristics:

domain size	826 x 646 km (120 x 90 points)
corners	14.69, 46.05 SW 25.26, 51.07 NE
horizontal resolution	7.18 km
vertical resolution	31 levels
time step	337.5 s
forecast length	48 hours / twice per day (00 UTC & 12 UTC)
coupling model	ALADIN/LACE (12.2 km horizontal resolution)
mode	dynamical adaptation
dynamics and physics	the same as ALADIN/LACE

- configurations:

ee927	creation of initial and lateral boundary conditions
e001	model forecast
postprocessing	on model levels & standard isobaric levels
e701	CANARI (optimal interpolation) recently ported

- products:

surface parameters in map form (2m temperature, 2m Tmax, 2m Tmin,
2m relative humidity, l0 m wind, precipitation, cloudiness)
meteograms for 22 cities over Slovakia
input for vertical cross-sections
inputs for the Nuclear Safety Authority (RODOS program)
generation of the automatic forecasts

- visualisation:

for central forecasting office, Internet and Intranet
using NCAR graphics, GMT software, HTML

- verification:

surface parameters of ALADIN/LACE and ALADIN/SLOK forecasts verified against SYNOP observations over the territory of SLOVAKIA
pseudoTEMP messages verified against TEMP observations
24 total precipitation verified against the local rainguage network

<u>*Main news*</u>

- update of the ALADIN/SLOK domain
- size of the domain increased (90x64 => 120x90)
- horizontal and vertical resolution kept

- automatic forecast generation

- on-line verification

- 2m temperature, l0m wind speed and wind direction
- last 2 runs of ALADIN/LACE and ALADIN/SLOK compared to actual SYNOP observations

- precipitation verification (diploma thesis)

- comparison of ALADIN/LACE and ALADIN/SLOK against our rainguage network observations (600 stations) - data interpolated into common grid
- 24h total amounts used
- contingency tables and continuous scores calculated - evaluation monthly with 3 months delay
- software ready to be used routinely at SHMI

- update for AL11T2 + CYCORA setting

- comparison of pseudoTEMP forecast
- with CYCORA: warmer and drier planetary boundary layer, increased wind speed

- RODOS

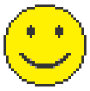
- inputs from ALADIN/LACE and ALADIN/SLOK for the RODOS program (Nuclear Safety Authority)

15. Operational version at Slovenian Meteorological Service

(more details jure.jerman@rzs-hm.si)

Last news in Newsletter 16.

Schinze price



In November 2000, the Schinze foundation (Austrian Meteorological Society) awarded its annual price to Mark ZAGAR (Slovenia) for his research work (see the summary of his PhD in the last Newsletter).

Doctor Ilian GOSPODINOV

The ALADIN project does now count one more doctor : Ilian Gospodinov passed with success the PhD defence on Thursday, December 7th, in Toulouse. Congratulations to our 7th ALADIN doctor.

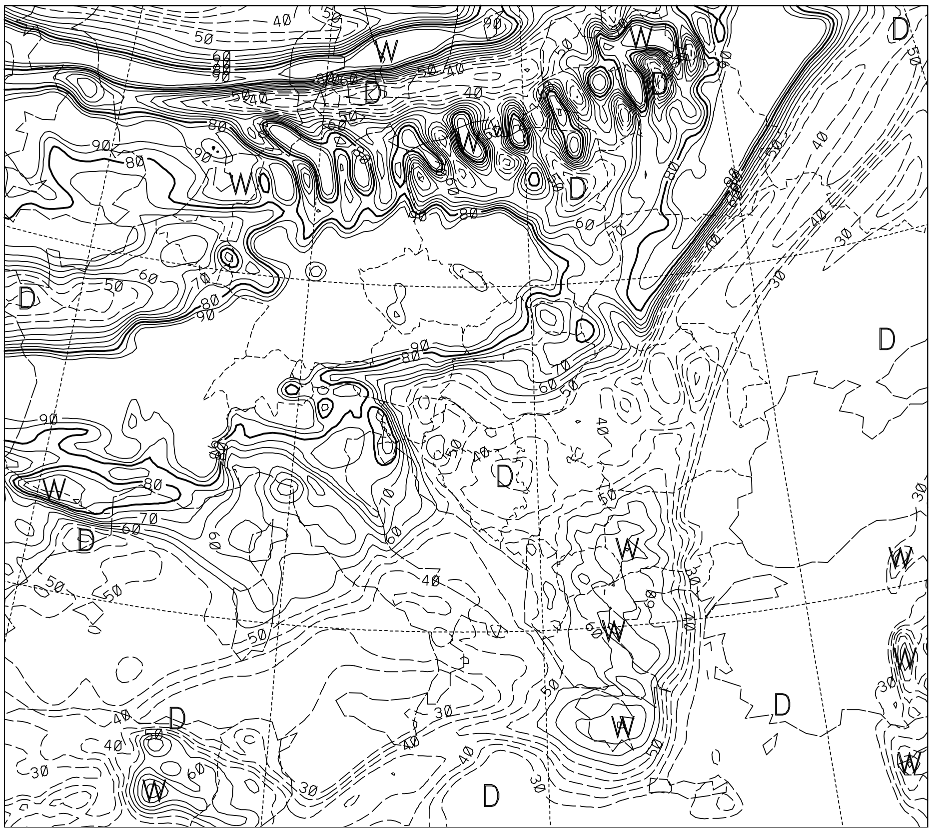
He is now "Docteur de l'Université Paul Sabatier avec mention très honorable" for his work on the conservation properties of 2 time-level semi-Lagrangian schemes. He already has one accepted paper, and another one under preparation about his work (QJRMS).

Two-time-level semi-Lagrangian method for atmospheric models:

Enhanced conservation and stability

The semi-Lagrangian (SL) semi-implicit (SI) method proposed by Robert (1981) has been investigated by many authors. The early versions of the method were three-time-level schemes since they were built on the basis of the previously existing Eulerian "Leap frog" schemes. Later on, the first two-time-level (2TL) schemes have proved to be more efficient and have been implemented into several operational models. One of the most important features of the early 2TLSL schemes was the extrapolation in time of the wind velocity to obtain the position of the middle point of the semi-Lagrangian trajectory. Temperton and Staniforth (1987) applied a linear extrapolation in time. We call this technique Classical 2TLSL.

Some discussions on the Classical 2TLSL can be found in Staniforth and Cote (1991). Already at that time, the extrapolation technique was recognized as a potential source of instability. However, no problems were reported at the time and the scheme was adopted worldwide. In some recent cases, characterized generally by strong wind gradients, spurious oscillations have been obtained with a number of 2TLSL models.



A typical example is the famous "Baltic Jet" case (see Fig. 1), where some non-meteorological noise was observed in the core of a strong mid-troposphere jet and was reported from almost all European 2TLSL models integrated over the East Atlantic region. In Fig. 1 the instability can be seen in the relative humidity field as a wave extended over the Baltic sea region.

The extrapolation in time for obtaining the middle point of the SL trajectory was identified as a source of the instability. Hortal (1998) studied the problem, developed and examined a new scheme which avoided the extrapolation and involved in the displacement computation only quantities from exact time steps. Hortal's scheme seemed to be successful in solving the noise problems and was adopted in all models linked to ECMWF/IFS.

Other problems of the SL technique are related to its interaction with orography. Similar oscillations to those in the "Baltic Jet" case can often be observed in the vicinity of mountains. The treatment of the non-linear residual of the forcing term in the momentum equation has been considered as a main source of such oscillations. The technique of spatial averaging was proved to reduce such noise and was adopted. As a result, the version of the Classical scheme for the non-linear residual, examined in this work, was invented. It consists of a linear extrapolation in time of the non-linear term and its averaging along the SL trajectory. Recently, Hortal (1998) contributed to solve the problem by implementing his SETTLS scheme also for the treatment of the non-linear residual.

