Climate Limited-area Modelling Community

February 2017

Newsletter

No. 8

Content

Save the date!

CLM-Assembly

19.-22. September 2017

Graz, Austria

The next CLM Assembly will take place in September 2017 in Graz, Austria. The Assembly is a great opportunity to meet and discuss with the other community members and to exchange experiences and ideas – don't miss it ☺

Please, book your room as soon as possible! The hotels rooms are becoming less available as there is an international event in modern art at about the same time. The local Assembly organizing team has managed to implement contingents at Hotel Mariahilf, Hotel Erzherzog Johann, and Hotel Ibis and will try to assist the participants in case of problems.

More information at: https://wegcwww.uni-graz.at/clm2017

We wish you all a happy new year 2017!

Specific efforts have been made during the past year to promote our work and to disseminate scientific results. As announced in the last newsletter, the Meteorologische Zeitschrift published a first set of different scientific articles around the development and application of the COSMO-CLM model. The second part has now been published by the Meteorologische Zeitschrift as "Recent developments in Regional Climate Modelling with COSMO-CLM, Part 2" in Vol. 25, No. 5 (see: http://www.schweizerbart.de/papers/metz/list/25#issue5). The five articles in the second special issue of this scientific journal address further aspects of high resolution regional climate modelling. The topic simulation of extreme events has found special consideration in three of the articles. Pardowitz et al. looked for an efficient method of quantification of the uncertainty of extreme events using slightly different model domains; Gutjahr et al. investigated the impact of different horizontal resolutions on simulating extreme events; and Huebener et al. referred to the application of COSMO-CLM for hydrological aspects, finding that extremes are often underestimated. On model dynamics, Ogaja and Will examined how the application of numerical horizontal diffusion influences model stability by implementing a new symmetric fourth order scheme (see also the contribution in the research notes below). Furthermore on physics, Schulz et al. describe a reduced underestimation of diurnal temperature range by using a new formulation for the thermal conductivity in the soil.

One of the big community projects in 2017 is the Coordinated Evaluation of Convection Permitting Climate simulations with COSMO-CLM5.0 (CECPC5.0). The aim of this effort in the working group CRCS is a coordinated parameter testing for high-resolution simulations similarly to the previously conducted project COPAT of the working group EVAL (which was for the regional scale). At the end, it is intended to provide a recommendation for the parameter settings for two different domains (lowland and Alpine), which will be very useful for the other COSMO-CLM users. Details of both projects can be found on the working group web pages.

The COSMO/CLM/ICON/ART User Seminar takes place from 06 to 08 March 2017 in Offenbach (for the first time together with the ICON community!), followed by several CLM working group meetings. We hope to see many of you there!

Enjoy reading the Newsletter,

Yours sincerely, Barbara Früh and Susanne Brienen

Five questions to … Andreas Dobler

Norwegian Meteorological Institute

1. In which context are you using COSMO-CLM?

At the moment, I am using the COSMO-CLM to provide data together with an evaluation of the model results for different parts of Norway and doing convection resolving climate simulations for Svalbard. This data is used in further modeling or analyses to answer scientific questions related to climate change. Additionally, I am involved in the development of a new regional climate model system and I am using the COSMO-CLM as a kind of bench-mark model, not only for the model output, but also for the user-friendliness.

2. Andy, you are a member of the CLM-Community for a quite long time now. What are, in your opinion the strength and the weaknesses of the CLM-Community?

One major strength in my opinion is the willingness to help each other within the CLM-Community and the good communication. The different communication tools (email, wiki, forum and webpage) are very helpful there, and I think they are used in a reasonable way by the CLM-Community. A weakness is the large fluctuation of researchers at Ph.D. and Postdoc level, but this is partly compensated by the more solid core of the community.

3. It was only recently that your affiliation changed to the "Norwegian Meteorological Institute". Did your main tasks and responsibilities also change? And what are the main perspectives of your new job?

