Climate Limited-area Modelling Community

January 2020

Newsletter

No. 14

Content

See YOU at

ICCARUS 2020

02 - 06 March 2020
Offenbach, Germany

Invited speaker:

Steve Derbyshire (UK Met Office) and Reiner Schnur (MPI-M)

Announcement:

CLM-Community Assembly 2020

15 – 18 September 2020

Berlin, Germany

Dear CLM-Community members,

all the best for the New Year 2020 and welcome to the 14th newsletter of the CLM-Community!

We are currently experiencing quite some changes in the CLM-Community. Barbara Früh stepped back as community coordinator after 6 years of great work during which she helped to build up the community as we can see it today and to advance towards its goals in many aspects – thanks a lot! The SAB elected Christian Steger from DWD as new coordinator. You can find a short presentation of him in the minutes of the community meeting of the last assembly in Paestum.

In addition, Nicole van Lipzig from University of Leuven is the new chair of the SAB. She succeeds Christoph Kottmeier from KIT who led the SAB in the last years. Thank you very much.

Current and former CLM-Community coordinators together at the 2019 Assembly dinner in Paestum: Christian, Barbara, Andreas. Photo by MTN Company

We have now arrived in the transition phase from the COSMO-CLM model to ICON-CLM. Every community member is invited to join the efforts in finalizing the first version of the model and performing the tests and analysis, which are necessary before ICON-CLM can be released to the community – the more people contribute, the sooner the new model will be available!

Following the NWP community, we will also start in spring 2020 to offer the Numerical Model Training Course only for ICON-CLM and not for COSMO-CLM anymore. A minor change is the transfer of the webpage to a new system, which comes along with some structural changes, which will hopefully take place unnoticed by most of the community members. However, if you encounter any problems, please let us know.

This newsletter contains an Interview with Astrid Kerkweg from the Research Centre Jülich and research notes from Florian Ehmele et al. on long-term variances of heavy precipitation from a large ensemble of RCM models and from Merja Tölle et al. on the uncertainty of albedo parameterization in extreme land use changes. Andrew Ferrone keeps us informed on the latest IPCC activities and Silje Sorland wrote an update on CORDEX-CORE and PRINCIPLES. As usual, you can also read a short review of the last assembly and an outlook to the next ICCARUS and Numerical Model Training.

Enjoy reading and we hope to meet many of you at ICCARUS in Offenbach in March.

Yours sincerely,

Christian Steger, Susanne Brienen and Anja Thomas

Five questions to … Astrid Kerkweg

Forschungszentrum Jülich

Photo by A. Kerkweg

Astrid Kerkweg is a senior scientist in the modelers group at IEK-8, Forschungszentrum Jülich (FZJ). She studied Meteorology at the University of Bonn, did her PhD work at the Max Planck-Institute for Chemistry (MPIC) in Mainz and received her degree in 2005 from University of Bonn. During her PhD and PostDoc time at MPIC and IPA, University of Mainz, she became and now is one of the main developers of the MESSy interface.

1. ***Astrid, you recently changed from University of Bonn to Forschungszentrum Jülich. Can you please tell us something about your new institute and your tasks there?***

At the Institute for Energy and Climate Research, Troposphere (IEK-8) physical and chemical processes in the troposphere, which have major impact on the chemical composition of the atmosphere, are investigated: these are, e.g., natural and anthropogenic tracer substance surface emissions, the chemical transformation of tracer substances and their distribution by atmospheric transport. As member of the modelling group, which uses, among others, the "Modular Earth Sub-model System" (MESSy), I participate in the HGF project Pilot-ExaESM, which aims at developing and testing ideas and procedures to make the present day earth compartment models ready for Exascale Earth System Modeling (ExaESM). I am working as a scientist at the institute and I'm involved in three different projects (openFRED, MarEns and SeAir). Moreover, I am contributing to two HZG-initiatives: one aims to establish a Coastal Data center, and the other aims at an Earth System model for coastal regions. Finally, I am working on proposals in the field of regional climate.

2. ***You are a member of the CLM-Community for quite a long time now. What are, in your opinion the advantages of the CLM-Community and where do you see room for improvements?***

The advantages are clearly the synergy effects gained by jointly developing and maintaining the model and its framework. The best examples are the COPAT initiatives, the project group ICON and the provision of the on-line diagnostic tools of COSMO-CLM/MESSy.

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Interestingly, the biggest advantage of the CLM-Community shows the largest room for improvement, i.e., the number of CLM-Community members doing important development work for community issues is decreasing, especially as some very engaged long-term members left the community due to retirement without an adequate replacement. Therefore it is important that all members of the CLM-Community do not only use the model and its framework, but also invest some time to contribute to community tasks.

3. *You are one of the main developers of the MESSy-Interface. Can you please explain the purpose of this interface and how other members of the CLM-Community could benefit from it?*

The Modular Earth Submodel System (MESSy) is a software providing a framework for a standardized, bottom-up implementation of Earth System Models (or parts of those) with flexible complexity. "Bottom-up" means, the MESSy software provides an infrastructure with generalized interfaces for the standardized control and interconnection (= coupling) of "low-level ESM components" (dynamic cores, physical parameterizations, chemistry packages, diagnostics etc.), which are called submodels.

The purpose of MESSy is therefore to provide a very flexible modelling infrastructure, allowing for model setups which are tailor-made for the specific research question. Moreover, it simplifies model development.

The trend - not only - in the CLM-Community goes to longer-term and/or higher resolved simulations, hereby encountering more and more limitations by storage space. Therefore, on-line diagnostic tools calculating the target variables directly during the model simulation become increasingly important.

One option is to use the MESSy-fied versions of the CLM-Community models. MESSy provides a variety of on-line diagnostic tools., e.g. (1) the direct output of simple statistics w.r.t. time, such as monthly mean, standard deviation, minimum, maximum, (2) the output of variables on distinct surfaces (e.g., pressure levels, potential vorticity iso-surfaces), (3) output of data along specific tracks, (4) the redirection and renaming of variables into specific output files, and (5) tendency diagnostics. All this is possible for all model variables without the need to modify the source code for each variable individually.

Further, the MESSy infrastructure provides the possibility to integrate tailor-made on-line diagnostics into the model without modifying the COSMO-CLM code itself. CLM-Community members can use a COSMO-CLM/MESSy version including all diagnostic submodels, reducing post-processing efforts and data amount.

Currently, MESSy is connected to the ICON modeling framework to make the same diagnostic tools available to the CLM-Community for ICON-CLM in the future.

4. *You are also the coordinator of the working group SUPTECH. Can you give us an overview of the tasks of this working group and your job as coordinator?*

SUPTECH stands for “SUPport and TECHnical issues”. This working group combines all those people concerned with the CLM-Community software itself and/or with the support of this software. The CLM-Community does not only comprise COSMO-CLM itself, but also additional software like INT2LM and EXTPAR. Additionally, the starter package including the subchain environment is an important tool to simplify conducting simulations with COSMO-CLM. In addition to the maintenance of these software packages, once a year a training course is offered to teach how the available software can be used.

Support is achieved by several information platforms: i.e. the CLM-Community Homepage, the Redmine system (RedC), the Namelist Tool and WebPEP.

Especially the Homepage and the RedC provide a number of additional helpful scripts. All these platforms and software have to be maintained and further developed.

In the SUPTECH meetings all CLM-Community members taking responsibility for one of the above listed issues/tasks meet and discuss all important topics. Recently discussed issues are, e.g., the transition from COSMO-CLM to ICON-CLM, the CCLM2CMOR tool, etc.

My task as coordinator is to organize the group meetings and to keep the overview about the ongoing required technical needs.

5. *What are your personal goals with respect to your scientific career?*

I am not the person dealing everyday with shaping the ideal academic career. The main issue is to have fun with the projects I am involved in and to get insight into new fields. Thus, I am moving to work with ICON-CLM and to investigate the impact of aerosol and cities on the atmospheric dynamics in the future.

