New priority project ‚Comparison of the dynamical cores of ICON and COSMO' (CDIC)

COSMO General Meeting
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Task 1: Good performance on a standard set of idealized test cases

e.g. Mountain flow tests, Linear Gravity waves, Warm bubble, …

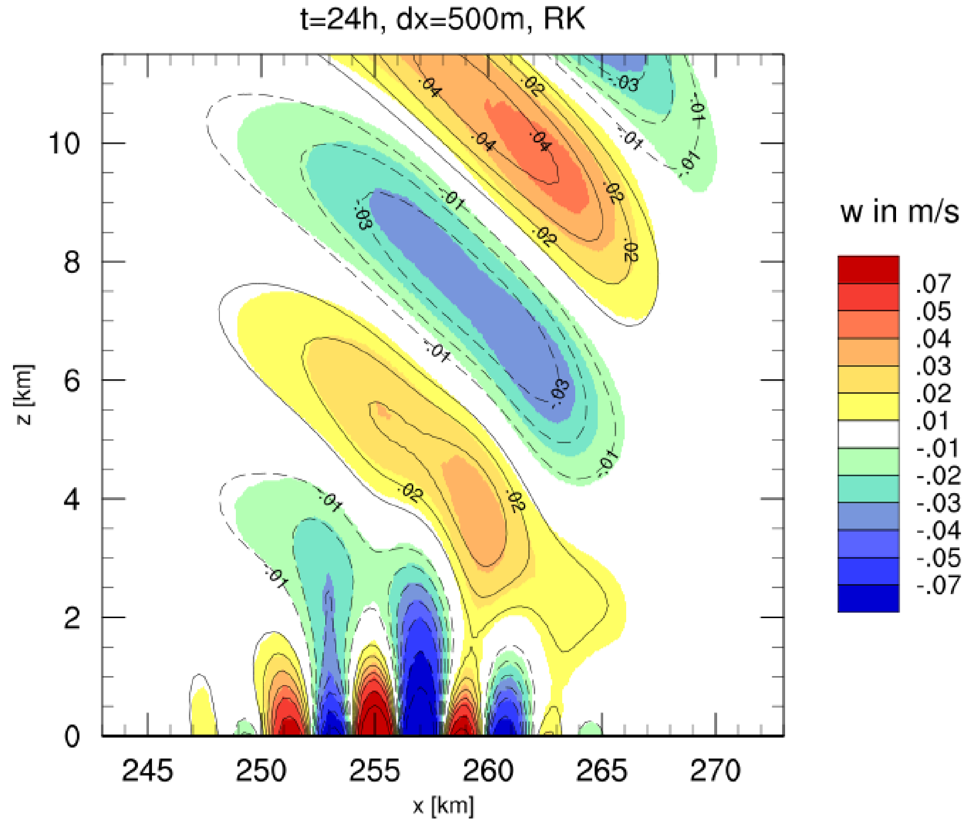
Requirements:
satisfying simulation of all defined tests.
Comparison with published results (for some of these tests even exact analytic solutions are available).
Some limits can be deduced, too,
e.g. maximum achievable steepness in mountain flow tests.
Possibly some test setups must be implemented first in ICON.

Deliverables:
a report (preferably a COSMO newsletter article) about the outcome of these tests.

Ressources:
DWD 0.2 FTE (Baldauf, DWD), 0.3 FTE (Barbu, ROM), 0.2 FTE (NN)

