

Bio diversity and sustainable development

In European NWP

ALADIN Consortium and development needs

- Some facts:
 - We are network and so development is organized as such:
 - We need good rules to be able to work together, to stay coherent while bringing new ideas in.
 - We must deliver high quality meteorological outputs with our means and so we need:
 - Sound and economic solutions: algorithmics;
 - Adaptation of our home applications to meet deliverables: modularity is a must;
 - “Grey zone” is a modeling slang, interaction of scales is continuous: a NWP system coping with this continuity is rather necessary and closer to reality than a “jump over” system.

Computational Economy (1/2)

- Radiative transfer – usually one of the most expensive computations of the model physics (in following we consider thermal part only).
 - A reference: RRTM scheme of ECMWF. Rather precise (140 spectral intervals), but expensive, intermittent call is obligatory.
 - ALARO concept: improve the existing ACRANEB scheme with new ideas, keep it cheap but with results approaching RRTM (is this possible with 1 spectral band only?)

Computational Economy (2/2)

DDH output:

Reference: current acra1

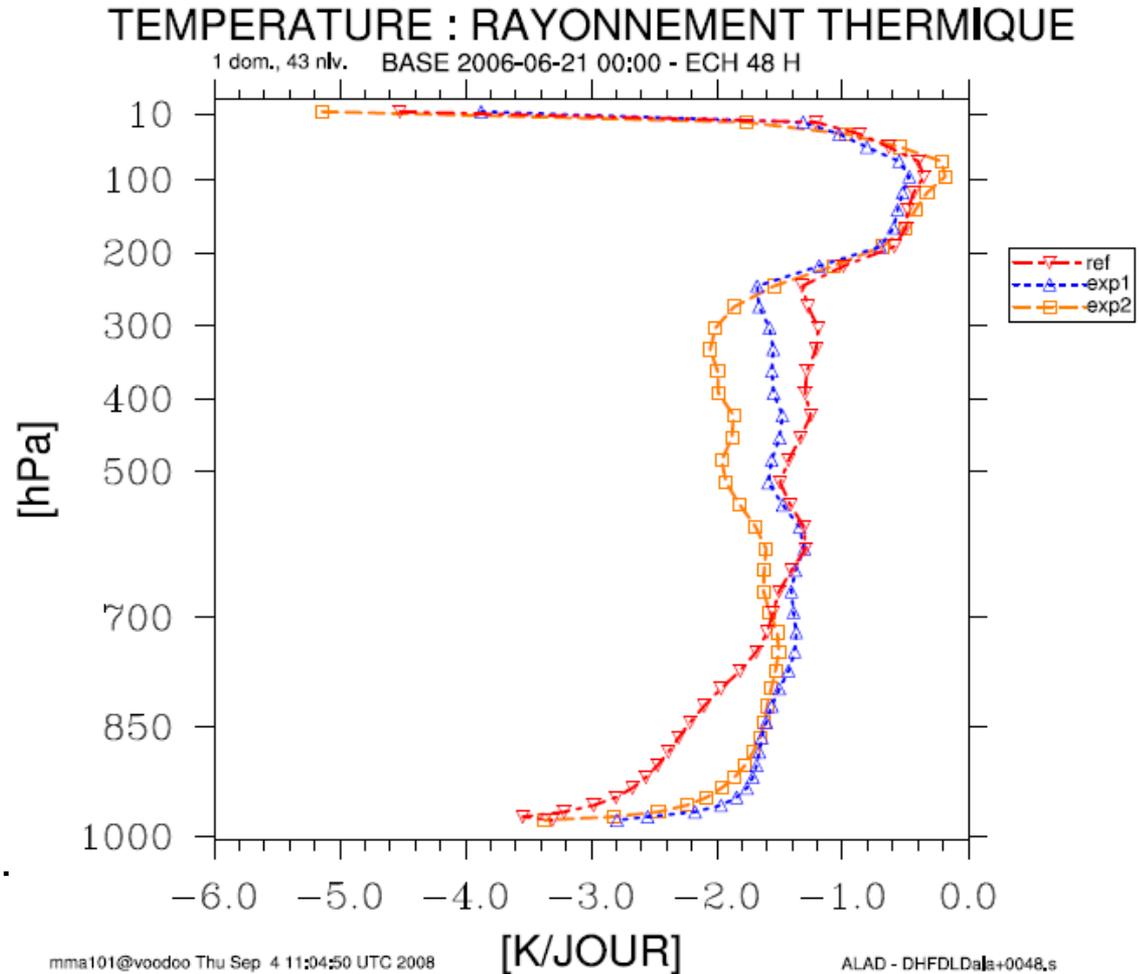
Exp 1: new acraneb

Exp 2: RRTM

People Involved:

G. Hello (tools), T. Kral
(new Malkmus-Pade fit,
correlation effect),

N. Pristov (NER statistics).



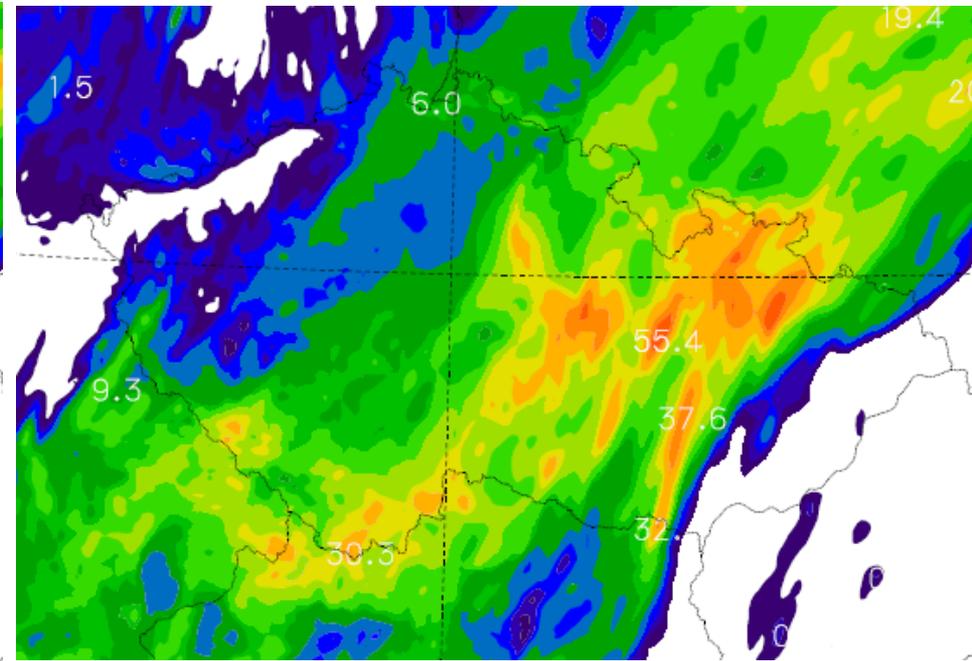
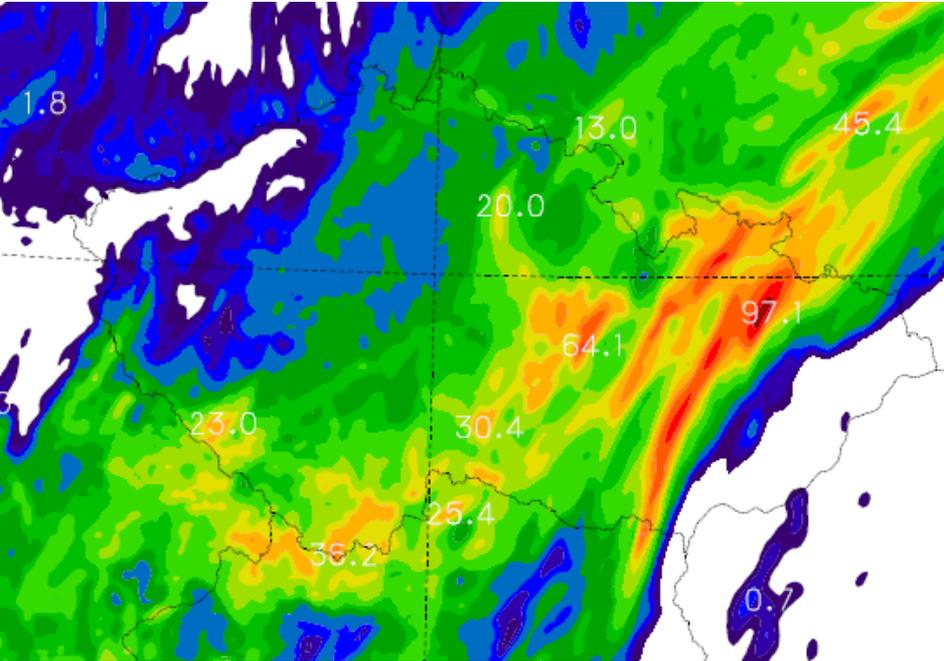
Importance of rules (1/2)

