Status of the COSMO-CLM System and its way to the next reunification

CLM-Community Assembly, 18-21 September 2018, Karlsruhe, Germany

Burkhardt Rockel

with contributions from Ulrich Schättler

Helmholtz-Zentrum Geesthacht

Climate Limited-area Modelling Community

INT2LM

Recent Official Version

- Last year's assembly
  - int2lm2.0_131101_clm4
    !! This version contains an error regarding the crossing of the date line !!

- After this assembly
  - int2lm_180226_2.05_clm1

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

src_namelist.f90

```
IF ( itype_profiles_vert_interp == 2 .AND. lcm2lm ) THEN
  PRINT *, "WARNING *** itype_profiles_vert_interp=2 is not valid for yinput_model='CM'"
  PRINT *, '         *** itype_profiles_vert_interp is reset to 1'
  itype_profiles_vert_interp = 1
ENDIF
```

i.e. itype_profiles_vert_interp=2 (changed extrapolation methods for model variables into valleys and over mountains) only applicable for double nesting in climate mode

src_decomposition.f90

for climate mode correct indexes regarding date line and pole crossing

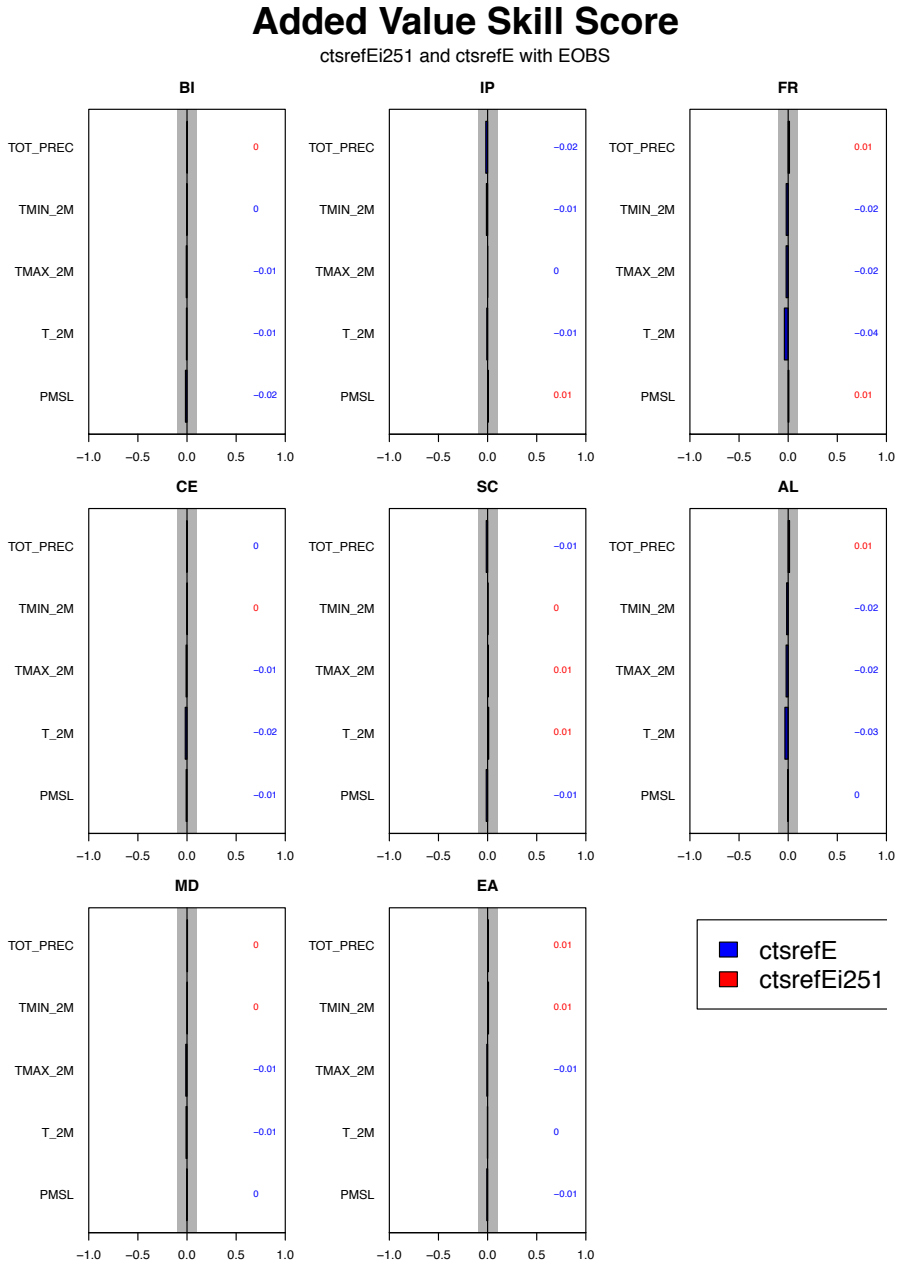
INT2LM Technical Testsuite

Date: 2018-08-23 12:36:24
Model versions:
INT2LM int2lm_180226_2.05_clm1
CCLM cosmo_180802_5.05_1

Test	Result
nx=1, ny=1	OK
nx=1, ny=3	OK
nx=3, ny=1	OK
nx=2, ny=3	OK
nx=3, ny=2	OK
14 digits date format (YYYYMMDDHHMMSS)	OK
Europe	OK
Equator	OK
North Pole	OK
South Pole	OK
Southern hemisphere date line crossing	OK
Mauritius small area	ERROR #12
Mauritius large area	OK
CMIP5 / MPI-ESM	OK
CMIP5 / CNRM	OK
CMIP5 / EC-EARTH	OK
CMIP5 / HC	OK
Reanalysis / ERAInterim	OK
Reanalysis / NCEP-CFSR	OK
