Climate Limited-area Modelling Community

CLM-Community Newsletter

No. 2 January 2014

Content

Happy New Year 2014!!!

Reviewing our common effort in improving our regional climate model COSMO-CLM and the interaction within the CLM-Community in the last year, we can take a positive summary: we already went a good piece of our way towards achieving our very challenging aims.

In 2013, a major modification to our community was the transition of the CLM-Community coordination from Andreas Will (BTU Cottbus) to me, Barbara Früh (Deutscher Wetterdienst). Of course such a change always induces some bumpiness but I hope you experienced it not too strongly. We were also able to release a new version of COSMO-CLM with which the contributions to the CORDEX activities were successfully performed.

Of course, there is still a good way to go to improve our model, to reduce the model's uncertainties and to further develop it towards a regional Earth system model. So, the main challenges for the upcoming year are - to my mind - to make a well-tested COSMO5-CLM package together with the reference configurations for some relevant domains and resolutions available, to finalize the future-oriented CLM-Community science plan, and to further improve our cooperation. Therefore, it would be great if we could place a strong proposal for HORIZON 2020 with major contributions from COSMO-CLM and the CLM-Community. I also very much appreciate the work which is done submitting a proposal for a COST action since this kind of funding would really help improving the cooperation between our members with benefits for all.

To this point I would like to thank all of you for supporting the CLM-Community in any way. I hope you will continue next year!

I remain with the warmest thoughts and best wishes for you and all your loved ones for a HAPPY and SUCCESSFUL NEW YEAR 2014.

Yours sincerely, Barbara Früh

Community Issues

CLM-Community Assembly in Zurich

In August 2013 we held our annual CLM-Community Assembly in Zurich, Switzerland. It was a very interesting conference which gave many new stimuli. That is why I as coordinator would like to take the opportunity to thank the organizers again for preparing the ideal arrangement.

As a new format we introduced the "hot topic café" for stimulating the discussions within the CLM-Community.

CLM-Community Assembly 2013, Zurich; Photo by Omar Bellprat

Hot topic café

Communication within the community

The webpage was criticized a lot, having an unclear structure and a poor visibility of important tools. A forum should be established and promoted on the wepage. The Redmine platform was not known to everyone, it should also be better advertised on the webpage. Emails were discussed ambivalently, as important communication tool but also as source of information junk.

Some members expressed the wish to establish a long term communication strategy. This should in particular clarify the role and content of each platform as to maximize synergies between them. One idea that came up was to create a "welcome package" that should be sent to members joining the community as part of the "welcome mail". The idea of the newsletter was generally welcomed, with the recommendation to include the abstracts of new publications.

Spring school should include a Redmine introduction and the individual parts should be easier distinguishable in the announcement.

Science plan

The science plan was recognized as an important communication tool to the outside world and it can be referred to when writing proposals. The majority of the participants thought it should be less than ten pages, with an extra part on the working groups. Room for future ideas and third party projects should be made. And it was requested that it is available on the webpage. Ideally, there should be presentation about it at the Assembly.

Community structure

It would be good to have an organigram for new members to get a better overview. The structure should be flexible with respect to new WGs/PGs. The role of SAB and TAG was unclear to some participants, and should be more transparent. Overlapping topics and meeting times were not very much approved. Some people though the WGs should be reorganized by regions or physics and applications. And the community structure and its bodies should be easier to find on the webpage with coherent and up-to-date information.

Outcome of Assembly survey

23 survey forms were handed back. Here is the essence of the results:

What did you like best?

Almost everyone commented on the excellent organization of the meeting! The good atmosphere for discussions within community was mentioned several times. Working group meetings, space and light of the poster set up was praised as well as the good quality of the talks, especially the invited talk by Christoph Schär. Six people liked the hot topic cafe as a new way for open and interactive discussions.

What did you dislike?

About half the people who participated in the survey complained about the packed program. The discussion time after the talks and in the breaks was too short. More preliminary information was requested especially about the parallel discussions.

What could be improved next year?

Many members agreed that the number of talks should be reduced, so that there is more room for discussion. To achieve this, it was suggested several times to convert talks to posters and have longer coffee breaks.

