Working group 3 : Physics

Participants :

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Report :

The main topics addressed in second medium-term research plan for ALADIN (1999-2001) were successively discussed. The ALATNET research plan (2000-2003) was checked afterwards.

Topic	Achievements	Program of work
Land surface medium ⇓ low	• New global dataset for soil tested (5') • New global dataset for vegetation (5') soon ready, draft version tested • New climatological surface fields (1°) created and tested • New fields available in 923, more tests of consistency • Importance of an improved description of urban areas shown • Improvements in the initialization by 927	• Update of 923 ⇒ **who** : Dominique Giard ⇒ **when** : summer 2001 • Introduction of a new surface type and improved characteristics for towns in 923 and physics ⇒ **who** : Mihaela Caian with help from Dominique Giard ⇒ **when** : summer 2001 • Computation and control of the updated vegetation datasets ⇒ **who** : Marek Jerczynski, Gergana Kozinarova and Maria Rousseva ⇒ **when** : june 2001 • Validation of the new clim files in assimilation mode, operational change ⇒ **who** : Toulouse team + Olivier Latinne ⇒ **when** : before end 2001 • Improved surface parameterization*, and associated changes in assimilation* ⇒ **who** : waiting for volunteers ⇒ **when** : idem • Creation of a higher resolution dataset for vegetation over Europe and Northern Africa (2'30 or less) ⇒ **who** : waiting for a volunteer (feasibility study by Marek Jerczynski) ⇒ **when** : before going to higher model resolutions (e.g. ≤ 6 km)

<table>
<tr>
<td>Snow cover

priority :
high
⇓
high</td>
<td>• Improved snow cover analysis available
• Improved description of the snow coverage and the albedo, taking into account vegetation, now available and tested in forecast mode</td>
<td>• Test of the snow analysis in assimilation mode
⇒ who : Lora Gaytandjieva with help from Françoise Taillefer
⇒ when : summer 2001
• Test of the new scheme, with the snow cover analysis, in assimilation mode
⇒ who : Eric Bazile
⇒ when : autumn 2001
• Introduction of both modifications in operations
⇒ who : Eric Bazile and Françoise Taillefer
⇒ when : before end 2001
• Coding the interface with the Fernandez' snow scheme (in cooperation with HIRLAM), improved description of snow age and of the impact of precipitations
⇒ who : Eric Bazile, Jadwiga Woyciechowska and ? (maybe the Bulgarian team will feel interested)
⇒ when : before end 2003, starting in autumn 2001 for the first point
• Improvement / update of the snow cover analysis (new observations, new variables)
⇒ who : Françoise Taillefer, Philippe Caille and ?
⇒ when : may start in September 2001</td>
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<tr>
<td>Water surface

priority :
medium
⇓
medium</td>
<td>• Available tools to improve the initialization of the temperature of lakes (923, 927)
• Tests of some parameterizations of the evolution of the temperature of lakes : using a simplified model embedded in ISBA or coupling with the Hostetler lake model
• Importance of a regular update of SST fields demonstrated ("Lézignan floods" case)
• New formulation of the evaporation over sea, taking into account the impact of convective precipitations, coded and tested (together with retunings of the current formulation of the roughness length)</td>
<td>• Improving climatological values for the temperature of lakes (collecting data)
⇒ who : all partners concerned; maybe the Hungarian team feels more interested
⇒ when : depending of individual interest
• Coding an alternative initialization of the temperature of lakes and islands in 927, and comparing both schemes
⇒ who : Ryad El Khatib for the coding, idem as for the first item for the test
⇒ when : idem
• Implementation of the parameterizations of lakes in the next libraries
⇒ who : Mihaela Caian with help from Eric Bazile
⇒ when : before end 2001 ?
• Testing the "Lézignan floods" case with an evolution of SST along the forecast controlled by the Hotstetler lake-type model
⇒ who : Mihaela Caian with help from Eric Bazile
⇒ when : before end 2001 ?
• Introducing the new formulation of evaporation over sea in operations
⇒ who : Eric Bazile
⇒ when : before end 2001 (CYCORA-3) ?
• Improving SST analysis (new observations), for assimilation
⇒ who : Françoise Taillefer, Philippe Caille with help from Portugal or Morocco
⇒ when : starting end 2001 ?</td>
</tr>
</table>