CORDEX / South America	OK
CORDEX / Central America	OK
CORDEX / North America	OK
CORDEX / Europe	OK
CORDEX / Africa	OK
CORDEX / West Asia	OK
CORDEX / East Asia	OK
CORDEX / Central Asia	OK
CORDEX / Australasia	OK
CORDEX / Antarctica	OK
CORDEX / Arctic	OK
Internally compressed caf files	OK
lm2lm	OK
INT2LM-CCLM via ncdf	OK
INT2LM-CCLM via grib1	OK
INT2LM-CCLM with lakes	OK
INT2LM-CCLM parallel ncdf I/O	OK
nx=1, ny=1 / nx=1, ny=3	MATCH
nx=1, ny=1 / nx=3, ny=1	MATCH
nx=1, ny=1 / nx=2, ny=3	MATCH
nx=1, ny=1 / nx=3, ny=2	MATCH
Europe int2lm_170406_2.04a_clm1 / int2lm_180226_2.05_clm1	MATCH
caf non-compressed / compressed	MATCH

Comparison int2lm2.0_131101_clm4 / int2lm_180226_2.05_clm1

COSMO-CLM5.0_clm10



COSMO-CLM

Recent Official Version

- Last year's assembly
  - COSMO_131108_5.00_clm9

- Today
  - COSMO_131108_5.00_clm10

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

February 2, 2018 H.-J. Panitz, IMK/KIT, U. Schaettler, DWD, Burkhardt Rockel HZG

* added new Namelist parameter lzint_above_ground to choose z-interpolation to height levels above ground

  relevant Namelist group: GRIBOUT

  parameter: lzint_above_ground

  lzint_above_ground=.FALSE. (Default): z-interpolation above Sea Level

  lzint_above_ground=.TRUE. : z-interpolation above ground

* set the 'l'-flag (land-sea dependency) for HORIZON, SKYVIEW, SLO_ANG, SLO_ASP, and SWDIR_COR

  which are only defined over land; corresponding initial data coming from INT2LM are undefined

  over water bodies since the 'l'-flag is also used in INT2LM

  modules affected:

* changes to correct a bug which causes a crash for the namelist option lradtopo=.TRUE.