- Example of the consistent computation of energy cycle: pressure gradient term
 - Need to compute gradient of RT.
 - When the gradient of the R part does not also account for hydrometeors, this omission leads to positive feed backs inside important precipitating systems.

Importance of rules (2/2)

Grad (RT) with qv only; dx = 2.3km

Grad (RT) with all species



Associated questions:

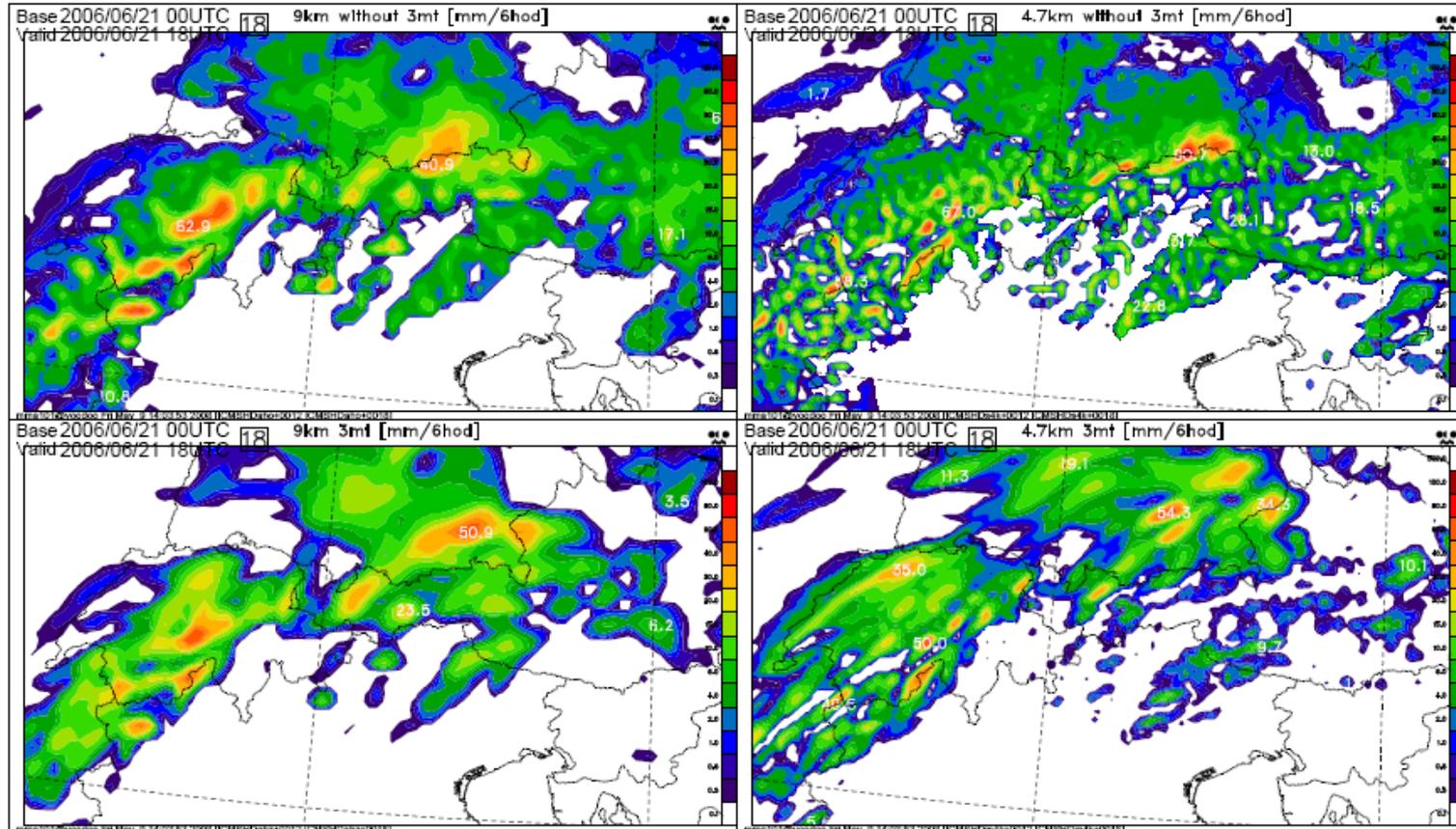
- Any other similar omission will likely cause similar feed-backs;
- Initialization: filtering RT is detrimental.

