LACE Working Group for Physics
Working plan 2005
Draft version

Neva Pristov
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Contents

1 Introduction

This document summarises the planned research and development of LACE working group for physics for the year 2005. The work is grouped in the five projects:

I. PBL cloudiness
II. Prognostic cloud water
III. Parameterization schemes, diagnostic tools
IV. Externalized surface
V. Validation, case studies, sensitivity studies

The first project is continuation of the work from previous year. The second project is also from previous year but work on it has not started yet. In the third group are developments/improvements of several parameterization schemes needed for clean dynamical/physical interface (which will allow to call different packages of physics using same ALADIN dynamics) and are harmonized with the proposed common action of ALADIN2 project (see "streams" approach by J.-F. Geleyn). Topics in the fourth group are coordinated with the working plan for the externalized surface module. The fifth project includes various topics mainly proposed by Austrian and Croatian group.
A planned work on physical/dynamical interface is included in the working plan of WG for dynamics and coupling but work on equations can be also included in the final report afterward.
Most of the planed work can be done locally, stays financed by LACE are planned for consultations with the supervisors or experts.
Topics listed in "streams", for which contributors are still missing, are not included in this plan; but can be added afterwards if somebody will be interested in them.

2 Progress in research topics

Research and developments topics in the frame of LACE working group for physics for year 2005 are listed.

2.1 PBL cloudiness

- **Stratus prediction**

  Objective: Improve the ALADIN forecast of low stratus. A large improvement was already achieved with the Seidl-Kann scheme but a few open questions still need to be clarified.
  Methods: Test if a strongly reduced horizontal T diffusion (found important for a good stratus forecast in basins and valleys) can be used operationally
  Test if a modification in vertical diffusion (E. Bazile) has a beneficial effect on stratus
  Priority: medium
  Realization: local work
  Risk evaluation: 1
  Estimated efforts: 3 person x month
  Contributors: A. Kann (At), H. Seidl (At)
  Schedule: 1st half of year 2005

2.2 Prognostic cloud water + orographic precipitation

Objective: Improve ALADIN forecasts of orographic precipitation. The model over forecasts rainfall amounts at windward slopes and on peaks and ridges, and under forecasts precipitation in valleys. There is also a tendency of the model to overestimate rainfall from low stratus (drizzle).
Methods: Get familiar with Lopez microphysics scheme prepared in Toulouse. Implement a simple microphysics scheme (ACPLUIE, with the compromise on the pseudo-fluxes, including the prognostic precipitating water and ice) which will be harmonized with physical-dynamical constrains. *(Link to stream G2/4)*
Test the scheme on a number of orographic precipitation cases (both rainfall and snow) to determine whether it improves the mountain/valley biases
Test the scheme on stratus cases. Determine whether the over forecasting of light rainfall from the stratus is reduced
Priority: medium
Realization: local work, visit to Toulouse, Prague
Risk evaluation: 1
Estimated efforts: 7 person x month
Contributors: C. Wittmann (At), T. Haiden (At), A. Kann (At)
Schedule:

2.3 Parameterization schemes, diagnostic tools

- **Parameterization of turbulence**

Objective: Improve diagnostic treatment of turbulent flux with introducing prognostic equation for turbulent kinetic energy.
Methods: Implementation of ARPEGE 1D TKE scheme with specific work to make it stable at high Courant numbers (longer integration time steps). *(Link to stream G1/3)*
Priority: high
Realization: local work, ?
Risk evaluation: 1
Estimated efforts: ? person x month
Contributors: M. Tudor (Hr), F. Vana (Cz), J. Cedilnik (Si)
Schedule:

- **Work on "mixed" radiation scheme**

  Objective: To achieve good cost/efficiency ratio in the radiative computation.
  Methods: Find out the geographical dependence for parameter alpha. Using the gaseous RRTM transmission function for computation of optical depths. *(Link to stream H2)*
  Priority: medium
  Realization: local work
  Risk evaluation: 1
  Estimated efforts: 4 person x month
  Contributors: N. Pristov (Si), A. Trojakova (Cz)
  Schedule:

- **Convection scheme**

  Objective: Improve the convective rainfall forecast with better scheme which can be also substitution for convection scheme in the 10 km version of Meso-NH.
  Methods: Implementation of J.-M. Piriou's ideas on the parameterized convective water cycle, on cloud stationarity hypothesis, on microphysics in updraft and on the entrainment rate and try to keep advantages of the current code. *(Link to stream H3)*
  Priority: high
  Realization: local work, ?
  Risk evaluation: 1
  Estimated efforts: ? person x month
  Contributors: R. Bubnova (Cz), M. Bellus (Sk), ?
  Schedule: after May

- **Triggering of convection**

  Objective: Improve the convective rainfall forecast of ALADIN, especially in mountainous areas. In summer, ALADIN often forecasts convective rainfall on days where none was observed.
  Methods: Test predictive value of INCA fields (ALADIN forecast+surface obs) for convection triggering, compare with radar and MSG data, and with ALADIN forecast
  Simulate the initial growth of convective towers in a more realistic way by modifying the entrainment parameterization (EP). The idea is to carry some 'memory' of the convective process from one time step to the next. *(Link to stream H3)*
  Priority: medium
  Realization: local work, short stay in Vienna to start
  Risk evaluation: 1
  Estimated efforts: 6 person x month
  Contributors: F. Wimmer (At), T. Haiden (At), M. Bellus (Sk)
  Schedule:

- **Diagnostic tool DDH for AROME and ALARO.**

  Objective: The DDH (Diagnostic par Domaines Horizontaux) diagnostic package exist in ARPEGE and ALADIN and is very useful diagnostic tool for physics development. The plan is to extend the DDH to the AROME, ALARO model.
  Methods: Implementation of the required modifications (barycentric velocity), introduction of new cloud prognostic species, microphysics phase changes. *(Link to stream C)*
  Priority: high
  Realization: local work, ?
  Risk evaluation: 1
  Estimated efforts: ? person x month
  Contributor: M. Bellus (Sk), T. Kovačić (Hr), N. Pristov (Si); supervisors J.-M. Piriou, J.-F. Geleyn
  Schedule:

2.4 Externalized surface

- **Diffusion scheme in ISBA**

  Objective: When running externalized surface scheme in offline mode with diffusion scheme in ISBA a bug was observed: At points where ice water is present in the soil, the first few level's temperature decreases dramatically in time (to -40 degree of celcius), and it needs several hours to relaxes to the 'right' value (the value calculated with force-restore scheme).
  Methods: Find (in initialization procedure and/or in calculation of melting of soil ice) and correct finally the bug, work further with the comparison of the 2 schemes (diffusion / force-restore scheme), tune the diffusion scheme to give the best results.
  Priority: medium
  Realization: local work
  Risk evaluation: 1
  Estimated efforts: 2 person x month
  Contributors: L. Kullmann (Hu)
  Schedule: August - September

- **The air-sea exchange scheme**

  Objective: Implementation of the air-sea exchanges into externalized surface module.
  Methods: Improvement of gustiness parameterization, the correction of roughness length over sea for strong wind cases is already implemented in ALADIN in Prague
  Priority: medium
  Realization: 0.75 month stay in Toulouse
  Risk evaluation: 1

Estimated efforts: 2 person x month
Contributors: M. Bellus (Sk)
Schedule: July, August

2.5 Validation, case studies, sensitivity studies

- **Evaluation of ALARO at grey zone resolutions**

Objective: To find the reason for time step dependence for precipitation amounts.
Methods: Effect of iterations of microphysics will be tested on non-convective case, to avoid possible interactions between convective and microphysics schemes. It is believed that dependence on time step is the problem of accuracy of the time integration of microphysical scheme. Possibility to use a higher order scheme will be investigated.
Priority: medium
Realization: local work
Risk evaluation: 2
Estimated efforts: 4 person x month
Contributor: T. Kovačić (Hr)
Schedule:

Objective: Compare ALARO and ALADIN results.
Methods: Perform equivalent ALADIN tests to the one of the ALARO prototype, to examine respective roles of ACPLUIE and ACCVIMP at different resolutions, interactions with dynamics, quality of the budget closure, etc.
Priority: medium
Realization: local work
Risk evaluation: 2
Estimated efforts: 3 person x month
Contributor: J. Cedilnik (Si)
Schedule: April-June

- **Soil moisture sensitivity**

Description: Research in previous year showed that initial soil moisture field is a major cause for negative T2m bias during daytime on summer sunny days.
Objectives: Set up a scheme for modifying initial soil moisture from real history of precipitation and check if T2m forecast error is reduced
Priority: medium
Realization: local work
Risk evaluation: 1
Estimated efforts: 2 person x month
Contributor: H. Seidel (At)
Schedule: 1st half of year 2005

- **Model application and validation in the nowcasting range (INCA)**

  Remark: This is not a physics topic per se but will provide a lot of information on model performance, relevant for ongoing and future physics developments.
  Objective: Detailed quantitative validation of ALADIN strengths and weaknesses with regard to very short range forecasts (up to +6h).
  Methods: Use the INCA analysis and nowcasting system to diagnose the three-dimensional spatial and temporal structure of ALADIN forecast errors
  Priority: medium
  Realization: local work
  Risk evaluation: 1
  Estimated efforts: 4 person x month
  Contributors: C. Wittmann (At), T. Haiden (At)
  Schedule: 1st half of year 2005

- **Study of micro physics scheme**

  Objective: Study of different microphysics schemes on MAP case.
  Methods: Usage of Kain-Fritch and/or Lopez micro physics scheme, evaluation of results.
  Priority: medium
  Realization: local work
  Risk evaluation: 1
  Estimated efforts: 1.5 person x month
  Contributors: Y. Wang (At)
  Schedule: summer 2005

- **Case studies using improved parameterization schemes**

  Objective: Include recent improvements (e.g. from ALADIN/CZ operational model) into other local operational models.
  Methods: Implementation of the new cloudiness and radiation schemes into ALADIN/HR and testing them on a synoptic case marked by a strong temperature inversion in inland part of Croatia lasting for several days. Improvements are expected in the low cloudiness and the surface temperature (2m AGL) diurnal pattern.
  Test the modified subgrid-scale orography representation on ALADIN/HR for several cyclone and bora cases.
  Priority: medium
  Realization: local work
  Risk evaluation: 1
  Estimated efforts: 4 person x month
  Contributor: M. Tudor (Hr), V. Tutis (Hr), D. Drvar (Hr), I. Stiperski (Hr)
  Schedule: March-May

- **Experiments with atmosphere-wave-ocean model**

  Objective: Find an impact of ocean and wave model data on Aladin forecast.
  Methods: As a first step to coupled atmosphere-wave-ocean model, there will be an attempt to use data from the wave and ocean model as input to Aladin (roughness length, surface temperature) and see the impact.
  Priority: medium
  Realization: local work
  Risk evaluation: 1
  Estimated efforts: 1 person x month
  Contributors: M. Tudor (Hr), I. Janekovic (Hr)
  Schedule: March, April

2.5 Summary of means

The following table is a short overview of the planned effort and needs of LACE support.

Table 1: Overview of the planned effort in 2005.

Topic	**Estimated effort** (person x month)	**LACE support**
PBL cloudiness	2	-
Prognostic cloud water	7	2 p x w
Parameterization schemes, diagnostic tools	10 ?	6 p x w
Externalized surface	4	-
Validation, case studies, sensitivity studies	18	-
Total	**41 p x m**	

Workshops	
ALADIN workshop in Bratislava	1 p x w
ALADIN training on AROME planned in Bucharest	7 p x w
EWGLAM meeting (Ljubljana)	1 p x w
Total	**8 p x w**