Shadowing effects (lradtopo=.TRUE.) should work now.

in case of lradtopo=.TRUE. reset values of slo_ang, slo_asp, and horizon to zero for non-land-points only

in case of lradtopo=.TRUE. reset values of skyview to

one for non-land-points only

IMPORTANT NOTE:

* applying lradtopo=.TRUE. requires nradcoarse=1; otherwise job would stop

* nradcoarse=1 requires lradf_avg=.FALSE.; otherwise job would stop

* src_soil_multlay.f90

delete factor 0.5 in definition of zalpha to be in accordance to ICON coding

* netcdf_io.f90

added a "T" in the time units attribute

seconds since 1979-10-01T00:00:00

changes due to the new option lzint_above_ground

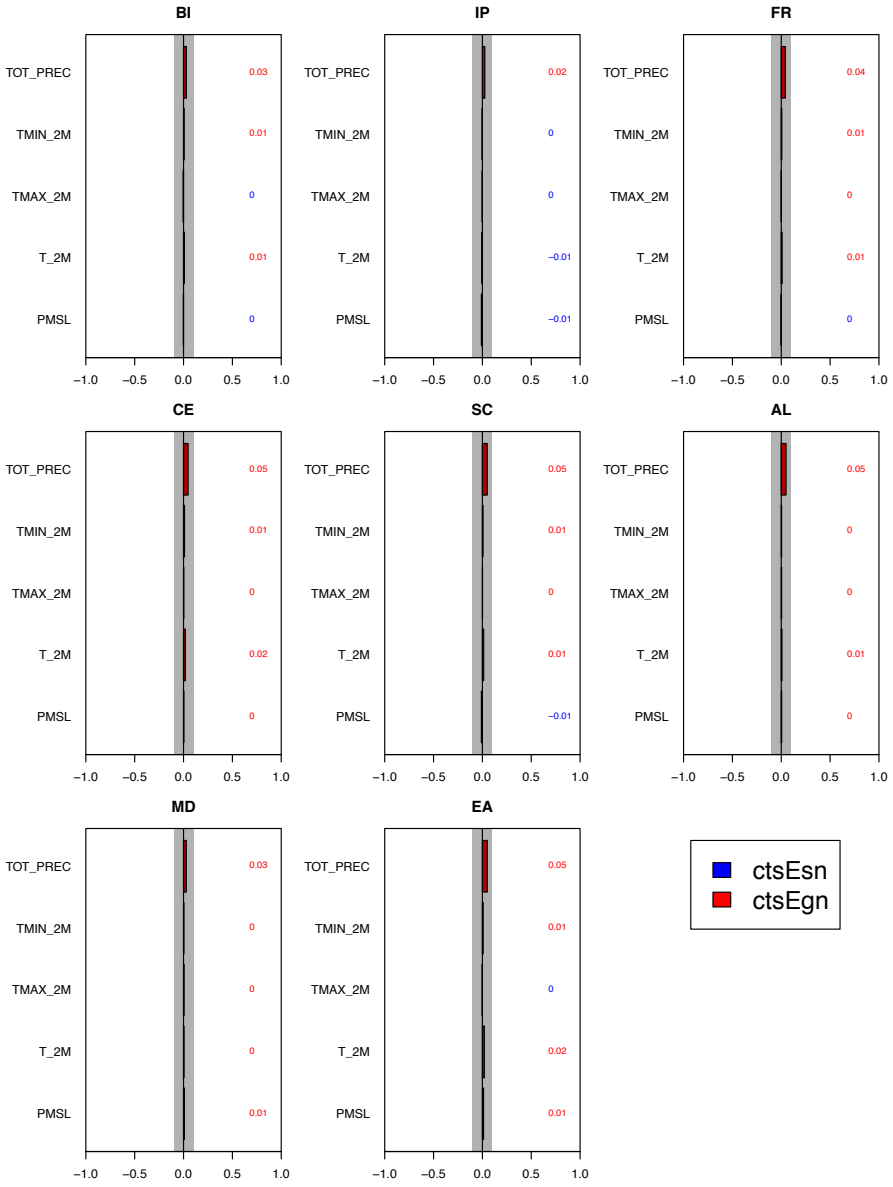
* src_spectral_nudging.f90

added option to nudge over all wave numbers (this is grid nudging actually) by setting isc_sn=-1, jsc_sn=-1 for lspecnudge=.TRUE. Other spectral nudging options can be used as usual.

