Regional Cooperation for
Limited Area Modeling in Central Europe

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ALADIN

ALARO-1 an overview

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DHMZ SHMU OMSZ ZAMG ROMANIA ANM

Outline

- Main developments
  - Turbulence scheme TOUCANS

    Ivan Bastak Duran, Filip Vana, Jean-Francois Geleyn
  - Radiation

    Jan Masek, Radmila Brozkova
  - Convection

    Luc Gerard, Doina Banciu
- News
  - ALARO-1 Working Days
  - ALARO-0 baseline version
- Plans

Main features:

- prognostic TKE system: advection, diffusion, buoyancy/shear production and dissipation
- emulation of different TKE schemes: QNSE, CCH02, EFB (quasi-coded), ..(via various stability functions)
- TKE and 'moist stability' dependent mixing lengths
- Shallow Convection Parametrisation (SCP) through modification of Richardson number (Ri)
- influence of moisture and phase changes on intensity of turbulence
- liquid water and ice ($q_{l/i}$) vertical turb.diffusion
- Third Order Moments parametrisation (following Canuto et al. (2007)) for heat and moisture

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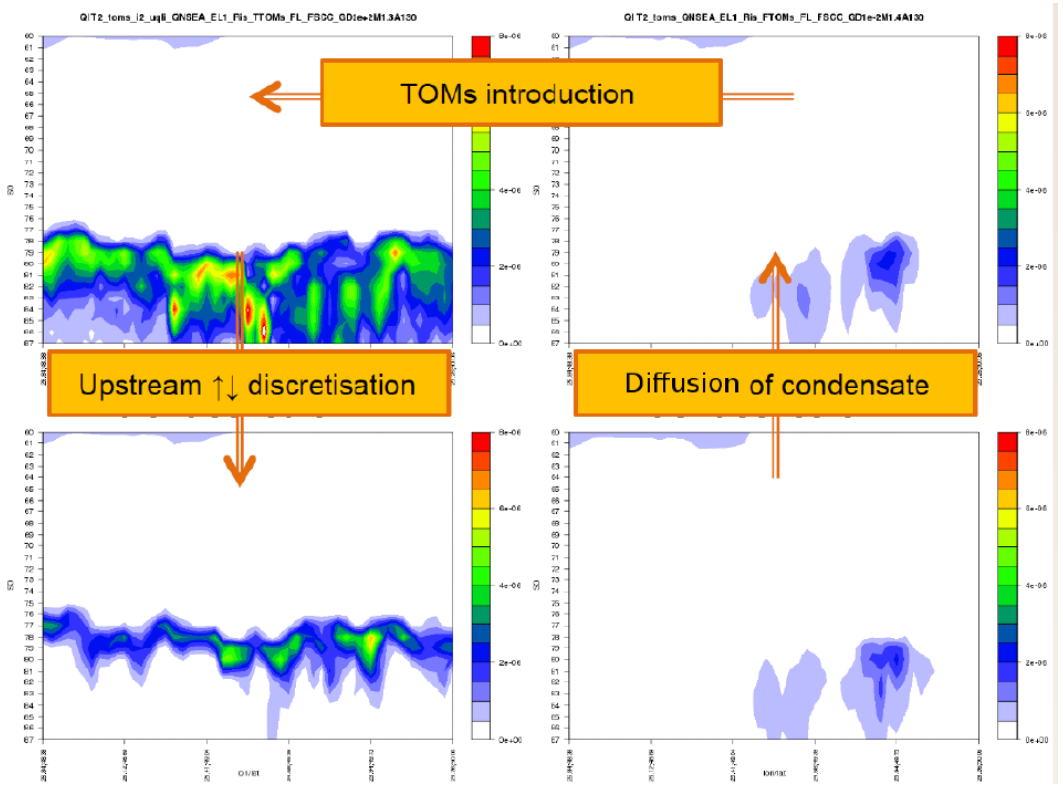
ice condesates vertical cross-section



accumulation of condensates in the region of (shallow convection) cloudiness

Ongoing:

