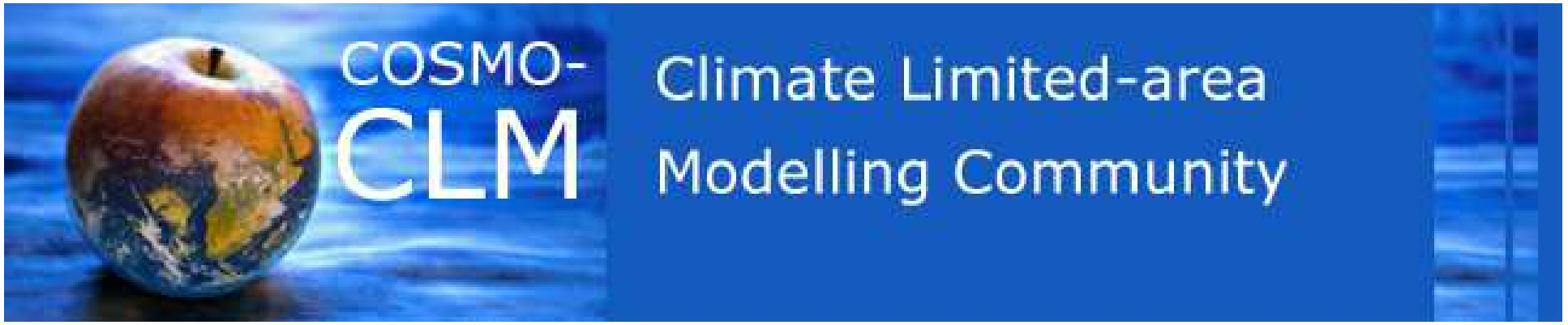


Current activities in the CLM-Community

Barbara Früh & CLM WG coordinators

COSMO General Meeting
September 07, 2016
Offenbach, Germany

Deutscher Wetterdienst
Wetter und Klima aus einer Hand
DWD

Overview

CLM-Community projects

- COPAT – Coordinated Parameter Testing - Project
- CECPC5 – Coordinated Evaluation of Convection Permitting climate simulations with COSMO5.0
- Test suite
- Regional climate system model

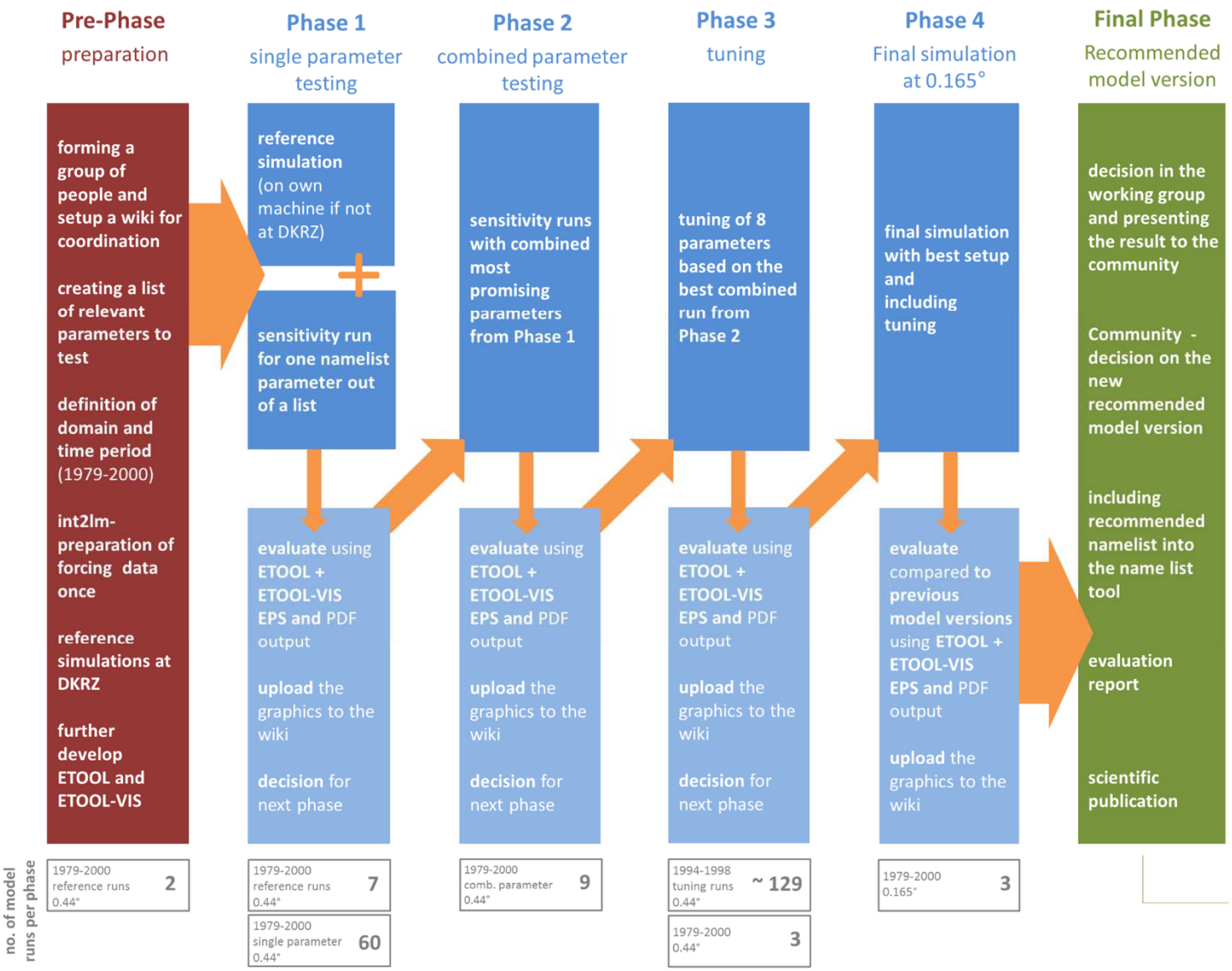
Climate forecasts downscaled with COSMO-CLM

- EUPORIAS
- MiKlip

CLM-Community issues

COPAT - Coordinated parameter testing

11/3/2016



COPAT - Coordinated parameter testing

11/3/2016

Final Phase

Recommended model version

decision in the working group and presenting the result to the community

Community - decision on the new recommended model version

including recommended namelist into the name list tool

evaluation report

scientific publication

new recommended CCLM model version:

COSMO5.0_clm6

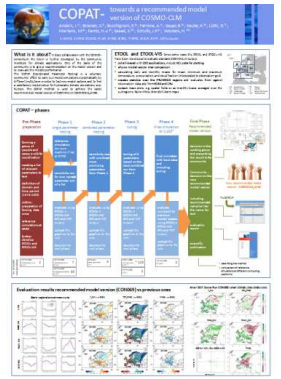
Evaluation Report

in progress.

