

SCA Reports for the COSMO-Model and INT2LM

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Source Code Administrators

Contents

- COSMO Versions implemented since September 2020
- INT2LM Versions implemented since September 2020
- COSMO 6.0
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COSMO Versions Implemented since September 2020

Version	Date	Contents (Highlights)	Results Changes
5.08	23.10.20	<ul style="list-style-type: none"> • Changes in Data Assimilation • Re-Unification with CLM / crCLIM • Implementation of EULAG • Changes in SPPT • Remove the coarse radiation grid • Modified Hailcast variable names • Update of cpp-dycore to GRIDTOOLS 2.0 • Update of OpenACC implementation to PGI compiler 20.4 • Bug fix in interpolation to p-levels 	<p>yes</p> <p>no</p> <p>no</p> <p>yes</p> <p>no</p> <p>no</p> <p>no</p> <p>no</p> <p>no</p>

Version	Date	Contents (Highlights)	Results Changes
5.09	25.02.21	<ul style="list-style-type: none"> • Implementation of a tile-approach for TERRA_URB • Additional green-house gas emission scenarios • CPP Dycore: Support for tracers with lbc=0 • NetCDF I/O: adapted asynchronous output for large netcdf files • Fix for running the seaice scheme 	<p>no</p> <p>no</p> <p>no</p> <p>no</p> <p>possible</p>

Version	Date	Contents (Highlights)	Results Changes
5.09a	18.05.21	<ul style="list-style-type: none"> • Preparations for the new multi-layer snow scheme SNOWPOLINO • Preparations for TERRA_URB • Additional adaptations for MESSy • Added a new internal switch lcalc_wmaxtrack 	<p>no</p> <p>no</p> <p>no</p> <p>no</p>

Version	Date	Contents (Highlights)	Results Changes
5.09b	02.06.21	<ul style="list-style-type: none"> • Fix in TERRA for sub-surface runoff • Added new diagnostic for soil water budget • Fixes for diagnostic variables related to new hydrology scheme 	<p>no</p> <p>no</p> <p>no</p>

Version	Date	Contents (Highlights)	Results Changes
5.10	21.07.21	<ul style="list-style-type: none"> Implemented TERRA_URB NetCDF I/O: restart in single precision; compression with zlib 	no no
5.11	28.07.21	<ul style="list-style-type: none"> Implemented SNOWPOLINO asynchronous prefetching of NetCDF boundary data 	no no
5.12	07.09.21	<ul style="list-style-type: none"> Update for TERRA_URB Update of radar forward operator EMVORADO Bug Fix for SNOWPOLINO 	no if used if used

INT2LM Versions Implemented since September 2020

Version	Date	Contents (Highlights)	Results Changes
2.08	30.10.20	<ul style="list-style-type: none"> • CLM unification (input of W_SNOW, T_SNOW is optional) • Several technical fixes for Kinne aerosol climatology • pack HSURF also with 24 bits (as HHL) 	no no no
2.09	02.06.21	<ul style="list-style-type: none"> • Added new external parameters for TERRA_URB • Unification between COSMO and INT2LM utility modules 	no no

