

# Notes on Session 3: Performance aspects and model physics

During the session, 11 presentations were given, including

## **2 overviews on**

- Operational SURFEX in ALADIN (J-F Mahfouf)
- Status of ARPEGE/ALADIN physics (Eric Bazile)

## **1 case study on**

- Convection (Jan Barkmeijer)

## **3 validation studies on**

- Clouds forecasts (Kristian Pagh Nielsen)
- Wind gusts (Javier Calvo)
- 2m temperature (Evgeny Atlaskin)

## **5 reports on new developments on**

- Lateral mixing in shallow convection (Wim de Rooy)
- Common framework for turbulence parametrizations (J-F Geleyn)
- Clear sky LW radiation functions for ACRANEB (Tomas Kral)
- Slant column radiation parametrizations (Bent Hansen Sass)
- Calculation of diagnostic screen-level variables (Laszlo Kullmann)

**At least 3 posters on physics developments**

From p-TKE to e-TKE (Ivan Bastak Duran)

Stability-dependent roughness (Carl Fortelius)

Study on HIRLAM temperature problems (Laura Rontu)

**One presentation in the HIRLAM parallel session**

Deep convection in AROME and ALARO (Sander Tijm)

**NEXT: Suggestions for discussion and possible recommendations (in inverse order!)**

# Interpolation for the diagnostic variables (presentation by Laszlo Kullmann)

New formula was shown to improve interpolation of e.g. T\_2m by the commonly used Geleyn-88 formula to something close to that by prognostic CANOPY in stable cases

- Possible applications: model output variables, upper air and surface data assimilation that utilize screen-level variables
- **Recommendation:** try in different code environments, tune/finalize, use?

# Clear sky LW radiation functions for ACRANEB (presentation by Tomas Kral)

Extraction of RRTM transmission data, revision of the fitting procedure, adding correction terms for the computation of optical depths for composite gases (no 2<sup>nd</sup> order terms needed).

All this helps to partially solve the problem of cooling rates due to LW radiation in ACRANEB.

**Recommendation:** Use the new developments?

Interactions with other parameterizations should be taken into account during the tuning process

## Slant column radiation parametrizations (presentation by Bent Hansen Sass)

- Idealized calculations show that cloud shadows might significantly influence the downwelling SW and LW surface fluxes far from the column where the present physical parametrizations treat them
- The effect could be handled making radiation calculations in a time-dependent slant column
- **Recommendation:** Make sensitivity study to see if the local effect is indeed significant in a 3D simulation with high temporal and spatial resolution. If yes, develop the formulation further, taking into account also the technical issues related to parallelization?

# Common framework for turbulence parametrizations (presentation by J-F Geleyn, poster by Ivan Bastak Duran)

It was shown that it is possible to derive a common framework for atmosphere and surface layer turbulence parametrizations, combining ideas of the TKE-parametrizations, the TKE+TPE approach by Zilitinkevich et al. and application of QNSE-based formulae.

**Recommendation:** give quite high priority for development and testing the unified approach in the various models in the HARMONIE framework ?

## Lateral mixing in shallow convection (presentation by Wim de Rooy)

- Derivation of entrainment-detrainment formulations from first principles was presented, with possible practical application in parametrizations and their evaluation. Reference: de Rooy and Siebesma, MWR 2008
- **Recommendation:** check similarity/potentials with/for 3MT ; develop the ideas further for the shallow convection and turbulence parametrizations among the models within the HARMONIE framework?
- **Additional forum for discussions: Workshop on moist processes, Norrkoping 15-18 June 2009!**



## **Verification of screen-level temperature forecasts in cold, stable northern cases (presentation by Evgeny Atlaskin)**

- standard scores against synop observations, special observations of Sodankylä and Helsinki testbed were presented
- All models underestimate the coldest temperatures
- **There was no time for discussion on Wednesday: Do you have some comments now?**

## **Verification of wind (gust) forecasts (presentation by Javier Calvo)**

- Extensive verification statistics of mean wind and gusts by HIRLAM over Spain: strong winds underestimated, weak winds overestimated. Different methods (3 empirical and 1 conceptual) to calculate (postprocess) the gust
- **Further suggestions?**

## **Validation of cloud forecasts against new satellite data (presentation by Kristian Nielsen)**

- Equations/theory of radiative transfer; presentation of satellite data and model data used in comparison. Parameters: (2D) cloud cover, 3D cloud condensate, effective radius, optical thickness
- Possible problems: snow cover, optically very thick cloud
- Comments made: validation of radiation fluxes by satellite (LW, SW)? **Further suggestions?**

# **Operational SURFEX in ALADIN (presentation by Francois Bouysse, given by J-F Mahfouf)**

Comparison of ALADIN with and without SURFEX has shown improvements and revealed needs for further development. In the presentation, some remaining issues were listed:

to understand: negative 10m wind bias has increased

to improve: frozen soil handling, extend validation to more options, soil surface OI validation, optimization tasks

**What remains to be done before it becomes operational ?**

# **ARPEGE/ALADIN physics (presentation by Eric Bazile)**

Recent modifications were listed, commented, validated globally and in ALADIN-France domain. Improvements in rainfall scores and fog were shown.

Perspectives: high resolution ARPEGE (T798), 8 km ALADIN, more layers; SURFEX implementation, corrections in shallow convection

Comments presented: ECUME evaporation adjustment?

## Experience with a strong outflow case in HARMONIE (presentation by Jan Barkmeijer)

- Convective case with precipitation, studied with different versions of HARMONIE with AROME physics, resolutions, options: of horizontal diffusion, evaporation, Eulerian/semi-Lagrangian, Mostly realistic precipitation, unrealistically strong outflow, large differences between experiments.
- Comments, suggestions made: Separation of cloudy/precipitating hydrometeors in case they are advected. Influence of lateral boundary definitions?
- **Problem of case studies:** possible combinations of different options approach to infinity; firm conclusions difficult ? **How to handle the problem?**

# Deep convection study at high resolution with AROME and ALARO (presentation by Sander Tijm and Lisa Bengtson)

- Generally there is too much precipitation (related to too much evaporation?)
- There is no convergence between the cases with and without 3MT when going to higher resolution (from 2.5 km, over 1 km to 500 m). Is the 'grey zone' larger than traditionally assumed ?
- Is there a unexpected interplay between physics and dynamics ?