- Testing and code debugging, tuning various options
- Searching for an optimal set-up for operational use
- Preparations for treatment of
  - prognostic turbulent total energy (TTE)
  - prognostic handling of mixing length
  - shallow convection cloudiness (SCC) using Tompkins approach with prognostic skewness and saturation deficit

ACRANEB2

- Gaseous transmissions fitted against SPLIDACO reference (H2O e-type continuum taken from MT_CKD model)
- Transmission part completely rewritten
- NER part unchanged thanks to suitably redefined inputs
- Intermittency introduced for transmissions in thermal, interactions with cloudiness are computed at every time-step
- Changes in statistical model are still expected

Radiation

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Problems solved in last months:

- Consistent spectral averaging in NER: double temperature dependency of broadband thermal transmissions (fundamental)
- Accuracy of individual gaseous fits
- Parametrization of non-random gaseous overlaps
  H2O e-type continuum is included into H2O transmission
- Broadband Voigt treatment (dominant above 70km)

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Error introduced assuming $T_e = T$

mid-latitude summer case, H_2O only (excluding e-type continuum)

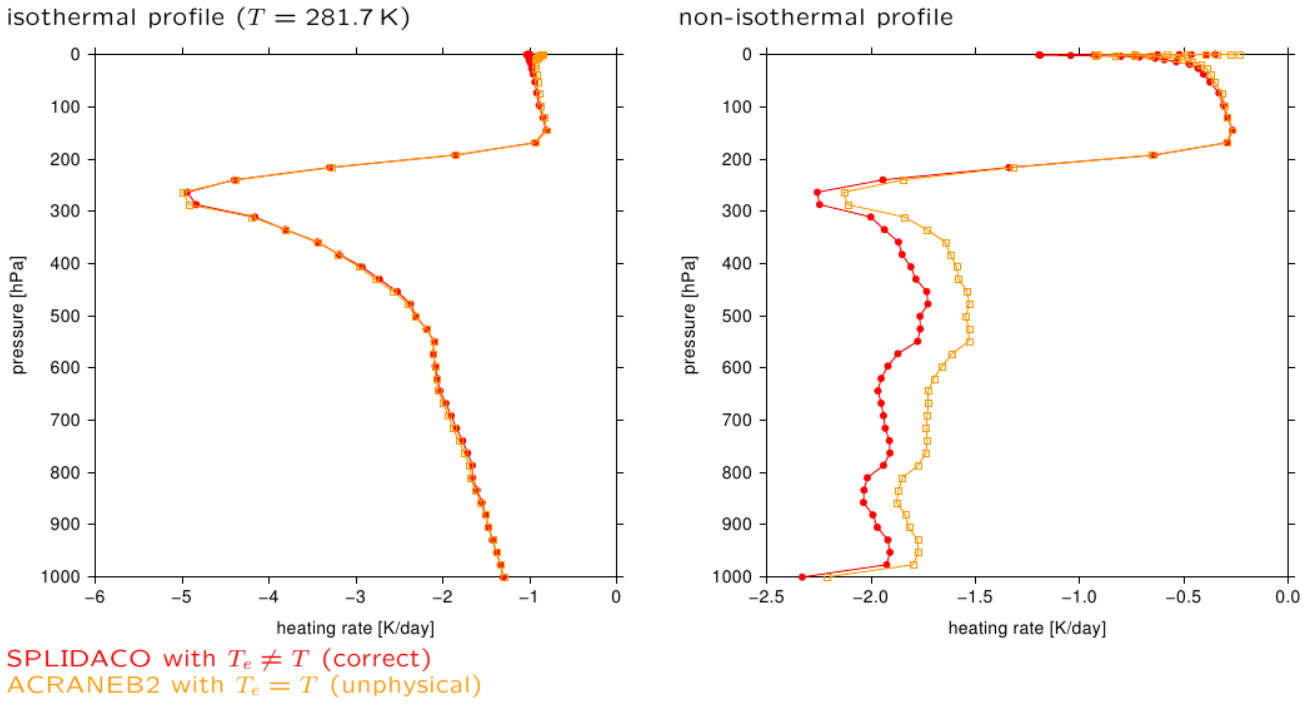

illustration of the problem

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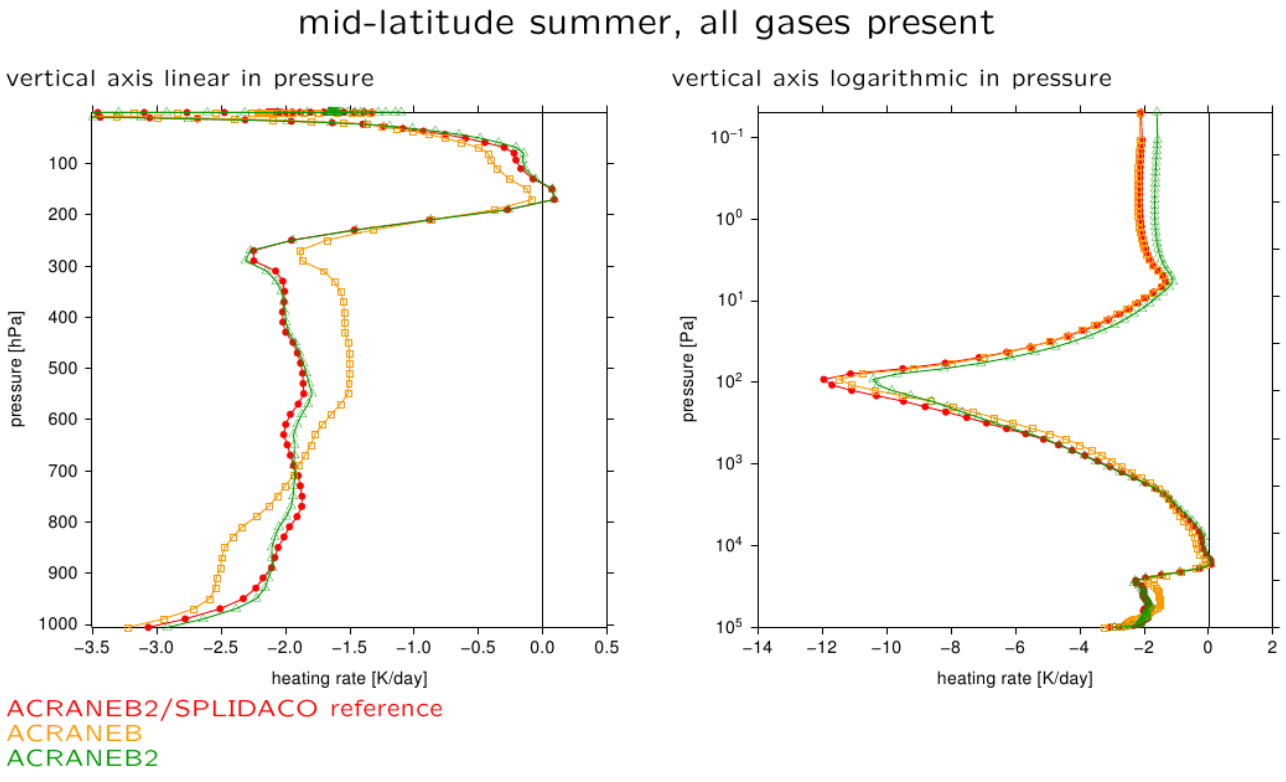
Comparison with old ACRANEB – thermal band



sufficient accuracy in clearsky case:

heating rates are within $\sim$0.1 K/day from SPLIDACO narrowband reference

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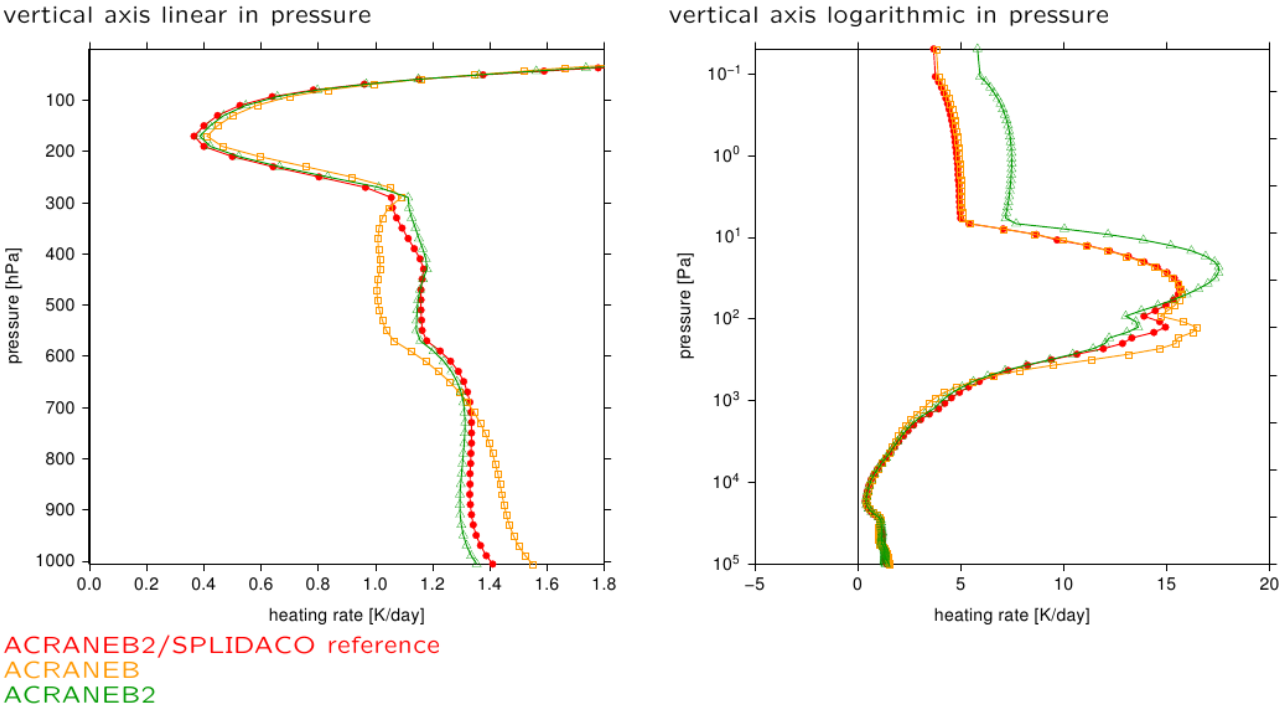
Comparison with old ACRANEB – solar band

mid-latitude summer, all gases present



Radiation

ACRANEB2 remaining issues:

- Put ACRANEB2 code into 3D model, perform basic validation, evaluate and possibly optimize CPU cost
- Retuning of statistical model, incorporating dependency on vertical resolution
- Validation in 3D model, comparison with RRTM, testing thermal intermittency
- Baseline version should be delivered in June

Convection

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CSD (complementary subgrid draft)

Deep convection parametrisation with a set of high resolution-specific features:
all the 3MT features plus (mainly)

- Perturbation approach to compute subgrid contibution to updraft
- Specific mixed closure (CAPE+MoCon), allowing mesh fractions up to 1
- Specific triggering (for complementary behaviour across resolutions)
- Gradually rising cloud top (cloud evolution over several time-steps)
- Perturbation approach also applied in unsaturated down-draft parametrization.