Thank you very much for the interview! ■

IPCC activities

Special Report on Climate Change and Land and Special Report on The Ocean and Cryosphere in a Changing Climate

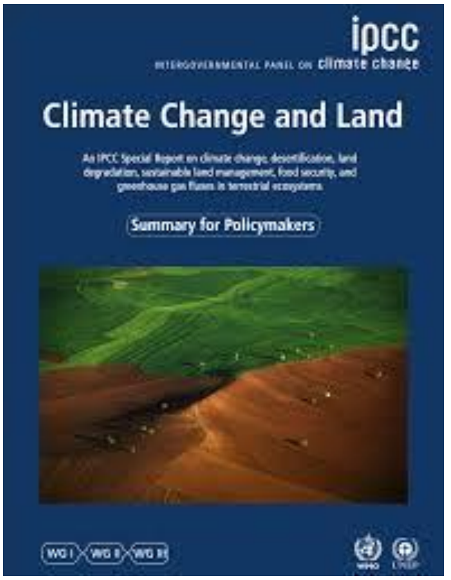
by Andrew Ferrone, Ministry of Agriculture, Viticulture and rural Development
Administration of agricultural technical services
Meteorological service
Luxembourg

Over the last six months, the Intergovernmental Panel on Climate Change (IPCC) met twice to adopt and accept two special reports. The first plenary was held from 2nd to 6th August 2019 in Geneva, Switzerland where the Special Report on Climate Change and Land (SRCCL) was accepted and it's Summary Report for Policymakers (SPM) adopted line by line. The second plenary was held from 20th to 24th September in the Principality of Monaco to adopt and approve the Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC).

Some key messages of the SRCCL include the following:

- The report highlights the vulnerabilities of land ecosystems and resources and food security to climate change as well as other land challenges. The frequency and intensity of some extreme climate and weather events impacting land has increased.
- Many low and medium cost and effective strategies, such as strategies based on land management, on value chain management, and on risk management, are available for integrated measures on climate change, land degradation, and food security
- All assessed pathways that limit warming to 1.5 °C or well below 2°C require land-based mitigation and land use change that remove CO2 from the atmosphere. Most of these include reforestation/ afforestation, reduced deforestation, and bioenergy. If applied at a large scale and in an unsustainable manner, land-based mitigation measures increase pressures on land and food security, and have negative effects on adaptation, land degradation and food security.
- Early climate action can bring both immediate and long-lasting sustainable development benefits and is mostly less costly than delayed action.

The full report can be found here: https://www.ipcc.ch/srccl



Some key messages of the SROCC include the following:

- Climate change impacts on the cryosphere and the ocean are already affecting humans and societies, for example through impairment of fisheries and damages to infrastructure. Other human dimensions impacted include food, health and wellbeing, Indigenous Peoples, tourism, trade and transport.
- Current emissions will continue to lead to long-term consequences well beyond 2100 due to system inertia; this applies in particular to ocean warming, permafrost thawing and sea-level rise resulting in multi-meter rises in the long term.
- Climate mitigation can significantly reduce these risks by slowing down already ongoing changes and allow more effective adaptation. The risks associated with higher emission pathways are significantly higher and, in some cases, exceed the adaptive capacity of ecosystems and societies.
- The risk of reaching so-called tipping points with catastrophic consequences in the ocean and cryosphere rises with increasing warming, in some cases even at temperatures below 2°C. This underlines the need to limit global warming to 1.5°C.

The full report can be found here: https://www.ipcc.ch/srocc

Upcoming meetings and reviews:

Sixth Assessment Report:

- Approval of the outline of the Synthesis Report 24.02. - 28.02.2020
- Expert review of the first order draft of the WG II contribution 18.10. - 13.12.2019

- Expert review of the first order draft of the WG III contribution 13.01. - 08.03.2020
- Expert and gov. review of the second order draft of the WG I contribution 02.03. - 26.04.2020
- Expert and gov. review of the second order draft of the WG III contribution 13.07. - 13.09.2020
- Expert and gov. review of the second order draft of the WG II contribution 07.08. - 02.10.2020
- Approval/Acceptance of the WG I contribution April 2021
- Approval/Acceptance of the WG III contribution July 2021
- Approval/Acceptance of the WG II contribution October 2021
- Adoption/Acceptance of the Synthesis Report May/June 2022

COP25/CMP15/CMA2: The longest COP in history

Only one month before the start of the conference scheduled to be held in Santiago in Chile, it was announced by the Chilean Government, that due to the social unrests in Chile, the conference could not take place as planned. Only a few days later, the Spanish government announced, that the conference, with over 26.700 registered participants could take place on the same dates from 2nd to 13th December as planned in Madrid in Spain.

During the session of the Subsidiary Body for Scientific and Technological Advice (SBSTA), two IPCC-SBSTA special events were held, where the authors of the two Special Reports that were adopted this year, presented the main findings of the reports and engaged in a dialogue with Parties. All information, including registered webcasts can be found here:
SRCCL: https://unfccc.int/event/srccl-special-event
SROCC: https://unfccc.int/event/srocc-special-event

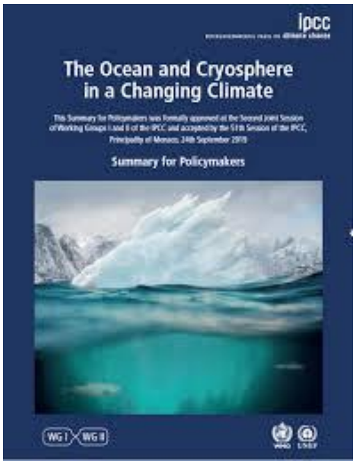
The SBSTA also held a second Earth Information Day (the first being held in 2016 in Marrakesh), which allowed Parties to get updates on the State of the global climate as well as on implementing of Earth observation and the need to support on regional and country level. Finally, a discussion on the need for Earth observation for science, policy and practice to respond to future climate risk was held in the framework of the Earth Information Day. All information, including registered webcasts can be found here: https://unfccc.int/topics/science/events-meetings/systematic-observation/earth-information-day-2019

The COP decided, amongst others, to hold a second period review from 2020 to 2022. The aim of the second Periodic Review is to enhance Parties' understanding of the long-term global goal of the Paris Agreement and the progress made in relation to addressing information and knowledge gaps. Furthermore, the Periodic Review also addresses challenges and opportunities for achieving the long-term goal and assess the overall aggregated effect of the steps taken by Parties in order to achieve it. In the framework of the Periodic Review, three Structured Experts Dialogues (in November 2020, in June 2021 and November 2021), in which Parties can exchange with scientist based on the published IPCC special reports and the upcoming 6th Assessment Report as well as other scientific publications. The decision can be found here:
https://unfccc.int/resource/cop25/cop25_auv_LTGG.pdf

The main outcome of the COP25 was the political decision, the so-called "Chile Madrid Time for Action", which could only be adopted after an extension of the negotiations by over 40 hours, making COP25 the longest COP of all times. This decision notes, amongst others, with concern the state of the global climate system and recognizes that action taken to address climate change is most effective if it is based on best available science. Further, the COP expresses its appreciation and gratitude to the IPCC and the scientific community for the Special Reports and invites Parties to use the information under all relevant agenda items. The decision can be found here: https://unfccc.int/resource/cop25/1cop25_auv.pdf

Upcoming meeting:

- COP26/CMP16/CMA3 from 9th to 20th November 2020 in Glasgow, United Kingdom



CORDEX activities

CCLM-simulations for different CORDEX domains

Silje Soerland (ETH Zurich)

In the last years, the CLM-Community has contributed with an extensive set of CORDEX simulations for several different domains: Europe, South Asia, East Asia, Australia, Africa and Central Asia. Seven CMIP5 GCMs have been downscaled with different versions of the COSMO-CLM model at horizontal resolutions of 0.44 (~50km), 0.22 (~25km) or 0.11 (12km) for the RCPs 2.6, 4.5 and 8.5. This is resulting in 80 simulations which are (or soon will be) published on the ESGF-node, available for the users and to be included in further research. Such a contribution would not have been possible without the community effort from the CLM-Community members!