Yes, I think it's the 6th affiliation now since I did join the CLM-Community for the first time. The main tasks have always shifted, some times more than others. I have started working at the Norwegian weather service about 1.5 years ago, and the main job task is now regional climate modeling, so I am closer to where I started than before. The main perspectives of the new job with respect to the COSMO-CLM are using it in new areas and trying to answer some relevant scientific questions with the help of the model.

4. In which way do you plan to contribute now to CLM-Community activities?

For the moment, I think I will be mostly involved in the evaluation of model results, including the convection resolving simulations. I will also try to get more active again in the support and technical issues.

Andreas Dobler is originally from Switzerland and studied Computational Science and Engineering at the ETH Zurich. After his PhD in Geosciences at the Goethe University in Frankfurt, he worked as PostDoc at FU Berlin and the PIK before coming to his current affiliation in April 2015. He is a community member since 2006.

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

Difficult question. I have now a permanent position where the main task is regional climate modeling. If you had asked me 2 years ago, I would probably have said this is my personal goal. It surely makes life easier, but I think it's time to adjust the goals now. Maybe establishing regional climate modeling at our institute a little bit more is a good starting point.

Thank you very much for the interview! ■

IPCC activites

44th Session of IPCC

by Andrew Ferrone

The Intergovernmental Panel on Climate Change (IPCC) met from 17th to 20th October 2016 in Bangkok (Thailand), with approximately 110 countries delegations attending. The plenary decided on the outline of a special report on "Global Warming of 1.5°C", to be published end of September 2018 as well as, the outline of a methodology report "2019 Refinements to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories" to be published in May 2019.
The report on Global Warming of 1.5°C will be about 200 pages long, starting with a short Summary for Policy Makers followed by five chapters:

1. Framing and context
2. Mitigation pathways compatible with 1.5°C in the context of sustainable development
3. Impacts of 1.5°C global warming on natural and human systems
4. Strengthening and implementing the global response to the threat of climate change
5. Sustainable development, poverty eradication and reducing inequalities →

The call for authors for this report was open until 11th December 2016. Publications can only be considered for this report if they have been submitted by the end of 2017 and accepted by the end of May 2018.

The full outline including more explanations can be found here: https://www.ipcc.ch/meetings/session44/l2_adopted_outline_sr15.pdf

Photo by IISD/ENB | Leila Mead (http://www.iisd.ca/climate/ipcc44/17oct.html)

COP22/CMP12/CMA1

by Andrew Ferrone

Under the United Nations Framework Convention on Climate Change (UNFCCC) the 22nd Conference of the Parties (COP22) and the 12th Meeting of the Parties to the Kyoto Protocol (CMP12) took place from 7th to 18th November 2016 in Marrakech. As the Paris Agreement entered into forced on 4th November 2016, less than a year after its adoption, the first meeting of the Parties to the Paris Agreement (CMA1) also met during this conference.

On the technical and scientific level, this meeting was used to take forward the implementation of the Paris Agreement. The agenda of the Subsidiary Body for Scientific and Technical Advice (SBSTA) included on its agenda under "Research" two agenda item points. First the COP took note of the new Global Climate Observing System (GCOS) implementation plan and encourage Parties to endorse it (http://www.wmo.int/pages/prog/gcos/)

Secondly the SBSTA provided advice on how the products of the IPCC can inform the Global Stocktake. As foreseen in the Paris Agreement, the first Global Stocktake will take place every five years, starting in 2023 (the 6th Assessment Report of the IPCC to be published in 2021-22 will be right in time to inform it) in order to take stock of the progress towards achieving the goals of the Paris Agreement and increase the ambition towards reaching these goals. The IPCC will consider in its following sessions how to align it's cycle (with a length of 7-8 years) with the Global Stocktake taking place every 5 years.