Multi-resolution behaviour

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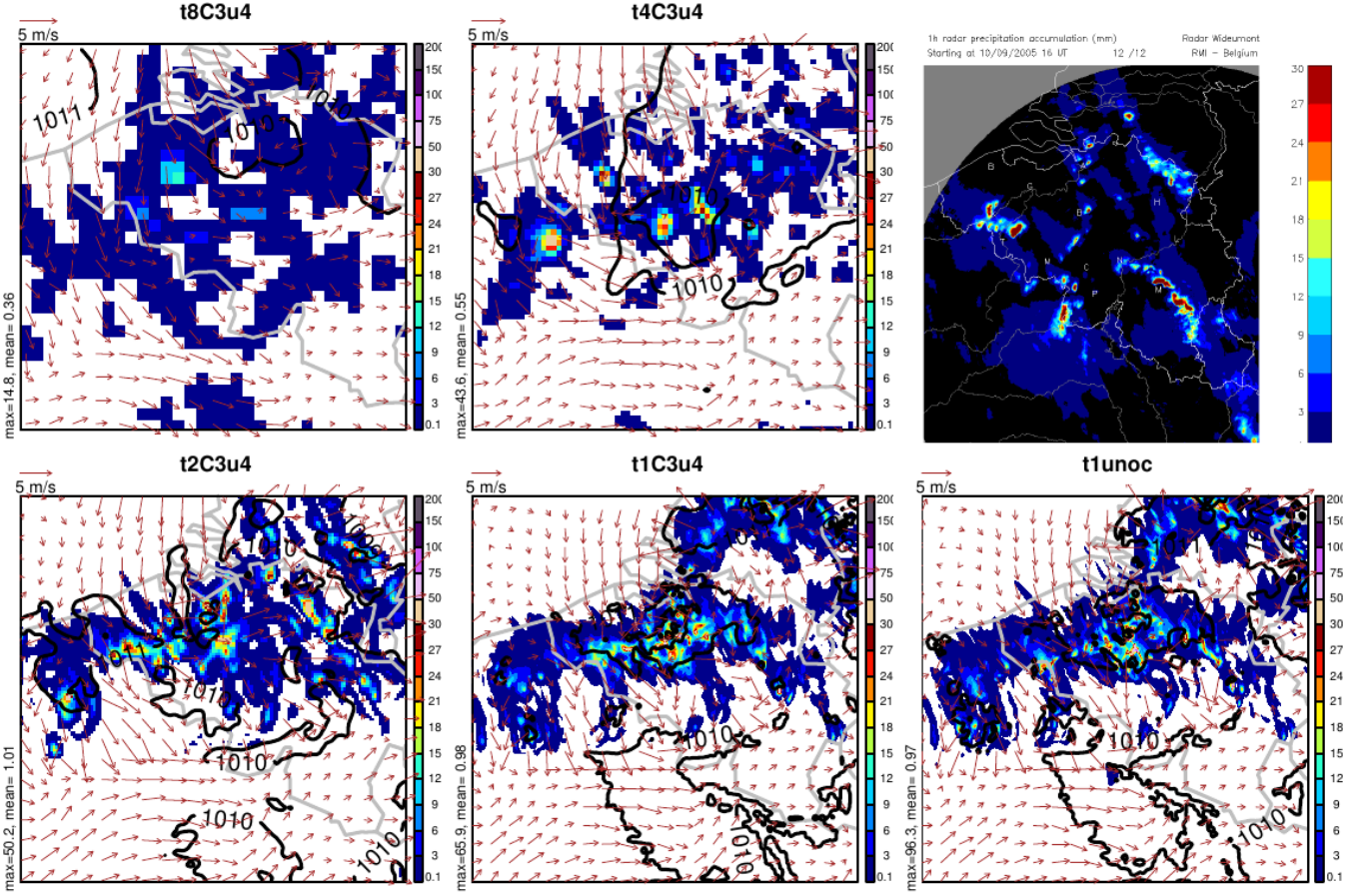
BB case, total precipitation at 8 km, 4 km, 2 km, 1km