Status HORIZON 2020 call

Within the new EU research program HORIZON 2020 a call for proposals called *WATER-2-2014/2015: Integrated approaches to water and climate* is published. The scientific challenge within that programme can to some extend addressed by regional climate models. Since it is very interesting to participate also with COSMO-CLM in that call, CMCC (namely Antonio Bombelli) volunteered to coordinate and submit a proposal to that call. We keep our fingers crossed for the success of this application.

Status COST action

The idea of submitting a COST action proposal was appreciated by many CLM-Community members. However, since the time was too short for the September call we decided to prepare a proposal for the March 2014 call. Andrew Ferrone volunteered as a coordinator. Again, we keep our fingers crossed for the success of this application.

New CLM-Community homepage

The CLM-Community homepage is still under revision. On our way trying to find the new

structure of our homepage we very much appreciated the comments from the 'hot topic cafe' and the 'assembly survey'. We made our best to consider all comments. Until the end of January a draft version of our new homepage shall be available. If you are interested in acting as a test user, please, feel free to contact us at clm.coordination[at]dwd.de.

COSMO/CLM/ART Training Course 2014

The COSMO/CLM/ART Training Course 2014 will take place from February 17th – 25th, 2014, in Langen, Germany. For the first time the basic training (Feb 17-21) is accompanied by an additional two day ART training (Feb 24-25) and a one day Community Land Model training (Feb 24). Unfortunately, the registration deadline ended already on Dec 13. We will be happy to welcome 62 participants.

COSMO/CLM/ART User Seminar 2014

The COSMO/CLM/ART User Seminar 2014 will take place from March 17th - 19th, 2014, in the conference area of the DWD headquarters building in Offenbach, Germany. Although the abstract submission already ended on December 11th, the conference registration is open until January 31st.

To ***subscribe to the Newsletter*** please send an email to clm.coordination[at]dwd.de.

CLM Community members have to send an email if they want to ***unsubscribe*** from the Newsletter.

IPCC plenary session

The physical science basis: Highlights of the new IPCC report

Impressions from Andrew Ferrone

Stockholm, September 26th 2013 - 6 p.m.: According to the agenda of the 36th plenary session of the Intergovernmental Panel on Climate Change (IPCC), and after one week of intense discussions, the meeting should now come to an end. The contribution of Working Group 1 (WG1) to the 5th Assessment Report (AR5) should now be ready for delivery. However, barely half of the 14.000 words that represent the Summary for Policymakers (SPM) have been accepted to this point – each one passing sheer endless scrutineering, eventually leading to several evening and night sessions.

Despite being exhausted, people in the room prepare for a long night with snacks and drinks full of sugar and caffeine. At that moment I realized that volunteering to represent Luxembourg at the IPCC was surely not a healthy choice. With the pressure of the press, eagerly waiting for the SPM to be accepted, a consensus is finally accepted at 5 a.m. on Friday morning - after another session of 9 hours without interruption.

Today I would like to show that the effort that everybody (259 authors, 1089 experts and representatives of approximately 110 parties) put into this report provides a strong basis for policymakers to build sound decisions on. Here, I highlight some of the differences with the 4th report (AR4) published in 2007.

Concerning responsibility, AR5 concluded that "it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century." This is an increase from 90% likelihood (very likely) in AR4 to 95% (extremely likely) in AR5.

Concerning future projections the IPCC introduced new scenarios, the so-called Representative Concentration Pathways (RCPs). A major difference with the previous scenarios from the Special Report of Emission Scenarios (SRES) published in 2000 is that RCPs also include explicitly possible climate policies, and lead to a stabilisation of radiative forcing at a given value at the end of this century (indicated by the number in the name of the RCP). The lowest RCPs can only be reached by actively removing carbon dioxide from the atmosphere at the end of this century.

Based on both future projections of global models and these scenarios, the AR5 concludes: "Global surface temperature change for the end of the 21st century is likely to exceed 1.5°C relative to 1850 for all RCP scenarios except RCP2.6. It is likely to exceed 2°C for RCP6.0 and RCP8.5, and more likely than not to exceed 2°C for RCP4.5" (the likelihoods being defined as follows: likely 66–100%, about as likely as not 33–66%).