COSMO 6.0

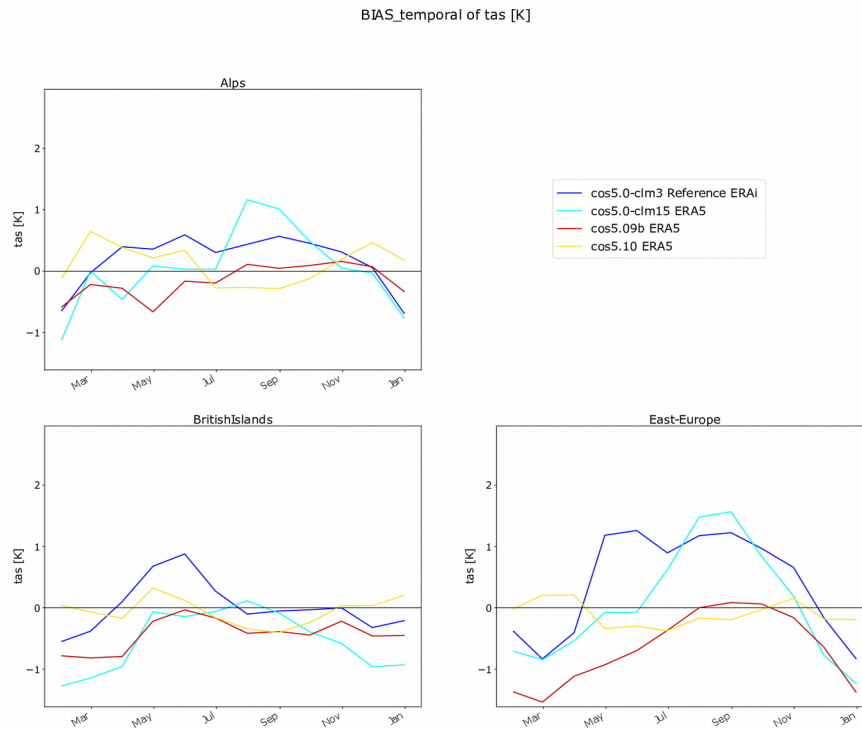
Status of COSMO 6.0

- The last commit to the github master has been done yesterday (Sept. 06th).
- Version 5.12 will be tagged this week.
- This version will be renamed to 6.0, once the validation runs of CLM and crCLIM are successful.
- The NWP Testsuite has been run for Version 5.08. For the NWP Testsuite configuration the results between 5.08 and 5.12 do not change.
 - The NWP Testsuite team came to the following conclusion (full text on: <http://cosmo-model.org/content/model/documentation/NWPSuiteReports.priv/default.htm>)

The analysis of the relative performance of the two model versions: 5.06 (operational version) and 5.08 (test version), the newer version of the model, on the whole, exhibits no significant changes in the performance, while in a few cases outperforms its predecessor.

News from CLM

Error in 2m temperature for 1981-1985



COSMO 5.10 seems to be really good.

Differences between 5.09b and 5.10 in namelist configuration.