In the first part of the thesis we make an attempt to analyze the 2TLSL method and examine the properties of different 2TLSL schemes. The instability problems, related to the 2TLSL trajectory scheme as in the "Baltic Jet" case, as well as the response of the SL to orography, related to the scheme for the treatment of the non-linear residual, motivated us to search for different solutions than the already existing ones. The insufficient conservation ability of the SL schemes has always been addressed as a disadvantage of the method. Several studies have measured how well certain quantities are conserved. To reveal the possible relationship between the choice of trajectory scheme and scheme for the non-linear residual, from one side, and the conservation of the model invariants in case of "Shallow Water" model, from the other side, is another objective.

In the beginning some general considerations are given. Then, an attempt to study the 2TLSL method analytically is presented. First, an exact solution of the 1D forced advection equation is introduced in order to illustrate the idea to use the explicit forcing term into the trajectory computation of the 2TLSL. Then, the second order accuracy of 2TLSL schemes is analyzed. As a result two theorems are derived and a particular trajectory scheme is proposed. The statements of the two theorems and the properties of various 2TLSL schemes are first examined with a simplified model which is designed to follow the computations of a 3D spectral NWP model.

The basic result from the analytical study and the experiments with the simplified model is that the uniform acceleration trajectory scheme is a very good solution for the trajectory problem of the 2TLSL method. In hydrostatic systems, the vertical momentum equation is reduced to a diagnostic balance equation between the pressure gradient force and the Earth attraction. The vertical velocity looses its independence as a prognostic variable. It is derived diagnostically from the continuity equation and has different level of complexity depending on the particular choice of vertical coordinate (see Kasahara 1974).

The problem with the explicit definition of the vertical momentum equation has never been put in consideration before because the 3TL schemes require a special treatment of the explicit terms coming from the numerical methods theory and providing stability while satisfying second order accuracy. The advection terms in the Eulerian model, for example, are treated in the same way for both the vertical and the horizontal. They are evaluated at the intermediate time level. In the 3TLSL scheme the vertical SL trajectory is computed in the same way as the horizontal one. The vertical velocity is evaluated at the intermediate time level and the middle point of the SL trajectory. An illustrative discussion on the 3TLSL and 2TLSL methods can be found in Staniforth and Cote (1991). The need of a redefinition of the discretization scheme for the vertical momentum equation in case of a hydrostatic model arises only in the 2TLSL.

In the first part of the thesis as well as in Gospodinov et al. (2001) it was demonstrated that an explicit estimate of the acceleration is required for a correct formulation of the trajectory scheme in case of a forced self advection one-dimensional problem. The proposed trajectory scheme has been named uniform acceleration trajectory scheme. Hortal (1998) also considered the possibility to apply the forcing term from the right-hand-side (RHS) of the horizontal momentum equation as an acceleration for the trajectory computation. However, he abandoned this approach in order to remain consistent with his vertical trajectory scheme.

The goal of the second part of the thesis is to examine the application of the uniform acceleration trajectory scheme also for the vertical 2TLSL trajectory in a hydrostatic model. For this purpose we derive an explicit estimate for the vertical acceleration in the environment of the hybrid vertical coordinate of Simmons and Burridge (1981). The particular choice is due to the choice of testing atmospheric model. It is the ALADIN model. Its dynamics is described first. Then the proposed vertical acceleration is presented built on the basis of the continuity equation. Then a comparison study of the same four trajectory schemes as in Gospodinov et al. (2001) but applied to the vertical 2TLSL trajectory in ALADIN. The schemes are tested for two different cases the "Baltic Jet" case dominated by horizontal advection and the "Cleopatra" case with a dominant vertical motion in a squall-line (see Banciu et al. 1999).

The perspectives in front of the 2TLSL method may be grouped in two parts. The first area of interest is in the hydrostatic atmospheric models. Since the global models with lower resolution will remain hydrostatic, it is important to keep the effort to improve the 2TLSL scheme for them. In this sense, the application of the proposed vertical trajectory scheme for a 2TLSL hydrostatic model can be beneficial. However, in the environment of a spectral model it requires significant additional computational effort mainly because of the second order derivatives necessary for the computation of the vertical acceleration. The examined vertical acceleration has also the disadvantage to be not complete in the diabatic case because of the incomplete tendency equation for the divergence. In a spectral model it is difficult to obtain derivatives of the physical tendencies. However, in case of a finite difference 2TLSL model, the explicit prognostic equation for the divergence could easily be completed in the diabatic case and the second order derivatives might require only small additional computational effort. In this case, the explicit trajectory scheme may be more efficient.

The second area of interest is the non-hydrostatic modeling. In this case, the implementation of the uniform acceleration trajectory scheme on the vertical is in general easier because the vertical velocity is an independent variable and has its own prognostic equation. However, the non-hydrostatic version of ALADIN is a particular one (see Bubnova et al. 1995). Its vertical coordinate system is kept identical to the one of the hydrostatic version of the model. The diagnostic vertical velocity is still active and used for the vertical SL trajectory computation. Hence, the proposed vertical acceleration can be beneficial for the non-hydrostatic model as well.

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ALADIN PhD Studies

The first RFR (Réseau Formation Recherche) lead 4 ALADINers to a PhD degree. Three out of the five students of the second RFR have already successfully defended. These PhD studies were mainly realized in Toulouse. The eighth defense will take place very soon.

Meanwhile, some PhD studies are going on without any specific funding as the PhD work is done mainly at home (in Belgium for Luc, in Morocco for Radi and Wafaa and in Toulouse for Jean-Marcel).

1. Radi AJJAJI : "Incremental deficiencies in a 4D-Var system"

The incremental approach proposed by Courtier et al (1994) reduces the computation cost of the original 4D-Var algorithm. An approximate solution is found iteratively by solving several quadratic cost functions, approximations of the original one, obtained by the linearization of the model and the observation operators at lower spectral truncations. The solutions at low resolution are used as a correction to update the initial state at high resolution. The constant term of the linearization represents the model equivalent at observation points and is always computed at full resolution. In this way non-linearities are taken into account.

At low resolution, the tangent linear version of the model is used to transport the errors (instantaneous increments) along the assimilation period. This linearized version of the model must take into account not only the dynamics part, but the physics as well.

However, physical processes such as condensation, convection, vertical diffusion, etc, are highly nonlinear and often discontinuous with frequent thresholds, which may cause serious convergence problems in the minimization. As a consequence, in the incremental 4D-Var framework, the errors (increments) are transported by a tangent linear model including a linearization of a regularized package of simplified physics. (Janiskova et al, 1997)

The operational 4D-Var at Météo-France uses a multiple-truncation incremental approach (Veerse and Thépaut, 1997) consisting in doing three minimizations at different truncations T42, T63 and T95; the forecast model being done at truncation T199 in stretched grid.

Some problems of unrealistic precipitation over Sahara area, which were already present in the 3D-Var ARPEGE version, are amplified with the 4D-Var implementation. The first part of this thesis tries to understand this problem in the framework of incremental 4D-Var.

Several 4D-Var assimilation cycles have been done over a period of 15 days (June 2000) with overestimated precipitations in the operational 4D-Var. The main results could be synthesized as it follows :

- When using a tangent linear model with and without (adiabatic mode) linearized simplified physics, the problem remains the same. This does not mean, however, that there is nothing to do (perhaps to tune) in the simplified physics.
- Applying or not semi external digital filters has the same neutral effect.
- When performing a multiple-truncation incremental 4D-Var in which the three different truncations are the same and equal to the greater one (T95), 24H cumulated precipitation over Sahara area are reduced by a factor of two.

