

LACE Working Group for Physics

Working plan 2006

Neva Pristov
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1 Introduction

In this document the topics for research and development in the field of physics in the year 2006 are listed.

Development on physical parameterizations (turbulence, convection, microphysics, radiation) which started in the second half of 2005 should be first completed. After that the effort will be focused at obtaining a basic version with new physical schemes. This is foreseen to be available till the end of June. In the second half of the year an extensive testing and validation can follow. Results are going to be compared with the current model version and other schemes. Experiments with AROME model at high resolution can also start this year, further development of INCA system in Austria will continue.

Continuation of work on the various parameterizations is foreseen and is depending on the results of previous tests and validation. Activities are going to be connected with common ALADIN, Meteo-France, HIRLAM plans.

2 Research topics

The work is still grouped in the five projects. The second one about prognostic cloud water could be joined with parameterization schemes, but is still left separately. Less work is planned for parameterization scheme developments, much more effort is devoted to testing and validation. Topics in the fourth group are coordinated with the working plan for the externalized surface module.

During the year some new topics can be defined and added. This mainly depends on the results of the tests of new parameterization schemes.

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: Implementation of the Seidl-Kann scheme into cy29t2 and comparison with “CE” cloudiness scheme. Tests whether Lopez microphysics scheme improves stratus prediction even without Seidl-Kann scheme and if unrealistic heavy drizzle (light rainfall) from the stratus can be reduced.

Priority: medium

Realization: local work

Risk evaluation: 1

Estimated efforts: 2 person x month

Contributors: A. Kann (At), H. Seidl (At)

Schedule: 1st half of year 2006

2.2 Prognostic cloud water

Objective: Improve ALADIN forecasts of orographic precipitation. The model overforecasts rainfall amounts at windward slopes and on peaks and ridges, and underforecasts precipitation in valleys.

Methods: A prognostic precipitation scheme (prognostic precipitating water and ice, use of the pseudo-fluxes between 5 water phases, collection, sedimentation of precipitation) which is harmonized with physical-dynamical constrains of the ALARO should be evaluated. Study of the behavior of the scheme with DDH on four selected cases with (mainly stratiform) precipitation showed that it is unstable. Stabilization and tuning is needed.

Priority: high

Realization: local work, stay in Ljubljana

Risk evaluation: 1

Estimated efforts: 1.5 person x month

Contributors: D. Drvar (Hr), J.Cedilnik (Si)

Schedule: January, June

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:

Prognostic TKE scheme was completed at the end previous year. Further evaluation and stability test of the scheme are needed.

Another approach is the work with TKE scheme implemented in ARPEGE/ARPEGE-clima in collaboration with Meteo-France team. Work started last year should be completed. Experiments with new version of 1D model (based on cy29t2) can help to have some conclusion about vertical discretization (half levels versus full levels). To answer the question if advection of turbulent kinetic energy is needed and on which scale experiment has to be performed.

Priority: high

Realization: local work

Risk evaluation: 1

Estimated efforts: 2 person x month

Contributors: F. Vana (Cz), J. Cedilnik (Si), M. Tudor (Hr), R. Brožkova (Cz)

Schedule: January-March

- **Work on “mixed” radiation scheme**

Objective: To achieve good cost/efficiency ratio in the radiative computation.

Methods:

- finish work on validation and improvement of the gaseous transmission function for computation of optical depths,

- use information of clouds in radiation scheme (cloud optical properties) – implement a cloud simulation model into cy29t2 and validation

- the retuning of the statistical model when all developments are available

Priority: high

Realization: local work, stay in Prague

Risk evaluation: 1

Estimated efforts: 4 person x month

Contributors: J. Mašek (Sk), A. Trojakova (Cz), N. Pristov (Si)

Schedule: January-June

- **Convection, microphysics, precipitation, turbulence**

Objective: To obtain base line version with all new physical schemes and prognostic variables.

Methods: Collect all developments on parameterization, try to solve the missing parts (treatment of entrainment and convective cloudiness, introduction of grid point moisture). Put everything together into the model code cy29t2, compile and make first tests (reliability). Preparation of basic description, technical requirements, guidelines for implementation with source code.

Priority: high

Realization: gathering in Brussels, local work, stay in Prague

Risk evaluation: 1

Estimated efforts: 4 person x month

Contributors: M. Tudor (Hr), J. Cedilnik (Si), F. Vana (Cz), J. Mašek (Sk), *L. Gerard (Be)*, *B. Carty (Be)*, *D.Banciu (Ro)*

Schedule: January-June

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

Objective: The DDH (Diagnostic par Domaines Horizontaux) diagnostic package exists in ARPEGE and ALADIN and is a very useful diagnostic tool for physics development. The plan is to extend the DDH to AROME, ALARO model.