CLM-Community issues

CLM-Community Assembly 2016

The CLM-Community Assembly 2016 took place in Lüneburg, Germany, and was organized by the colleagues of the Helmholtz-Zentrum Geesthacht. About 50 members attended the meeting with many interesting presentations and intensive exchange among the participants. As a social event, a wheel of fortune promised attractive prices for ideas on the improvement of the homepage. This was very successful, and some of the ideas could already have been implemented. For an overview of the suggestions and the status of the realization, see the Assembly web page: http://www.clm-community.eu/index.php?menuid=207&reporeid=349

Group photo at the Assembly 2016. Photo by Sabine Billerbeck.

Additionally, seventeen participants answered the survey of the Assembly 2016 and gave important feedback. The overall impression was very positive (see Fig. 1), praising especially the good organization, a good exchange/discussions with other members and the presentation quality. Most categorical questions were answered with "very good" with no particular extremes in any question. As least positive aspects the long days and the poster sessions were mentioned, as well as the fact that not enough members were attending. The time for discussion was criticized by some (especially after talks), but stated as satisfactory by others.

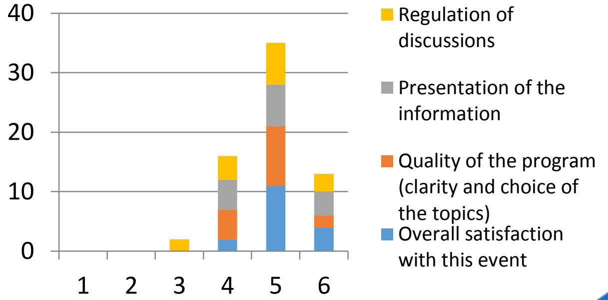

Fig. 1: Answers from the survey to questions of general aspects with marks ranging from 1 (very poor) to 6 (excellent).

The community webpage was found to be good in general, only with some parts outdated and some contents difficult to find. The CLM Newsletter is mostly read, but only partially or superficially.

Credits for climate data providers

Several institutions provide considerable amount of manpower and computing power to run climate projection simulations for the CLM-Community (e.g. in the context of CORDEX). Up to now, the credits for this work (which are sometimes important to get more funding) were very limited. Currently, it is discussed how this can be improved. In particular, it was decided to change a little the naming such that the institution that actually run the simulations is also visible. Furthermore, it is intended to define a DOI for each set of simulation and to make sure that every contributor (groups / individuals / institutions involved in the preparation and realization of the simulations) is included in the overview tables which are available e.g. on the CORDEX website. Finally, every user of the simulations is asked to acknowledge also the data provider in all publications.

You will find more details at

http://www.clm-community.eu/dokumente/upload/naming-of-projections_20170118.pdf.

Research notes

Climate change intensifies night-time storms over Lake Victoria

Wim Thiery[1,2,3], Edouard Davin[1], Sonia I. Seneviratne[1], Kristopher Bedka[4], Stef Lhermitte[5] and Nicole van Lipzig[3]

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Introduction

Lake Victoria is divided among Uganda, Kenya, and Tanzania. With a surface close to 70,000 km2, it is the biggest lake in Africa. The lake is also a notoriously dangerous place for the 200,000 people who go fishing there at night. The International Red Cross estimates that between 3,000 and 5,000 fishermen per year lose their lives in violent storms on the lake.

That Lake Victoria can be so stormy at night is related to the circulation in the atmosphere above the enormous water surface. During the day, a breeze develops that flows from the cool water towards the warm land. At night, we see the opposite: the land breeze flows away from the cooling land towards the warmer lake. As the lake is shaped like a circle, these land breezes from all directions converge above the lake. Add evaporation to this cocktail and you get a lot of storms, rain, wind, and waves.

Present-day storm patterns

Thanks to new NASA satellite products we were able to map the number of hazardous thunderstorms and their locations in East Africa – every 15 minutes for a period ranging from 2005 to 2013 (Fig. 2). During the day, most storms rage over the surrounding land, especially the typical afternoon thunderstorms that are caused by local upsurges of warm air. At night, these storms concentrate above Lake Victoria and the other African Great Lakes.