Download the package from file:"cosmo_131108_5.00_clm10.tgz"

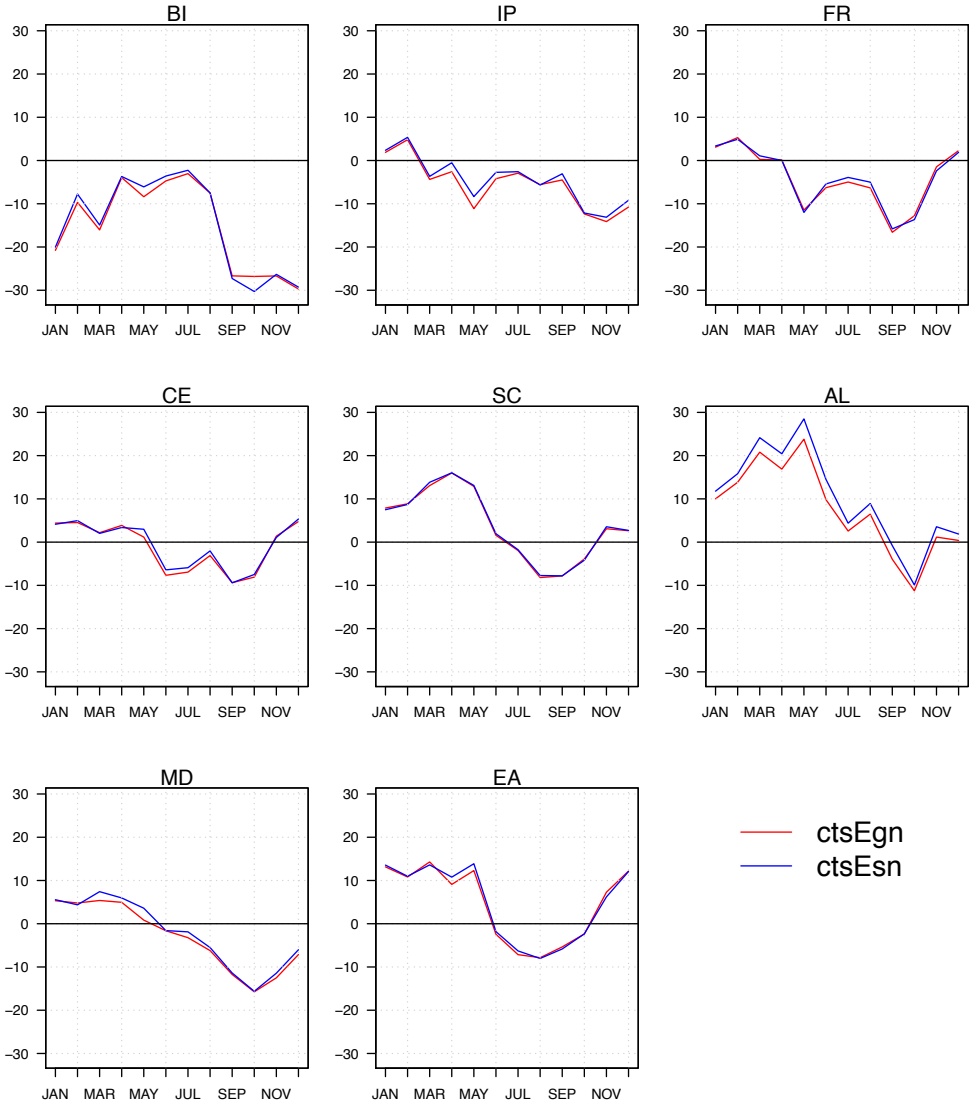
Added Value Skill Score

ctsEgn and ctsEsn with EOBS



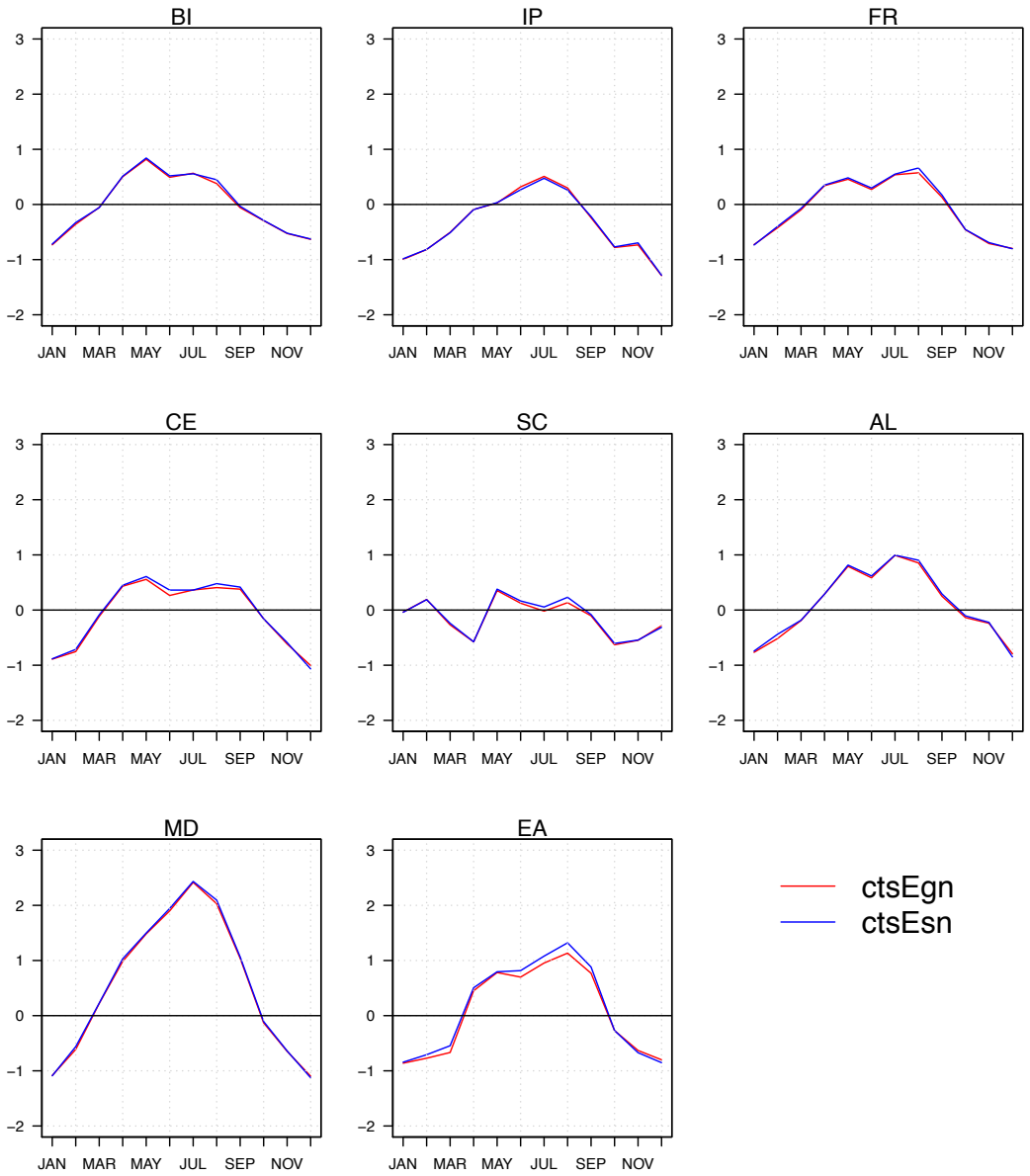
BIAS CCLM – EOBS (TOT_PREC)

Difference in [kg m–2]



BIAS CCLM – EOBS (T_2M)

Difference in [K]



DLAT=0.44

DLON=0.44

IE_TOT=132

JE_TOT=129

Number of processors: 96

Spectral Nudging +44% CPU time

Grid Nudging within variation of different CPUs

Roadmap to the next reunification (Status: Last Year's Assembly)

- The COSMO version for the next reunification will be 5.6

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

  —>September 2018
- Afterwards a COPAT like evaluation will be performed intended to be put for vote for the recommended model version at CLM Assembly 2019