Currently, there are several groups looking into these different simulations, to assess the model performance, model transferability, and the impact from changing the horizontal resolution and model version on the climate change signal. Table 1 lists the number of simulations available for each domain for the two resolutions. There are CORDEX style COSMO-CLM simulations done for other domains, however, those simulations have not downscaled any GCMs or are not published on the ESGF-node.

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Filling the EURO-CORDEX matrix

The European region is one of the most downscaled area of the CORDEX domains, where up to 12 CMIP5 GCMs have been downscaled with more than 9 different RCM, at two different horizontal resolutions. This is a unique dataset, but it also comes with challenges in how to construct a multi-model ensemble. The 3-D matrix, given by the number of GCMs downscaled by RCMs for different RCPs, is still insufficient to span the full uncertainty dimensions. As part of the Copernicus Climate Change Service (C3S), there is now an ongoing project with the goal to produce well-coordinated RCM simulations for the European domain at 12km horizontal resolution. These simulations are intended to serve the international climate adaptation and impact community, consistent with the overarching goals of Copernicus (https://climate.copernicus.eu/climate-projections).
The project Producing RegIoNal ClImate Projections Leading to European Services (PRINCIPLES) consist of 9 partners with 9 different regional climate models, and ETH Zürich is contributing with the GPU version of the COSMO/COSMO-CLM model (COSMO-crCLIM). The simulations that will be produced during the project will focus on a sub-set of 6 CMIP5 GCM that have already been downscaled over Europe, and will in this way supply the already existing 3-D matrix from EURO-CORDEX. The 6 GCMs are: HadGEM2-ES, ECEARTH, CNRM-CM5, NorESM1-M, MPI-ESM-LR, and IPSL-CM5A-MR. The project started in 2017 and will go on until 2021, and at the end of the project, the existing RCM simulations for EUR-11 will have doubled. ■

***Table 1**: The number of COSMO-CLM simulations for the different domains (EUR: Europe, AFR: Africa, AUS: Australia, EAS: East-Asia, WAS: South-West Asia), driven by ERA-Interim/GCMs. The ERA-Interim simulation is the evaluation run, and is typically from 1979-2000/2010. The GCM driven run includes a historical simulation (1950-2005) and one or more of the scenarios RCP2.6/4.5/8.5 (2006-2099).*

For each domain, two different horizontal resolutions are used: 0.44 (50 km), and 0.11 (~12 km, only for Europe) or 0.22 (~25 km, for all the other domains). The member r1 is used for all the GCMs, except for EC-EARTH (r12), and for MPI-ESM, three different members have been simulated (r1,r2,r3). The HadGEM-ES is used for all domains, except for East-Asia, where HadGEM-AO is used.

Domain	ERA-Interim		MPI-ESM*		HadGEM**		CNRM-CM5		EC-EARTH		CanESM2		NorESM		MIROC5		
	0.11/ 0.22	0.44	0.11/ 0.22	0.44	0.11/ 0.22	0.44	0.11/ 0.22	0.44	0.11/ 0.22	0.44	0.11/ 0.22	0.44	0.11/ 0.22	0.44	0.11/ 0.22	0.44	Domain sum
EUR	2	2	6	3	3	1	2	1	4	1	1		1		2	1	26
AFR	2	1	2	2	2	2		2		2			2				14
AUS	1	1	2	2	2					2			2				10
EAS	1	1	2	2	2	2		2		2							12
WAS	1		2	1					1				2				6
GCM sum	7	5	14	10	9	5	2	5	5	7	1		7		2	1	**80**

CLM-Community issues

Review CLM-Community Assembly 2019

Susanne Brienen (Deutscher Wetterdienst)

The 14th CLM-Community Assembly had been organized by the colleagues from the Italian Aerospace Research Center / Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC). It took place in Paestum, an ancient greek city south of Naples in Italy. Nearly 40 members of the community took the opportunity to present their work and discuss recent developments and results with respect to COSMO-CLM.

In 23 talks and 8 posters, the attendants presented their work and discussed it with the other participants. In addition, Professor Antonio Navarra, the president of the CMCC presented the current and planned activities of CMCC as invited speaker and also gave an outlook on possible future developments in the area of climate and earth system modelling.

The working groups CO, SUPTECH, SOILVEG, CRCS, EVAL, CP and ICON, as well as the SAB, met for discussing the latest developments and open issues of the various topics of the CLM-Community and presented the current status on Friday in the community meeting. Please note, that a few positions of working group coordinators or deputies are vacant – if you are interested in taking over one of these tasks, please see the minutes of the community meeting and contact the CLM coordination office!

Some of the current research foci of the presented work were the investigation of extremes and diurnal cycles from convection-resolving simulations, modelling of urban effects, application of the model in domains outside Europe and the coupling of other components of the earth system such as land and ocean models. One major aspect which concerns the whole community and which was discussed intensively during the meeting, is the further development of ICON-CLM and the preparation of the coordinated evaluation of COSMO-CLM 6.0 and ICON-CLM. Anybody who is interested in joining these efforts, is invited to contact the coordinators of PG ICON and WG EVAL.

Apart from science, the organizers put up a very nice social program including very good Mediterranean food and some insight in the history of the area with the visit of the Paestum greek and roman temples. This gave the participants even more opportunity to get in contact and continue their discussions form the plenary sessions and working group meetings.

Thanks to CMCC for a great assembly 2019. See you in Berlin from 15 – 18 September 2020!

Group picture at the Assembly 2019. Photo by MTN Company

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Numerical Model Training Course 2020

Christian Steger (Deutscher Wetterdienst)

The Numerical Model Training Course in 2020 will take place from 30 March to 03 April in the DWD Training Center in Langen, Germany. It will be the first training without a course for the COSMO modelling system. DWD already stopped the training for NWP applications of COSMO in 2019 and also the CLM-Community will not offer a COSMO-CLM course this year anymore.

The NWP part of course has already been replaced by a course for the limited area mode of ICON (ICON-LAM) last year. This year, the NWP course will be held as usual from Monday to Thursday with theoretical lectures and practical exercises. Unfortunately, the CLM-Community cannot yet offer a complete four-day ICON-CLM training in 2020 for several reasons, but there will be a one-day introduction course for the preliminary version of ICON-CLM on Friday, as one of three additional courses to the (NWP) ICON-LAM training. The CLM-Community training course team hopes that a complete course for ICON-CLM can be offered again from next year onwards.

Further information about the Numerical Model Training Course is available on the webpage www.dwd.de/training.

Outlook ICCARUS 2020

Christian Steger (Deutscher Wetterdienst)

The next ICCARUS (ICON-COSMO-CLM-ART User Seminar) will take place in Offenbach, Germany, from 02 to 06 March 2020. On Monday, Tuesday and Wednesday there will be oral and poster sessions that cover different aspects of model development and application in numerical weather prediction and climate modelling. Forty-six presentations are scheduled for the oral sessions, including invited talks by Steve Derbyshire (UK Met Office) about atmospheric waves and by Reiner Schnur (MPI-M) about the Land Model JSBACH. Furthermore, there will be five solicited talks by Bernhard Vogel (KIT; overview ICON-ART), Günther Zängl (DWD; overview ICON-NWP), Panos Adamidis (DKRZ; overview ICON infrastructure), Ulrich Schättler (DWD; overview COSMO) and Marco Giorgetta (MPI-M; overview ICON at MPI-M).