Methods

To project the impact of climate change on extreme precipitation patterns in the region, we performed a number of climate simulations using COSMO-CLM², which couples the non-hydrostatic regional climate model COSMO-CLM version 4.8 to the Community Land Model version 3.5 (CLM3.5; Davin and Seneviratne, 2012). The COSMO-CLM² simulations are described and evaluated in Thiery et al. (2015); they benefit from high spatial resolution (~7km; Docquier et al., 2016), an advanced land surface representation (Akkermans et al., 2014) and an interactive lake model, FLake, which was extensively tested over the African Great Lakes (Thiery et al., 2014a-b). We downscale the COSMO-CLM CORDEX-Africa evaluation simulation for 1996-2008 (CTL; Panitz et al., 2014) as well as the MPI-ESM-LR driven CORDEX projection (Dosio and Panitz, 2016) for the periods 1978-2010 (HIS) and 2068-2100 (FUT) under RCP8.5.

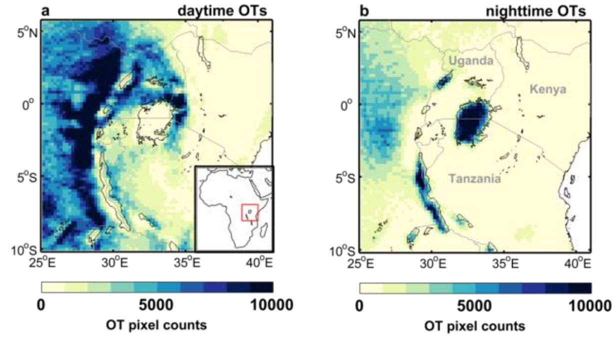

Fig. 2: Lake imprint on severe thunderstorm occurrence in East Africa. Satellite-based Overshooting Top (OT) detections during 2005-2013, (a) from 12:00 to 18:00 EAT (daytime) and (b) from 00:00 to 12:00 EAT (night time), respectively, as derived from the Spinning Enhanced Visible and Infrared Imager (SEVIRI) over equatorial East Africa. →

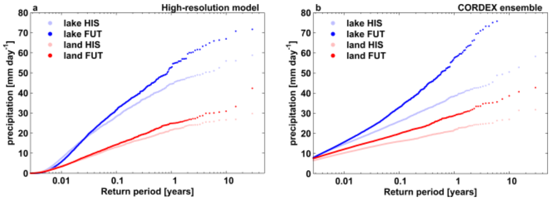

Fig. 3: Projected end-of-century changes in precipitation return periods over Lake Victoria. 24h Lake (blue squares) and land (red squares) return periods from (a) COSMO-CLM2 and (b) the ensemble of nine CORDEX-Africa members employing a lake model for their simulations (RCA4 only). Light colors indicate historical (1981-2010) return periods while dark colors indicate projected (2071-2100) return periods under RCP8.5.

Extreme precipitation projections

Under a business-as-usual scenario, the projected increase in extreme rainfall (nighttime precipitation above the 99th percentile) over Lake Victoria is 2.4 +/- 0.1 times higher as the rainfall over the surrounding land (1.8 +/- 1.0 times in the CORDEX ensemble). As a result, the lake will become a hotspot for night-time storms. Very extreme rainfall events that occur only once every 15 years today will occur almost every year by the end of the century (Fig. 3a). In contrast to the increase in extremes, the annual mean precipitation projected by the high-resolution model declines over the lake by 6%, consistent with the CORDEX ensemble (Souverijns et al., 2016; Dosio and Panitz, 2016). By providing ensemble projections at coarser resolution (~50 km), the CORDEX initiative enables uncertainty assessments within the constraints of the quality of both the downscaling tool and the lateral boundary conditions. Although some differences occur between the high- and coarse-resolution projections, it is clear that the lake effect on the future precipitation distribution is robust (Fig. 3). This is further confirmed by the fact that the projected response in the coarse-resolution ensemble is to a large extent independent of the driving global model. In particular, every CORDEX simulation projects a reduction in over-lake precipitation for all bins below the 90th percentile and an amplification of the increase in the highest bins, thereby corroborating the high-resolution model.