Concerning the rise of sea level, AR5 could put more confidence in its projections as the new generation of models managed to close the budget of different contributions (thermal expansions, melting of ice-caps and glaciers) compared to observations. This led to a projection of a rise of 40 to 60 centimetres by the end of this century with a maximum of 1 meter.

Concerning extreme weather, the IPCC concluded, based on much broader literature

than was available for AR4 that humans have already contributed to an increase in the frequency and duration of heat waves and an intensification of heavy precipitation events. More warming will not only very likely further enforce such changes but will also likely intensify some tropical cyclones and worsen drought spells.

Further reading:

IPCC, WG1 contribution to AR5:
http://www.ipcc.ch/report/ar5/wg1/#.UqV4oxCc5ZI

Report of the Earth Negotiation Bulletin of the 36th session of the IPCC:
http://www.iisd.ca/download/pdf/enb12581e.pdf

Remember

… part of **your scientific success** relies on the work of those people providing the reference model, 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" in each publication.

New member institutions

Nanjing University
(http://english.njust.edu.cn/)

Understanding the regional climatic and environmental processes over East Asia. The current research interests include using multi-models to simulate the impacts of large scale land use/cover change on regional climate, and to project high resolution regional climate change over Asia.

Contact: Shuyu Wang
(wsy[at]nju.edu.cn)

Technical University of Crete
(http://www.tuc.gr/3324.html)

Climate change and weather extremes impacts on water resources, agriculture and tourism, analysis of hydrological extreme events (flood - water scarcity & droughts leading to desertification), flash flood forecasting using C-Band radar data.

Contact: Ioannis Tsanis
(tsanis[at]hydromech.gr)

The Cyprus Institute
(https://www.cyi.ac.cy/)

Modelling the chemical aging of dust particles and aerosol-cloud-radiation interaction.

Contact: Swen Metzger
(s.metzger[at]cyi.ac.cy)

Research notes

Urban effects in climate simulations for CORDEX Europe

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Topic DWD-003

Abstract

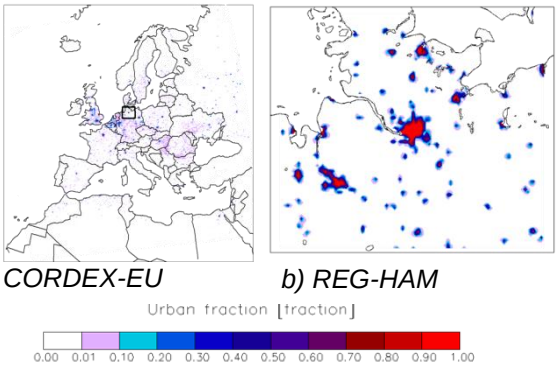
As the COSMO-CLM is increasingly used for studying effects of urbanization on the environment it is important to quantify the relevance of representing urban land use at different spatial scales. The regional model COSMO-CLM coupled to the Town Energy Budget (TEB) model [*Masson*, 2000] is used for quantifying the effect of the inclusion of the detailed urban land parameterization on the climate variables over Europe (Euro-CORDEX) at a spatial resolution of 0.11° (~12 km) and over a smaller domain around the city of Hamburg (REG Hamburg) at a spatial resolution of 0.025° (~2.8 km). A possible urban effect to the climate variables (daily mean 2m-temperature and daily total precipitation) is quantified by comparing the model simulations with the standard and the "urbanized" models for two model domains. Additionally the statistical significance of the urban effects on the climate variables is analysed. This analysis allows to better design the model set-up for the future modelling studies of the urbanization effects on the regional climate.

Motivation

As the power of computing systems rises, it allows using complex climate models such as COSMO-CLM (CCLM) for climate simulations on fine spatial scales below 5 km. This allows performing detailed studies on complex phenomena within the planetary boundary layer such as the urban atmosphere. The urban heat island (UHI) and the specific roughness of urban land cover are usually omitted in climate simulations on coarse spatial scales but should be resolved on grids < 5 km.

