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# **SCA Report for the COSMO-Model**

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## Congratulations for 18 Years of COSMO (Model)



Grown up at last



But still need care and guidance

## The Last Versions

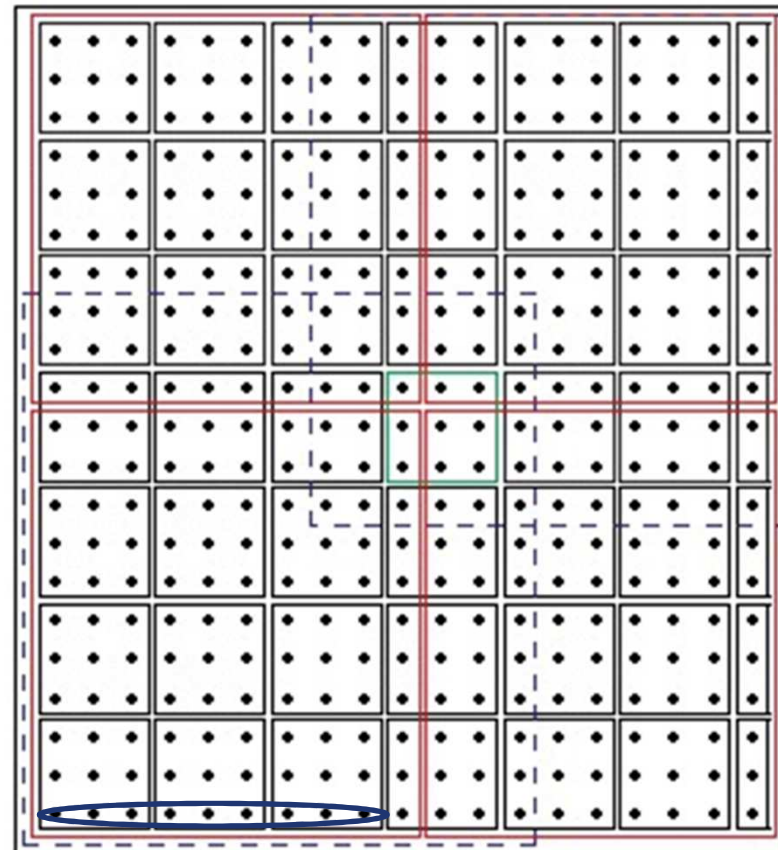
Version	Date	Contents (Highlights)	Results Changes
5.03	02.12.15	<ul style="list-style-type: none"> <li>• blocked version of Ritter-Geleyn radiation</li> <li>• changed calling sequence of assimilation and relaxation</li> <li>• POMPA contributions</li> </ul>	no yes no
5.04	10.03.16	<ul style="list-style-type: none"> <li>• removal of AOF interface in assimilation</li> <li>• configurable targeted diffusion of cold pools</li> </ul>	no no
5.04a	10.05.16	<ul style="list-style-type: none"> <li>• blocked version of prognostic TKE scheme</li> <li>• bug fix in slope-dependent divergence damping coefficient</li> </ul>	yes yes
5.04b	16.07.16	<ul style="list-style-type: none"> <li>• blocked versions of all convection modules</li> <li>• new boundary condition module src_lbc.f90</li> </ul>	no yes

## Changes in COSMO-Model 5.3

- Assimilation
  - feedback files and extended reading of scatterometer and AMDAR data
  - change of calling sequence of assimilation and relaxation (POMPA)
- Dynamics
  - Redesign of 3D diffusion to improve stability
  - Interface to C++ dynamical core and serialization (POMPA)
  - Possibility to switch on/off the Euler dynamics and tracer advection
- Technical Changes
  - Make grib\_api useable for centers other than DWD
  - Computation of pure diabatic temperature tendencies (TTENS\_DIAB) and Lightning Potential Index (LPI)

## Changes in COSMO-Model 5.3 (II)

- COSMO-ICON Physics:
  - Microphysics: implement possibility to run the microphysics at the beginning of the time loop: `lgsp_first`
  - Radiation:
    - implement a blocked version of Ritter-Geleyn radiation and the corresponding interface
    - this version also supports the possibility to work on a coarser grid



## Changes in COSMO-Model 5.04

- Removal of AOF interface in the assimilation
- Configurable targeted diffusion of cold pools (`l_diff_cold_pools`)
- Simple clipping for semi-lagrange advection scheme
- Better treatment of clouds and precipitation during diabatic DFI
- Further technical changes
- GPU Management

## Changes in COSMO-Model 5.04a

- COSMO-ICON version of prognostic TKE turbulence scheme
  - The ICON version of TURBDIFF has been implemented in blocked data format, including a major reorganization of the code (subroutines turbdiff and turbtran in extra modules, introduced a utility module for turbulence).
  - Now there is an option to compute vertical diffusion after the turbulence scheme (instead of doing it after the dynamics).
  - Another option of computing vertical diffusion after all physical parameterizations still has to be implemented (most probably 5.04d).
  - New Namelist variable: `itype_vdif`
  - This scheme is still under testing and not yet the default scheme.
  - Some already existing namelist variables will change their default value, once this scheme will become the default scheme.