As usual, Thursday and Friday are reserved for the working group meetings of COSMO and the CLM-Community. For the first time, also working group meetings of the ICON community will take place at ICCARUS because it has been decided to include the ICON developer meeting in ICCARUS this year.
More information, including the preliminary program, are available on the ICCARUS webpage www.dwd.de/iccarus. The registration is still open until 9 February! We hope to meet many of you in March in Offenbach.

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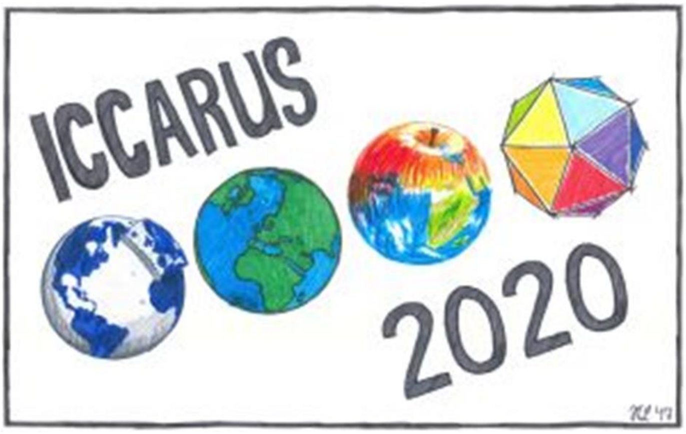

Long-term Variances of Heavy Precipitation across Central Europe using a Large Ensemble of Regional Climate Model Simulations

Florian EHMELE[1], Lisa-Ann KAUTZ[1], Hendrik FELDMANN[1], Joaquim G. PINTO[1]
[1]Karlsruhe Institute of Technology (KIT)

More details can be found in:

Ehmele, F., L.-A. Kautz, H. Feldmann and J. G. Pinto (2019): Long-term Variances of Heavy Precipitation across Central Europe using a Large Ensemble of Regional Climate Model Simulations. Earth Syst. Dynam. Discuss., DOI: 10.5194/esd-2019-47, in review.

Feldmann, H., Pinto, J. G., Laube, N., Uhlig, M., Moemken, J., Pasternack, A., Früh, B., Pohlmann, H., and Kottmeier, C. (2019): Skill and Added Value of the MiKlip Regional Decadal Prediction System for Temperature over Europe, Tellus A: Dynamic Meteorology and Oceanography, DOI: 10.1080/16000870.2019.1618678

Introduction

Widespread flooding events are among the major natural hazards in Central Europe. Nevertheless, extreme floods are rare and associated with high return periods, which may exceed 100 years. The period with comprehensive observations is too short to assess properly the risk of such events and to create reliable statistics. One possibility to deal with this issue is to consider large simulation ensembles and treat them as a quasi-stochastic data set. Such an approach is followed in the present study. Focus is given to the PRUDENCE region Mid-Europe (ME) and extensive areal precipitation potentially leading to widespread river flooding.

Model Setup

During the BMBF MiKlip project (Marotzke et al., 2016), several generations of initialized global decadal hindcast ensembles were produced. In addition, regional downscaling with CCLM for Europe was performed to assess the skill and added value of regional decadal predictions (Feldmann et al., 2019). These regional hindcast ensembles were combined with additional simulations to a new large ensemble of consistent CCLM simulations - called LAERTES-EU (LArge Ensemble of Regional climate modEl Simulations for Europe).

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LAERTES-EU has a horizontal resolution of 0.22° covering the years 1900 to 2018. This period is extended to 2028 using decadal predictions. In total, LAERTES-EU consists of over 12.500 simulated years, and can be divided into four data blocks. Block 1 consist of three long-term simulations (each 110 years) assimilating 20CR reanalysis data (Compo et al., 2011). These simulations serve as initial conditions for data block 2, which consists of a three-member decadal hindcast ensemble with starting dates separated by one year from 1910-2009. Both data blocks use MPI-ESM-LR global simulations as forcing data. Data block 3 contains the downscaling of five un-initialized (historical) simulations of MPI-ESM-HR with CMIP5 observed natural and anthropogenic forcing. Data block 4 encompasses two sets from the downscaling of decadal hindcasts with MPI-ESM-HR starting in 1960 with a five-member ensemble using CMIP5 forcing and a 10-member ensemble using CMIP6 forcing.

All simulations generally follow the observed climate forcing, but differ with respect to the representation of the observed climate variability. Nonetheless, the four blocks can be grouped into a large ensemble, since the RCM simulations were all performed with the same setup. In order to reduce well known limitations of climate model simulations (e.g. Berg et al., 2012), a dry-day adjustment was performed as climate models tend to overestimate the number of wet days with low intensities (drizzle-effect). The E-OBS data set (Haylock et al., 2008) serve as reference for the evaluation and the dry-day correction. In addition, the high-resolution HYRAS data set (Rauthe et al., 2013) was applied as a second observational reference.

Results

The precipitation distribution of LAERTES-EU was in the range of the observation uncertainty between E-OBS and HYRAS. A positive trend for ME for the ensemble mean was observed throughout the entire period, as depicted in Figure 1 for the yearly 99% percentile of spatial mean precipitation as an example (+7%). The large variability for the first decade of the 20th century has to be regarded with caution. This period is affected by a smaller ensemble size and potential problems with some of the driving simulations (Müller et al., 2014). From 1910 onward, the curve is smoother, especially since 1960 due to the increased number of members between 1960 and 2020. Nevertheless, a continuous trend is visible. The detected positive trends are more pronounced towards more extreme percentiles.

The calculation of the 99% percentile of Fig. 1 is based on dry and wet days.

In contrast, the R99pTOT index from ETCCDI (Fig. 2) sums up the precipitation amounts of all days above the 99% percentile for wet days with R > 0.1mm.

In terms of the ensemble mean, the positive trend for ME is even more pronounced, with a relative change throughout the entire period of approx. 35%. This indicates that dry spells became longer (or more frequent) and that precipitation during the most extreme wet days became more intense. The number of days exceeding the climatological threshold (e.g. 99% percentile, not shown) likewise shows strong positive trends for ME (approx. 40%), which increases towards higher percentiles. In both cases, the predictions for the upcoming decade show continuation of past tendencies.

Generally speaking, there is an intensification of the positive trends towards the heavy tail of the precipitation distribution (ME). On shorter time scales, the time series show largely (multi-) decadal oscillation variability.

Conclusions

The four data blocks of LAERTES-EU are consistent and have similar precipitation distributions, which are within the uncertainty of the observations. In terms of areal precipitation, the ensemble spread also covers the range of observed values. Positive tendencies are more pronounced for the higher percentiles. Distinct variability can be found on shorter time scales. The predictions for the upcoming decade show continuation of past tendencies. The RCM simulations used for the study strongly depend on the assimilated natural and anthropogenic forcing and therefore, the analyzed variability and trends might be spurious. Nevertheless, statistical investigations (e.g. distributions or return periods) become more robust due to the large ensemble size.

Applications

LAERTES-EU is currently used as input for hydrological discharge modeling for several European river catchments to derive discharge simulations for flood risk assessments. For this purpose, a bias correction was performed on LAERTES-EU data to reduce differences between simulated and observed precipitation fields (Kautz et al., 2019, in prep.).

A detailed analysis of decadal oscillations, teleconnections, or seasonal variations is in preparation. In the near future, temperature and wind data will be added to LAERTES-EU to enable the consideration of other meteorological extreme events and compound events.