Orography priority : high ⇓ high	• New global dataset (2'30) tested • Available tool to use local, higher resolution, data • New formulation of the cost function taking into account the fraction of water, and improving the representation of coasts • Importance of a local tuning of orography demonstrated • New formulation of the enveloppe available • "Lift" parameterization analyzed for small scales and shown as not suitable • Evidence of remaining problems (case studies, assimilation, ...)	• Introduction in operations of the new dataset ⇒ **who** : Dominique Giard, with help from Patrick Saez ? ⇒ **when** : before end 2001 • Local retuning of orography ⇒ **who** : each team ⇒ **when** : before the operational change of clim files • Study of the description and impact of the orographic roughness length ⇒ **who** : Philippe Nomérange ?, Richard Mladek, and ? ⇒ **when** : before end 2003 ? • Exploring other issues ⇒ **who** : Philippe Nomérange ?, Richard Mladek, and ? ⇒ **when** : before end 2003 ? • SMALL WORKSHOP REQUIRED FOR COORDINATION ⇒ **who** : R. Mladek + P. Nomérange ? + J.F. Geleyn + ? (+ D. Giard for 923?) ⇒ **when** : before end 2001
Radiation priority : high ⇓ high	• Introduction of improved optical properties of clouds in operations • More precise description of optical depth, with a positive impact but an unstable behaviour	• Some alternative retunings ⇒ **who** : ? with help from Jean-François Geleyn ⇒ **when** : before end 2001 (CYCORA-3) ? • Deeper modifications to be discussed after the training course (end 09/2001)
Convection **Updraughts and downdraughts** priority : high / medium ⇓ high / medium	• Two PhD theses completed • New prognostic cloud scheme designed and tested • Parameterization of updraughts and downdraughts in operations • Some more refinements put in operations	• Checking the interface with dynamics for the new variables ⇒ **who** : Luc Gérard and Ilian Gospodinov ⇒ **when** : summer 2001 • Some more tunings and case studies, impact of resolution and background ⇒ **who** : Luc Gérard, Doina Banciu, Eric Bazile, Jean-Marcel Piriou, Karim Bergaoui ("warm surfaces"), Austrian team ("orography") ⇒ **when** : end 2002 ? • Interaction with other developments (e.g. ql, qi) and new refinements ⇒ **who** : previous team + ? ⇒ **when** : ?
Prognostic cloud water content priority : medium ⇓ medium	• "Functional Boxes" approach coded and tested for some parameterizations	• Definite tests for Functional Boxes → keep or forget ⇒ **who** : Eric Bazile ⇒ **when** : before end 2001 • Definition of new objectives • Introduction of precipitating water ? • Cooperation with other groups (GMME, HIRLAM) • Interaction with the description of visibility • *Interaction with the PhD thesis of Margarida Belo Pereira on the assimilation of water*

Vertical diffusion **PBL** **Low-level cloudiness** priority : medium ⇓ high	• Positive impact of CYCORA-1+2 even if CYCORA-1, designed as a temporary measure of emergency, lead to some problems • Problem of mixing length well identified but no solution found so far • New formulations of the dry turbulent fluxes have improved the prediction of cyclogenesis events • Diagnostic studies from operations or EUROCS data, explaining why low-level cloudiness is under-estimated; new approach coded and tested, improving EUROCS case; cloud resolving models data now available to study clouds capped by inversion.	• PhD thesis : Study of the realtionship between turbulent fluxes in deeply stable PBL situations and cyclogenetic activity ⇒ **who** : André Simon, with help from Jean-François Geleyn ⇒ **when** : early 2002- end 2004 ? • Moving progressively to an improved CBR-type scheme, in cooperation with HIRLAM, GMME and GMGEC ⇒ **who** : Martin Gera, with help from ? ⇒ **when** : before end 2003 • Improving the representation of low-level cloudiness ⇒ **who** : Jean-Marcel Piriou, Janko Merse, Siham Sbii, Blazenka Vukelic, ⇒ **when** : • Improved diagnostics ⇒ **who** : ⇒ **when** : • Interaction with the representation of visibility ⇒ **who** : each team ⇒ **when** : • WORKSHOP REQUIRED FOR COORDINATION ⇒ **who** : A. Simon + M. Gera + L. Gérard + J.F. Geleyn + J.M. Piriou + ? ⇒ **when** : not later than early 2002
Ozone **Aerosols** **Thermodyn.** priority : low ⇓ low	• Ozone coded as a prognostic spectral variable • Impact of the climatological profile of ozone demonstrated • 923 updated for aerosols • *Preliminary study for the visibility analysis taking into account aerosols* • More precise formulations of thermodynamics tested	• Checking the interface with physics for ozone ⇒ **who** : Dominique Giard ⇒ **when** : 2002 ? • Test of new climatological profiles of ozone in ARPEGE, introduction of an annual cycle ⇒ **who** : Mihaela Caian, with help from Dominique Giard for 923 ? ⇒ **when** : 2002 ? • Comparison of the two studies on thermodynamics ⇒ **who** : Mihaela Caian ⇒ **when** : before end 2001 ? • Towards an intermediate version for thermodynamics ? ⇒ **who** : ? ⇒ **when** : ? • Deeper modifications to be discussed after the training course (end 09/2001)