  —> September 2019
- Finally, the COSMO6.0-CLM will be the version to which the ICON-LAM test simulations will be compared

  —> September 2020

COSMO and ICON Physics

Scheme	COSMO	ICON
Microphysics	prognostic water vapour, cloud water, ice, rain, snow, graupel (Doms, 2004; Seifert, 2010)	
Radiation	Ritter-Geleyn δ two-stream	RRTM
Subgrid scale orography	Lott and Miller (1997)	
Turbulence	prognostic TKE scheme (Raschendorfer)	
Surface Schemes	TERRA (Heise and Schrodin, 2002) FLake (Mironov) Sealce (from IFS)	
Convection	Tiedtke or shallow	Tiedtke-Bechtold
	Tiedtke-Bechtold (optional)	

Latest Developments

Version	Date	Contents (Highlights)	Results Changes
5.05a	22.06.18	• Dynamics: 2nd order Bott scheme together with deformational correction method • Porting additional parts to GPU: diagnostics, output • Changes to prepare implementation of Radar Forward Operator	if used no no

21.07.18: Implemented the bug fix in turb_transfer.f90 in patch version 5.05a_1

DWD only, not yet distributed to COSMO

Versions 5.06 and Beyond

Version 5.06 (February 2019)

- POMPA: Port of Assimilation and LHN (already in 2018) 5.05b
- Radar forward operator (EMVORADO) (hopefully, in 2018) 5.05c
  - still needs some technical clean up and documentation
  - tests at DWD are ongoing
- Higher order horizontal discretizations (by end of 2018) 5.05d
  - already available; see plans by WG 2
- Mire parameterization
- Ground water runoff (by Linda Schlemmer)
- Technical modifications from data assimilation

Version 6.0 (December 2019 at latest)

- Urban module: tests in PT AEVUS are ongoing (see updated PT plan)
- Unification with CLM Version (work in progress)

Further (Technical) Issues

- COSMO-EULAG: Code and documentation available since last Friday, still have to take a look. Timeline for implementation will be discussed by SMC.
- Removal of coarse radiation grid (perhaps 5.06, work in progress)
- Optimization of copy-in / copy-out (perhaps 5.06)
- Use of CLAW directives to optimize physical parameterizations for GPU
- GPU Port for Tiedtke-Bechtold convection (whenever ready)

Roadmap to the next reunification (Status: Today)

- 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

!! One year delay !! Possibilities for speed up ??

Starter Package

Changes Starter Package

- Last year's assembly
  - Version 2.5
- Today
  - Version 2.7

Version 2.6 2017/12/15

- in post.job.tmpl
  - New functions have been implemented (based on scripts by Klaus Keuler and Ronny Petrik):
    - windspeed10M
    - derotatewind10M
    - winddir10M
    - snowfraction
    - addfields ASWDIR_S ASWDIFD_S -> ASWD_S
    - subtractfields ASOD_T ASOB_T -> ASOU_T
    - addfields RUNOFF_S RUNOFF_G -> RUNOFF_T
    - addfields RAIN_CON SNOW_CON -> PREC_CON
    - addfields SNOW_GSP SNOW_CON -> TOT_SNOW
    - addfields TQC TQI -> TQW
    - windspeedp
    - windspeedz
    - derotatewindz
    - derotatewindp
    - winddirp
    - winddirz

Version 2.7 2018/01/23

- Fixed error:
  - The recently (version 2.6) introduced intentionally empty directory utils was not extracted from the GIT archive. This causes an error during the initialization of the starter package.
- Changes:
  - Added a "./" before the subchain call.
  - Added yncglob_institution in the namelist in cclm.job.tmpl
  - different organisation of time series on pressure- and z-levels in post.job.tmpl
  - include z-levels above sea level and above surface in functions.sh.tmpl

Test Suite

Changes Test Suite

- Last year's assembly
  - Version 1.3
- Today
  - Version 1.5

v1.4, v1.5

Climatological Testsuite

align with starter package version 2.7

Technical Testsuite

align with the technical testsuite v2.2 of MeteoSuisse/C2SM

Sources

int2lm_131101_2.00_clm4
cosmo_131108_5.00_clm10

Thank You!