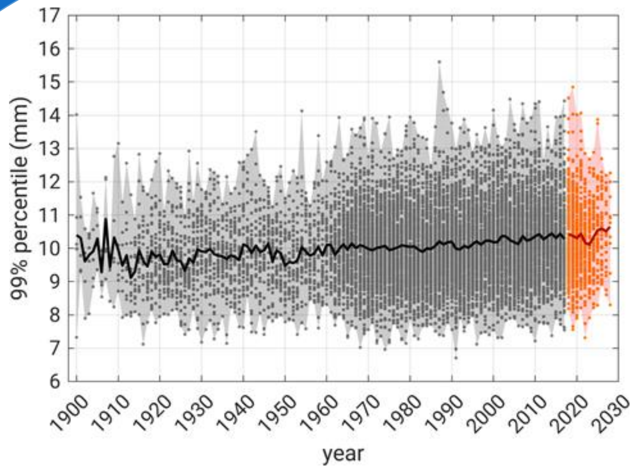

Fig. 1: Time series of the yearly 99% percentile of spatial mean precipitation for Mid-Europe (ME) of the LAERTES-EU ensemble mean (solid line), and the ensemble spread (dots and shaded area) during the past (black/gray) and the predictions (reddish). The climatological mean 1961-1990 is 10.0 mm.

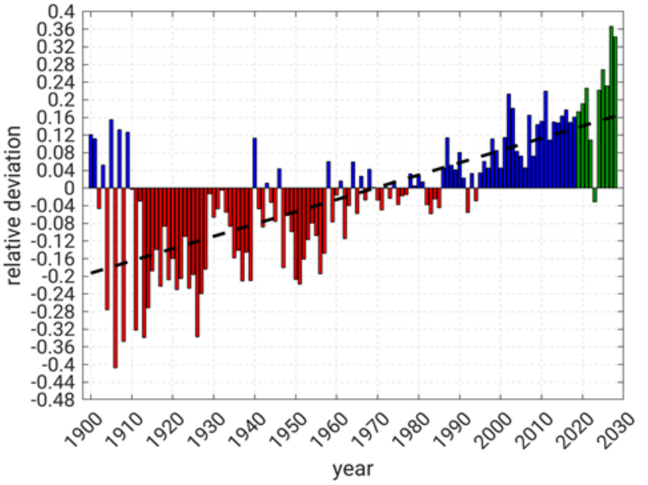

Fig. 2: Relative deviation of the R99pTOT index of the LAERTES-EU mean compared to the climatology (1961-1990) for ME. Red bars indicate negative (dry), blue bars positive (wet) anomalies. The predictions are given in green. The black dashed line indicates a linear regression.

References

Berg, P., Feldmann, H., and Panitz, H.-J. (2012): Bias correction of high resolution regional climate model data, J. Hydrol., 448-449, 80 – 92, DOI: 10.1016/j.jhydrol.2012.04.026.

Compo, G. P., Whitaker, J. S., Sardeshmukh, P. D., Matsui, N., Allan, R. J., Yin, X., Gleason, B. E., Vose, R. S., Rutledge, G., Bessemoulin, P., Brönnimann, S., Brunet, M., Crouthamel, R. I., Grant, A. N., Groisman, P. Y., Jones, P. D., Kruk, M. C., Kruger, A. C., Marshall, G. J., Maugeri, M., Mok, H. Y., Nordli, Ø., Ross, T. F., Trigo, R. M., Wang, X. L., Woodruff, S. D., and Worley, S. J.: The twentieth century reanalysis project, Q. J. R. Meteorol. Soc., 137, 1–28, DOI: 10.1002/qj.776, 2011.

Haylock, M. R., Hofstra, N., Klein Tank, A. M. G., Klok, E. J., Jones, P. D., and New, M. (2008): A European daily high-resolution gridded data set of surface temperature and precipitation for 1950–2006, J. Geophys. Res. Atm., 113, DOI: 10.1029/2008JD010201.

Kautz, L.-A., F. Ehmele, P. Ludwig, H. S. Lentink, M. Kadlec, B. Buldmann, H. Feldmann, F. D. Kelemen and J. G. Pinto (2019): Towads the Development of a Pan-European Stochastic Precipitation Dataset, Nat. Hazards Earth Syst. Sci. Discuss. (in prep.)

Marotzke, J., Müller, W. A., Vamborg, F. S. E., Becker, P., Cubasch, U., Feldmann, H., Kaspar, F., Kottmeier, C., Marini, C., Polkova, I., Prömmel, K., Rust, H. W., Stammer, D., Ulbrich, U., Kadow, C., Köhl, A., Kröger, J., Kruschke, T., Pinto, J. G., Pohlmann, H., Reyers, M., Schröder, M., Sienz, F., Timmreck, C., and Ziese, M. (2016): MiKlip: a national research project on decadal climate prediction, Bull. Am. Meteorol. Soc., 97, 2379–2394, DOI: 10.1175/BAMS-D-15-00184.1.

Mueller, W. A., Pohlmann, H., Sienz, F., and Smith, D. (2014): Decadal climate predictions for the period 1901–2010 with a coupled climate model, Geophys. Res. Lett., 41, 2100–2107, DOI: 10.1002/2014GL059259.

Rauthe, M., Steiner, H., Riediger, U., Mazurkiewicz, A., and Gratzki, A. (2013): A Central European precipitation climatology - Part I: Generation and validation of a high-resolution gridded daily data set (HYRAS), Meteorol. Z., 22, 235–256, DOI: 10.1127/0941-2948/2013/0436.

Uncertainty of Albedo Parameterization in Extreme Land Use Changes in the Regional Climate Model COSMO-CLM

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More details and additional references can be found in:
Tölle, M. H., M. Breil, K. Radtke, H.-J. Panitz, 2018: Sensitivity of European temperature to albedo parameterization in the regional climate model COSMO-CLM linked to extreme land use changes, Frontiers Environmental Science, DOI: 10.3389/fenvs.2018.00123

Introduction
Vegetation changes impact the energy and water balance by modifying the short- and long-wave radiation, and atmospheric turbulence. This results in alterations in the fluxes of momentum, heat, water vapor, and CO2 as well as other trace gases, and both anorganic and biogenic aerosols including dust between vegetation, soils, and the atmosphere (Pielke et al., 2011).

Previous studies based on observations and models are uncertain about the biophysical impact of af- and deforestation in the northern hemisphere mid-latitude summers, and show either a cooling or warming (Alkama and Cescatti, 2016). The spatial distribution, magnitude and direction are still uncertain (Pitman et al. 2009). Albeit consensus exists about the impact of land cover change on climate in winter by the snow-masking effect in high latitudes (Bonan et al. 1992). High uncertainties occur in Central and Southern Europe, where the forest proportion is relatively small. Here, afforestation could have a potential high impact. The climatic extent of afforestation depends on the ratio between the increased net short-wave radiation and the increased aerodynamic roughness or evapotranspiration of forest. This proportion, however, strongly depends on the used regional climate model (RCM) and its model uncertainties. The question, whether these model uncertainties are higher than the potential impact of land cover change, has not yet been investigated.

Therefore, we compare the regional climate response due to different albedo parameterizations in the state-of-the-art regional climate model COSMO-CLM (recommended version 5.0 clm9) with the impact of idealized land use change scenarios (either af- (FOREST) or deforestation (GRASS) as described in Davin et al. 2019). The standard operational albedo configuration is considered in the control and one afforestation simulation (EVALUATION and FOREST1 respectively), where the albedo depends on the soil type and soil moisture, and is further modified by plant and snow fraction. A constant background albedo of 0.15 is applied with no distinction between different vegetation types. Another afforestation simulation (FOREST2) distinguishes between deciduous (0.15) and evergreen (0.1) forest and grass (0.2) albedos. The difference between FOREST2 and a further afforestation simulation (FOREST3) is that the soil albedo does not depend on soil moisture for FOREST3. The standard operational albedo is considered for the GRASS simulation. All simulations are performed for the EURO-CORDEX domain at 0.44° horizontal resolution for the period 1986-2015, and the model is forced with ERA-Interim reanalysis data (Dee et al. 2011). The land cover change experiments are compared to the control run with no land cover change.