Multi-resolution behaviour

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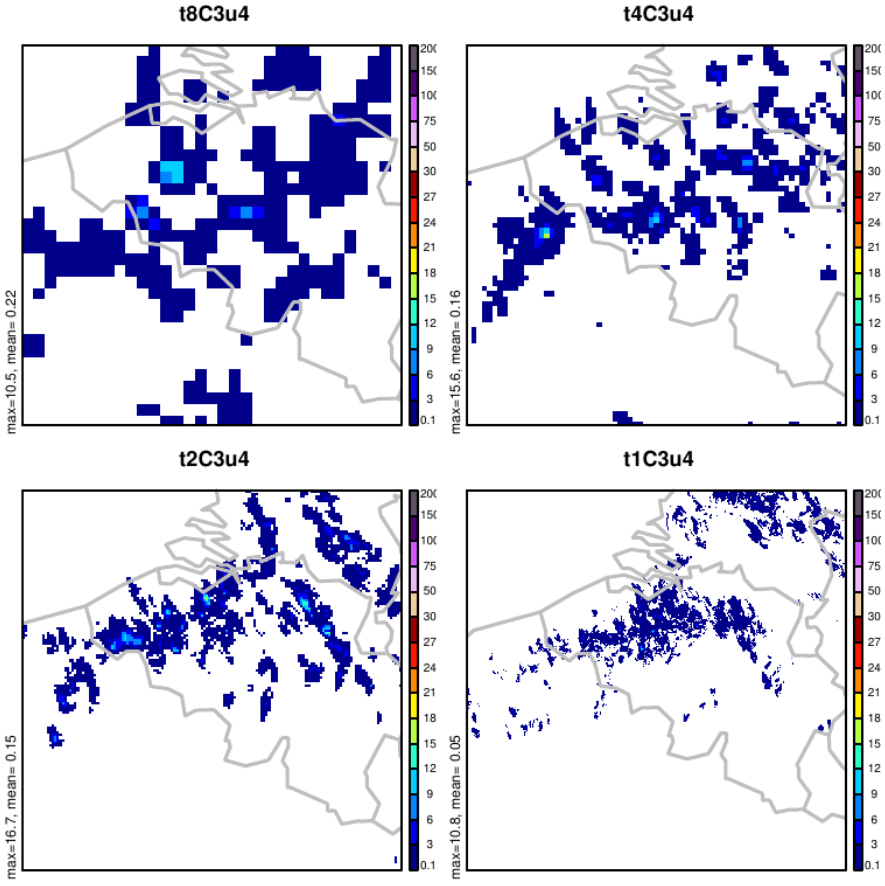
BB case, sub-grid precipitation at 8, 4, 2, 1km