Methods: Some modifications in budgets outputs are needed in order to obtain all possible fluxes inside AROME physics packet.

Priority: high

Realization: stay in Toulouse, local work

Risk evaluation: 2

Estimated efforts: 2 person x month

Contributor: T. Kovačić (Hr); supervisors J.-M. Piriou

Schedule: January-April

2.4 Externalized surface

- **Diffusion scheme in surface**

Objective: Results from externalized surface scheme in off-line mode with diffusion scheme in ISBA are improved after solving problem in initialization of the water and ice content. Still some strange behavior of water content can be observed at the begin of simulation.

Methods: Find the reason for such behavior with further analysis and comparison against observations. Comparison of different surface schemes inside AROME where surface-atmosphere are already coupled (not off-line mode).

Priority: medium
Realization: local work
Risk evaluation: 2
Estimated efforts: 1 person x month
Contributors: L. Kullmann (Hu)
Schedule: when cy30 will be available

2.5 Validation, case studies, sensitivity studies

- **Evaluation of parameterization developments**

Objective: Validation of parameterization developments, the consistent introduction of more complex options, explore new possibilities in sets of parameterizations.

Methods: Perform basic tests for each parameterization separately and then all together, case studies (orographic precipitation, convection, ...) also on the cases proposed from verification group to test and compare physical parameterization issues, daily parallel (off-line) runs. More detailed list should be prepared

Priority: high

Realization: local work

Risk evaluation: 1

Estimated efforts: 6 person x month

Contributor: local teams

Schedule: can start when stable base-line version is available

- **Tuning of the precipitation forecast**

Objective: Improve ALADIN forecast of precipitation (orographic, convective precipitation, drizzle from low stratus).

Methods: Study of various combination of schemes (convection, microphysics) available in the model to determine which is best suited. Study effect of different parameter settings in Lopez scheme on precipitation forecast in order to find good operational tuning. Study the impact of coupling 3D prognostic fields needed in Lopez scheme. Perform tests with ALARO-0 physics. Compare ALADIN, ALORO, AROME results and INCA precipitation analysis.

Priority: medium

Realization: local work, 1 week in Toulouse

Risk evaluation: 1

Estimated efforts: 3 person x month

Contributors: C. Wittmann (At), F. Wimmer (At), Y. Wang (At), *E.Bazile (Fr)*

Schedule: whole year

- **Soil moisture sensitivity**

Objective: Initial soil moisture field is a major cause for negative T2m bias during daytime on summer sunny days. The technical environment (data flow, scripts) for modifying initial deep and surface soil moisture from real history of precipitation is prepared.

Methods: An initial deep and surface soil moisture field are modified, according to the computation of soil moisture reduction day by day based on INCA 1km analysis. For the estimation of daily reduction of soil moisture also actual evapotranspiration (Penman-Monteith type formula) will be used, so besides 2m temperature and relative humidity fields also wind speed, insolation, cloudiness will be included. Modified fields of initial soil moisture will be available once per day and used in experiments for validation. First step is to check if T2m, RH2m forecast error is reduced.

Priority: medium

Realization: local work

Risk evaluation: 2

Estimated efforts: 2 person x month

Contributor: H. Seidel (At)

Schedule: 1st half of year 2006

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

Remark: Nowcasting is becoming more and more important and INCA application is being developing for this purpose. Besides can provide a lot of information on model performance.

Methods: Implementation of adaptive ALADIN bias-correction for temperature based on analog method, improved interpolation of observation correction taking into account anisotropy of topography, case studies on the benefit of ALADIN/INCA analyses of convective diagnostic parameters.

Priority: medium

Realization: local work

Risk evaluation: 1

Estimated efforts: 6 person x month

Contributors: T. Haiden (At), F. Wimmer (At)

Schedule: 1st half of year 2006

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 2006.

Topic	Estimated effort (person x month)	LACE support (person x month)
PBL cloudiness	2	
Prognostic cloud water	1.5	1
Parameterization schemes, diagnostic tools	12	1.75
Externalized surface	1	
Validation, case studies, sensitivity studies	17	0.25
Total	33.5	3

LACE support for stays:

Dunja Drvar - Ljubljana - 1+3 weeks - prognostic precipitation scheme

Martina Tudor - Prague - 4 weeks - ALARO-0 base-line version

Neva Pristov - Prague - 3 weeks – radiation

Christoph Wittmann – Toulouse – 1 week – Lopez scheme

One month stay is left as a reserve for the second half of the year for a subject yet to be defined.

LACE support to gathering in Brussels:

Neva Pristov -Brussels – 5 days

Jure Cedilnik – Brussels - plane ticket

Martina Tudor – Brussels – plane ticket