As a first conclusion, we can suppose that the multi-incremental approach has a bad impact over tropical areas. In the concept of this approach, a lot of combined factors are present and could explain this fact :

- First, the hypothesis saying that the large scales forces the shortest could be not valid at the vicinity of the tropics.
- There is a large difference between the resolution of direct full model which computes the equivalent observations, and the minimization resolutions.
- Some physical processes (related to humidity) are not taken into account in the tangent linear model.
- etc.

In order to be able to conclude about theses factors, a set of single observation analyses has been performed to compare the increments between a simple truncation incremental (T95, T95, T95) analysis and a multiple truncation incremental (T42, T63, T95) one.

A single observation of specific humidity injected at the beginning of the assimilation period in the middle of the Sahara zone causes different increments of specific humidity in term of shape and magnitude between the two analyses : the pattern is larger in multi-incremental analysis and the values are bigger. The impact of this observation on temperature and geopotential increments are still the same between the two experiments.

Other single observations of temperature and geopotential were injected separately at the same location, experiments which didn't create any big differences.

Now, similar experiments are being done by injecting single observations at the middle and the end of the assimilation period. The behavior of the total and partial cost functions (related to observations and first-guess), are also checked to make conclusions about the convergence of the two different approaches (simple incremental and multiple incremental).

2. *Doina BANCIU : "Specific small scale diabatic forcing in ALADIN at the limit of the hydrostatic assumption"*

The PhD defense will take place in Bucarest (Romania) on February 26th, 2001 and Doina promises us a nice final report for the next Newsletter.

3. *Luc GERARD : "Physical parameterization for a high resolution operational Numerical Weather Prediction model.*

Some parameterization hypotheses taken for the global model ARPEGE loose their validity with small mesh sizes and time steps, and should be refined to ensure a better behavior for mesh sizes below 10 km.

After presenting the ensemble of the physical parameterizations of the ALADIN model, our work focus on the deep convection scheme, which contained the more critical approximations. Before thinking of non-hydrostatic physics, several wants of the scheme had to be answered. A first packet came with the CYCORA/CYCORA-bis enhancements, from which we developed the horizontal momentum advection and the pressure gradient aspects, with the so-called 'Connex Active Layers' calculation. After this we felt the need to relax the hypothesis of quasi-equilibrium between the large scale forcing and the convective activity, which led us to relaunch developments around prognostic draught vertical velocity and mesh fraction. The availability of the prognostic mesh fraction gave us a chance to revisit another limitation, the negligible convective mesh fraction hypothesis. The prognostic scheme seems to give better results already with mesh sizes of 7 km. There still remain, in our view, particular topics that should be addressed. The highly needed introduction of prognostic suspended condensed phases is still under development by others. We could also mention the lack of a local mass budget for each layer, or the problems associated to some artificial separations, as the difficulty to link large scale and subgrid effects, or reciprocal influences between updraught and downdraught.

On the way to develop non-hydrostatic effects in the physical package, a first step was also done with the vertical turbulent diffusion of the two non-hydrostatic variables. These variables could also in the future play a part in other parameterizations, like the convection scheme.

4. Jean-Marcel PIRIOU : "Correction of compensating errors in physical packages ; validation with special emphasis on cloudiness representation"

The purpose is to investigate the methods used to validate the physical packages of NWP models. The aim is to improve the methods, in order to better point out the compensating errors between physical parameterizations. 3D and 1D model runs will be used, looking at results both from large scale and small scale points of view. Special attention will be paid on the life cycle of clouds, at these different scales.

5. Wafaa SADIKI : "A posteriori verification of analysis and assimilation algorithms and study of the statistical properties of the adjoint solutions

<u>Summary</u>

This project of thesis aims at improving the knowledge of the assimilation systems based on variational approach. It is particularly a question to develop a set of diagnostics allowing to validate a posteriori any analysis and assimilation algorithm, by estimating the accuracy of the error statistics (observation, background) specified in entry of the assimilation system. Besides a detailed study of the adjoint solution can allow to reflect the errors affecting the assimilating model. The propose is to investigate objective methods to define the error statistics required by the assimilation.

This work splits into two main topics :

- Tuning of information error parameters in the ALADIN 3D-Var framework, by a posteriori evaluation .
- Identifying and quantifying the assimilating model errors in the ARPEGE 4D-Var framework, using the adjoint solution corresponding to the minimizing solution.

<u>Results obtained</u>

Only the study on the limited area model was so far approached. Some diagnostics have been tried in ALADIN, to adjust the "lagged-NMC" background error statistics computed using the NMC method. Such statistics allow to reduce the energy in the large-scale spectrum, and to have more mesoscale representative analysis increments. This problem is, in its simplest formation, equivalent in reassessing the relative weight of background and observation cost function by tuning the ratio "λ=Jo/Jb".

In first method, scores with respect to the radiosonde observations are computed. They give an objective measure of the quality of the analysis. It consists in generating distance of background errors, between radiosonde observations located in the ALADIN domain, and forecast fields at 06 hour range. Thus, we can use the ALADIN error contribution, to calibrate the variances in the "lagged NMC" statistics. As result, this method seems to indicate that the parameter "λ" that we try to calibrate in ALADIN must be close to 1.

A posteriori calibration used by Talagrand (1998) and Talagrand and Bouttier (1999), concerns the evaluation of the internal consistency of the background error statistics specified in entry of the assimilation system. According to this diagnostic, a variational system is called "consistent", if the statistical average of the cost function at its minimum is simply proportional to the number of observations.

The application to the 3D-Var in ALADIN produced similar results to those obtained by the ECMWF system : the innovation vector (difference between the most recent forecast and the new observations) is overestimated. However, the daily variability of the diagnostic, revealed in the limited area model, is more marked than in a global model. Concerning the tuning of the parameter "λ", the first results suggest that such a tuning (aiming at a single parameter) is not sufficient.

On the other hand, in association with G. Desroziers (CNRM/GMME), a finer evaluation concerned both terms of cost function (background and observation term). The framework is given by an analysis problem with realistic data. The diagnostic uses a randomized method as required by the Generalized Cross Validation. The idea here is to simulate both background and observations variances that should give the best analysis. The results for the current ALADIN 3D-Var system, show an under-estimation of the background error variance, and an overestimation of the observation one.

6. Filip VANA : "The dynamical and physical control of kinetic energy spectra in a NWP spectral semi-Lagrangian model"

The PhD study is mainly completed (see report in Newsletter 18). Now, Filip will put pen to paper and write his thesis.

ALATNET PhD and Post-Doc Studies

The first ALATNET young researchers began their work in the second half of 2000. Full coordinates of the ALATNET young researchers (both in their home service and in the ALATNET centers where they will work) and reports of their work can be found on the ALATNET web pages (***http://www.cnrm.meteo.fr/alatnet/***). .

1. Gianpaolo BALSAMO : "Coupling a variational assimilation of gridpoint surface fields with a 4d variational assimilation of upperair spectral fields"

Report of the first stage (1st September - 30th November 2000)

The analysis of surface parameters has an important role for short- and medium- range weather forecast. The lack of direct observations for soil moisture and soil temperature, and the substantial physical and technical problems involved in the use of remote sensing, has leaded to develop indirect schemes based on the relation with 2 meters variables (and temperature and relative humidity), using different techniques (Optimal Interpolation, Nudging, 1D-var).

All these techniques are based on the assumption that the near surface atmosphere is informative about the soil state, and therefore are not reliable in every meteorological situation (for instance in case of strong horizontal advection, where the screen-level parameters are mostly related to the upper model levels).

The NWP mesoscale model ALADIN is used to perform the 48h forecast with 10 km grid-length. The ISBA scheme, implemented in ALADIN (as in ARPEGE), threats the exchanges of water and energy between soil, vegetation and atmosphere. It counts a 2 soil layers parameterization for soil temperature and soil wetness with a forcing restore constraint, as described in Blackadar (1976) and Deardorff (1977).