Multi-resolution behaviour

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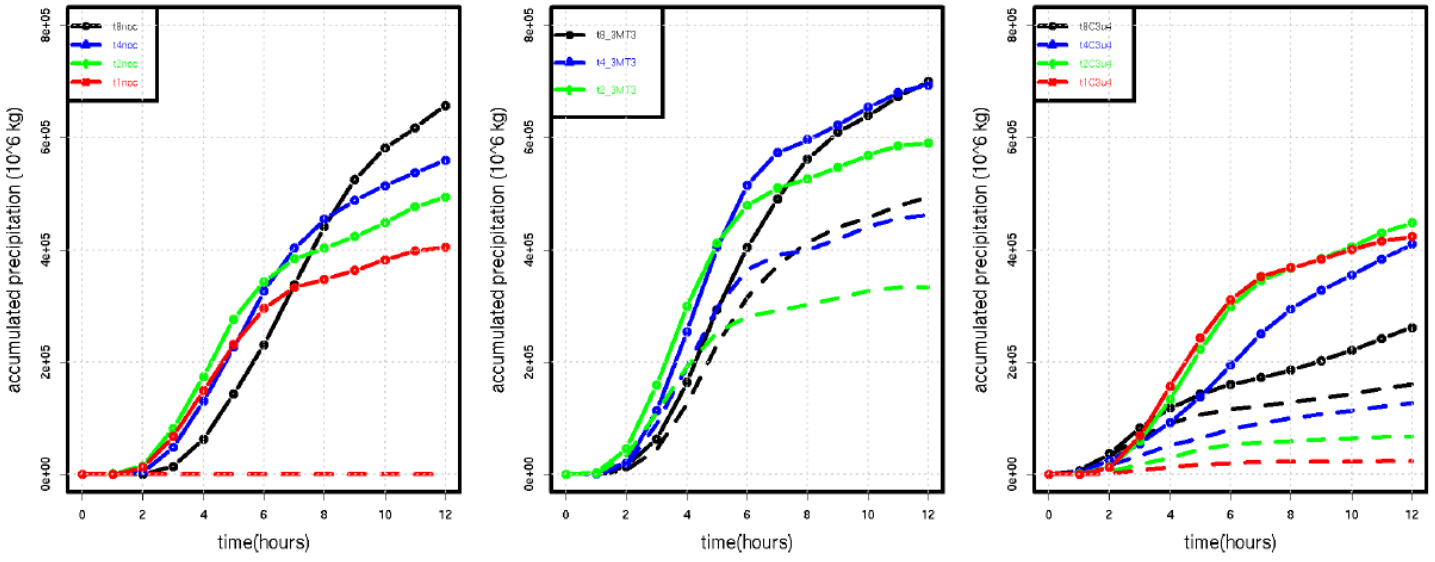
Total precipitation accumulation in time



NoCP 3MT CSD

8km, 4km, 2km,1km, total (solid) vs subgrid (dash)

The extinction of the subgrid part is well apparent for the CSD

ALARO-1 developments code status

- TOUCANS implemented into main ALADIN library cy36, cy38, cy39
- ACRANEB2 external tool
- CSD implemented into local cy36 version (Brussels, Prague)

Event

ALARO-1 Working Days, Ljubljana, 13-15 June 2012

- www.rclace.eu/?page=136
- participants, 13 countries, ALADIN, LACE, HIRLAM
- status overview, plan

ALARO-0

A baseline of the ALARO-0 version is available

- all recent improvements are included
- a reference
- base for new developments implementation
- recommended for the operational use at > 4 km resolution
- can be used also at 2 km resolution

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A baseline of the ALARO-0 version improvements mostly in moist part

- Sedimentation of cloud water and ice
- Protection of convective condensation below diagnosed LCL
- Corrections in downdraft and updraft computations
- Retuning in cloudiness, convection and sedimentation computations
- Mixed type of closure instead of pure moisture convergence one in 3MT
- Adaptive detrainment is made dependent on total evaporation (precipitation) at previous time-step
- Entrainment rate is made dependent on rel. humidity of environment at previous time-step

ALARO-1 Outlook and plans

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ALARO-1 ($<$ 10 km, down to 1 km)

assembling strategy in 2 steps:

- step 1: radiation, TOUCANS, unsaturated downdraft
- step 2: CSD, TOUCANS evolution, prognostic graupel, thermodynamic adjustment,
  unified cloud treatment in radiation, shallow convection, thermodynamic adjustment and 3MT

ALARO-1 Outlook and plans

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- validation
  - investment in testbeds and facilities
  - validation of developments (2 steps)
  - tests at higher resolution (scales around 2 km mesh-size)
- development
  - cloud scheme, 3D extension of turbulence, microphysics
  - stochastic physics (CA) and Rash Kristjansen condensation scheme with 3MT and TOUCANS
  - an interface with SURFEX: coupling of SURFEX with TOUCANS
- regarding code design
  - tests of physics-dynamics interface
  - revisit of APLPAR aimed at big blocks such as radiation, turbulence, microphysics.

Thank you.

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