3 Poster

„COPAT - towards a recommended model version of COSMO-CLM“ at

- COSMO User Seminar 2016, March in Offenbach
- EGU 2016, April in Vienna
- ICRC CORDEX 2016, Mai in Stockholm



2 Scientific Publications (peer-reviewed)

„ COPAT - towards a recommended model version of COSMO-CLM“
in e.g. GMD – Geoscientific Model Development; *in progress.*
Intercomparison of reference runs; *no title yet. in progress.*

COORDINATED EVALUATION OF CONVECTION PERMITTING CLIMATE SIMULATIONS WITH COSMO5.0 (CECPC5.0)

- Perform a systematic analysis of COSMO-CLM at the convection permitting scale (2.8 km) in climate mode
- Up to now: Setup based in NWP setups
- Be able to recommend a setup to new users in regions investigated and provide a first guess for other regions

CECPC5.0 - People

Pre-Phase
preparation

- forming a group of people and setup a wiki for coordination
- creating a list of relevant parameters to test
- definition of domain and time period (1979-2000)
- int2lm-preparation of forcing data once
- reference simulations at DKRZ
- further develop ETOOL and ETOOL-VIS

LIST - Andrew Ferrone (coordination)

ZAMG - Ivonne Anders
GUF - Erwan Brisson
Wegener Center - Andras Csaki , Marie Piazza, Heimo Truhetz

KU Leuven - Matthias Demuzere , Nicole van Lipzig
DWD - Susanne Brienen, Barbara Früh
BTU - Klaus Keuler
KIT - Hans-Jürgen Panitz,
HZG - Burkhardt Rockel

CECPC5.0 - Parameters to be investigated

Pre-Phase
preparation

- forming a group of people and setup a wiki for coordination
- creating a list of relevant parameters to test
- definition of domain and time period (1979-2000)
- int2lm-preparation of forcing data once
- reference simulations at DKRZ
- further develop ETOOL and ETOOL-VIS

Parameter	Standard	Test
llake	FALSE	TRUE
itype_fast_waves	2	1
hd_corr_trcr_bd	0	1
iadv_order	5	3
lconv	TRUE	FALSE
lrad_topo	FALSE	TRUE
y_scalar_advect	BOTT2_STRANG	BOTT4, BOTT2
itype_aerosol	1	2(Tegen)
itype_evsl	2	3,4
itype_turb	3(?)	1,2(?)
lsso (?)	TRUE	FALSE
itype_root	1	2
itype_heatcond	1	2
itype_albedo	1	3

CECPC5.0 - Regions

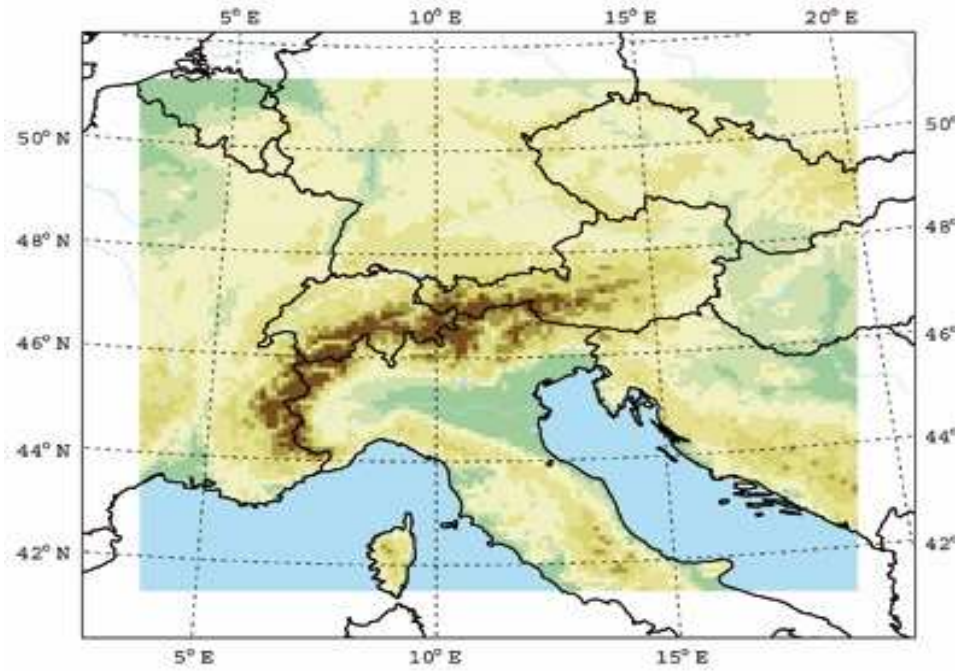
Pre-Phase
preparation

- forming a group of people and setup a wiki for coordination
- creating a list of relevant parameters to test
- definition of domain and time period (1979-2000)
- int2lm-preparation of forcing data once
- reference simulations at DKRZ
- further develop ETOOL and ETOOL-VIS

Two regions:

- **Alpine region**: will be nearly identical as in FPS
- **Lowland**: setup expected to be transferable to FPS region

→ collaboration with CORDEX Flagship studies (FPS)



CECPC5.0 - Time period

Pre-Phase
preparation

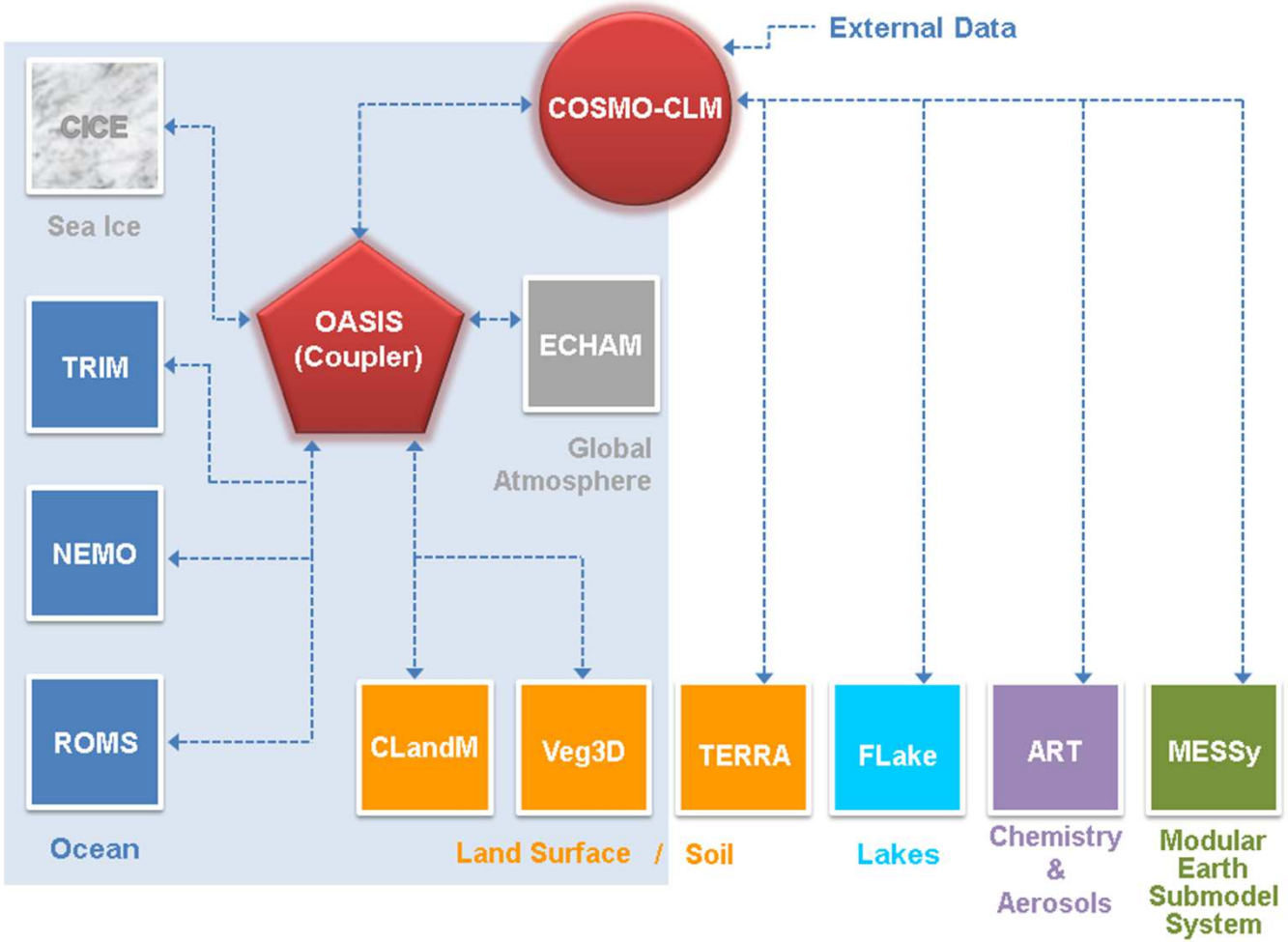
- forming a group of people and setup a wiki for coordination
- creating a list of relevant parameters to test
- definition of domain and time period (1979-2000)
- int2lm-preparation of forcing data once
- reference simulations at DKRZ
- further develop ETOOL and ETOOL-VIS