Evaluation of COSMO 6.0

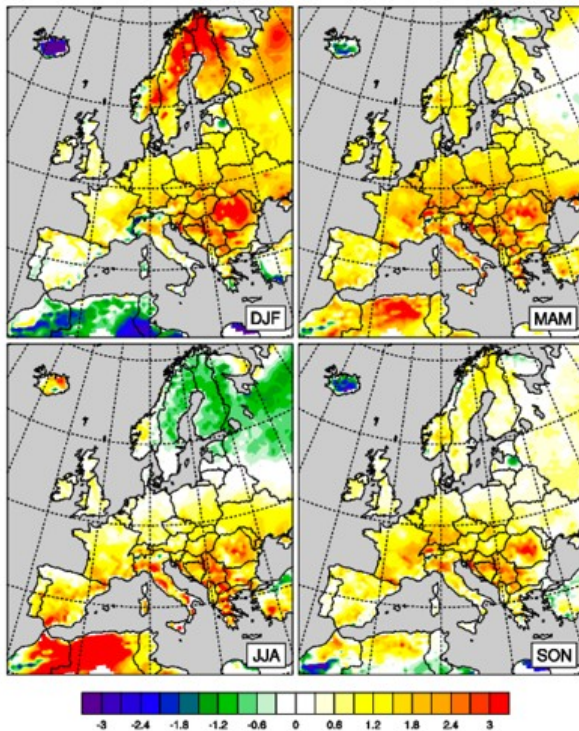
ETH, Christoph Schär's group

Validation over EURO-CORDEX – 12 km

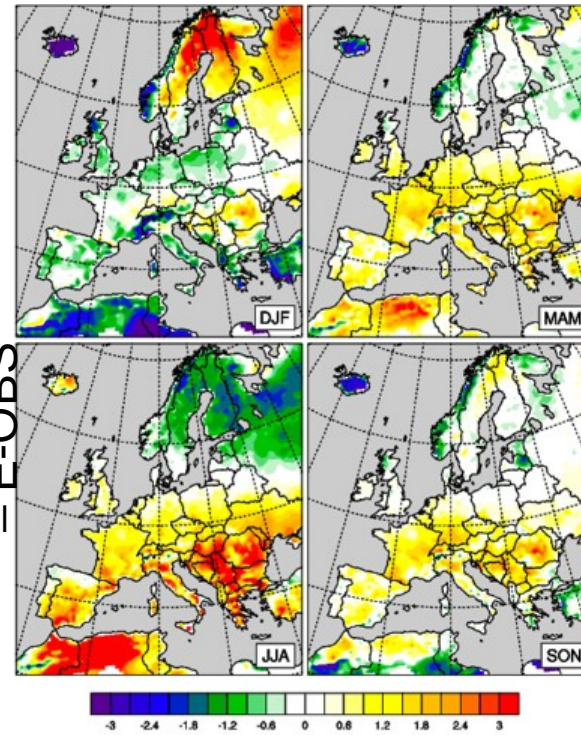
1980-1987

Seasonal mean temperature at 2m

COSMO-ORG
E-OBS



COSMO-crCLIM
- E-OBS



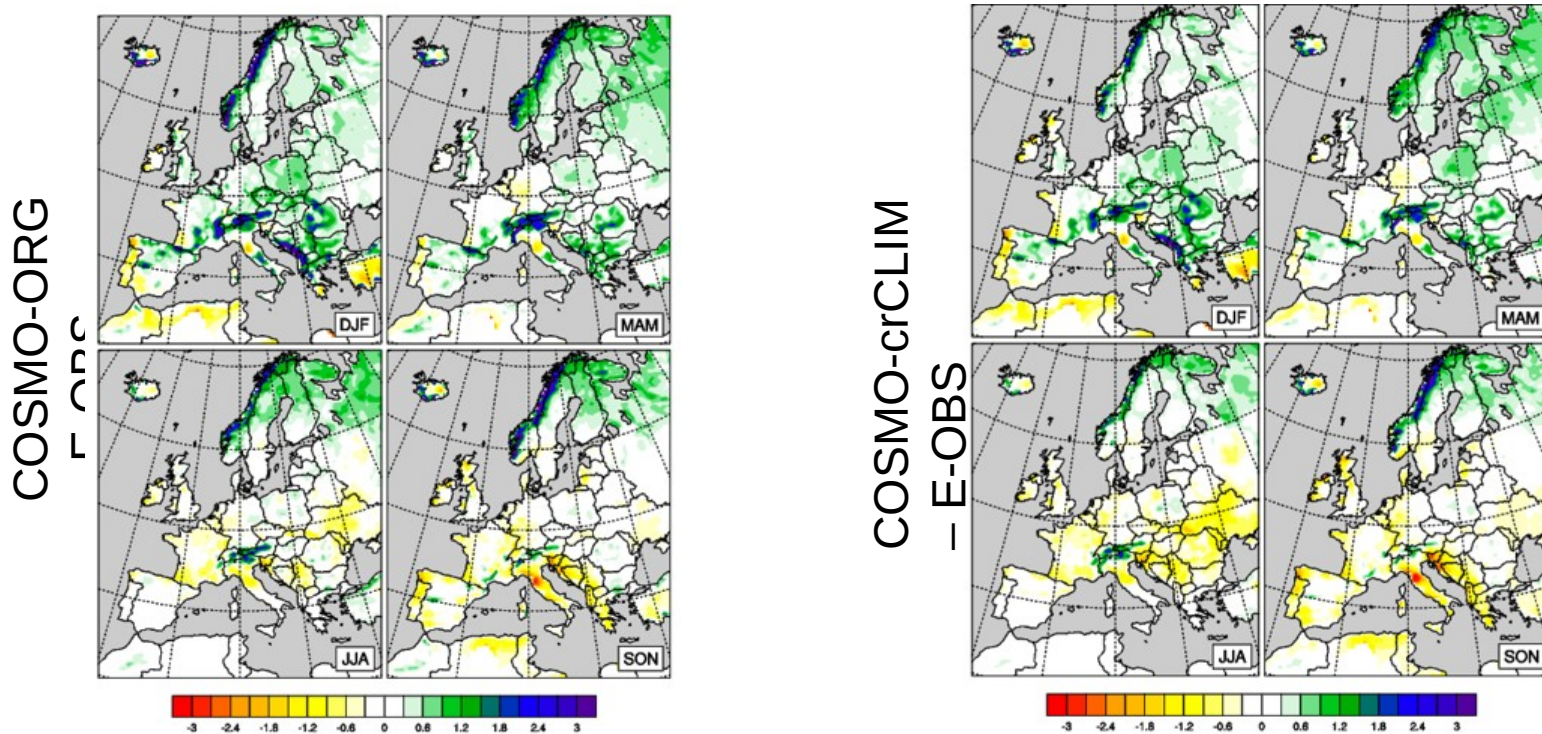
COSMO6 generally too warm compared to COSMO-crCLIM: may be related to changes in TERRA

