Recent developments of the COSMO-CLM Model System

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Burkhardt Rockel,

Daniel Rieger,

Ulrich Schättler

Climate Limited-area Modelling Community

Preprocessed GCM/ Reanalysis

„INT2LM-Ready“ Reanalyses at DKRZ

Reanalysis	dx	dt	Time Period
NCEP-RA	~208 km	6h	1948 - present
NCEP-CFSR	~55 km	6h	1979 - 2010
ERA40	~125 km	6h	1959 - 2002
ERAInterim	~78 km	6h	1979 - present
ERA20C	~125 km	6h	1900 - 2010
JRA55	~62 km	6h	1958 - present
MERRA2	~ 50 km	3h	1980 - present
ERA5	~ 31 km	1h	1994 - present

ERA5 ongoing https://tools.clm-community.eu/sims/index.php

INT2LM

Recent Official Version

- Last year's assembly
  - int2lm_180226_2.05_clm1

- Today
  - int2lm_180226_2.05_clm2
    - This version holds mainly a bug fix in interp_utilities.f90 to allow dateline and pole crossing domains (the correction in INT2LM-v2.05_clm1 alone does not do the job for all grid widths).
    - In io_utilities.f90 introduce additional possibilities for the name of 3rd dimension (not just "time") when reading netCDF input files.

History of changes:
http://redc.clm-community.eu/projects/int2lm
-> Menu *History*

COSMO-CLM

Recent Official Version

- Last year's assembly
  - COSMO_131108_5.00_clm10

- Today
  - COSMO_131108_5.00_clm16

History of changes:
http://redc.clm-community.eu/projects/cclm
-> Menu *History*

- added support for netcdf formatted restart files
  - new namelist parameter in IOCTL:
    yform_restart
    default: yform_restart='bina'
    in case of netcdf restart I/O:
    yform_restart='ncdf'

- New diagnostics is implemented for model output
  - wind direction at 10 m height and its frequency, WDIRLAT_10M, WDIRLAT_10M_FREQ
  - total density, RHO_TOT
  - average wind speed (3D) based on the output interval, VABS_AV
  - average wind speed at 10 m based on the output interval, VABS_10M_AV
  - the turbulence intensity maximum based on the interval defined by hincmxu, TURB_INTENS
  - wind sector statistics at 10M height (frequency distribution of wind direction, maximum wind speed and mean wind speed), VABS_10M_SECAV, VABS_10M_SECMAX
  - averaged direct downward sw radiation on a plane directed normal to the sun (includin and excluding orographic shading), ASWDIR_SN, ASWDIR_SNO
  - solar elevation and azimuth angles, SUN_EL, SUN_AZI
  - mean cloud cover over an output time interval, CLCT_AV

- Several bug corrections, e.g.
  - The interpolation for producing model output on constant height levels above Earth surface was fixed for method itype_vertint=2.
  - prevent model from crashing when no output parameter is defined in a gribout namelist block
  - allow for missing_value==-1.E20 in CIN_MU, CIN_ML, CAPE_MU, CAPE_ML in case of netCDF output

Starter Package

Changes Starter Package

- Last year's assembly
  - Version 2.5
- Today
  - Version 3.1.1

Version 3.0 2019/02/18

This version contains a major reconstruction.

- Removal of the sed commands in the subchain scripts.This has two major impacts:

1. no more variables in the form @{VARIABLE}
2. no need for templates anymore, instead of directories *templates* and *jobs* only one *scripts*.

Versions 3.1 and 3.1.1

- remove the time_bnds variable from instantaneous time series
- remove the values of variables that include *time* in their *cell_methods* attribute for time step 0.

COSMO-CLM 6.0

Roadmap to the next reunification (Status: Last Assembly)

- The COSMO version for the next reunification will be 5.6

  —> February 2019

- The reunification version will be COSMO 6.0. It is intended to be finished before CLM Assembly 2018.

  —>December 2019

  Afterwards a COPAT like evaluation will be performed intended to be put for vote for the recommended model version at CLM Assembly 2019

  —> September 2020

- Finally, the COSMO6.0-CLM will be the version to which the ICON-LAM test simulations will be compared

  —> September 2021

Roadmap to the next reunification (Status: Today)

- The reunification version will be COSMO 6.0. It is intended to be finished before CLM Assembly 2018.

  —>December 2019, testing in forecast mode until 20March 20

- Afterwards a COPAT like evaluation will be performed intended to be put for vote for the recommended model version at CLM Assembly 2019

  —> September 2020

- Finally, the COSMO6.0-CLM will be the version to which the ICON-LAM test simulations will be compared

  —> September 2020?? More likely in 2021??