- One year runs (to limit CPU needs)
- Based on an analysis of the following parameters
  - frequency of days with precipitation > 15 mm/day
  - maximum precipitation intensity
  - frequency of 10-day dry period
  - longest dry period
- year **2007** was selected for analysis
  (storm Kyrill happened on 17th January 2007)

The COSMO-CLM Testsuite

- Version 1.0 of the COSMO-CLM Testsuite is completed
- The Testsuite consists of two parts
  - A Technical test
    - based on the Meteorological Testsuite of Meteo Swiss with additional checks for the climate mode (netCDF files, restarts, SAMOA)
  - A Climatological test
    - 5 Years simulation
    - compared to observations (presently PMSL, T_2M, TMAX_2M, TMIN_2M, TOT_PREC from EOBSv13.1)
    - Standard plots (Bias, QQ, Probability density function agreement, Equal sided skill score, Taylor diagrams)
- Discussion on additional features in CLM-Community Coordination and SUPTECH groups
- Use for judging COSMO-CLM development

Regional Climate System Model



Unified OASIS3-MCT interface for coupling with regional oceans, land surface and global atmosphere models

A. Will and S. Weiher (BTU), N. Akhtar (GUF), J. Brauch (DWD), M. Breil (KIT), E. Davin (ETH), H.T.M. Ho-Hagemann (HZG), E. Maisonnave (CERFACS), M. Thürkow (FUB)

Model Systems Coupled with 4.8 (and 5.0)	Institution	Coupled Model Component		Coupling mode
		First	Second	
CCLM+CLM	ETH	CLM		Sequential
CCLM+VEG3D	KIT	Veg3D		Sequential
CCLM+NEMO-MED12	GUF and DWD	NEMO-MED12		Concurent
CCLM+TRIMNP+CICE	HZG	TRIMNP	CICE	Concurent
CCLM+MPI-ESM	BTU and FUB	ECHAM	MPIOM	Sequential

„Description, Performance and Optimum Configuration“,

see Will et al. (2016), Geoph. Model Dev.

MiKlip Ensemble System (Global: MPI-ESM)

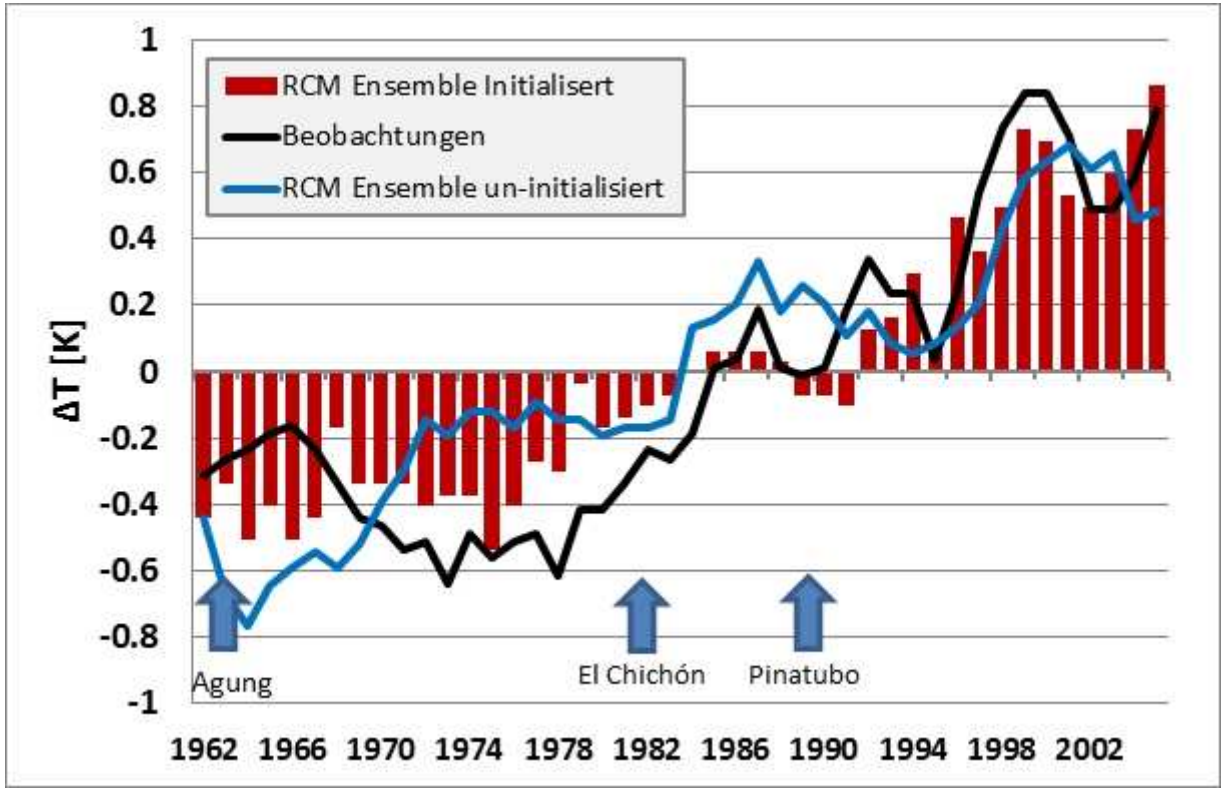
Annual Starting Years 1961 – 201x

Baseline0 b0 (=CMIP5)

- MPI-ESM-LR
  - 3(10) member
- Initialization
  - Ocean:
  - Anomaly T&S from NCEP forced MPIOM
- 1-day time lagged init.

MPI-ESM-	Atmosphere	Ocean
LR	T63L47	1.5° L40
MR	T63L95	0.4° L40 TP
HR	T127L95	0.4° L40 TP

Initialized vs. un-initialized ensembles



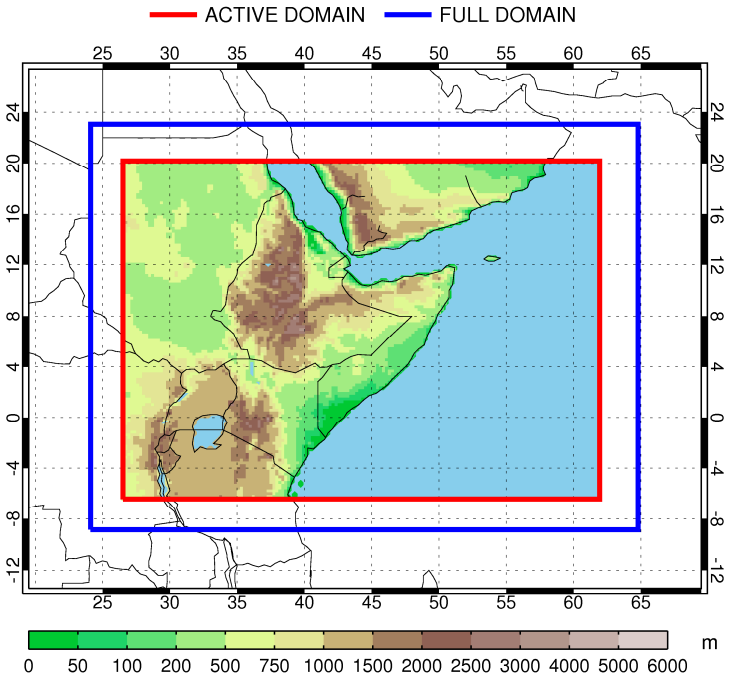
7 member CCLM 4.8_17, 0.44°, forcing MPI-ESM-LR historical
7 member CCLM+REMO, 0.44°, forcing MPI-ESM-LR initialized b1