Marie-Estelle Demory

Validation over EURO-CORDEX – 12 km

1980-1987

Seasonal mean precipitation biases

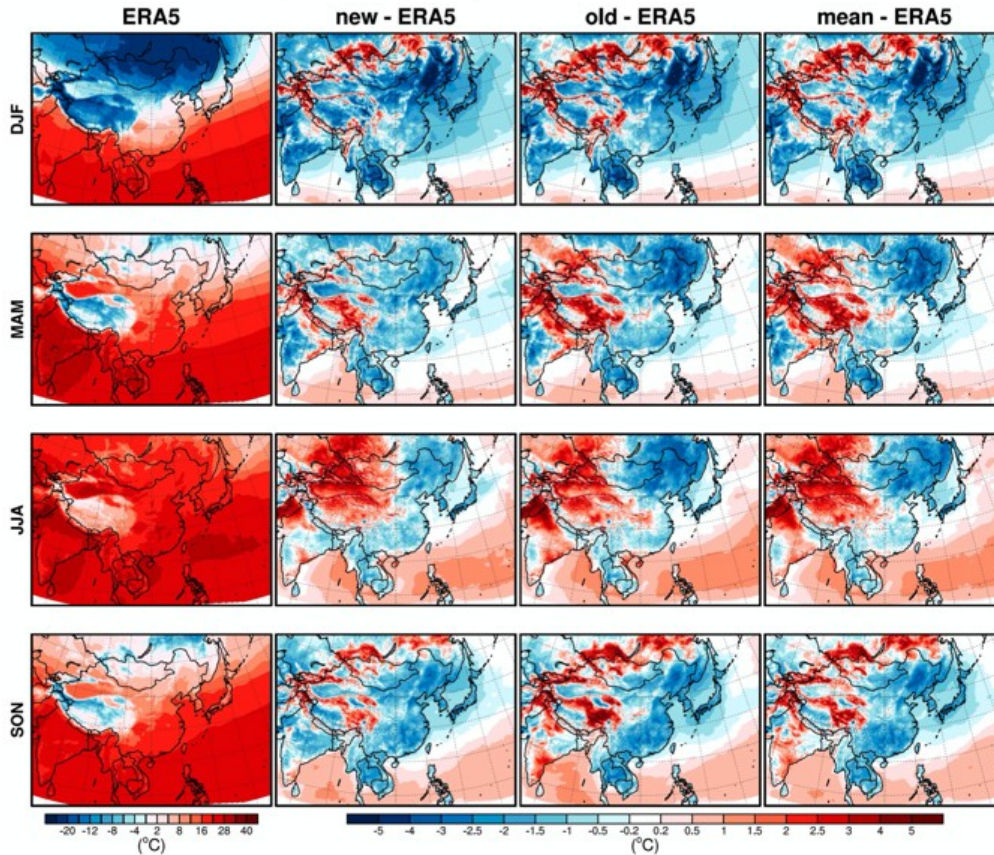


COSMO6 slightly wetter over orography and coast lines compared to COSMO-crCLIM, but same bias patterns