Implementation of CLM Changes in Progress

- Restart Files in NetCDF: already implemented
- Discussions about additional diagnostics started (new GRIB fields, but also new "leveltypes")
- Several bug fixes and technical modifications already implemented earlier

CONSORTIUM FOR SMALL SCALE MODELING

COSMO

Deutscher Wetterdienst

Wetter und Klima aus einer Hand

DWD

SCA Reports for the

COSMO-Model and INT2LM

Ulrich Schättler, Daniel Rieger

Source Code Administrators

Contents

- Versions implemented since September 2018
- INT2LM 2.06
- Documentation
- Plans for the next Versions

Versions Implemented since September 2018

Version	Date	Contents (Highlights)	Results Changes
5.05a	13.07.18	• Bug fix in turb_transfer (see 5.05_1) • Porting additional COSMO parts to GPU (output, diagnostics) • Bott advection scheme with deformational correction method (BOTTDC2) • Changes for Radar Forward Operator EMVORADO	yes no no if used no

Version	Date	Contents (Highlights)	Results Changes
5.05b	14.12.18	• Finalize port to GPU (LHN, Nudging, climate mode, FLake) • Writing radar composites to restart files	no no

Version	Date	Contents (Highlights)	Results Changes
5.06	27.02.19	• Running in single precision (fixes in TERRA; interfaces to RTTOV) • Implementation of mire parameterization • Modifications to GNSS STD operator • New features for Latent Heat Nudging • New wind gust tuning • Implementation of lockfile mechanism	no if used if used if used if used no

Version	Date	Contents (Highlights)	Results Changes
5.06a	21.05.19	• Implementation of skin temperature formulation in TERRA • Modifications to turbulence scheme due to unification with ICON	if used no

Version	Date	Contents (Highlights)	Results Changes
5.06b	to be expected 20.09.19	• Implementation of radar forward operator • Revised cloud radiation coupling (T^2RC^2) • GPU optimizations (CLAW for graupel scheme; asynchronous copy to and from block structure; moved GPU transfer in lgetai (data assimilation)) • Running COSMO-LEPS in GRIB 2 (new local section 28) • Interpolation to z-levels above ground • output of wind speed and direction on model-, z- and p-levels • Additional packing for GRIB 2 fields (grid_ccsds, grid_jpeg, grid_png)	no no no no no no no

Version	Date	Contents (Highlights)	Results Changes
5.06b	20.09.19	• Option to write restart files in NetCDF • Spectral Nudging (CLM): possibility of grid nudging • • (ongoing work) Data Assimilation (new observation types: tower, temphirs; Superobbing of high-resolution profiles; and many more) • • • • Soil and surface schemes: alignment with ICON	no if used yes (nudging; FeedbackFiles) slightly

From my "St. Petersburg Notes"

- Restart (also for CLM)
  - There were problems with restarts at ETH. Therefore CLM should test the restart functionality of COSMO 5.0x very early (before release of 6.0)
  - This can be done now
- Documentation (for GPU; GRIDTOOLS)
  - how to include in COSMO Documents: still has to be done
  - first level support is own SysAdmin
  - Laptops are not supported
- TERRA standalone: no actions yet
  - has to be updated to blocked data structure
  - should have an interface to ICON

INT2LM 2.06

Version	Date	Contents (Highlights)	Results Changes
2.06	24.05.19	• New external parameter fields for slope of orography (S_ORO) and skin conductivity (SKC)	no
		• Refactoring lockfile mechanism	no
		• Interpolation of hhl_in to hhl_gl (instead of recomputing)	slightly
		• Deactivate computation of control geopotential (with lcontrol_fi=.FALSE.)	no
		• Introduced NetCDF4 as optional output format (ylm_form_write = 'nc-4')	no

Version	Date	Contents (Highlights)	Results Changes
2.06a	coming soon	• Running COSMO-LEPS in GRIB 2 • Modifications for MESSy	no no