Usually, the CCLM is used in a cascade of nested domains to provide a smooth down-

scaling of the spatial resolution. Therefore the question arises: should such phenomena as UHI be resolved in the climate simulations within all model domains or would it be sufficient to resolve it within the only finest-scale model domain?



a) CORDEX-EU *b) REG-HAM*

Figure 1. Model domains: (a) the CORDEX-Europe with the spatial resolution of 0.11° (~12 km) and (b) the nested model domain in the region of Hamburg with the spatial resolution of 0.025° (~2.8 km). In the panel (a) the solid black line shows the place of the nesting.

To answer this question we perform climate simulations with and without an explicit urban parameterization for two different spatial resolutions and analyse differences between them as described below.

Model simulations

The regional non-hydrostatic climate model CCLM version 4.8_clm17 is used for this sensitivity study of climate simulations to the inclusion of the urban land cover. CCLM was previously coupled [*Trusilova et al.*, 2013] to a parameterization for urban land cover – the Town Energy Budget (TEB) model [*Masson*, 2000].

We perform four model simulations: two for the Euro-CORDEX domain with a spatial resolution of 0.11° and two for the nested domain for the region of Hamburg with a spatial resolution of 0.025° (Figure 1).

For each of the model domains one simulation uses the TEB parameterization for urban land and one not (Table 1). The simulations HAM_{std} and HAM_{urb} are both nested into EU_{std}. The simulation time is 1989/01/01-2009/01/01. It was chosen based on the availability of ERA-Interim Reanalysis data [*Dee et al.*, 2011] used for the initialization of the model and as the forcing data at its lateral boundaries.

Table 1. Model simulations

Simulation name	Domain/spatial resolution	Urban parameterization (on/off)
EU_{std}	CORDEX-EU / 0.11°	off
EU_{urb}	CORDEX-EU / 0.11°	on
HAM_{std}	REG-HAM / 0.025°	off
HAM_{urb}	REG-HAM / 0.025°	on

We compare the pairs of model simulations {EU_{std}; EU_{urb}} and {HAM_{std}; HAM_{urb}} and calculate the mean differences in 2-m temperature and precipitation for winter (DJF) and summer (JJA) seasons. On the mean differences we apply the Manns-Whitney Test (temperature) and the Sign-Test (precipitation) in order to find only statistically significant values. The Kolmogorov-Smirnov Test is used to determine different value distributions in time of temperature and precipitation.

Results

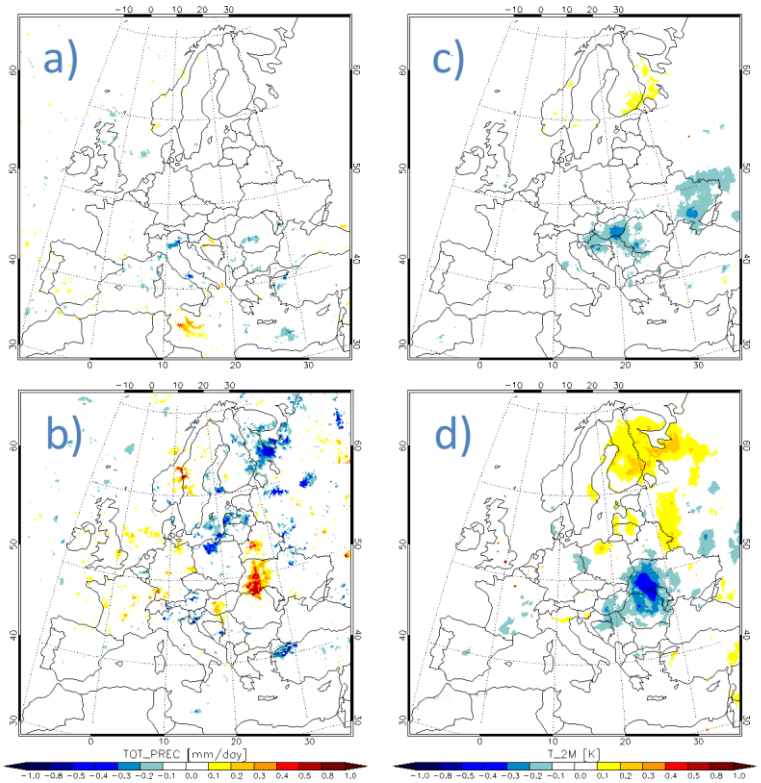


Figure 2 Results of the comparison for {EU_{std}; EU_{urb}}: statistically significant differences in mean winter precipitation (a) and winter 2-m temperature (c), summer precipitation (b) and summer 2-m temperature (d).

