# LACE Working Group for Physics
# Research Topics and Targets and Questions for the year 2004

Thomas Haiden (1st draft)
(remarks from Dijana Klaric )

## Introduction

The document is oriented to the two aims: to propose the research and the development for 2004 of LACE working group for physics, and to list the opened questions related to research in ALADIN physics. The research in physics in the year 2004 will be focused to the project and topics already started in 2003. The work will be grouped in the five projects:

I. Shallow convection / PBL cloudiness
II. CAPE & deep convection triggering
III. Orographic drag/envelope
IV. Physics/dynamics interface
V. Prognostic cloud water

Further on, the proposed initialisation of the ALADIN 2 project, and the topics related to the test of AROME prototype (Meso-NH physics), might bring the new fields of interest, that will be implemented in the working plan of LACE Working Group for Physics.

## P1 Shallow convection / low cloudiness

**Questions to answer & some specific work steps**
**Shallow convection**

- Prognostic cloud water + vertical diffusion scheme may or may not be sufficient to model stratocumulus (tests in 1-d)
- Maybe even a diagnostic cloud water scheme would be sufficient?
- In what respect is circulation inside stratocumulus different from K-diffusion? (make theta_L, q_T simulations with ALADIN-C)
- Theoretical criterion for stratocumulus break-up proven to be necessary but not sufficient (why exactly?): revisit literature

**Stratus**

- Study Linz and Graz soundings (they are not assimilated) for recent stratus case
- Try to converge Xu-Randall and Seidl-Kann: tuning

- Problem of sounding obs rejection appears to be not as bad anymore, since vertical diffusion has been reduced in stable conditions, and Xu-Randall cloudiness is used in ARPEGE
- But: initial condition at in-between locations (Linz, Graz) are still too smooth and far from observed values
- Model apparently unable to create sharp inversions during forecast unless there is cloudiness
- Make experiments with allowing Ri to get larger than Ri_cr (i.e. set Ri_cr to very high value)
- Check to what extent smooth inversions are a result of limited vertical resolution
- What exactly happens at cloud top? Can (theta_L,q_T)-diffusion create realistic cooling at the cloud layer top?
- If we move from stratus to stratosumulus, how do we verify?
- If stratocumulus CAN be described by K-diffusion, what about transition stratocumulus->cumulus? How do we model non-precipitating cumulus?
- Switch point cumulus/stratocumulus: buoyancy yes/no (LFC reached or not)
- Horizontal extent of clouds: grid-scale or subgrid-scale?
- In the model: as soon as stratus cover < 1, subgrid cloudiness scheme sets in

**Proposed actions:**
Convergence between Xu-Randall and Seidl-Kann schemes (tuning in 3-d)

**Means:** 1 person x month
**Contributors:** Alexander Kann

**Proposed actions:**
Experiments on inversion formation and sustenance (3-d cycling experiments)

**Means:** 3 person x months
**Contributors:** Alexander Kann
Laszlo Kullmann
Gergely Boloni

**Proposed actions:**
Requirements for vertical diffusion and vertical resolution to simulate formation of sharp inversions (1-d studies)

**Means:** 2 person x months
**Contributors:** Thomas Haiden

**Proposed actions:**
Analysis of radiative flux divergence and cooling rates in cloud layer (1-d)

**Means:** 1 person x month
**Contributors:** Helga Toth

**Total means per project:** 7 person x months
**Calendar:**

## P2 Deep convection

**Questions to answer & some specific work steps**

**Deep convection**

- Enter grey zone (more comparison experiments on 7 km and 4 km). Maybe the grey zone is not as 'bad' as anticipated.
- Focus on triggering and development stage of deep convection
- Triggering: if entrainment for shallow cu is increased, what happens to resolve precipitation?
- Are non-precipitating cu possible in the model?
- Effect of envelope orography on deep convection: make tests
- Explicit deep convection experiments with NH 2.5-km ALADIN simulations (comparison with MM5?), also for Vienna hail case

**Proposed actions:**
Adopt latest version of Luc Gerard's prognostic scheme for further studies
**Means:** 3 person x months, (1 month in Brussels?)
**Contributors:** ? (1 month)
**Proposed actions:**
Effect of non-envelope (mean orography) on deep convection
**Means:** 1 person x month
**Contributors:** Franz Wimmer
**Proposed actions:**
Study initiation and development stage of deep convection using radar and satellite
**Means:** 3 person x months (2 months in Vienna)
**Contributors:** Franz Wimmer
Martin Bellus
**Total means per project:** 7 person x months
**Calendar:**

## P3 Orographic drag / envelope

**Questions to answer & some specific work steps**
**Orographic drag parametrization**

- JFG's 3 proposals: (a) new theoretical justification for tau_w ~ H at F>F_c, (b) new vertical partitioning of gwd deposition, (c) application of lift force to geostrophic wind
- Do beta testing of latest ACDRAG version

**Proposed actions:**
Experiments with, and validation of, newly revised scheme with non-envelope
**Means:** 1 person x month
**Contributors:** Franz Wimmer (1 month)
**Proposed actions:**
Validation of wind forecasts at high mountain stations (dx=10 km, 2.5 km)
**Means:** 1 person x month
**Contributors:** Klaus Stadlbacher (1 month)

**Total Means per project:** 2 person x months
**Calendar:**

## P4 Physics –dynamics interface

**Proposed actions:**
Further analysis of physics instabilities (possibly including meso-NH schemes)
**Means:** 2 person x months
**Contributors:** Martina Tudor (2 months)

**Total means per project:** 2 person x months
**Calendar:**

## P5 Prognostic cloud water

**Questions to answer & some specific work steps**
**Prognostic cloud water**

- Test advective effects in stratus cases
- Test effects of prognostic clw on orographic rainfall, smoothing effect expected
- How sensitive are rainfall amounts to not-so-well-known parameters in Kessler-type scheme, e.g. autoconversion rate?
- To what extent can the current precip patterns be re-created as a limiting case of the Lopez scheme with very large conversion rates?

**Proposed actions:**
Solve problem in current implementation of Lopez scheme
**Means:** 1 person x month
**Contributors:** Laszlo Kullmann (1 month)
**Proposed actions:**
Implement Lopez scheme in CY28
**Means:** 1 person x month
**Contributors:** Alexander Kann (1 month)
**Proposed actions:**
Sensitivity/tuning of Lopez scheme on orographic precipitation cases
**Means:** 2 person x months
**Contributors:** Christoph Wittmann (2 months)

**Total Means per project:** 4 person x months
**Calendar:**