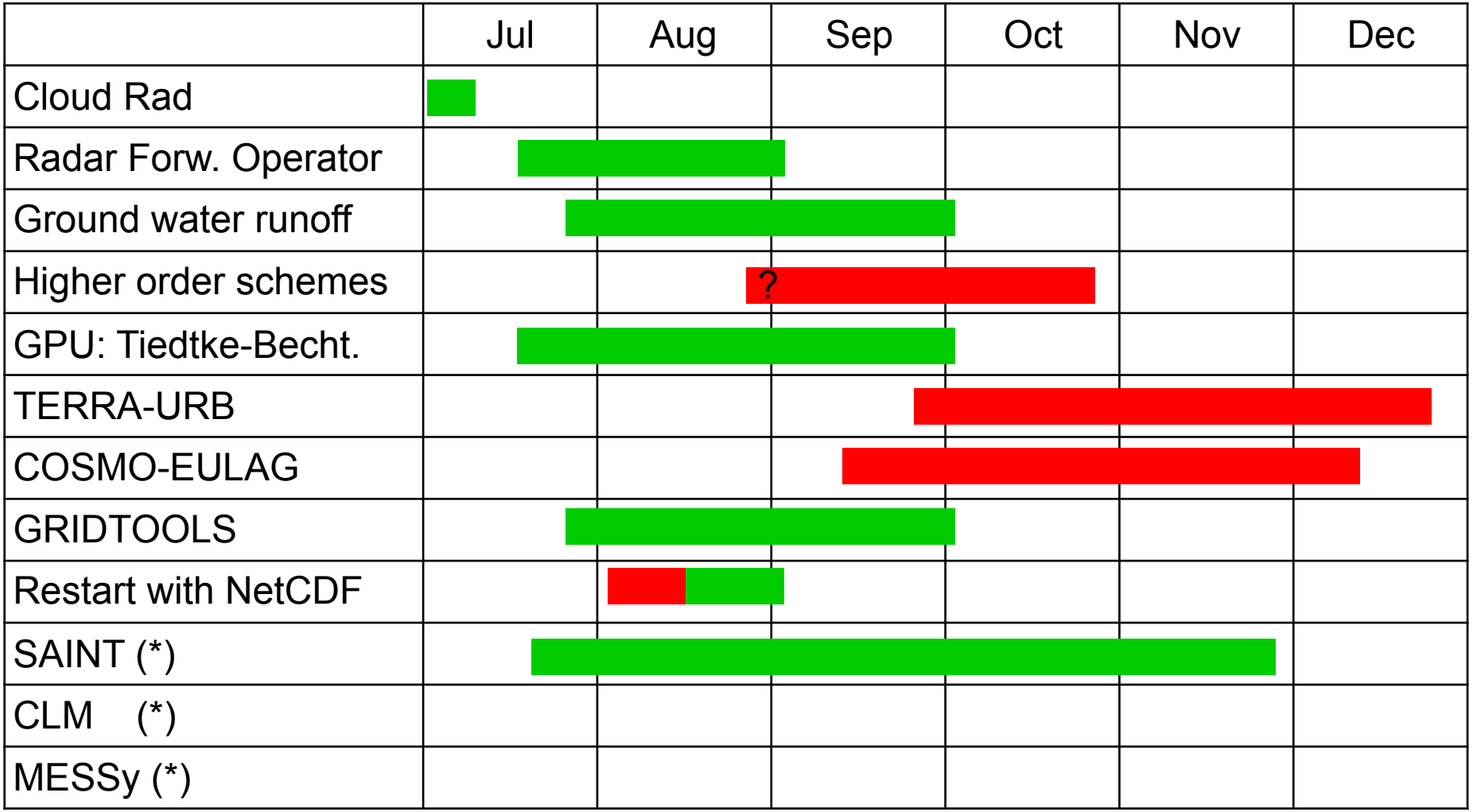
Distribution of new INT2LM and COSMO

- The new versions have not yet been distributed!
- A first (not yet complete) report from the NWP Test Suite has been provided last Thursday (Sept. 5th)
- Impact of COSMO 5.06 seems to be neutral in double precision.
- Comparing double and single precision, only in few cases differences were noticeable.
- But no results from precipitation so far.

Nevertheless:

- Good indication, that COSMO 5.06 can be accepted as new official version.

Plans for the Next Versions


Jul
Aug
Sep
Oct
Nov
Dec
Cloud Rad
Radar Forw. Operator
Ground water runoff
Higher order schemes
?
GPU: Tiedtke-Becht.
TERRA-URB
COSMO-EULAG
GRIDTOOLS
Restart with NetCDF
SAINT (*)
CLM (*)
MESSy (*)

(*) Some Comments

- SAINT:
  - First implementation is using a TERRA version modified by Matthias Raschendorfer for implicit treatment of heat conduction equation
  - This version has been updated lately by Matthias for treatment of multi snow levels
  - Pitfall: Do not know when Matthias version of TERRA will be implemented operationally
- CLM: Unification has started:
  - Restart Files in NetCDF: already implemented
  - Discussions about additional diagnostics started (new GRIB fields, but also new "leveltypes")
  - Several bug fixes and technical modifications already implemented earlier
- MESSy: there will also be an update from the MESSy Community

Thank You!