EUPORIAS

EUropean Provision Of Regional Impact Assessment on a Seasonal-to-decadal timescale

main task:

- **Task 21.2** Dynamical Downscaling over East Africa

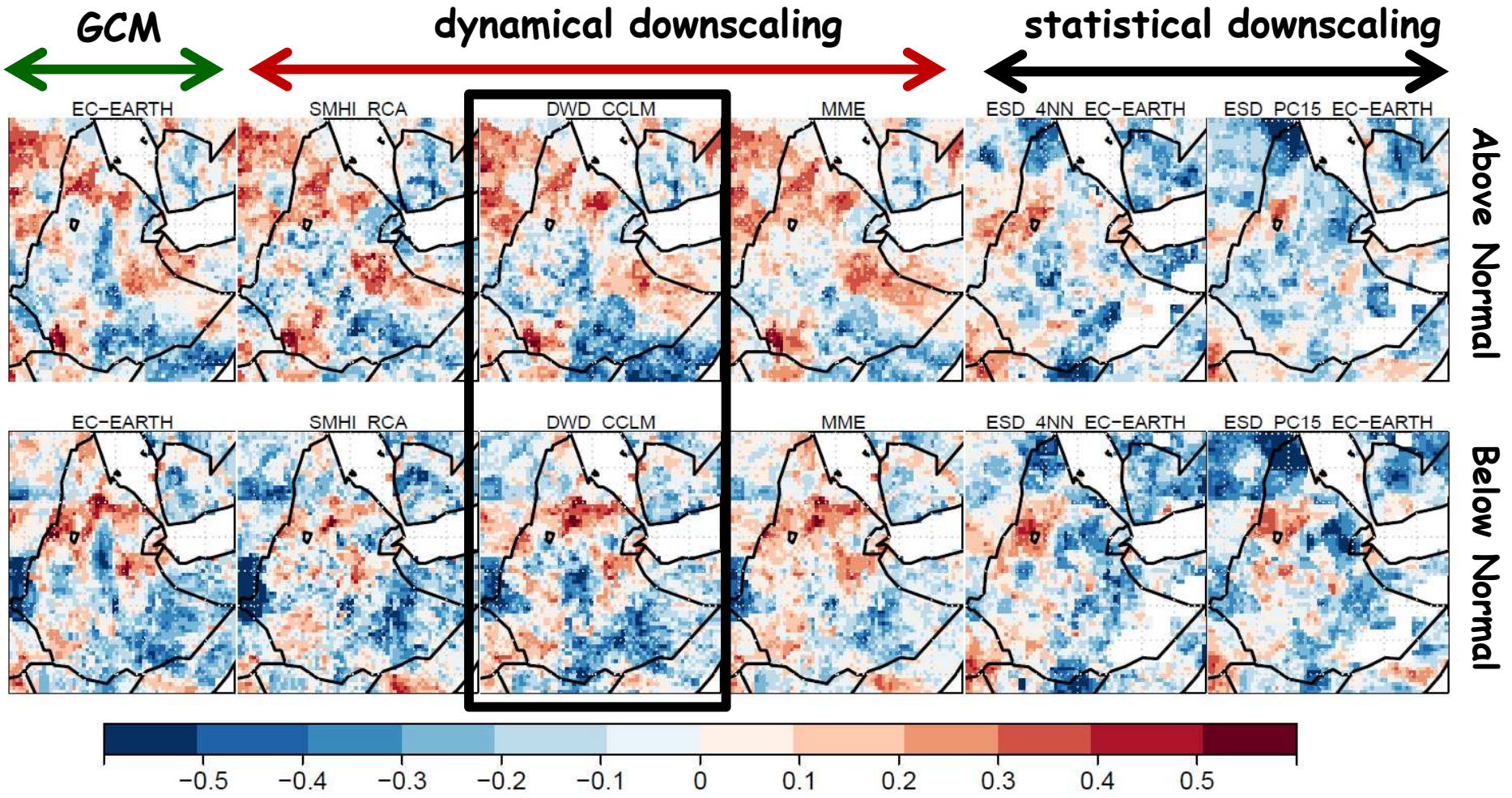


Institutes involved => DWD, SMHI, ENEA, UC, UL-IDL, Met Office

Seasonal forecasting over East Africa

EUPORIAS

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Summer mean rainfall
(June-to-September; 1991-2010)
MME=CCLM4, RegCM4, RCA4, WRF, WRF

Brier Skill Score (BSS)

perfect score: BSS = 1
good skill: BSS > 0
no skill: BSS = 0
bad skill: BSS < 0

Wp21.2 partners: SMHI (lead), **DWD**, ENEA, UC, UL-IDL, Met Office U.K.

CLM-Community Special Issue

Part I

Meteorologische Zeitschrift - Vol. 25 Issue 2 (8 articles)

published in May 2016

Part II

to be published in September 2016

Meteorologische Zeitschrift - Vol. 25 Issue 5 (5 articles)

http://www.schweizerbart.de/papers/metz/list/25#issue2

CLM-Community Special Issue

PART I:

1. **Keuler et al.:** *Regional climate change over Europe in COSMO-CLM: Influence of emission scenario and driving global model*
2. **Haslinger et al.:** *Future drought probabilities in the Greater Alpine Region based on COSMO-CLM experiments – spatial patterns and driving forces.*
3. **Brisson et al.:** *Modelling strategies for performing convective permitting climate simulations*
4. **Keller et al.:** *Evaluation of convection-resolving models using satellite data: The diurnal cycle of summer convection over the Alps*
5. **Hassanzadeh et al:** *Impact of topography on the diurnal cycle of summertime moist convection in idealized simulations*
6. **Brienen et al.:** *A Central European precipitation climatology – Part II: Application of the high-resolution HYRAS data for COSMO-CLM evaluation*
7. **Smiatek et al.:** *Impact of land use and soil data specifications on COSMO-CLM simulations in the CORDEX-MED area*
8. **Trusilova et al.:** *The urban land use in the COSMO-CLM model: a comparison of three parameterizations for Berlin*

CLM-Community Special Issue

PART II:

1. **Schulz et al.:** *On the ground heat flux simulated by the land surface scheme TERRA of the COSMO atmospheric model*
2. **Ogaja et al.:** *Fourth Order Conservative Discretisation of Horizontal Euler Equations in the COSMO Model and Regional Climate Simulation*
3. **Pardowitz et al.:** *Estimating uncertainties from high resolution simulations of extreme wind storms and consequences for impacts*
4. **Gutjahr et al.:** *Impact of the horizontal resolution on the simulation of extremes*
5. **Hübener et al.:** *Evaluation and projection of high and low precipitation extremes simulated by COSMO-CLM4.8 for four small river catchments in Hessen, Germany*