Marie-Estelle Demory

Validation over CORDEX-EAST ASIA – 12 km

Seasonal surface temperature (2001)



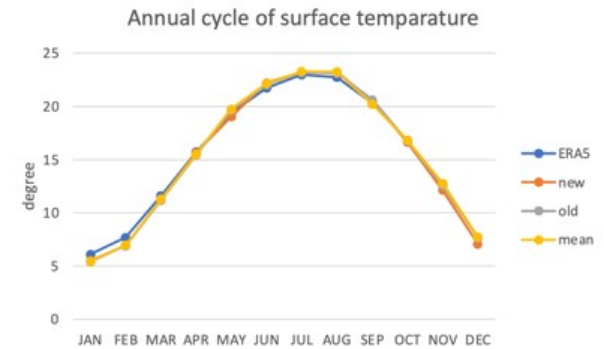
Sensitivity to surface albedo

Domain: CORDEX-EA

Δx : 12 km

Simulation period: year 2001

Soil spin-up: year 2001-2010

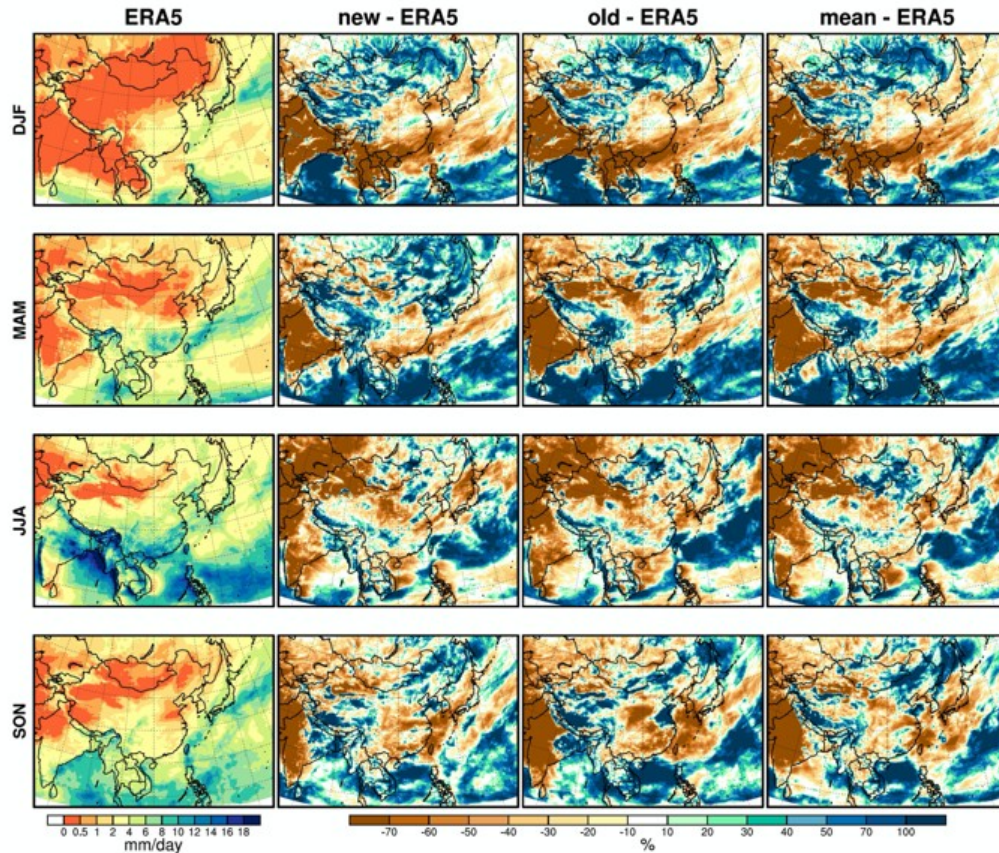


new: monthly values of total albedo derived from MODIS satellite data
old: soil albedo only in dry and saturated conditions
mean: monthly values of total albedo derived from MODIS satellite data averaged over 12 months