Contributors: S. Malardel & Y. Bouteloup (sensitivity),
R. Brožková & P. Smolíková (DFI problem)

Continuity of scales (1/4)

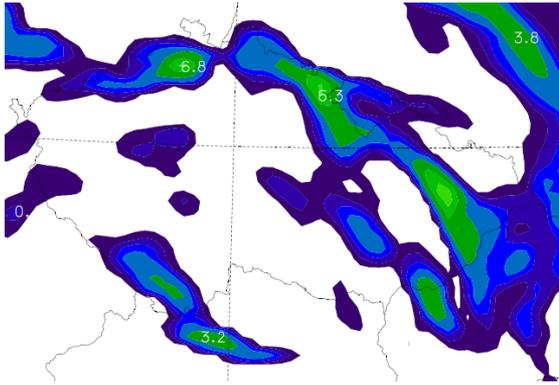
- So called “grey zone syndrome” happens when classical split between resolved and sub-grid scale precipitation processes does not work well. It happens at scales where the “sub-grid” notion is not well defined for any kind of precipitating convection.
- Modeling needs to be enhanced to capture this transition.
- ALARO concept - 3MT scheme for precipitating processes: adjustment and cascade, prognostic convection equations, geometry of sub-grid parts, time-step organization.

Continuity of scales (2/4)

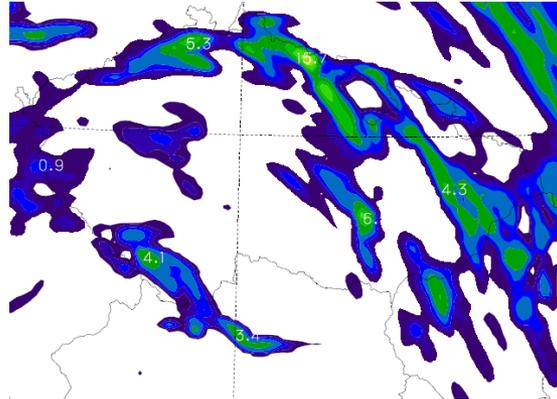


3MT gives consistent results.