The skin layer is of about 1 cm and the total soil layer is of order of 100 cm. Parameterization for frozen water content and snow is considered. Since the total soil layer controls mainly the evaporation from soil towards the atmosphere, the initialization for this layer and correction to the initial field has to be carefully applied.

The application of sequential analysis for water content based on relation with near surface atmosphere without strong physical constraints could lead to oscillation within the assimilation cycle or in subsequent forecasts.

Study of diurnal biases for Screen-Level parameters in ALADIN-France

The quality of the current configuration of ALADIN France forecast for Screen-Level Variable has been tested: 48 Hours forecast runs with hourly output from ALADIN France are evaluated on a high resolution dataset for hourly observations of 2m temperature and relative humidity.

A catalogue of the critical bias/rms for these variables is built over a selection of cases likely to be highly sensitive to soil surface initialization. The quality of 2 meters forecasting is estimated over a set of significant cases and an attempt to identify forecast errors due to initialization and physical parameterization is made. This step is also required to state the reliability of assimilation technique from 2 meters variables over the guess provided by the model.

In anticyclonic circulation, for instance, a weaker dependency from the upper level variables allows to state a clearer correlation between screen level variables and soil conditions.

The dataset consistency is obtained by application of the operational quality control. Removal of station gathering less than 80 percent valid observation during the case period is also applied. Station at elevation higher than 800 m are not considered. The check of OMG (observation - guess) is performed over the subdomain [LAT(42 , 52);LON(-5 , 10)].

A subjective selection of Meteorological Cases is done to obtain a period of several days of anticyclonic circulation interesting the considered subdomain according to indications provided by sensitivity study (Bouttier et al., 1993) where near-surface atmosphere is mostly informative about soil state (strong radiation forcing, weak winds, no precipitation). Cyclonic and trough synoptic pattern are also considered for completeness.

It is performed the mean BIAS and RMS over the period for each selected case:

- Mean temporal plot (Average of the hourly scores for X days for all the stations),
- Mean geographical plot (Average of the hours score for X days)

are analyzed for the cases:

- Anticyclonic 29-07/02/2000 ; 13-18/06/2000 ; 03-12/09/2000.
- Cyclonic 22-27/12/1999 ; 01-10/06/2000 ; 21-30/07/2000.

The check for screen-level variables forecasts has shown that the 2m forecast for T and RH is mainly unbiased in the 48 hours periods and bias on hourly base is of small entity. The bias is showing diurnal periodicity. The BIAS and RMS are increasing in June case and some inter-annual periodicity can be supposed. This case is further studied to check the importance of soil moisture initialization.

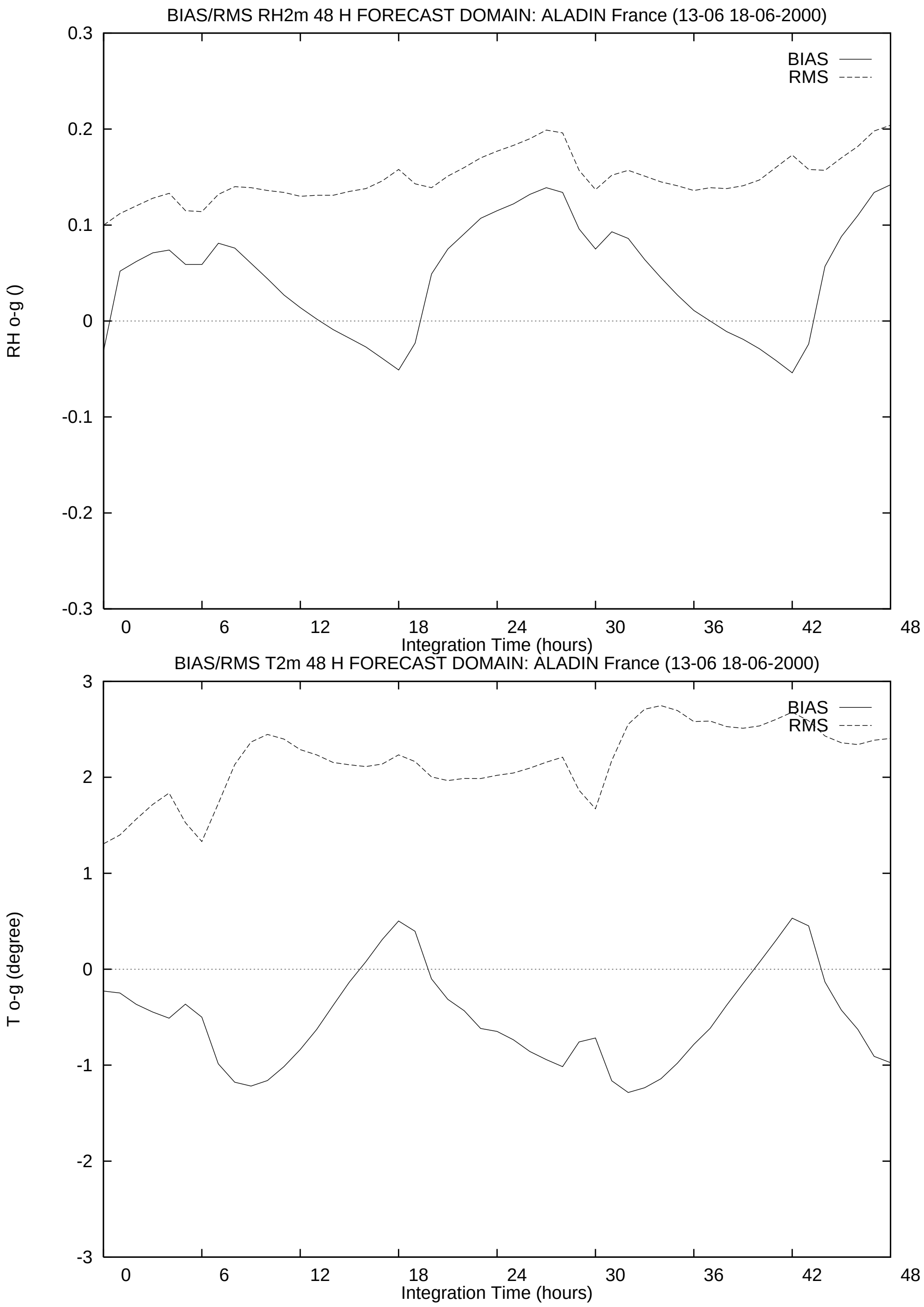

Figure 1 - Mean BIAS and RMS in the selected cases (as an example - the June case)