CLM-Community Assembly 2016

September 20 – 23, 2016

Leuphania University

Lüneburg, Germany

Helmholtz-Zentrum Geesthacht
Zentrum für Material- und Küstenforschung

CLM-Community Assembly 2017

September 19 - 22, 2017

Karl-Franzens-Universität Graz / University of Graz

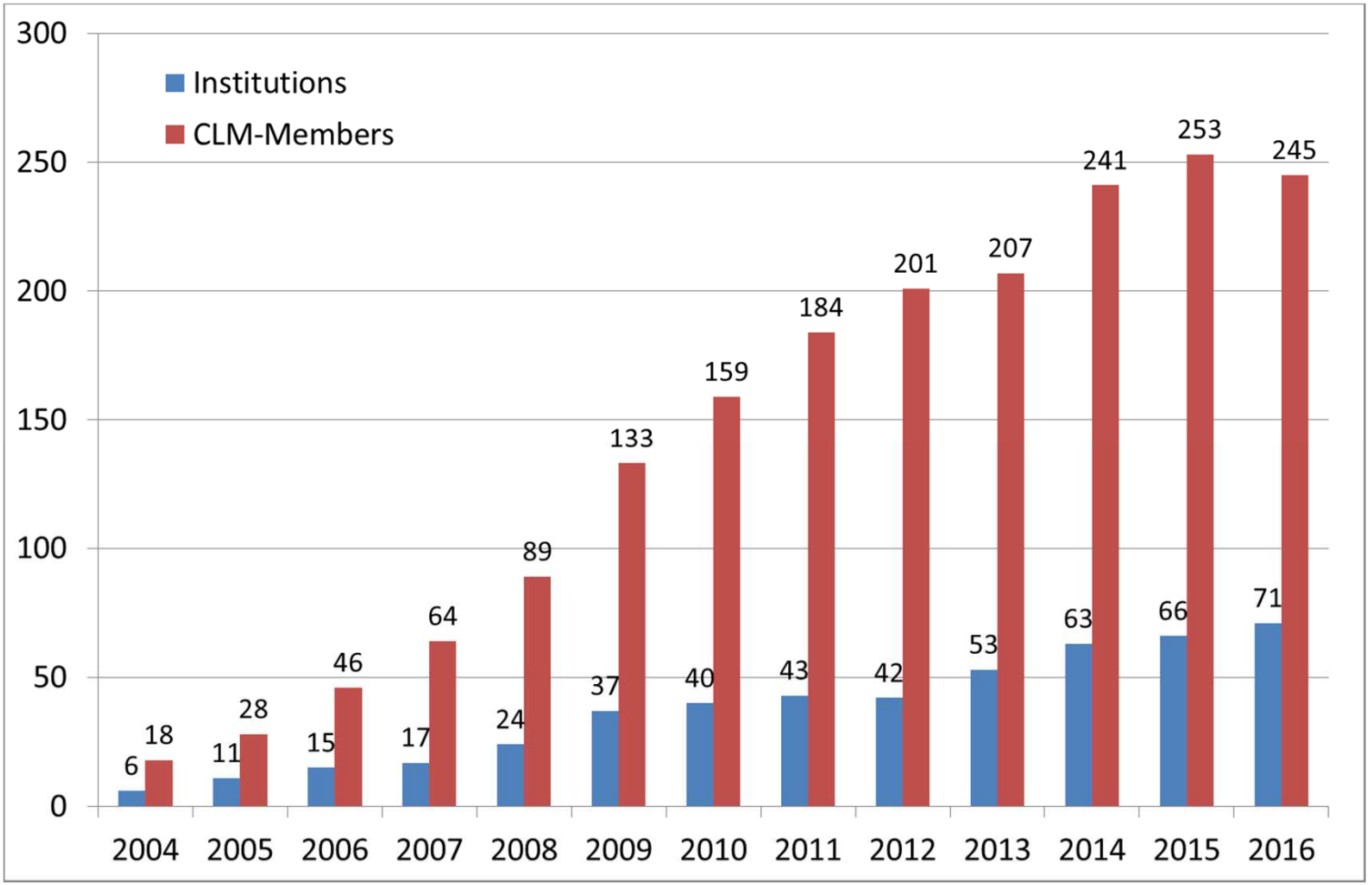
Wegener Center for Climate and Global Change

Austria

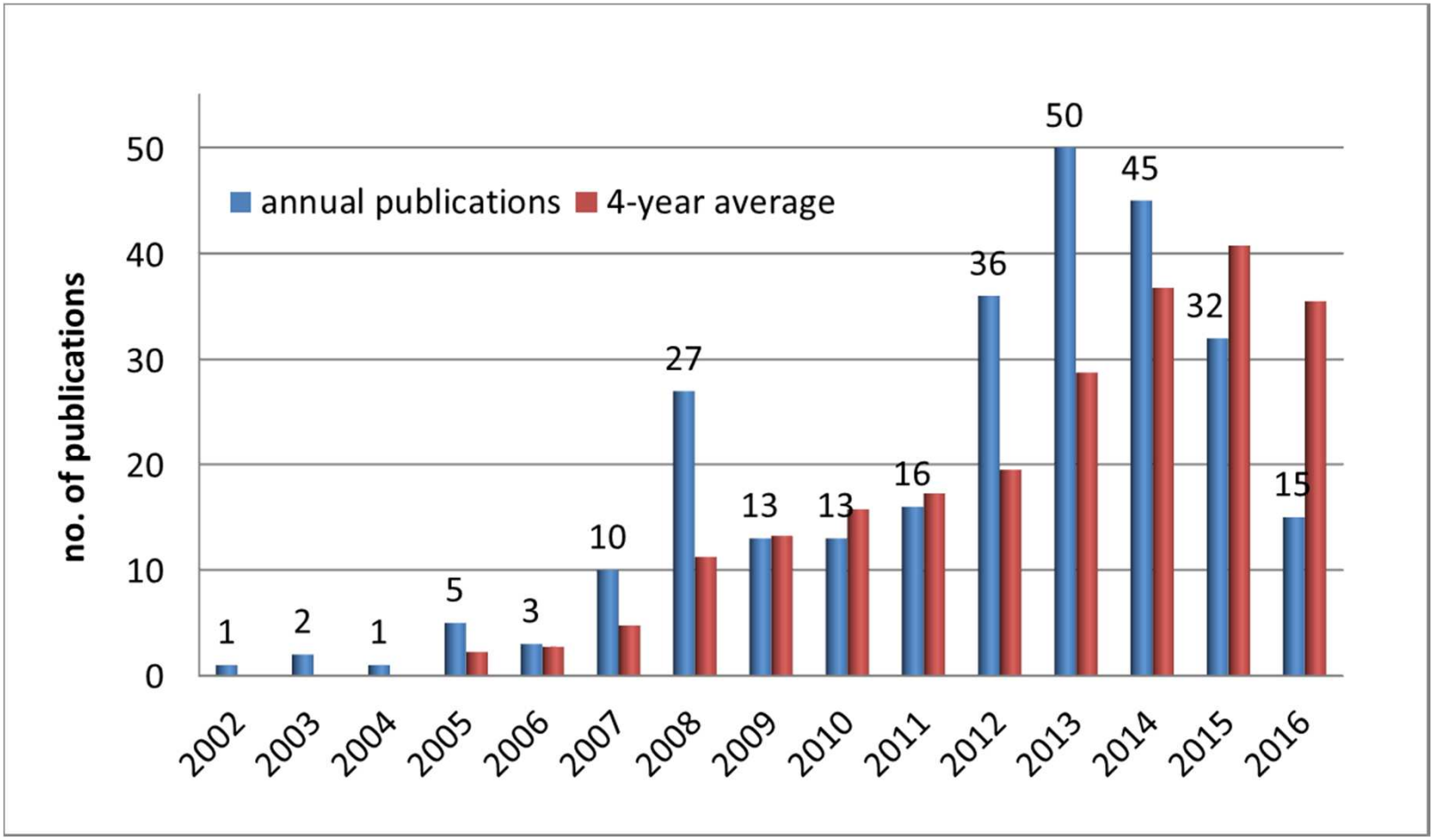
http://wegcenter.uni-graz.at/de/wegener-center/


Thank you very much for your attention!!!