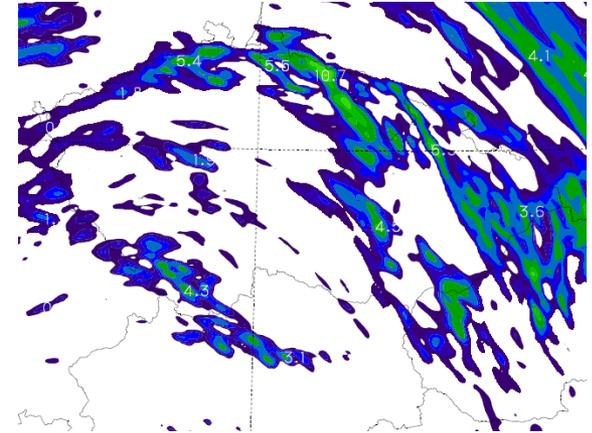
Continuity of scales (3/4)



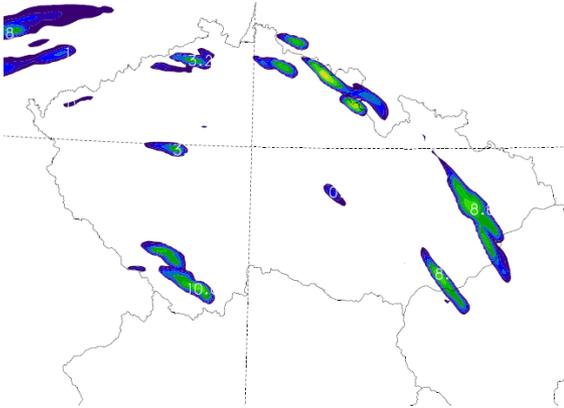
3MT 9km



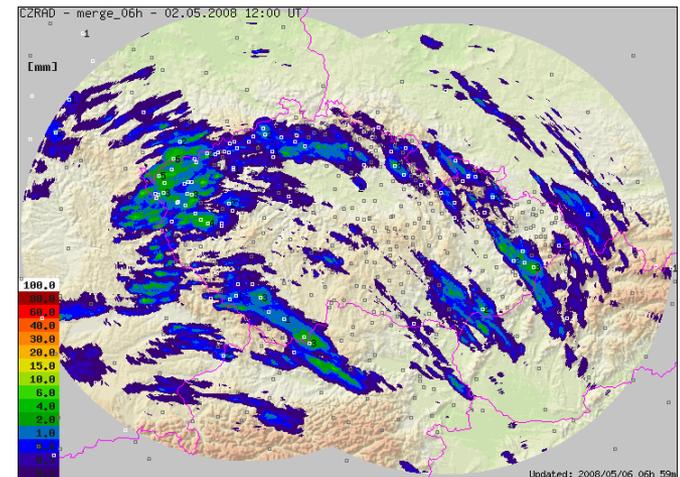
3MT 4.5km



3MT 2.3km

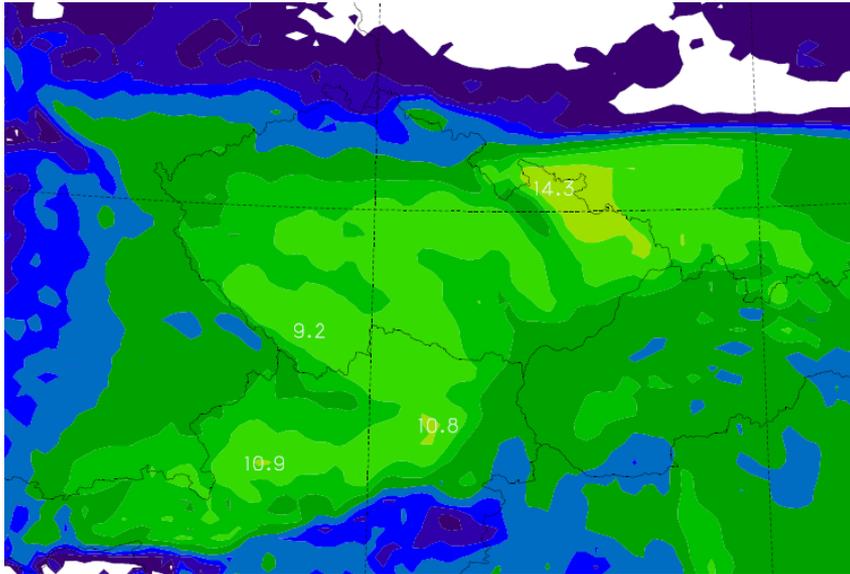


No deep convection 2.3km

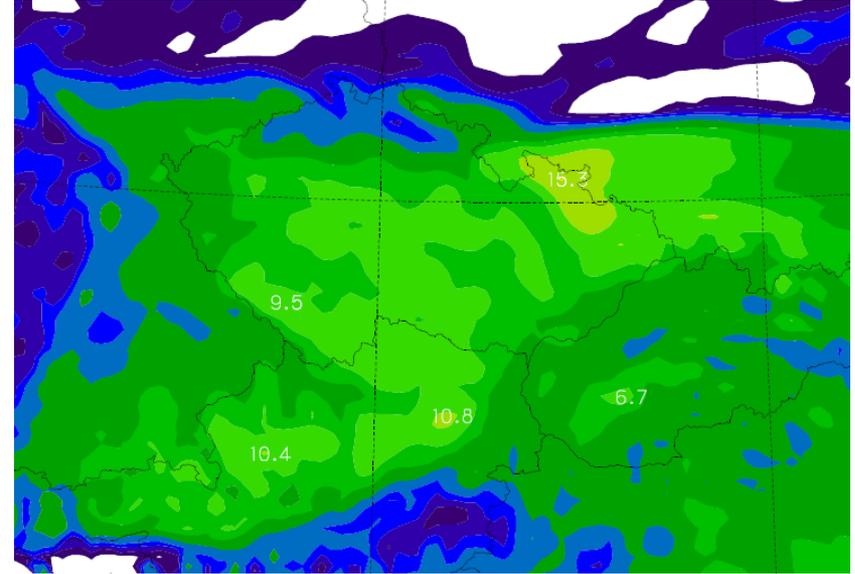


Observations: 6h sum

Continuity of scales (4/4)