Ruolan Xiang

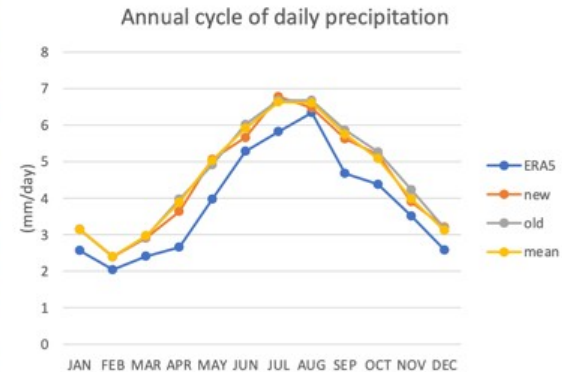
Validation over CORDEX-EAST ASIA – 12 km

Seasonal daily precipitation (2001)



Sensitivity to surface albedo

Domain: CORDEX-EA
 Δx : 12 km
 Simulation period: year 2001
 Soil spin-up: year 2001-2010



new: monthly values of total albedo derived from MODIS satellite data
old: soil albedo only in dry and saturated conditions
mean: monthly values of total albedo derived from MODIS satellite data averaged over 12 months

Ruolan Xiang

Calibration over South Atlantic – test August 2016

Calibration of 2-km resolution simulation over tropical Atlantic following Bellprat et al. (2012, 2016)

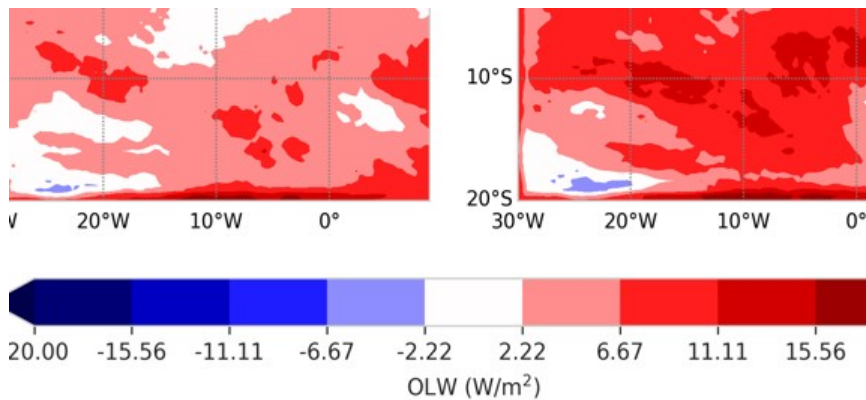
- Objective calibration with 5 parameters
- Methodology mostly based on satellite data (CM-SAF)
- Strong bias in outgoing SW: large improvement with optimum parameter values, at expense of outgoing LW radiation (but note that scale is more sensitive for OLR)

Parameter setting	qi0	tur_leng	clc_dia	rat_se	cloud_nu
Optimum values	1.46E-05	79.6	0.938	7.03	1.03E+07
Default values	5E-6	100	0.5	20	5E8