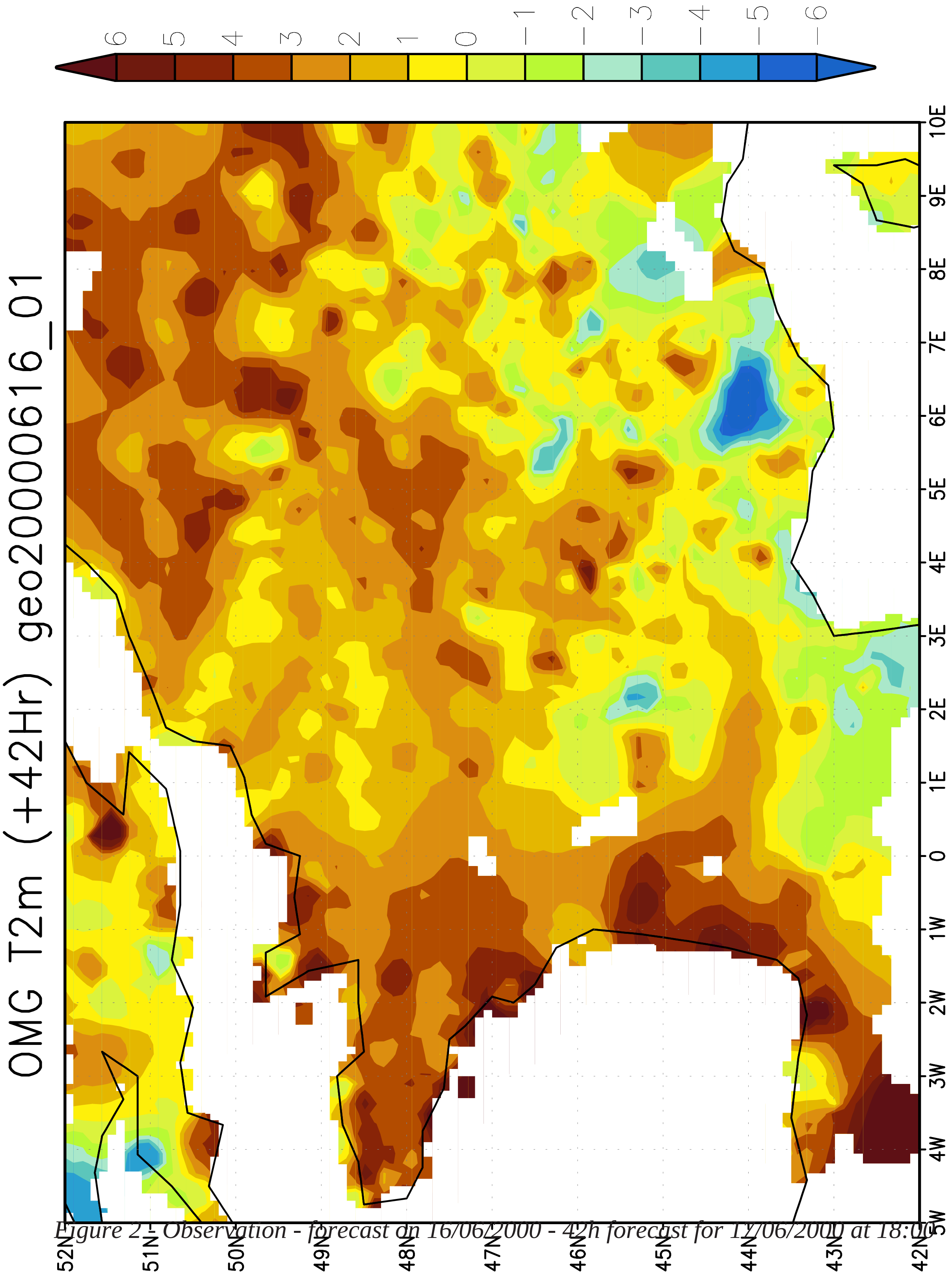

Figure 2 : Observation - forecast on 16/06/2000 - 42h forecast for 12/06/2000 at 18:00