CLM-Community development



CLM-Community development of publications



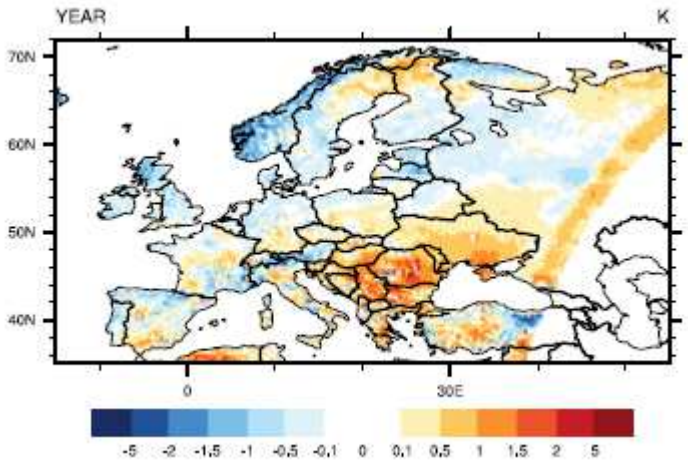
COPAT - Coordinated Parameter Testing - Project

Aim: Coordinated parameter testing to give a recommendation on the parameters to the users and have an evaluated community version in the end based on COSMO5.0 including an evaluation report

Participants

Susanne Brienen (DWD), Andrew Ferrone (LIST), Beate Geyer (HZG), Klaus Keuler (BTU), Daniel Lüthi (ETHZ), Anne Roches (ETHZ), Hans-Jürgen Panitz (KIT), Meriano Mertens (DLR), Jan-Peter Schulz (DWD), Hendrik Wouters (KUL), Ivonne Anders (ZAMG)

Domain and Setup:



Model version:

COSMO5.0_clm1; COSMO5.0_clm3a
together with int2lm2.0

Spatial resolution:

0.44° for all testruns, 0.165° for final evaluation run

Forcing:

ERAinterim 1979-2000)
(preprocessed data available via DKRZ)

Cooperation between COSMO Consortium and CLM Community

is highly desirable

… some collaborations already exist

- External parameters for COSMO (NWP) and COSMO-CLM (climate) EXTPAR/PEP Source Code Administration (SCA) D. Lüthi
- Closely cooperating Working groups
  - WG2/WG DYNNUM
  - WG3b/WG SOILVEG

… but it could still be improved!

Burkhardt Rockel, HZG

4th Order Energy Conserving Spatial Schemes in COSMO 5.0

Jack Ogaja and Andreas Will, BTU Cottbus, Germany

04.09.2016

New 4th order discretisation is implemented in COSMO 5.0 :

- **full 4th order horizontal discretisation of the Euler equations** l_higher_order_ss = .TRUE.
- **new kinetic energy conserving symmtric advection scheme *(Morinishi et al. JCP 1998, 2010)*** ladv_symmetric = .TRUE

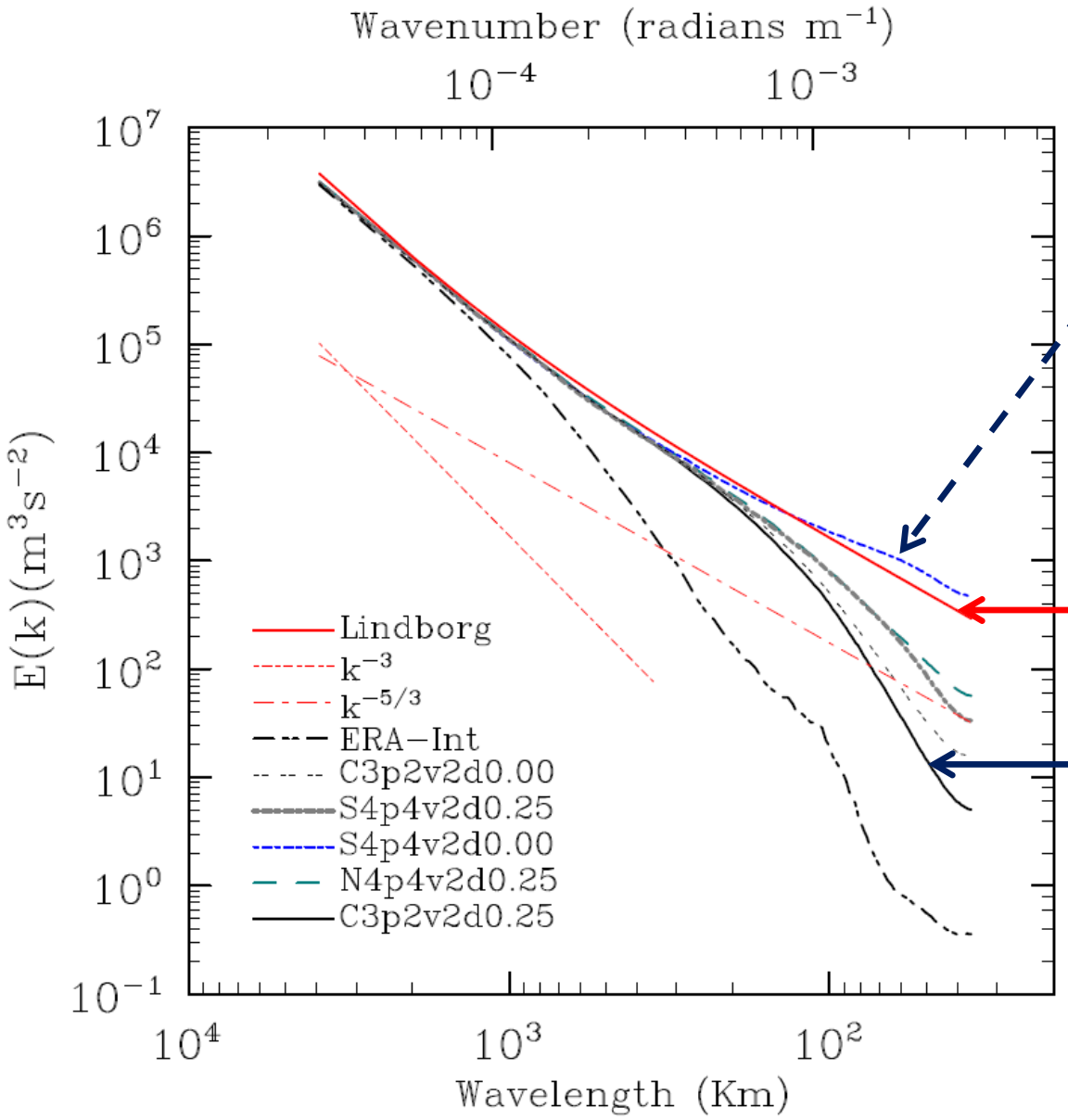
Climate simulations (18km, 7km) and idealised test cases reveal:

- **Model stability without any explicite or implicite horizontal diffusion**
- **Increased effective model resolution by approximately factor 2**
- **2% additional computing costs**
- **Tuning of physical parameterizations (convection, turbulence) necessary**

COSMO-DE test simulations: successful for 1 month

1. Effective model resolution

see Ogaja&Will (2016) Meteorol. Z. for details



Kinetic energy spectra for COSMO 4.24, CORDEX-EU configuration

4th order symmetric (new)

$$S4^* := \frac{9}{8}\overline{u^{O4,\lambda}\delta_\lambda u}^{\lambda} - \frac{1}{8}\overline{u^{O4,\lambda}\delta_{3\lambda} u}^{3\lambda} + \frac{9}{8}\overline{\hat{v}^{O4,\phi}\delta_\phi u}^{\lambda} - \frac{1}{8}\overline{\hat{v}^{O4,\phi}\delta_{3\phi} u}^{3\lambda}$$