ALARO without 3MT



ALARO with 3MT

Case of large frontal system without real convective activity.
Results with and without 3MT scheme are **robust**.

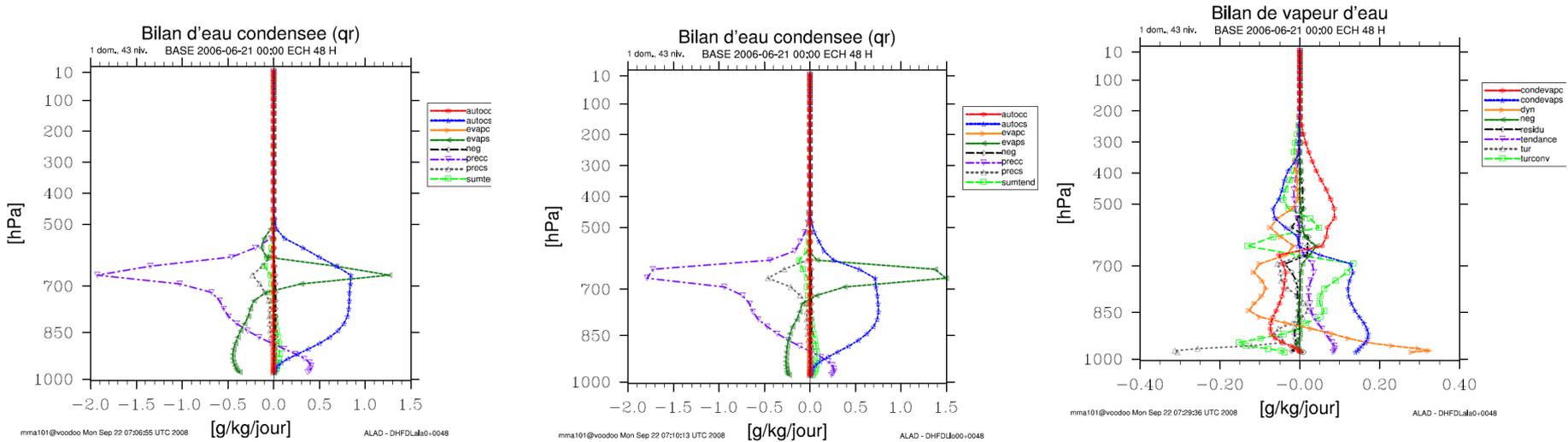
Contributors: L. Gerard (cascade, prognostic approach), J.-M. Piriou (split of micro-physics and transport), D. Banciu and R. Brožková (tunings, validations).