Test of the dynamical core: flow over mountains

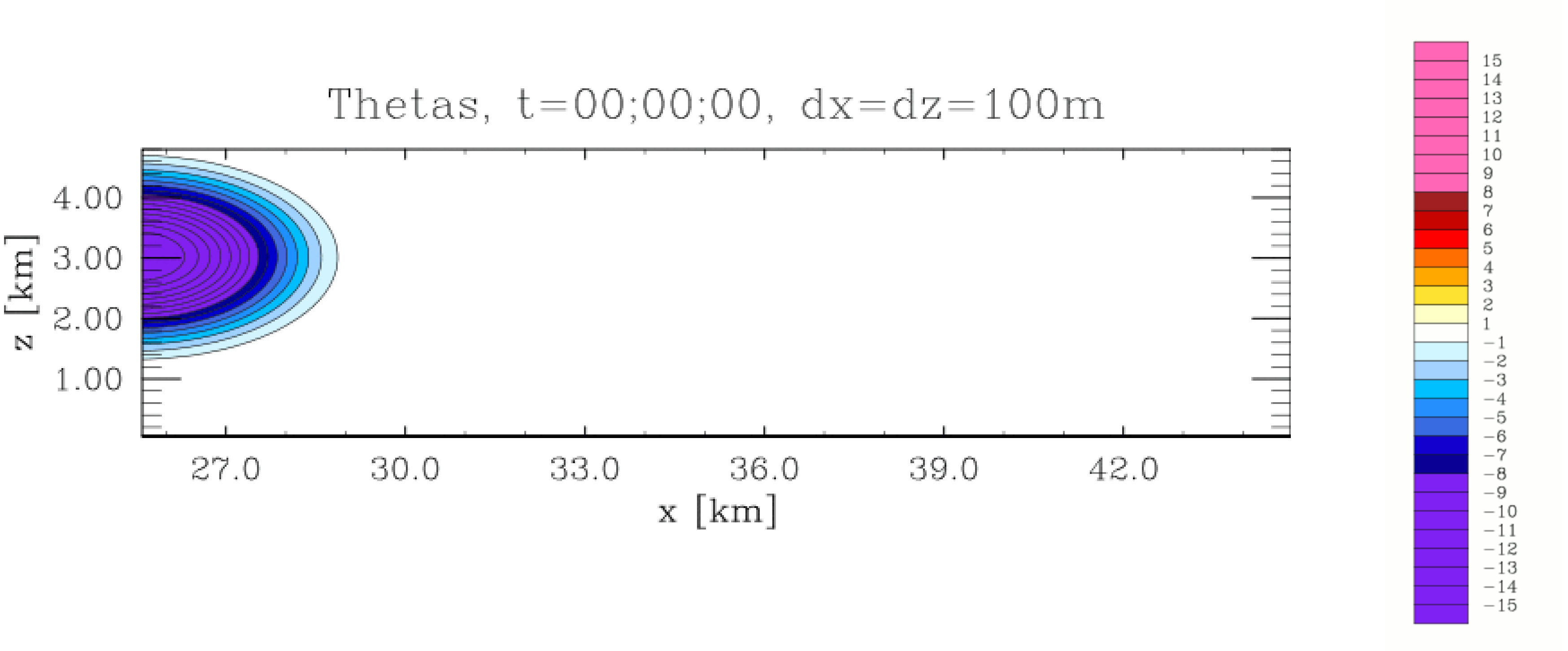
series of hills,
inflow velocitiy U_0=10 m/s,
stratification N=0.01 1/s,
Δx=500 m
(Schär et al. (2002) MWR)



shaded: RK scheme
contours: analytic solution
(*Baldauf (2008) COSMO-Newsl.*)

Test of the dynamical core: density current (Straka et al., 1993)

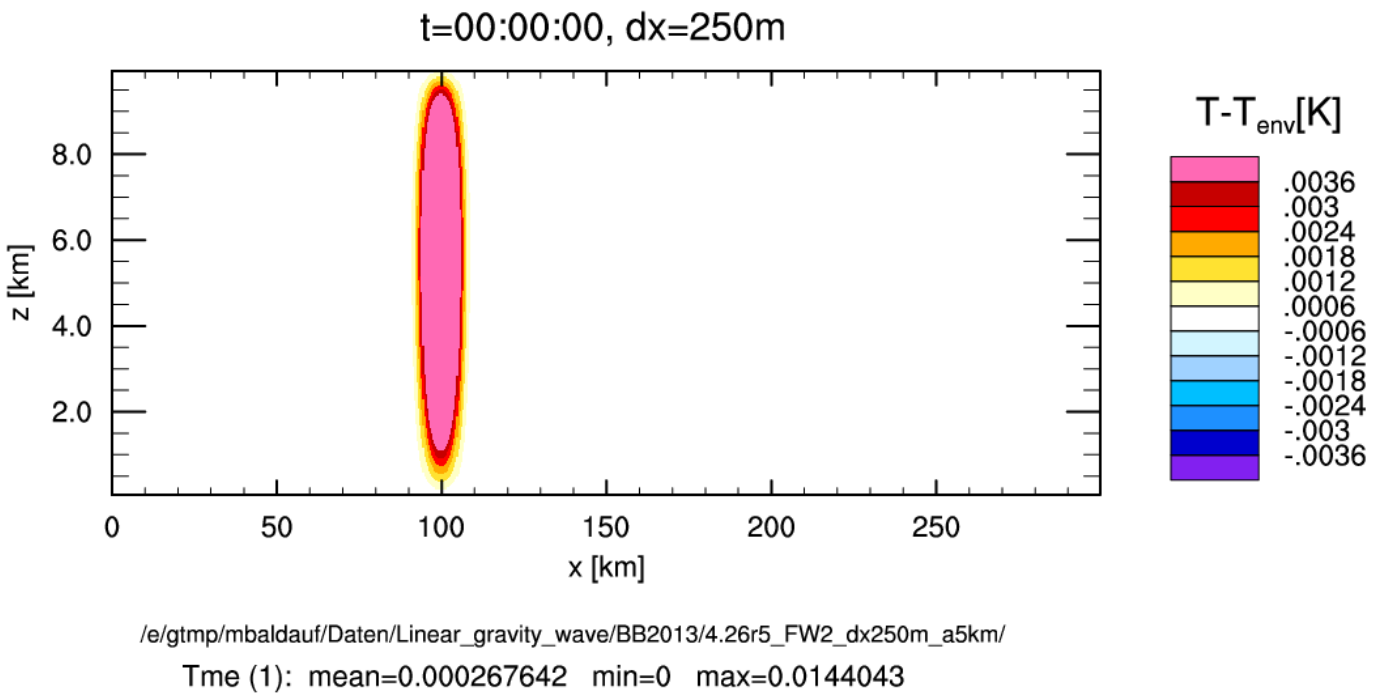
θ' (in K)