Results

Afforestation warms the climate in winter, and strongest in mid-latitudes (Fig. 1 A to C). Results are indifferent in summer owing to opposing albedo and evapotranspiration effects of comparable size but different sign.

Thus, the net effect is small for summer. Depending on the albedo parameterization in the model, the temperature effect can turn from cooling (FOREST1) to warming (FOREST2, FOREST3) in mid-latitude summers. The summer warming due to deforestation (GRASS) is up to 3° C higher than due to afforestation (Fig. 1 A). The cooling by grassland or warming by forest is in magnitude comparable and small in winter.

The surface albedo is decreased year-round for the afforestation simulations due to the lower albedo of forest compared to grassland (Fig. 2). Largest differences occur between the GRASS and the FOREST simulations for the northern und mid-latitudes in winter, where the snow masking effect of trees is strongest (Fig. 2 B and C). In summer, GRASS reflects the most of the incoming radiation followed by FOREST3, EVALUATION and FOREST1, and then FOREST2 (Fig.2 A). Major albedo differences occur due to different vegetation types, and minor albedo differences occur due to the specified parameterization in the model. An exception is Southern Europe, where the albedo parameterization is a high uncertainty factor.

Central Europe turns cooler for FOREST1 in summer (Fig. 1 and 3). Here, the albedo parameterization does not depend on vegetation type and is similar to that of the EVALUATION simulation (Fig. 2 C). Thus, climatic changes result mainly from changes in partitioning between turbulent fluxes and surface roughness. The higher evapotranspiration is, the more cloud coverage increases, strengthens the downward long-wave radiation, and reduces the incoming radiation. This results in a cooling effect. Contradictory Central Europe turns warmer for FOREST2 and FOREST3 (Fig. 3) due to the reduced albedo of 1 to 2 percent compared to EVALUATION in summer (Fig. 2 C), which increases the available energy at the surface. The increased net incoming radiation and higher aerodynamic roughness of forest transfer more energy to turbulent fluxes. GRASS is warmer due to major decreases of latent heat and increase of sensible heat fluxes. Associated with it is a reduced cloud cover due to reduced evapotranspiration, which is also seen in the reduced downward long-wave radiation. Thereby, the net incoming radiation increases. All FOREST simulations show a warming in Southern Europe (not shown). Despite the higher evapotranspiration potential due to the higher leaf area index of forest, there is less evapotranspiration. This may be translated to less soil moisture available for evaporation, which is also reduced. Thus, the Bowen ratio is increased, and more sensible heat is released to the atmosphere.

Sensible heat and net short-wave radiation show the most variability among experiments, which is connected to albedo variations between the FOREST simulations (Fig. 2 D).

Conclusion

The strength of the described near-surface temperature changes depends on the magnitude of the individual biophysical changes in the specific background climate conditions of the region. Thus, the albedo parameterization need to account for different vegetation types. Furthermore, we found that, depending on the region, the land cover change effect is more important than the model uncertainty due to albedo parameterization.

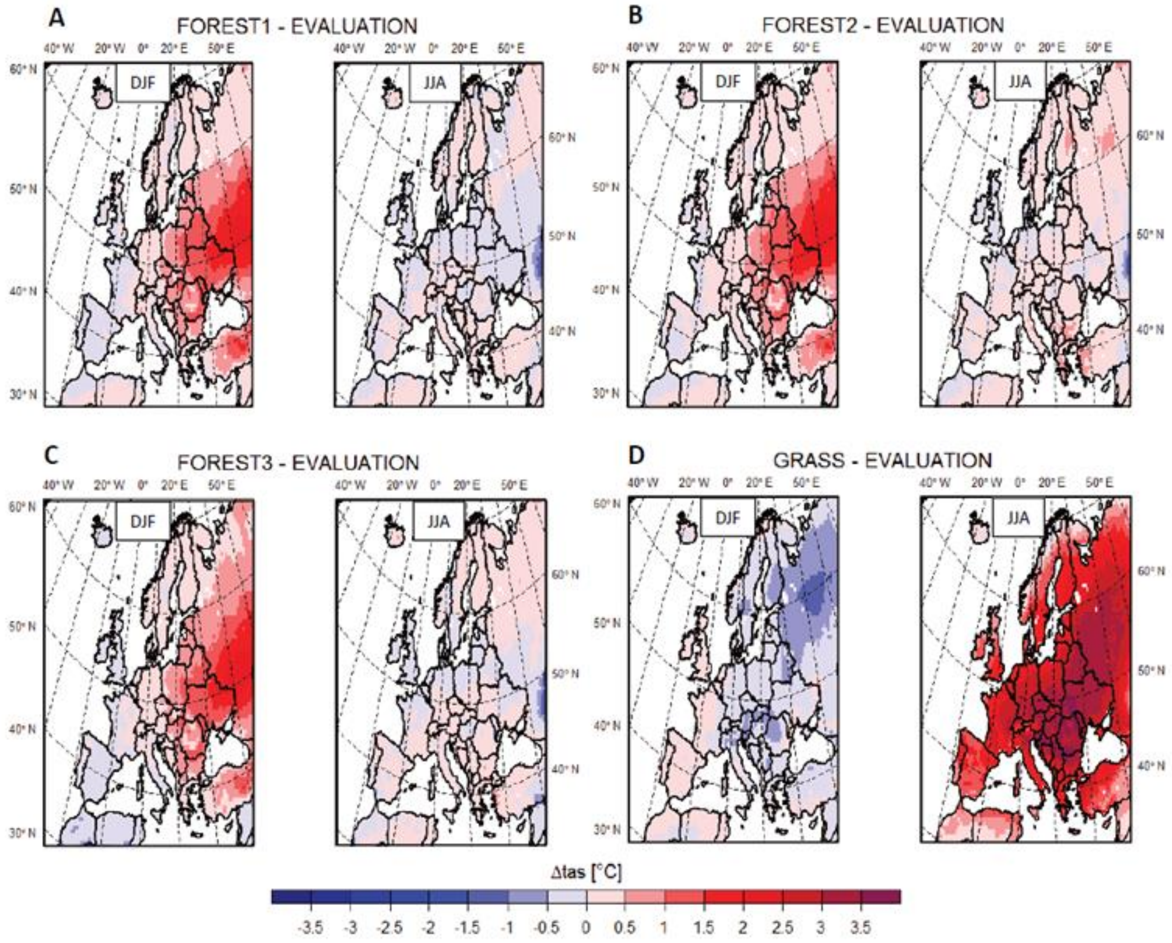

__Fig.1__: Spatial distribution of mean seasonal near-surface air temperature changes over the EURO-CORDEX domain for the conversion to forest with three different albedo parameterizations [FOREST1 (A), FOREST2 (B), FOREST3 (C)], and to grassland [GRASS (D)] for winter (DJF, left) and summer (JJA, right) for 1986–2015. The difference between experiments and the EVALUATION simulation with no land cover change is displayed.