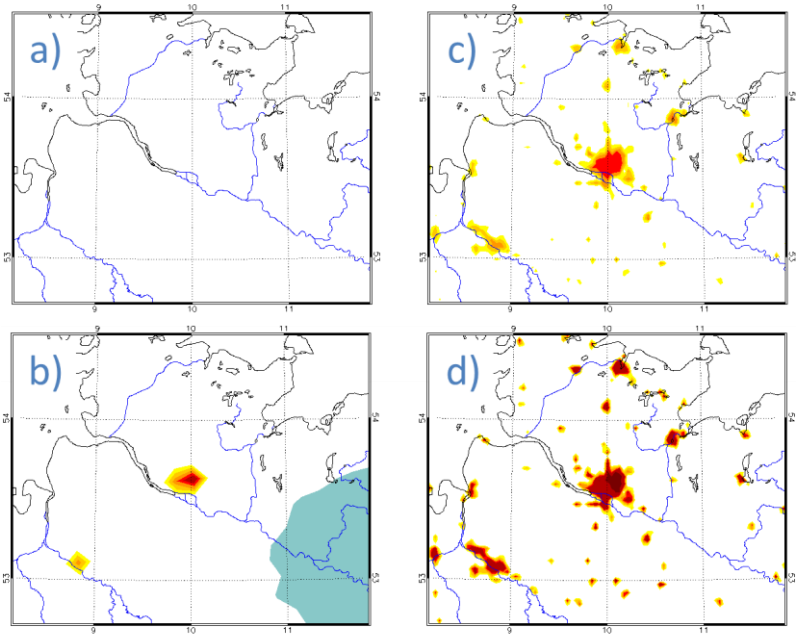


Figure 3. Statistical significant differences of mean daily temperature in the Hamburg region between EU_{std} and EU_{urb} (a,b) and between HAM_{std} and HAM_{urb} (c,d) for winter (a,c) and summer (b,d).

the neighbourhoods and can be directly attributed to the urban land cover.

Although we cannot proof it with only 20 years of climate simulations we expect the temperature/ precipitation differences between the simulations EU_{std} and EU_{urb} in the west Ukraine and Karelia to converge to zero over a longer period of simulations, e.g. over 100 years.

The differences of total daily precipitation for DJF and JJA in the Hamburg region were not statistically significant (not shown) and, therefore, we only compare the mean daily temperature differences between the two pairs of simulations {EU_{std}; EU_{urb}} and {HAM_{std}; HAM_{urb}} (Figure 3).

We analyse the statistically significant differences of daily precipitation and daily mean temperature between EU_{std} and EU_{urb} comparing the seasonally averaged daily mean temperature and total precipitation. In DJF the precipitation differences are negligible (Figure 2a) and the temperature differences are small (< 0.3 K, Figure 2c). The maps of mean temperature and precipitation differences show some dependence in JJA: where the rain amount is larger in EU_{urb} the mean daily temperature is lower (Figure 2b, d) and vice versa. This effect is explained by the cooling of the land surface by the additional precipitation and by the relative warming due to “missing” precipitation (less cooling by evapotranspiration). The area of the strongest temperature reduction (with an increase of precipitation) is in the western part of Ukraine. Another area with statistically significant differences in the climate variables – temperature increase and precipitation reduction – is the region of Karelia (divided between Finland and Russian Federation, northeast of Europe). Both these regions and their surroundings have a relatively low degree of urbanization. Therefore, the observed temperature/precipitation changes cannot be directly attributed to the presence of the explicitly parameterized urban land cover in the regional model. On the other hand, the JJA temperature increase in London, Paris, Stockholm, Moscow etc. reaches up to over 0.5 K (Figure 2d) and is rather local i.e. does not directly modify temperatures of