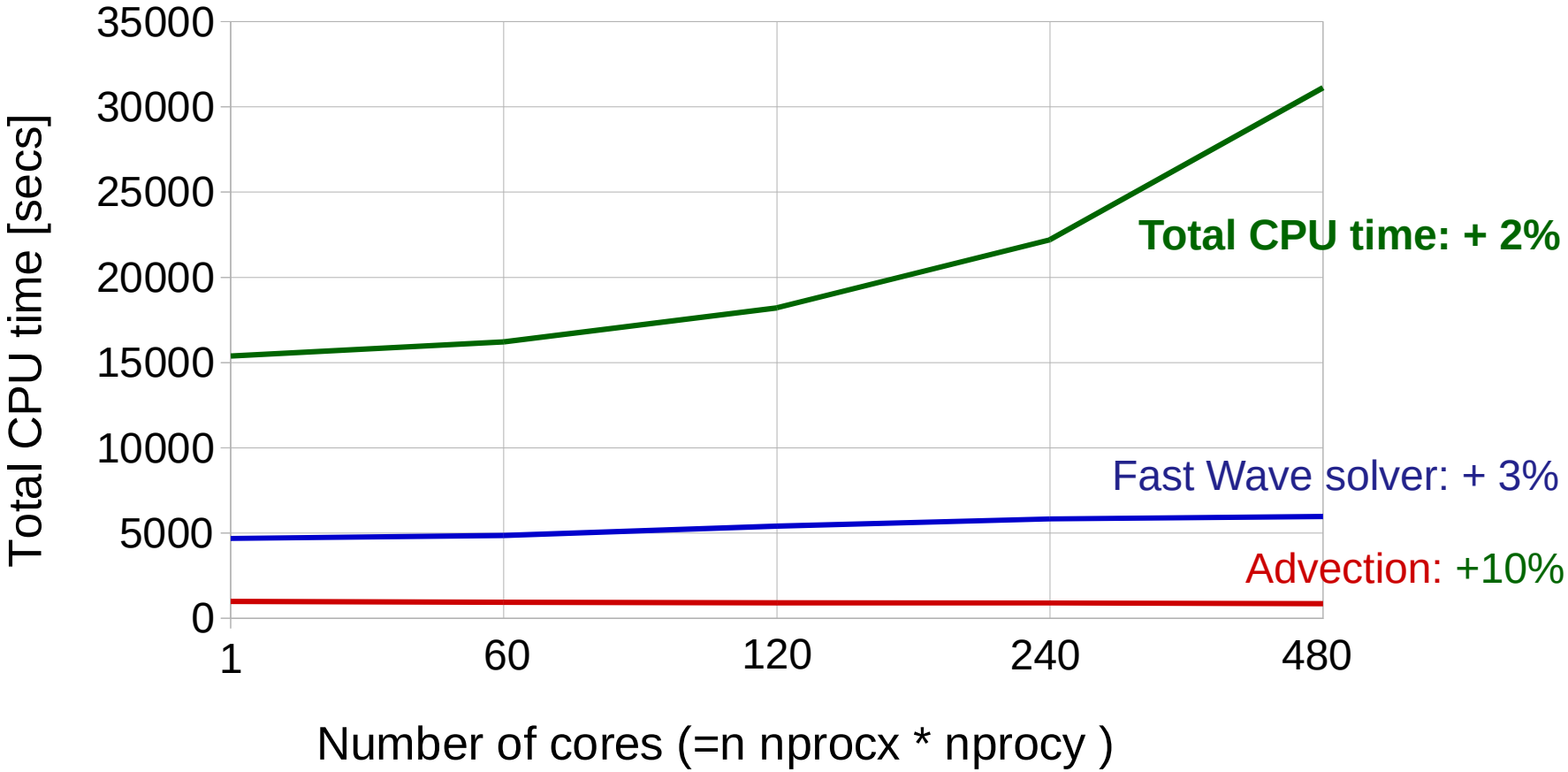
Observations (Lindborg)

3rd order upwind (reference)

Scalability of 4th order symmetric [Total CPU time]
and Difference of Computing Costs (+/- n%)
in comparison with 3rd order upwind

Mistral: DKRZ

(69647 grid points)

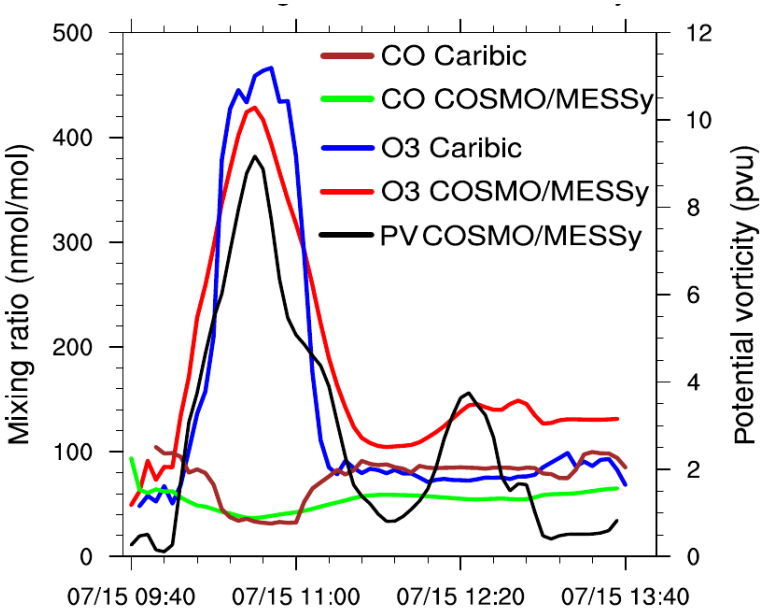


News from CCAR

Implementation of the aerosol module M7 with simplified chemistry in COSMO-ART/M7 finished.

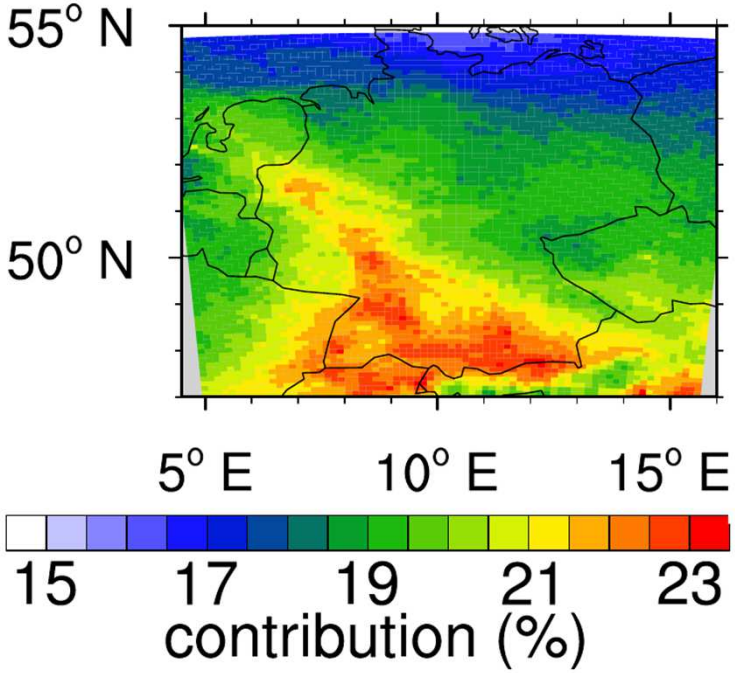
Chemistry – Clouds – Aerosol -Radiation

Evaluation with respect to tropospheric gas phase chemistry of COSMO-CLM/MESSy and first studies involving complex chemistry finished.



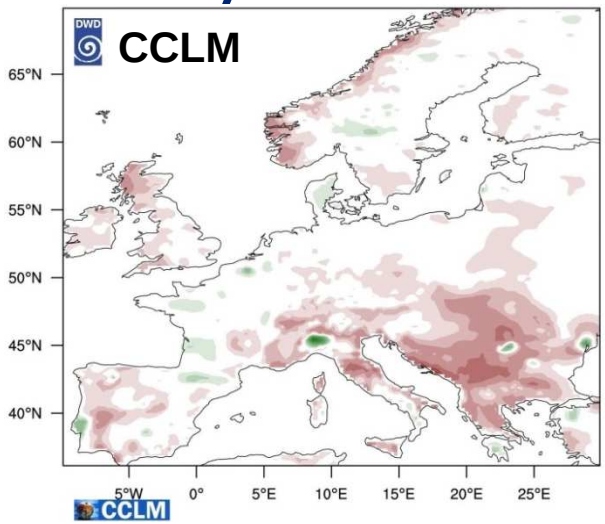
Comparison of COSMO-CLM/MESSy with aircraft in situ data over Europe (CARIBIC).