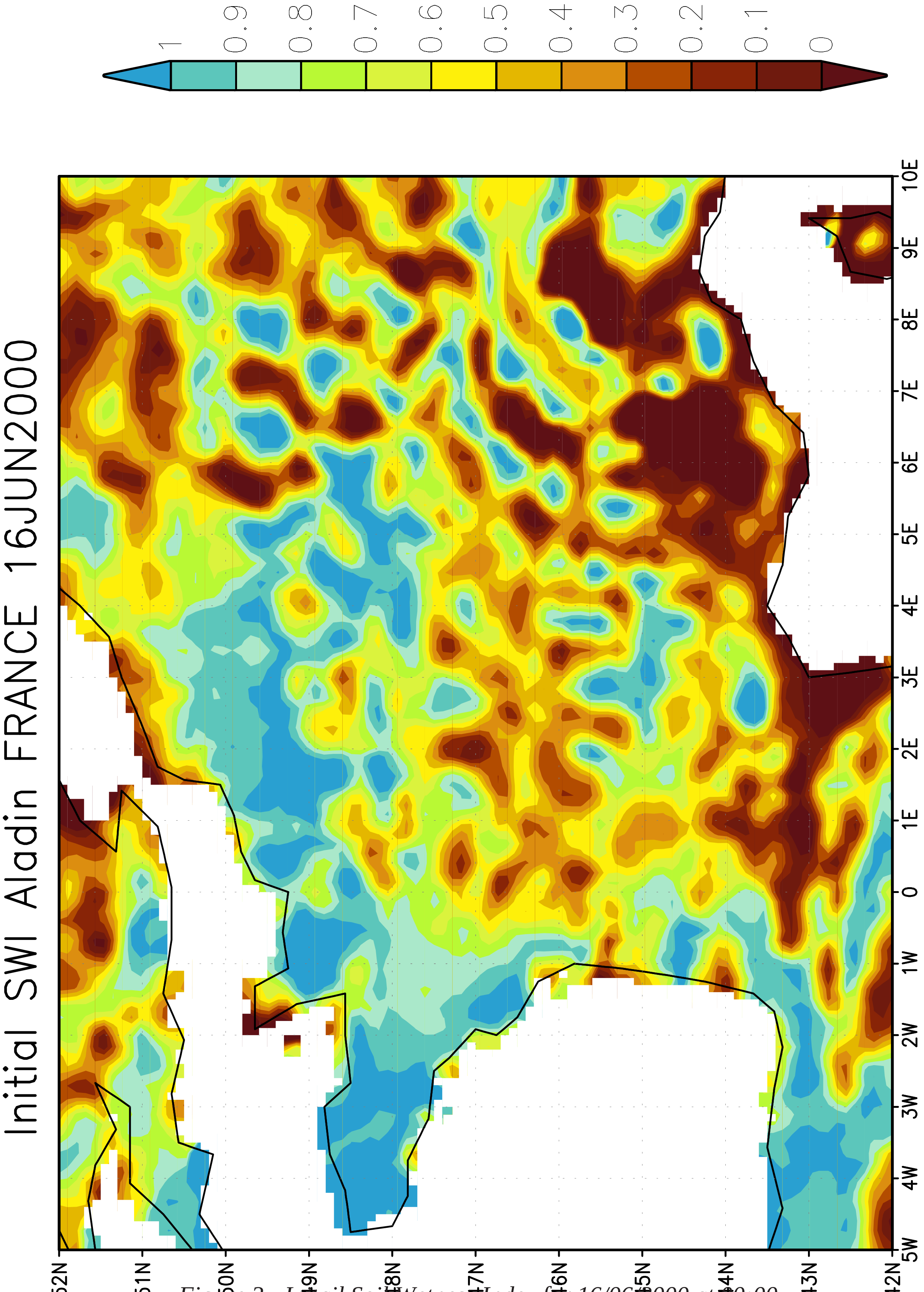

Figure 3 - Initail Soil Wetness Index for 16/06/2000 at 00:00

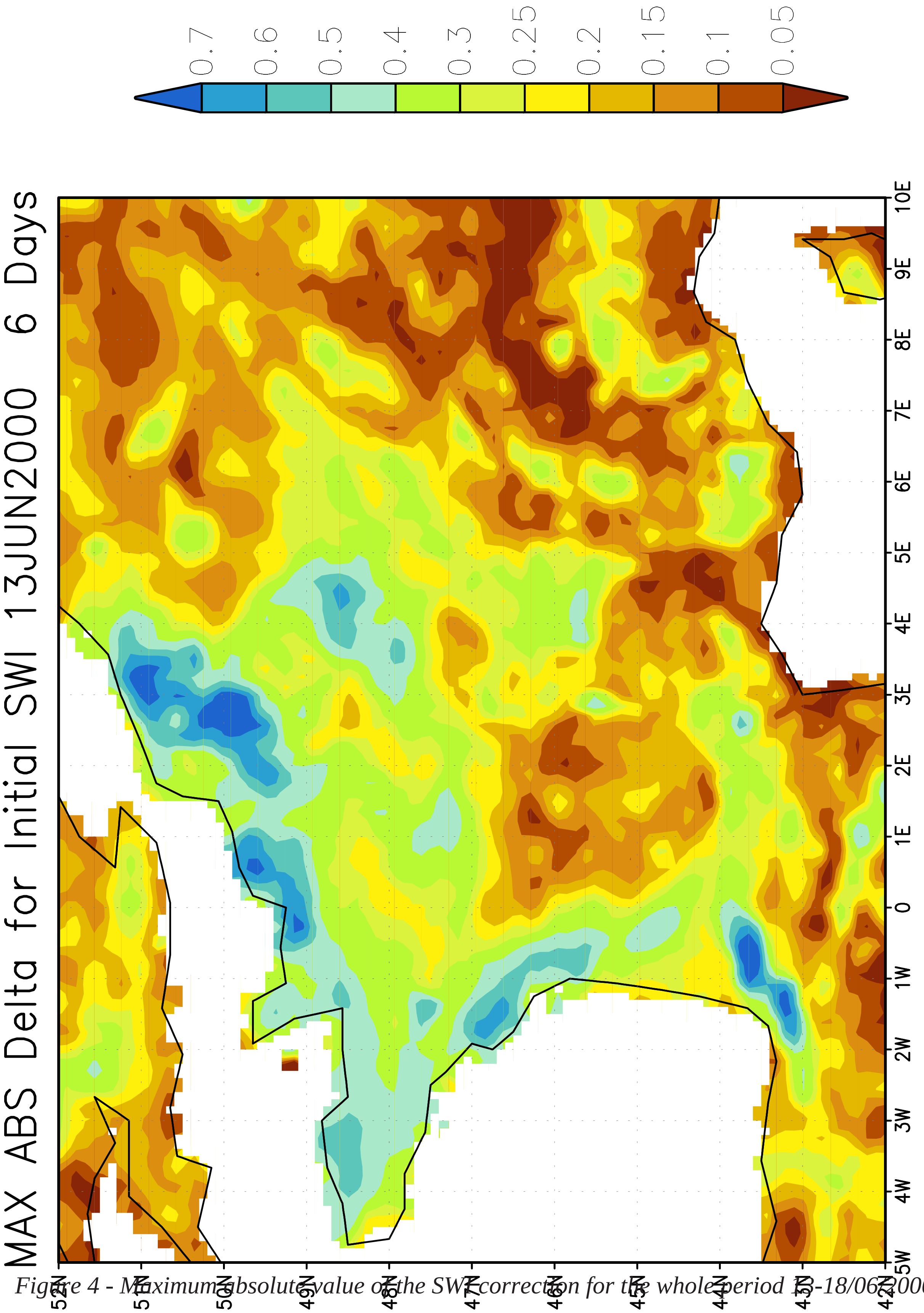

Figure 4 - Maximum absolute value of the SWI correction for the whole period 13-18/06/2000

Note that what was considered here was the skill of the entire system analysis + forecast while to test only the forecast skill of the scheme, the analysis should be disabled using for instance a climatological initialization.

The initialization for SWI in the June Case

The soil wetness impact on 2 meters variables forecast is investigated for the 13-18/06/2000 case where BIAS and RMS are larger. The Soil Wetness Index is chosen as it encompasses the water content in the total soil in a fractional form. Correlation of errors is unreliable for SWI, due to the lack of observations for soil variable and no fine resolution climatology for SWI. A correlation between Strong biases of T_2m and unrealistic values of SWI can be shown in well developed AC days where the impact of other processes is reduced. The 17/06/2000 is selected for the comparison as showing the best AC pattern over the Target domain and previously 4 days of AC circulation (mainly clear sky).

The Analysis Correction applied in the initialization of SWI is investigated in the June Case. The entity of readjustments applied to initial SWI is evaluated by looking at the mean absolute value of the SWI correction provided by the analysis in subsequent days are computed for the whole period 13-18/06/2000. Maximum absolute value of the SWI correction is similarly calculated. The huge correction applied for the total soil layer water content (~ 1m depth) during the considered period are unrealistic and follow mainly the readjustments of the OI analysis of surface parameters (the ISBA parameterization scheme is not providing such big variations during forecasts).

The Sequential Analysis by OI technique for Surface Fields

A sequential analysis by application of Optimum Interpolation on a mesoscale domain allows a tuning of coefficients on ALADIN France domain with a lower number of constraints to the coefficients in operational use for LAM than for GCM. Furthermore a high resolution network is available for validation and the application of the method is a preliminary step before going to a variational approach. In order to compute the OI coefficient, it is necessary to provide the errors statistics for screen-level and surface variables.

The Errors statistics (Stat. NMC method)

The statistics are performed in winter and summer meteorological seasons separately, using a NMC type formulation for the forecast errors. Some constraints for the statistics are applied. For soil temperature Delta T_2m < 8 degrees and Delta H_2m < 60 percent. For soil moisture, in addition, are not considered grid points characterized by glaciers, snow cover, precipitation in the past 3 hours of forecast, and points with frozen soil. The assumption for observational errors are of 1 degree for 2 meters temperature and 0.10 (10 percent) for 2 meters relative humidity. The formulation of the OI coefficients is then obtained by solving a system of linear equations derived by minimizing the root mean square error of the estimation.

Conclusions and perspectives

The RMS and BIAS study for the current operational configuration show relatively small errors, but correction applied to soil fields (SWI) in order to minimize 2m errors are unphysically large and not constrained by any climatological value. The test on a specific case shows that not the entire information for the analysis is extracted for 2m correction and there is still ground for improvements. The contribution of a surface analysis (sequential or variational) based on ALADIN France guess is considered. A first set of OI coefficients is calculated but fine tuning of OI coefficients has to be done. Application of sequential analysis on surface analysis, and also the 1D-VAR analysis for surface variable with multiple time windows (24 or 48 hours) will be considered in later work.

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Bouyssel F., Cassé V. and Pailleux J., 1999. - "Variational surface analysis from screen level atmospheric parameters". Tellus, n.51A, 453-468.

2. Christopher SMITH : "Stability analysis and precision aspects of the boundary condition formulation in the non-hydrostatic dynamics and exploration of the alternatives for discrete formulation of the vertical acceleration equation both in Eulerian and Semi-Lagrangian timemarching schemes"

Trapped Lee Waves: A New Test for Nonhydrostatic Aladin

Trapped Lee Waves

Stratified flow over orography provides a broad range of idealised test problems, suitable for studying the dynamics of numerical weather prediction models. Typically two regimes of flow are studied in the context of a two-dimensional vertical slice model. In the first, the hydrostatic regime, an isolated mountain is chosen whose width is long in comparison to the length scale set by the ratio of the wind speed to the buoyancy frequency. The second regime is the nonhydrostatic regime, in which the mountain is narrow in comparison to the length scale for buoyancy oscillations. In both these regimes gravity waves are generated by the flow over the mountain. For the hydrostatic regime gravity wave propagation is more or less confined to the region directly above the mountain, whereas, for the nonhydrostatic regime, there is strong propagation of gravity waves downstream.

When setting up a numerical model to simulate these two cases of orographic flow, the upper boundary condition is generally found to cause often severe difficulties. Most NWP models have upper boundary conditions which reflect at least some of the gravity wave energy reaching the top of the model. In the case of a model with a rigid lid upper boundary these reflected waves are of sufficient strength to completely change the nature of the solution in the lower part of the model domain. In order to avoid this problem some form of absorbing (or sponge) layer is used in the upper layers of the model. This has the effect of masking the upper boundary condition from the interior dynamics of the model. Consequently the two standard orographic flow tests, described above, do not provide a suitable environment in which to study the behaviour of alternative upper boundary condition formulations -- except in the case where a true radiation boundary condition is being attempted. In real NWP applications, the expense and complexity of a radiation boundary condition is often avoided, if it is found that the use of numerical diffusion is sufficient to control gravity wave reflection. It is therefore of interest to be able to study upper boundary condition formulations, independently of the issue of gravity wave reflection. The phenomenon of trapped lee waves fits these requirements very well.