Whereas the simulations EU_{std} and EU_{urb} do not show any statistically significant difference in the mean DJF temperature in the region of Hamburg (Figure 3a) the simulations HAM_{std} and HAM_{urb} show a temperature effect of < 0.5 K from the urban land cover (Figure 3c). In JJA, the effect of the urban land use is visible in the coarse-scale and in the fine-scale simulations (Figure 3b, d). However, the coarse-scale simulations EU_{std} and EU_{urb} produce a weaker effect < 0.5 K (Figure 3b) than the HAM_{std} and HAM_{urb} (Figure 3d). The weaker effect corresponds to a larger area of averaging (within a model grid cell) and illustrates the importance of parameterizing the urban land use at fine spatial scales that allows capturing the extreme values of urban temperatures.

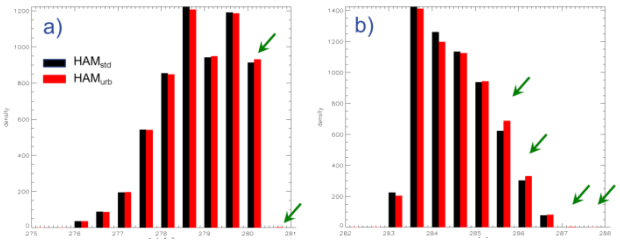


Figure 4. Histograms for mean daily temperature in winter (a) and summer (b) for HAM_{std} (black) and HAM_{urb} (red). Temperature values are taken from the model domain REG-HAM (Figure 1b). Green arrows show important discrepancies between the histograms.

For the mean temperature differences in HAM_{urb} and HAM_{std} we build histograms (Figure 4). The histograms show more fre-

quent occurrences of high mean daily temperatures in HAM_{urb} than in HAM_{std} in both seasons. In DJF the simulation HAM_{urb} shows values above 280 K, whereas the simulation HAM_{std} does not (Figure 4a). In summer the "shift" of the HAM_{urb}-histogram towards the higher values is even stronger, especially for values above 285 K (Figure 4b). The Kolmogorov-Smirnoff Test also indicates different statistical distributions of temperatures between the simulations in both seasons.

Conclusions

Based on the comparison of temperature and precipitation differences in the European model domain at ~12 km spatial resolution and of the Hamburg area at ~3 km we suggest to:

- include a parameterization for urban land on spatial scales of ~3 km and below
- omit the parameterization for urban land on coarse spatial scales such as ~12 km, unless its effects on the atmosphere are in the research focus of the particular application (e.g., for a study of pollution dispersion, land cover conversion from vegetated to urban etc.)

For nested model simulations, when intermediate model nests are used for the downscaling purposes only, the omission of the urban parameterization on the coarse spatial scale helps to reduce the computational time.

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Upcoming events

2014 February 2nd - 6th AMS Annual Meeting, Atlanta, USA

2014 February 5th - 6th COSMO SMC Meeting, Bologna, Italy

2014 February 10th - 13th Int. Conference of Subseasonal to Seasonal Prediction, Washington, USA

2014 February 17th -21st COSMO/CLM Training Course, Langen, Germany

2014 March 17th -19th COSMO/CLM User Seminar, Offenbach, Germany

2014 April 27th - May 2nd EGU - European Geosciences Union General Assembly 2014 in Vienna, Austria

2014 June 16th - 19th Third International Regional-scale Climate Modelling Workshop 2014, Lund, Sweden

2014 September 2nd - 5th CLM-Community Assembly 2014 in Frankfurt, Germany

2014 September 8th - 12th COSMO General Meeting in Athens, Greece

2014 October 06th - 10th EMS & ECAC in Prague, Czech Republic

Further meetings are listed on

http://www.clm-community.eu/index.php?menuid=11

Please send all information on ***new publications related to COSMO-CLM*** (***peer-reviewed as well as reports, theses***, etc.) with corresponding links to clm.coordination[at]dwd.de for ***listing on the community web page and in the Newsletter***. Please do not forget to ***name the project*** in the topic browser to which it is related.

Recent publications

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