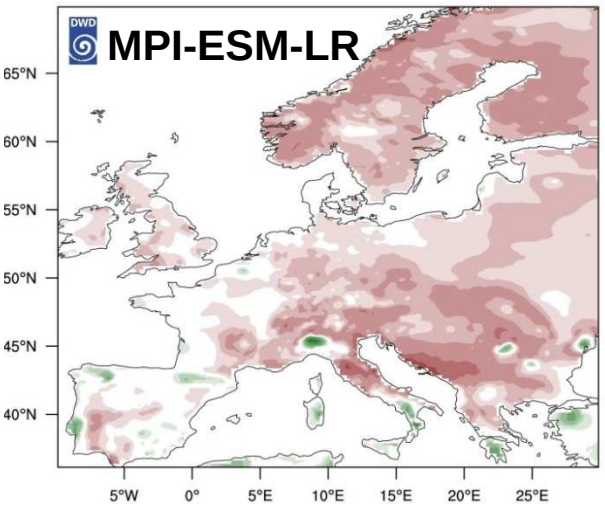
Mertens et. al, 2016

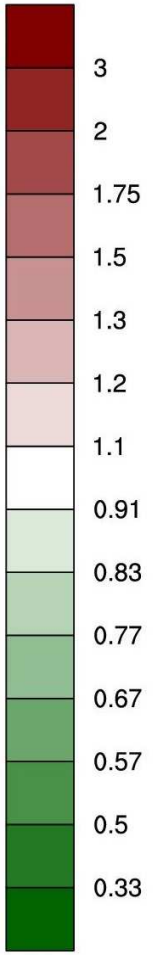


95 percentile of the contribution of road traffic emissions to ground level ozone over Germany for the period JJA 2008.

Reliability

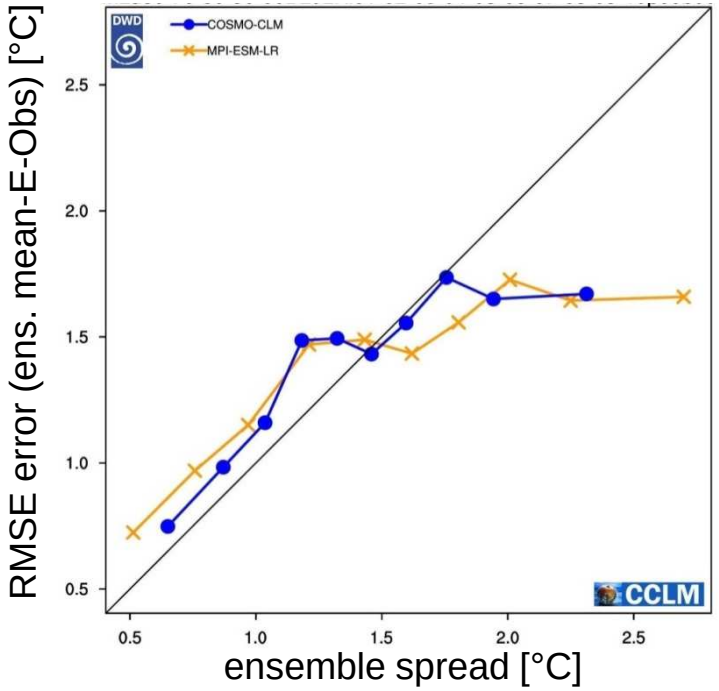






underdispersive ← → overdispersive

Spread Error Diagram (DJF)
annual mean year 2-9

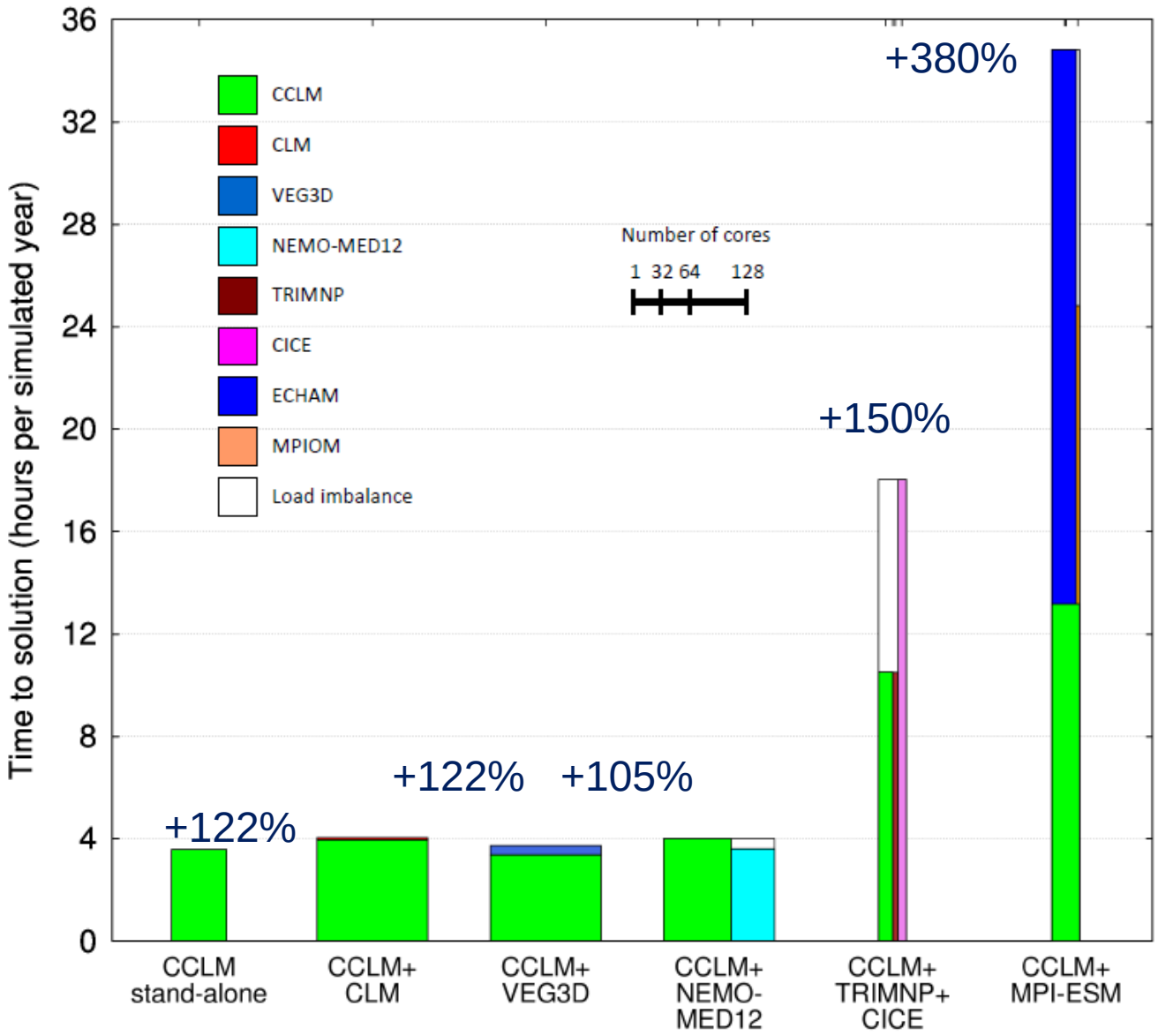


$$ESS = \frac{Ens_{Spread}}{Ens_{Mean\ Error}}$$

Ensemble Spread Score (ESS)
annual temperature, years 2-9
Baseline0 CCLM and MPI-ESM-LR

Optimum configuration:

Time to Solution (vertical axis) and Costs (surface)



Machine: blizard,DKRZ
Domain: CORDEX-EU

Additonal costs [%]
in comparison to COSMO-CLM

Results:

- Costs of field exchange and communication by OASIS negligible
- scalability problems identified
- unnecessary additional costs identified