In the standard orographic flow tests the horizontal wind at the inflow does not vary with height. However, in the nonhydrostatic regime, if the inflow wind is made to increase linearly with height, then all gravity wave modes undergo internal reflection. This provides an idealised model for trapped lee wave flow. Analytical solutions exist for this kind of flow (Keller, Journal of Atmospheric Sciences 1992), albeit with a linearised equation set. Since gravity wave energy does not propagate strongly towards the top of the domain, in the trapped lee wave case, it is possible to obtain clean numerical solutions without the need for sponge layers or other forms of damping.

Results

Experiments conducted so far with the trapped lee wave model have lent support to the following conclusions:

- It is unnecessary to apply additional smoothing in the calculation of the vertical average of horizontal wind. This was previously done near the upper and lower boundaries in order to cure an apparent instability near the upper boundary. However, recent modifications to the calculation of the pressure gradient terms have removed this problem. (Work in progress by Pierre Bénard.)

- Aladin does not achieve steady state (or quasi-steady state) solutions for the trapped lee wave problem. The duration through which the model may be integrated, while remaining close to the steady state solution, shows considerable sensitivity to the form of discretisation used in approximating vertical derivatives of the horizontal wind. Such terms occur in several places in the nonhydrostatic formulation of the model. So far only the term relating to vertical pseudo-divergence has been extensively tested. Linear interpolation of differences across full layers appears to be the best form of discretisation to use here, rather than the existing formulation which uses differences between full-level and half-level winds.

Future Work

Topics for future work include:

- Investigation of the numerics of the vertical discretisation used in nonhydrostatic Aladin, with particular attention to vertical derivatives together with upper and lower boundary conditions.

- Set up test case for neutral flow over orography with periodic lateral boundary conditions. This test case should be particularly useful for examining the alternatives for a lower 'free slip'-type boundary condition. In addition, this test should also be useful for examining the performance of the semi-Lagrangian advection scheme over well-resolved orography.

3. Cornel SOCI : "Sensitivity studies using a limited-area model and its adjoint for the mesoscale range"

The purpose of this study was to establish the role played by the initial conditions (IC) and lateral boundary conditions (LBC) in short range mesoscale forecast. The adjoint method has been used to compute the gradients of the forecast errors with respect to the ICs and LBCs. These were introduced as small perturbations of the type $\delta x=- \alpha*\tilde{N}x$ in the initial data, x being the model state fields and α a scaling factor. The sensitivity tests were carried out for different forecast range and integration area. We have tried to distinguish between the errors coming from a lack of information in LBCs and inaccuracies in the initial state.

'Irish Christmas Storm' or the 24 December 1997 case

The domain used for the experiments has a grid size of 30km, elliptic truncation T49 and 150x144x19 points. The integration time chosen in this study was mainly 36 hours starting from 23 December 1997, 00UTC. The results have demonstrated that the ICs play a leading role for a good forecast. On the contrary, the forecast is less sensitive to the modifications in the LBCs. In Fig.1a the gradients with respect to the IC are shown. Large gradients values are concentrated in the southwestern part of the domain. This is the region where small perturbations introduced in ICs have a positive impact on the forecast. For example, 2.5 hPa have been added in the sea level pressure field taken the difference between operational ICs and the modified one. Starting from these modified initial data, the model arrives to a solution that gives birth to a cyclonic core over the British Islands as it is illustrated in Fig. 1b. The pressure of the cyclone center is 983 hPa, close to the verifying analysis available 24 December 1997, 12UTC whose core is 988 hPa but is very far from the reality since at Valentia meteorological station, the mean sea level pressure was 975 hPa. Even if the forecast cyclone is not as deep as in reality, we can say that the errors coming from ICs are responsible for the failure of the operational forecast. These experiments are in accord with those undertaken for the same case but with the global ARPEGE model (G. Hello at. al, 2000).

The second French storm or the 27 December 1999 case

The domain used in our studies was the operational ALADIN-France (T95, 288x288x31, dx=9.9km). For this high-resolution integration area a first problem regarding the gradients computation has been revealed. The strong punctual gradients over the Alps have been found (Fig. 2a). These structures are present in adiabatic model and they do not vanish whenever the Eulerian time step is reduced from 40 to 10s. It was found that even for 10s timestep there are high values over the orography for certain levels. For diminishing these unrealistic values, the boundary layer height (ho) and the scale factor for the wind speed (u*) in the adjoint linear simplified physics (Buizza, 1993) have been modified. Another way to get rid of these structures was to change the trajectory truncation in adjoint model (ex. from T95 to T35). Again like for Irish storm the influence of the LBCs is in positive sense but is rather weak. An improved forecast is obtained if the ICs are modified. The sensitivity forecast was able to move the center of the cyclone closer to the verifying analysis but with a very high price. For example, more than 5hPa have been added into a region where a rest of useful gradient was present over Biscaye Bay. It is very likely that an important part of the gradient has already gone out from the domain crossing the western boundaries and it should be found over the Atlantic Ocean.

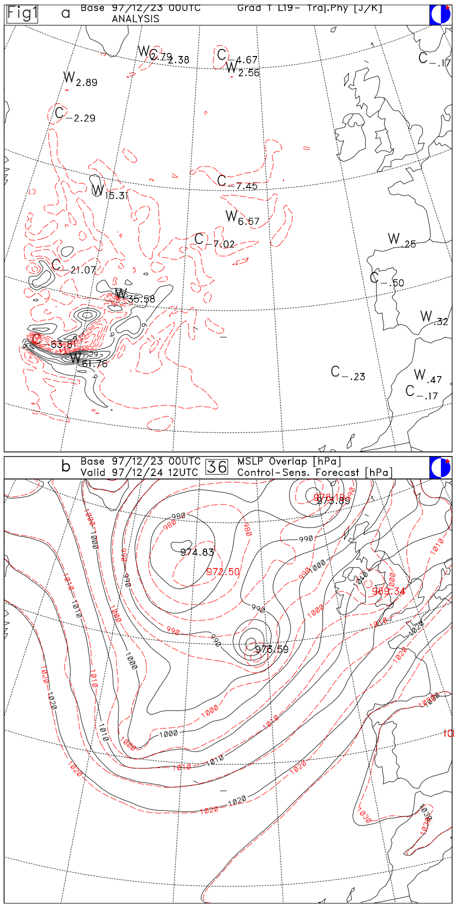

Fig.1. 24 December 1997 case
a - temperature gradient at level 19
b - sea level pressure overlap between control (black) and sensitivity forecast (red)

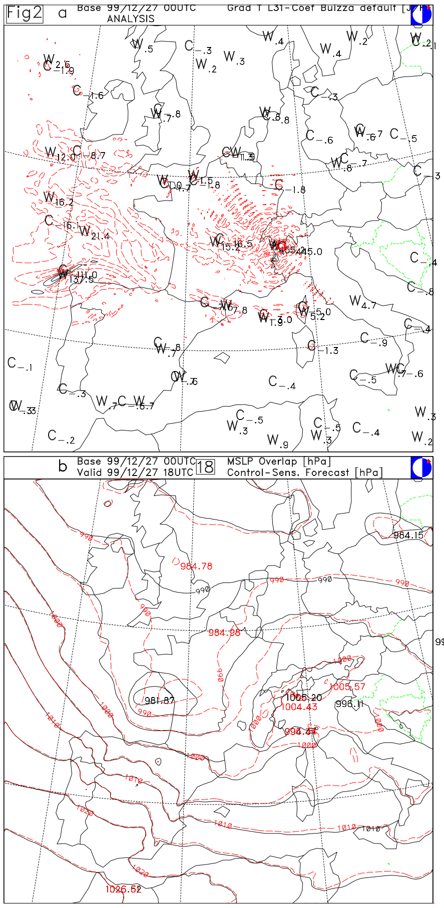

Fig.2. 27 December 1997 case
a - temperature gradient at level 31
b - sea level pressure overlap between control (black) and sensitivity forecast (red)

Discussion

During this first ALATNET stay, the study has been concentrated on the effect of both the perturbations in lateral boundary data and in initial conditions in the prediction of a rapid evolving cyclogenesis. In all the experiments in which only lateral boundary perturbation was injected, the impact in the forecast was very marginal. On the contrary, we have shown that the errors in ICs are more responsible for the forecast failure. This is not because the information coming from the coupling area is perfect. The reason could be that the utilized technique for deriving LBCs gradients is not proper for ALADIN. We think that this failure is due to the coupling method (Davies) used and we could say that for a future 4D-Var assimilation in ALADIN a new coupling method should be imagined which, eventually, should be able to distinguish between inflow and outflow region of the domain.