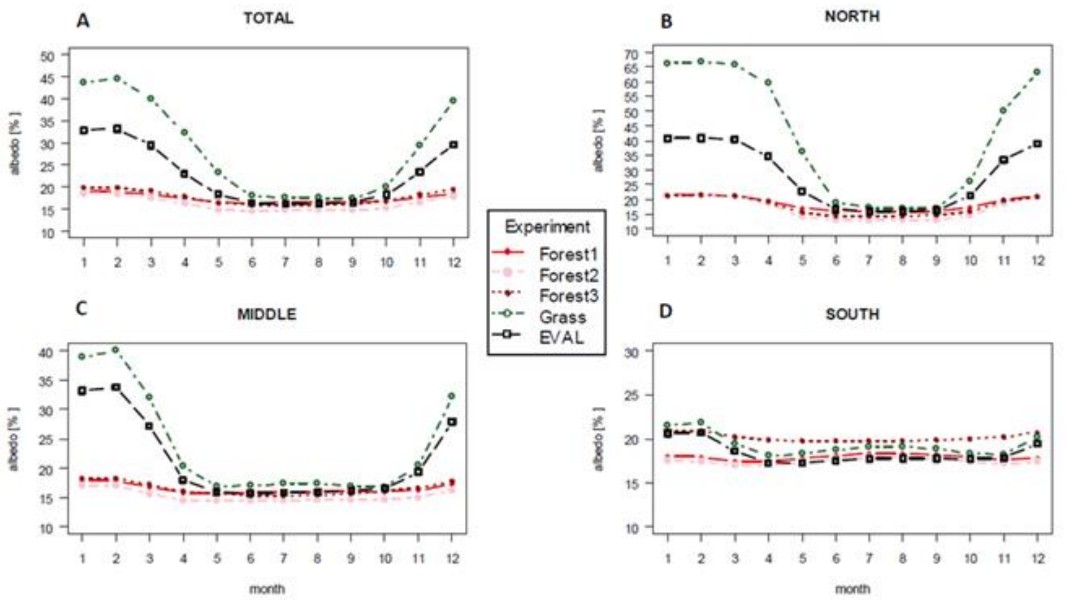

Fig. 2: Domain averaged long-term mean seasonal cycle of the albedo of FOREST1 (red), FOREST2 (rose), FOREST3 (dark red), GRASS (dark green), and EVALUATION (black) over all land points only for 1986–2015. Albedo values are displayed for the whole of the domain TOTAL (A), and with latitudinal separation in NORTH (B) for high-latitudes (note the different y-axis scale), MIDDLE (C) for mid-latitudes, SOUTH (D) for the Mediterranean (note the different y-axis scale).

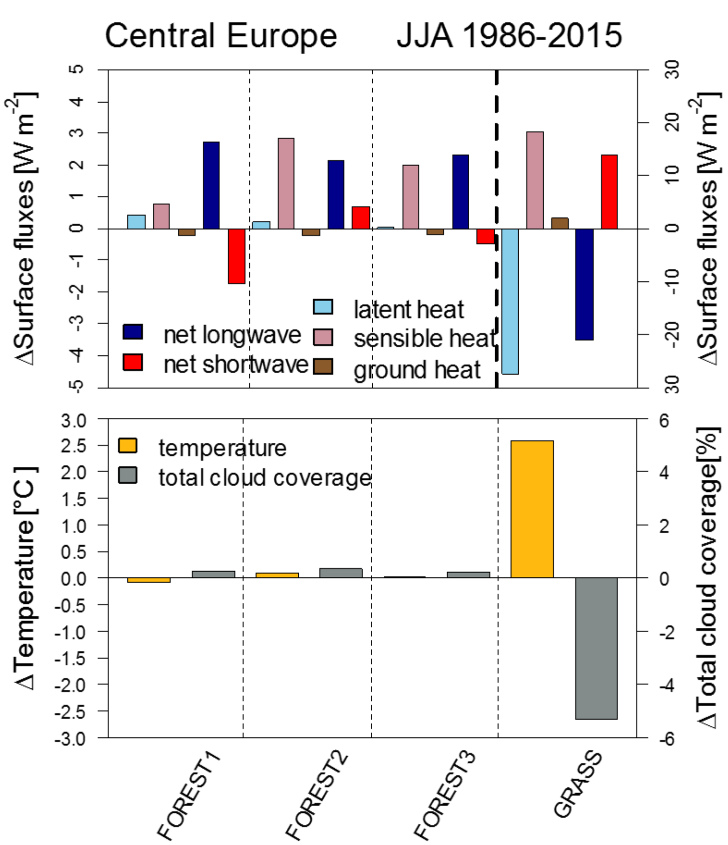

Fig. 3: Mid-Europe averaged long-term mean changes of sensible heat flux (light red), latent heat flux (light blue), ground heat flux (brown), net long-wave radiation (blue), net short-wave radiation (red), and of near-surface temperature (yellow), total cloud coverage (grey) in summer for 1986 to 2015. Changes relative to the EVALUATION simulation are displayed for FOREST1, FOREST2, FOREST3, and GRASS. Difference between experiments and the EVALUATION simulation with no land cover change is displayed over land points only. Note the different y-scale.

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References

Alkama, R., and Cescatti, A. (2016). Biophysical climate impact of recent changes in global forest cover. Science 351, 600–604. doi: 10.1126/science.aac8083

Bonan, G. B., Pollard, D., and Thompson, S. L. (1992). Effects of boreal forest vegetation on global climate. Nature 359, 716–718

Davin, E. L., D. Rechid, M. Breil, R. M. Cardoso, E. Coppola, P. Hoffman, L. L. Jach, E. Katragkou, N. de Noblet Ducoudré, K. Radtke, M. Raffa, P. M. M. Soares, G. Sofiadis, S. Strada, G. Strandberg, M. H. Tölle, K. Warrach-Sagi, V. Wulfmeyer, 2019: Biophysical impacts of forestation in Europe: First results from the LUCAS Regional Climate Model intercomparison, Earth System Dynamics, DOI: 10.5194/esd-2019-4

Dee, D. P., and Coauthors, 2011: The ERA-Interim reanalysis: configuration and performance of the data assimilation system. Q J R Meteorolog Soc, 137, 553-597

Pielke, Sr A., Pitman, A., Niyogi, D., Mahmood, R., McAlpine, C., Hossain, F., et al. (2011). Land use/land cover changes and climate: modeling analysis and observational evidence. WIREs Clim. Change 2, 828–850. doi: 10.1002/wcc.144

Pitman, A. J., de Noblet- Decoudré, N., Cruz, F. T., Davin, E. L., Bonan, G. B., Brovkin, V., et al. (2009). Uncertainties in climate response to past land cover change: First results from the LUCID intercomparison study. Geophys. Res. Lett. 36:L14814. doi: 10.1029/2009GL039076

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2019

Akhtar, N., A. Krug, J. Brauch, T. Arsouze, C. Dieterich, B. Ahrens (2019): European Marginal Seas in a regional atmosphere-ocean coupled model and their impact on Vb-cyclones and associated precipitation. Clim. Dyn., 53, https://doi.org/10.1007/s00382-019-04906-x

Arndt, J.A., A. Aulinger, V. Matthias (2019): Quantification of lightning-induced nitrogen oxide emissions over Europe. Atmospheric Environment, 202, Pages 128-141

Bader, R., M. Sprenger, N. Ban, S. Rüdisühli, C. Schär, T. Günther (2019): Extraction and Visual Analysis of Potential Vorticity Banners around the Alps IEEE Transactions on Visualization and Computer Graphics. in press, https://doi.org/10.3929/ethz-b-000343049

Brogli, R., S.L. Sørland, N. Kröner, C. Schär (2019): Causes of future Mediterranean precipitation decline depend on the season. Environ. Res. Lett., 14, 114017. https://doi.org/10.1088/1748-9326/ab4438

Caldas-Alvarez, A. (2019): Atmospheric Moisture Effects on Deep Convection in the Western Mediterranean. PhD Thesis. http://dx.doi.org/10.5445/KSP/1000097100

Darko, D., K.A. Adjei, E.K. Appiah-Adjei, S.N. Odai, E. Obuobie, R. Asmah (2019): Simulation of climate characteristics and extremes of the Volta Basin using CCLM and RCA regional climate models. Theoretical and Applied Climatology, Vol. 135, Issue 1–2, pp 741–763

Dosio, A., R.G. Jones, C. Jack, C. Lennard, G. Nikulin, B. Hewitson (2019): What can we know about future precipitation in Africa? Robustness, significance and added value of projections from a large ensemble of regional climate models. Clim. Dyn. 53, 5833–5858. doi:10.1007/s00382-019-04900-3.