ALATNET work plan (March 2000 - February 2004) : topics related to physics

The programme of work is split in 12 main topics. Each partner is responsible for 1 to 4 topics, even if the basic work is shared between all teams. The numbering of the involved research centres is :

1 Toulouse (Fr) 2 Bruxelles (Be) 3 Prague (Cz) 4 Budapest (Hu) 5 Ljubljana (Si)

1. <u>Theoretical aspects of non-hydrostatism (NH)</u> **P3**

2. <u>Case studies aspects</u> **P5**
   - 2b: Validation of the current physics and non-hydrostatic dynamics : comparison to hydrostatic dynamics, to observations, identifying problems
   - 2d: Validation of the refinements in physics, identifying feed-backs and residual problems *P1 & P2*

   <u>Note : responsibility shared with Romania for physics</u>

3. <u>Noise control in high resolution dynamics</u> **P3**

4. <u>Removal of the thin layer hypothesis</u> **P1**

5. <u>Coupling and high resolution modes</u> **P5**

6. <u>Specific coupling problems</u> **P3**

7. <u>Reformulation of the physics-dynamics interface</u> **P2**
   - 7a: Study of the interactions between non-hydrostatic features and physical parameterisations *P1 & P3*
   - 7b: Analysis of the problems related to a 1-dimensional physics, impact of an exact introduction of diabatic forcing *P1 & P5*
   - 7c: Sensitivity of the physics/dynamics interface to vertical resolution *P3 & P1*

8. <u>Adaptation of physics to higher resolution</u> **P2**
   - 8a: Parameterisation of the small-scale features of convection *P1*
   - 8b: Test, retuning and improvement of the various physical parameterisation in the framework of a very high resolution *P5*
   - 8c: Improved representation of boundary layer *P1*
   - 8d: Improved representation of orographic effects *P5, P1*

9. <u>Design of new physical parameterisations</u> **P1**
   - 9a: Implementation of a new parameterisation of turbulence *P5 & P2*
   - 9b: Use of liquid water and ice as prognostic variables, implementation of a new microphysics parameterisation *P2*
   - 9c: New parameterisation of exchanges at sea and lake surface *P4 & P2*
   - 9d: Improved representation of land surface, including the impact of vegetation and snow *P2, P4 & P5*
   - 9e: Refinements in the parameterisations of radiation and cloudiness *P4 & P2*

10. <u>Use of new observations</u> **P1**

11. <u>3D-Var analysis and variational applications</u> **P4**

12. <u>4D-Var assimilation</u> **P1**
    - 12d: Improvement of the treatment of humidity in data assimilation *P2, P3, P4 & P5*

Main ALADIN / ALATNET PhD theses and Post-Doc positions with topics related to physics

Ilian Gospodinov

Post-Doc, Bruxelles

Reformulation of the physics-dynamics interface for a non-hydrostatic high resolution model

Martin Gera

Post-Doc, Bruxelles

Improved representation of boundary layer

Jean-Marcel Piriou

Pre-Doc, Toulouse

Correction of compensating errors in physical packages; validation with special emphasis on cloudiness representation

André Simon

Pre-Doc, Toulouse

Study of the relationship between turbulent fluxes in deeply stable PBL situations and cyclogenetic activity

Margarida Belo Pereira

Pre-Doc, Toulouse

Improving the assimilation of water in a NWP model

Karim Bergaoui

Pre-Doc, Toulouse (still under discussions)

Impact of a prognostic mass-flux convection scheme for NWP over Northern Africa and the Mediterranean Sea