## Changes in COSMO-Model 5.04a (II)

### → Dynamics

- Bug fix in the slope-dependent divergence damping coefficient: A missing metric correction term has been inserted in the subroutine `init_div_damping_coeff`.
- The effect is an increase of the divergence damping coefficient in the middle troposphere over steep terrain and a further reduction directly over mountains.
- This Bugfix will improve numerical stability in steep terrain.
- Due to this change the range of values for the namelist variable `divdamp_slope` changes from `[20.0...100.0]` to `[0.1...3.0]` with a new default value of `1.0`



## Changes in COSMO-Model 5.04b

- Implementation of convection schemes in blocked data format
  - Tiedtke- and shallow convection from the COSMO-Model
  - Tiedtke-Bechtold from IFS (ICON-Version)
  - A new optional closure type (after Boeing) has been implemented for shallow convection
- Implementation of a new boundary condition module `src_lbc.f90`
  - Contains subroutines to set special boundary conditions
  - Up to now these routines are only called in the dynamics

## Further Plans

### → 5.05 (October 2016)

- TERRA, FLAKE, SEAICE (from ICON) and TERRA-URB 5.04c
- TURBDIFF: additional changes for calling vertical diffusion 5.04d
- Technical changes related to KENDA
- Implementation of a GPS slant delay operator
- Stochastic PBL perturbation

### → Integration of POMPA work

- All parameterizations in blocked data format: Q4 2016
- All parameterizations able to run on GPU (with OpenACC) Q1 2017
- Integration of further (small) changes in dynamics Q4 2016
- GPU port of Nudging and LHN Q1 2017

## COSMO-ICON Physics and GPUs

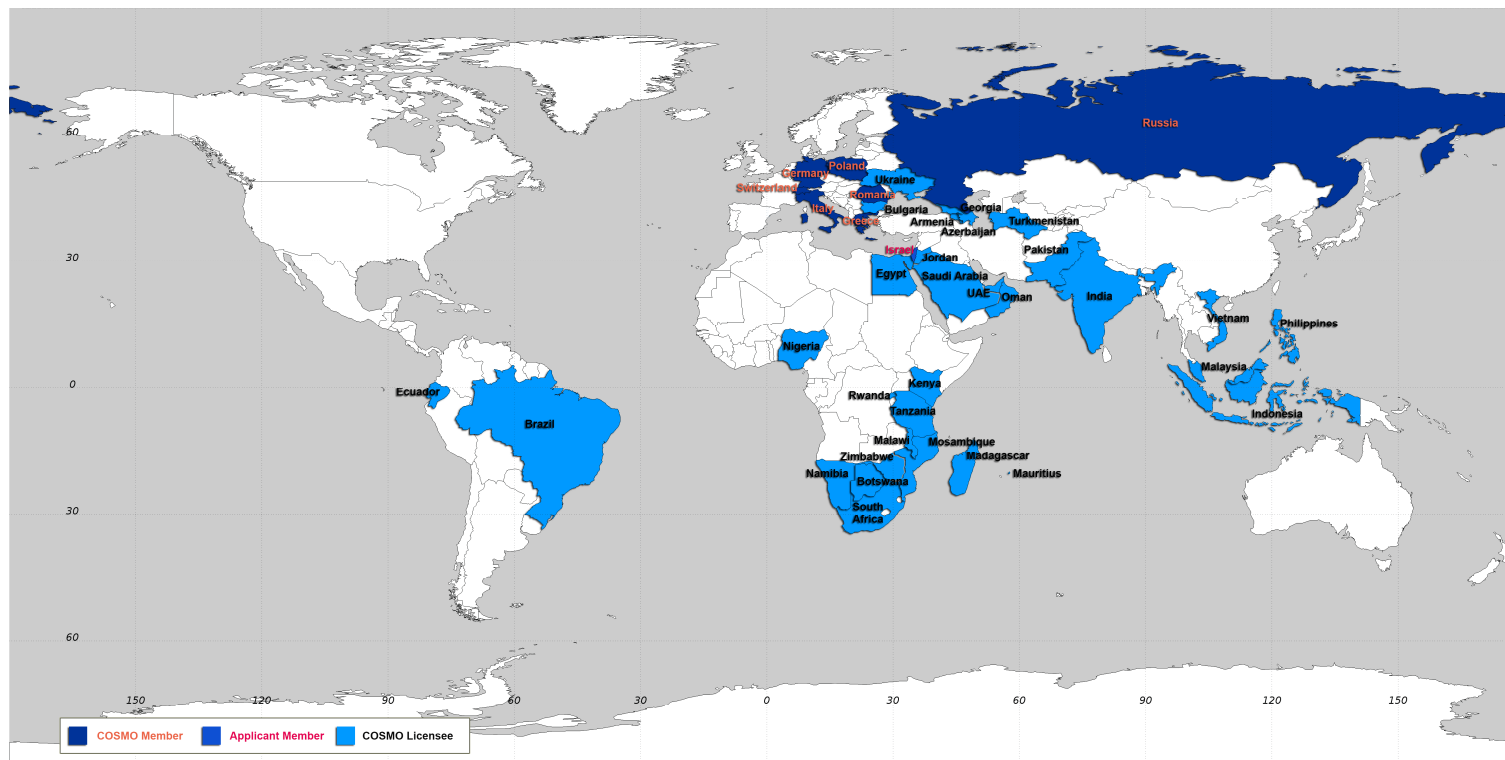
Scheme	Blocked Version	GPU
Microphysics	yes	no
Radiation	yes	yes
Subgrid-scale Orography	no	no
Turbulence	yes	no
Surface Schemes	yes	no
Convection	yes	only shallow

Blue: In COSMO and ICON

Black: Only in COSMO

## Question to the Audience

For how many people does COSMO produce daily forecasts?



For 1.7 billion of people: about a fourth of the earth's population!



Thank you  
very much  
for your  
attention