Outgoing longwave radiation

Before calibration

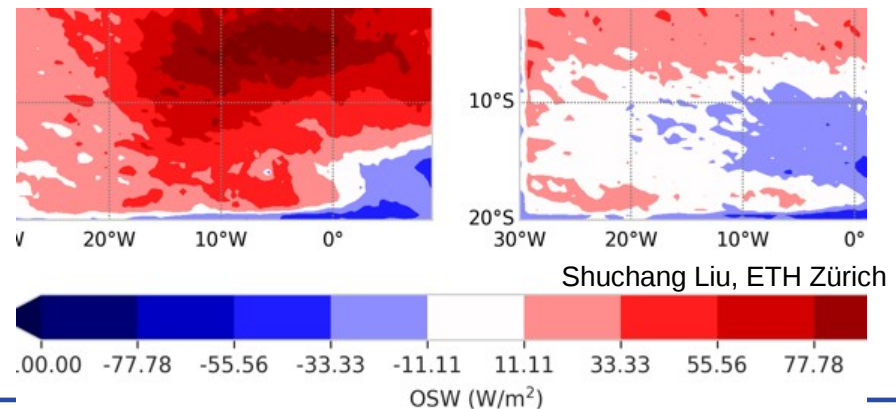
After



Outgoing shortwave radiation

Before calibration

After



Shuchang Liu, ETH Zürich



Update of Documentation

- Release Notes for the latest versions (but 5.12) are available
- Update of Documentation for 6.0 is ongoing (expected in the next days)
 - All parts of the documentation will appear on the COSMO web page without DOIs first.
 - Once Version 6.0 is released, the documentation for this version will get DOIs.
 - In the meantime you have the chance to check the documentations for correctness, missing pieces, etc.

COSMO □ ICON

Actions in the Last Year

- Modified the organization of branches in the ICON Repository:
 - icon-nwp-dev is no longer in use; main icon-nwp branch now is „master“
 - icon-cosmo-master, icon-cosmo-dev, and icon-clm-dev are no longer available
 - all developments (also from COSMO partners) can now branch from the master
- How to start with ICON? You can find useful information and links on:
 - <http://cosmo-model.org/content/support/icon/default.htm>
 - accessible from the main page
 - For example: Link to a document „ICON for Developers“

ICON on new ECMWF Computer

- Some of the COSMO partners use ECMWF resources to run the models. Therefore it is of interest, how ICON performs on the new ECWMF system.
- TEMS: Test and Early Migration System: 60 compute nodes, consisting of 2 x AMD EPYC Rome 7H12 processors with 128 cores per node.
- Daniel and Sascha made some first steps and put up configuration files to compile and link ICON.
- IMS colleagues made tests to compare performance to ccb.
- I did some tests with ICON-D2.

Tests by IMS and DWD

IMS
(from
Yoav)

platform	Nodes	tasks/node	threads	N tasks	time sec	SBU	Time TEMS/CCB	SBU TEMS/CCB	
CCB	10	36	2	360	370	597	1	1	reference
TEMS	3	128	2	384	424	866	1.22	1.45	with HyperThreading
TEMS	3	64	4	192	412	841	1.19	1.41	with HyperThreading
TEMS	3	64	4	192	410	837	1.18	1.40	with HyperThreading
TEMS	3	32	8	96	396	809	1.14	1.35	with HyperThreading
TEMS	3	16	16	48	454	927	1.31	1.55	with HyperThreading
TEMS	3	128	1	384	425	868	1.23	1.45	no HyperThreading
TEMS	3	64	2	192	874	1784	2.52	2.99	no HyperThreading
TEMS	3	32	4	96	801	1665	2.31	2.79	no HyperThreading
TEMS	3	16	8	48	793	1619	2.29	2.71	no HyperThreading
TEMS	12	32	4	384	315	2573	0.91	4.31	Sparce runs
TEMS	24	16	8	384	291	4753	0.84	7.96	Sparce runs

DWD:

ICON-D2 (1 h forecast)	CCA (Cray) 4 nodes (128 cores)	TEMS (Intel) 1 node (128 cores)	Factor
Total	277.847	348.907	1.256
nh_solve	134.890	192.099	1.424
physics	76.083	80.794	1.062
model init	27.715	16.077	0.580

Summary of Problems

- **Memory-bandwidth**, mainly in the dynamics: Can that be resolved by a proper „memory-binding“ or compiler options?
- Or are there some code bottlenecks? Need to do a profiling.
- Timings in the physics or other model parts are comparable.
- **Communication** times have to be investigated more closely. I see some differences between IMS tests and my tests with ICON-D2 (which I do not yet understand).



Thank you
very much
for your
attention!