Test of the dynamical core: Linear, unsteady gravity wave

Skamarock, Klemp (1994) MWR

Baldauf, Brdar (2013) QJRMS



Task 2: Ability to handle real-/semi-idealised cases reasonably well

Simulation of real orography and more or less real inflow conditions without any physical parameterizations stably at least for a limited time and without showing any serious drawbacks.

Requirements:
perform tests with a few proposed test cases: a few selected areas (Alps, Sochi area), resolutions 7 km …1 km … 0.5 km, inflow conditions (e.g. a winterly strong wind inflow).
→ comparison of the computation time
→ inspection of the meteorological fields
→ further diagnostics, e.g. kinetic energy spectra.

Deliverables:
a report (preferably a COSMO newsletter article) about the outcome of these tests.

Ressources:

0.2 FTE (deMorsier), 0.1 FTE (Baldauf), ~0.4 FTE (Dumitrache, Barbu), ~0.4 FTE (Shatunova, Blinov)

Task 3: Scalability/Performance suitable for operations as well as for future supercomputing platforms

Both the currently used supercomputing platforms and also near future architectures should be supported → massively parallel machines (IBM, Cray, with several 1000, 10000 … processors).
(no vector machines, use of GPUs depends on progress in ICON openACC impl.)

Requirements:
approximately linear scalability (strong scaling) for at least 2 different machines (IBM/Cray/…) for one realistic model setup (← task 2).

Deliverables:
a report at the COSMO GM is sufficient.

Ressources:
0.1 FTE (Prill), 0.1 FTE (deMorsier)

Task 4: Identification of differences in dynamical core formulations and their assessment

Assess differences in

- time integration scheme (HE-VI/time-split versus HE-VI/non-split versus semi-implicit) → results in different computing time and different needs of damping mechanisms (e.g. divergence damping)
- grid structure (quadrilateral versus triangular elements). → differences between the advection 5th order versus 3rd order could be visible.

Assess if ICON is able to overcome current shortcomings of the COSMO model (steep terrain, Conservation) and its ability for future model requirements.

Requirements:
literature study (model documentations); code inspection, consideration of the results of tasks 1-3. The differences should be summarized and assessed

Deliverables: a report at the COSMO GM (or a COSMO newsletter article)

Ressources: 0.2 FTE (Baldauf), 0.1 FTE (Zängl)

Task 5: Suitability of ICON dynamical core for other applications than NWP (climate, chemistry, ...) compared to the COSMO model

It should be efficient for longer time runs (climate) and also well balanced for coarse resolutions. There should not occur any drifts in the model;
A restart of runs should be possible.

Requirements:
literature study. Estimations about run time needs in a climate mode.
A test in a climate mode to recognize possible drifts.
Climate runs should be reproducible on different platforms in a statistical sense.

Deliverables:
a report at the COSMO GM

Ressources:
0.5 FTE (NN) from CLM community?

Task	Contributing scientist(s)	FTEs 2016	FTEs 2017	Start	Deliverables	Date of delivery	Preceding tasks
L	M. Baldauf (DWD)	0.1	0.1	09/15		09/17	-
1	M. Baldauf (DWD) C. Barbu (NMA)	0.2 0.3		09/15	implementation of test cases is available in ICON vXX	09/16	-
	N.N., M. Baldauf (DWD)		0.2		report (possibly COSMO NL)	03/17	
2	M. Baldauf (DWD) G. deMorsier (MeteoCH) R. Dumitrache, C. Barbu (NMA) M. Shatunova, D. Blinov (RHMC)		0.1 0.2 ~0.4 ~0.4	03/16	report (possibly COSMO NL)	09/17	-
3	F. Prill (DWD)	0.1		09/15	oral report at COSMO GM	09/16	-
	G. deMorsier (MeteoCH)		0.1	09/16	oral report at COSMO GM	09/17	-
4	G. Zängl, M. Baldauf (DWD)	0.3		09/15	oral report at COSMO GM	09/16	-
5	N.N. (CLM-community?)		0.5	03/16	oral report at COSMO GM	09/17	-

3.0 FTE in total (1.0 in 2016, 2.0 in 2017)
2.3 FTE are assured (1.0 in 2016, 1.3 in 2017)
0.7 FTE are open (in 2017)

The estimation of FTEs assumes that the coworkers have a solid skill in working with the ICON code!