In the future, other case studies will be carried out mainly to study the impact of simplified physical parameterization in ALADIN adjoint model. Then we will concentrate on the sensibility of mesoscale phenomenon inside the forecast area.

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4. Klaus STADLBACHER : "Systematic qualitative evaluation of high-resolution non-hydrostatic model"

Due to the fact, that I have the luck to have the opportunity to work in the framework of ALATNET-project in Ljubljana, I will just make available this first report.

I started to work in Ljubljana in September 2000 and the first part is lasting for twelve months and a second thirteen-month stay will start in September 2002.

The main purpose of the work is to systematically evaluate the non-hydrostatic version of the ALADIN-model together with the results for very high resolutions (down to 1km), respectively. Most of the time of these first months were used to set up a proper working environment, to learn all the 'wheres', 'whens', 'whos' and 'hows', that are needed for starting model experiments and displaying results.

To reach the above mentioned goal, it is first necessary to find a database of cases, that allows to investigate the performance of the different model settings. The MAP database provides a proper source for finding such cases, cause for the IOP's large amounts of data (model and observation ones) are available within short time. For the first case the 00-run of 23rd of October 1999 (MAP-IOP 9) was chosen. In the following pictures one example of comparison between non-hydrostatic and hydrostatic dynamics is shown. The resolution is about 5km and semi-Lagrangian time scheme was used (timestep 60s).

The precipitation in this example is mainly 'stratiform' (the resolved part is below 10%) and caused by a front, which approached from the west, had its main activity in northern Italy and was already weaker, when affecting the shown domain. The precipitation patterns look quite similar, although there is remarkable difference, when focus is put on the area of maximum precipitation (northwest-Croatian coast). The maximum value forecasted by the hydrostatic run exceeds 150 mm/2h, while in the non-hydrostatic run the maximum value is around 90mm/2h. Of course both values are unrealistic high, and the too strong influence of the mountains near the coast might be the reason. Unfortunately the setting of LSRCON was different for the two runs, so it has still to be checked, if difference is only due to this fact. Nevertheless the forecasted patterns are similar to the observed precipitation, although this maximum cannot be found (just some mm of prec. in this region). So it seems that the non-hydrostatism maybe damps this negative effect, compared to the hydrostatic one.

For the next future an intensive study of this case is planned with focusing on forecasts for different domains (which cover the area, that were affected most by this front), higher resolution and higher frequency of coupling (this one was created with 6-hour coupling frequency from ALADIN/LACE).

I would also like to use this first official report for saying a big "THANK YOU" to everybody in HMZ (and especially in OpTiM-group), who was endeavored to create excellent working conditions for me here. This includes buying new computer devices, supporting me in any imaginable way and repainting of my office as well. Further I would also like to thank all, who wasted some time in explaining me either how to use Slovenian busses and that the third Croatian TV-channel is very good for watching sports, or any more important stuff, that was necessary to be able to run the model and to visualize results.

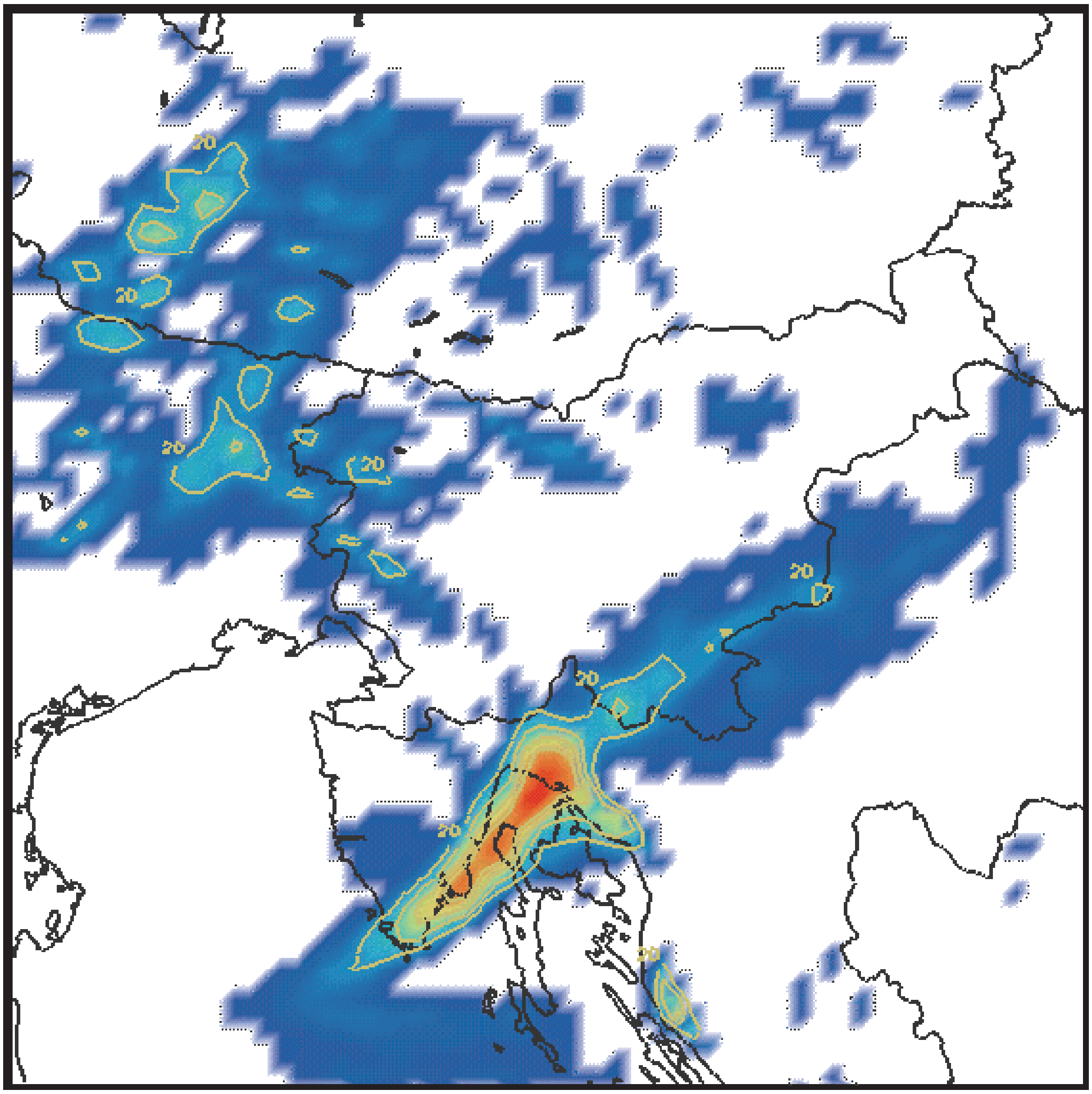

Figure 1: precipitation forecast [mm/2h] 1999231000+22h - resolution: 5km - hydrostatic dyn. - isohyetes are equally spaced (20 mm)