Ehmele, F., L.-A. Kautz, H. Feldmann, J.G. Pinto (2019): Long-term Variances of Heavy Precipitation across Central Europe using a Large Ensemble of Regional Climate Model Simulations. Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2019-47

Fotso-Kamga, G., T.C. Fotso-Nguemo, I. Diallo, Z.D. Yepdo, W.M. Pokam, D.A. Vondou, A. Lenouo (2019): An evaluation of COSMO-CLM regional climate model in simulating precipitation over Central Africa. Int. Journal of Climatology

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Helsen, S, N. v. Lipzig, M. Demuzere, S. Vanden Broucke, S. Caluwaerts, L. De Cruz, R. De Troch, R. Hamdi, P. Termonia, B.v. Schaeybroeck, H. Wouters (2019): Consistent scale-dependency of future increases in hourly extreme precipitation in two convection-permitting climate models. Clim. Dyn., DOI https://doi.org/10.1007/s00382-019-05056-w

Hentgen, L., N. Ban, N. Kröner, D. Leutwyler, Schär, C. (2019): Clouds in convection-resolving climate simulations over Europe. J. Geophys. Res. – Atmos., 124, 3849–3870. https://doi.org/10.1029/2018JD030150

Hu, X., B. Huang, F. Cherubini (2019): Impacts of idealized land cover changes on climate extremes in Europe. Ecological Indicators, 104, 626-635

Imamovic, A., L. Schlemmer, C. Schär (2019): Mountain Volume Control On Deep-Convective Rain Amount. J. Atmos. Sci., 76, 605-626, http://doi.org/10.1175/JAS-D-18-0217.1

Josipovic, L., A. Obermann-Hellhund, E. Brisson, B. Ahrens (2019). Bora in RCMs: impact of model resolution on simulations of gap winds and wave breaking. Croatian Meteorological Journal. In print.

Kelemen, F. D., C. Primo, H. Feldmann, H., B. Ahrens (2019): Added Value of Atmosphere-Ocean Coupling in a Century-Long Regional Climate Simulation. Atmosphere, 10 (9), Article: 537. doi:10.3390/atmos10090537

Leps, N., J. Brauch, B. Ahrens (2019): Sensitivity of Limited Area Atmospheric Simulations to Lateral Boundary Conditions in Idealised Experiments. J. of Advances in Modeling Earth Systems (James), https://doi.org/10.1029/2019MS001625

Mussetti, G, D. Brunner, J. Allegrini, A. Wicki, S. Schubert, J. Carmeliet (2019): Simulating urban climate at sub-kilometre scale for representing the intra-urban variability of Zurich, Switzerland. Int. J .Climatol. 1– 19, DOI: 10.1002/joc.6221

Panosetti, D., L. Schlemmer, C. Schär (2019): Bulk and structural convergence at convection-resolving scales in real-case simulations of summertime moist convection over land. Quart. J. Roy. Meteorol. Soc., Q. J. R. Meteorol. Soc., 145, http://doi.org/10.1002/qj.3502

Primo, C., F.D. Kelemen, H. Feldmann, B. Ahrens (2019): A regional atmosphere-ocean climate system model (CCLMv5.0clm7-NEMOv3.3-NEMOv3.6) over Europe including three marginal seas: on its stability and performance. Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2019-73

Schipper, J. W., J. Hackenbruch, H.S. Lentink, K. Sedlmeier (2019): Integrating Adaptation Expertise into Regional Climate Data Analyses through Tailored Climate Parameters. Met. Z., 28 (1), 41–57. doi:10.1127/metz/2019/0878

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Remember!

… part of your scientific success relies on the work of those people providing the reference model setup, maintain the codes, etc. Therefore, it would be more than a sign of courtesy to offer them co-authorships once in a while.

Please, do not forget to state that you used the “COSMO model in Climate Mode (COSMO-CLM)” and, please, also include the statement “COSMO-CLM is the community model of the German regional climate research community jointly further developed by the CLM-Community” in each publication.

Schlager, C., G. Kirchengast, J. Fuchsberger, A. Kann, H. Truhetz (2019): A spatial evaluation of high-resolution wind fields from empirical and dynamical modeling in hilly and mountainous terrain. Geosci. Model Dev., 12, 2855–2873

Schulthess, T.P., P. Bauer, O. Fuhrer, T. Hoefler, C. Schär, N. Wedi (2019): Reflecting on the goal and baseline for exascale computing: a roadmap based on weather and climate simulations. IEEE Computing in Science and Engineering, 21 (1), 30-41, DOI: 10.1109/MCSE.2018.2888788

Wiese, A., E. Stanev, W. Koch, W., A. Behrens, B. Geyer, J. Staneva (2019): The impact of the two-way coupling between wind wave and atmospheric models on the lower atmosphere over the North Sea. Atmosphere, 10(7), 386; https://doi.org/10.3390/atmos10070386

2018

Ban, N., J. Rajczak, J. Schmidli, C. Schär (2018): Analysis of precipitation extremes using generalized extreme value theory in convection-resolving climate simulations. Clim. Dyn., https://doi.org/10.1007/s00382-018-4339-4

Breil, M., G. Schädler, N. Laube (2018): An Improved Soil Moisture Parametrization for Regional Climate Simulations in Europe. JGR Atmospheres, Vol. 123, Issue 14, Pages 7331-7339

CH2018 (2018): Climate Scenarios for Switzerland, Technical Report. National Centre for Climate Services, Zurich, 271 pp, ISBN: 978-3-9525031-4-0, https://www.ch2018.ch/

Christner, E., F. Aemisegger, S. Pfahl, M. Werner, A. Cauquoin, M. Schneider, F. Hase, S. Barthlott, G. Schädler (2018): The climatological impacts of continental surface evaporation, rainout, and sub-cloud processes on δD of water vapor and precipitation in Europe. J. of Geophysical Res./Atmospheres, 123 (8), 4390-4409. https://doi.org/10.1002/2017JD027260

→

Dieng, D., P. Laux, G. Smiatek, D. Heinzeller, J. Bliefernicht, A. Sarr, A.T. Gaye, H. Kunstmann (2018): Performance Analysis and Projected Changes of Agroclimatological Indices Across West Africa Based on High-Resolution Regional Climate Model Simulations. JGR Atmospheres, 123, Issue 15, 16, pp 7950-7973

Moemken, J., M. Reyers, H. Feldmann, J.G. Pinto (2018): Future Changes of Wind Speed and Wind Energy Potentials in EURO-CORDEX Ensemble Simulations. J. of Geophysical Res./Atmospheres., 123, https://doi.org/10.1029/2018JD028473

Reszler, C., M.B. Switanek, H. Truhetz (2018): Convection-permitting regional climate simulations for representing floods in small-and medium-sized catchments in the Eastern Alps. Nat. Hazards Earth Syst. Sci., 18, 2653–2674, 2018, https://doi.org/10.5194/nhess-18-2653-2018

Sprenger, M., J. Schmidli, L. Egloff (2018): The Laseyer wind storm – case studies and a climatology. Met. Z., 27 (1), 15-32, DOI: 10.1127/metz/2017/0854

Willkofer, F., F.-J. Schmid, H. Komischke, J.I. Korck, M. Braun, R. Ludwig (2018): The impact of bias correcting regional climate model results on hydrological indicators for Bavarian catchments J. of Hydrology:, Vol. 19, pp 25-41

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Apr 28 – 29	Nordic coupled atmosphere-wave-ice-ocean modelling workshop, Helsinki, Finland
May 03 – 08	EGU General Assembly 2020, Vienna, Austria
Sep 07 – 11	EMS Annual Meeting 2020, Univ. of Economics, Bratislava, Slovakia
Sep 07 – 11	COSMO General Meeting, Geneva, Switzerland
Sep 15 – 18	CLM Assembly, Berlin, Germany

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