Modularity (1/2)

- Modularity is one of strong features of IFS.
- At the level of physics, ALARO concept is to have modularity at the level of processes.
- Very useful comparisons, “competition of ideas”, identification of weaknesses, various complexity (cost consideration), natural push toward cleaner codes.

Modularity (2/2)

Example: what about ARPEGE microphysics in 3MT: autoconversion, collection, evaporation and melting.



ALARO processes

ARPEGE processes

Difference of qv budget:
interesting feedback on
convective activity.

Contributors to microphysics: B. Catry, J.-F. Geleyn, R. Brožková

To conclude, example of extracts from a Strategy document of LACE (7 Partners): a good mirror of the needs

- Access to research results:
 - Keep focus by concentrating on **operations oriented research and development**, mainly via LACE Projects and Project deliverables.
 - Continue covering all basic aspects of NWP both at consortium level and at the level of NMSs.
- Use of research achievements in operations:
 - Continue to participate in the maintenance of the ALADIN software and tools
 - Ensure proper interaction with IFS for the purpose of portability and interoperability
 - Maintain **operational flexibility at NMS level** by introducing and maintaining a full NWP setup at every Member
 - Tailor operative choices **to the means and needs of each Member**
 - Monitor the performance of operational applications, and use this feedback in research and development
- Cost minimization:
 - Focus on **the algorithmic aspects reducing computational cost**
- Deterministic forecast:
 - Maintain to cover the CE and SEE domains for a 3 day range, with increasing spatial resolution, together with user dependent special applications
 - Make the ALADIN system **efficient and continuously adjustable for spatial resolutions down to 2 km**, using appropriate vertical resolutions
 - Keep both the hydrostatic primitive and the non-hydrostatic equation systems and **a rather complete set of physical parameterizations** available for operational use

Summing up, ALARO-0 was a rather cheap, transparent, purpose-oriented and upward compatible development

- Manpower cost: ~10 person x years for a nearly complete rewriting of a physical set, at 30% CPU cost overhead for an unchanged grid.
- We said (June-July 2005) what we would do and we did what had been said, with the expected rather satisfying result for the 'grey-zone'.
- The outcome fits the Partners' needs on several aspects (see above!).
- The mix of innovative features (M-T, prognostic convection, mass-flux from entrainment specification only, unique joint input to microphysics) and of ascending compatibility choices (p-TKE, cloudiness, radiation) worked well.
- However ...

However, the objective to ‘construct a bridge’ between ALADIN and AROME was preserved only theoretically (tools exist but no concrete means) and may now be at stake

- Calendars were not favourable.
- Risks might have appeared too high to our colleagues.
- Disagreements on issues of ‘modularity’, ‘methodology’ and ‘priorities’ blurred the scientific and technical exchanges.
- Before all, the respective scopes of ambition were diverging (multi-scale vs. single science-target).
- Are we (or maybe not) at a crossroads where the trends will either further diverge or start being reconciliated?
- *This is perhaps a way to consider the present ‘days’, but the relevant topics are very fragmented.*