At the same time COSMO-CLM^2 clearly outperforms all CORDEX models as well as a state-of-the-art reanalysis (ERA-Interim) in terms of precipitation representation, underlining the benefits of enhanced resolution and use of a lake model for climate simulations over the region.

Conclusions

Our results emphasize a major hazard associated with climate change over East Africa with potential severe human impacts. Lake Victoria directly sustains the livelihood of 30 million people living at its coasts and its fishing industry is a leading natural resource for East African communities. However, given the projected increase in extreme over-lake thunderstorms, the current vulnerability of local fishing communities and their growing exposure driven by rapid urbanisation along the lakefront, this lake is likely to remain the most dangerous stretch of water in the world.

At the same time, our results make it possible to better predict extreme storms over the lake and to reduce the vulnerability of the local fishermen. The next step therefore consists of developing a new satellite-based early warning system for the region.

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Thiery, W., et al.: LakeMIP Kivu: evaluating the representation of a large, deep tropical lake by a set of one-dimensional lake models, Tellus A, 66, 21390, 2014b.

Thiery, W., et al., The impact of the African Great Lakes on the regional climate, J. Climate, 28(10), 4061-4085, 2015.

More details about this work can be found in:

Thiery, W., Davin, E.L., Seneviratne, S.I., Bedka, K., Lhermitte, S., van Lipzig, N.P.M., 2016, Hazardous thunderstorm intensification over Lake Victoria, Nature Communications, 7, 12786 (http://www.nature.com/articles/ncomms12786)

■

Mesoscale atmosphere ocean coupling enhances the transfer of wind energy into the ocean

D. Byrne[1,2], M. Münnich[1], I. Frenger[3,4], N. Gruber[1,2],

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Ocean mesoscale processes are a crucial element of the large-scale oceanic circulation and as such have major implications for climate and ocean biogeochemistry. Ocean Eddies (20–300 km) can be thought to act as a 'limiting or regulating factor'. For example, they act to counteract the northward wind driven flow in the Southern Ocean, which, to a large part, determines efficacy of global carbon and heat cycling, or, as another example, eddies act to suppress Net Primary and Export production in Eastern Boundary Upwelling Systems, which is currently projected to increase due to an increase of nutrients into the euphotic zone via increased upwelling under climate change. The magnitude of the "regulating factor" eddies provide depends upon the energy contained in the mesoscale eddy field. It is therefore critical that we understand and estimate the energy contained within and the pathways via which ocean eddies are powered. While next generations of climate models are expected to increase their ocean resolution to the oceanic mesoscale, computational constraints will still make it impossible to increase the atmospheric resolution to the same level, i.e. the interaction between the ocean and atmosphere at the mesoscale (tens of kilometers or less) will remain unresolved. Currently, the prevailing view is that mesoscale atmosphere-ocean interactions lead to, if anything, a reduction of the energy transfer from the atmosphere to the ocean.

In this research, we present results in contrast to this prevailing view. Specifically, we identify and describe a mechanism that leads to a new energy pathway between the atmosphere and the ocean mesoscale. The sign of this energy exchange - whether it injects or extracts energy from the ocean – firstly, depends upon the presence and sign of a background large scale wind gradient in which the ocean eddies live. For example, a negative wind gradient (defined as an increase in wind speed from north to south) results in either a 'spin-up' (anticyclonic eddy) or 'spin down' (cyclonic eddy) forcing owing to the unbalanced wind strength across the eddy (see Fig. 4).

Secondly, it depends upon the response of the overlying atmosphere to the sea-surface temperature (SST) anomalies that are associated with ocean eddies, i.e. warm or cold anomalies compared to the surrounding waters. The anomalous heat fluxes, associated with positive SST anomalies destabilize the atmosphere above them, causing more momentum from higher up in the atmospheric boundary layer to be mixed downward, leading to stronger surface winds (Fig. 4). Cold SST anomalies have the opposite effect, stabilizing the overlying atmosphere and reducing the near-surface winds.

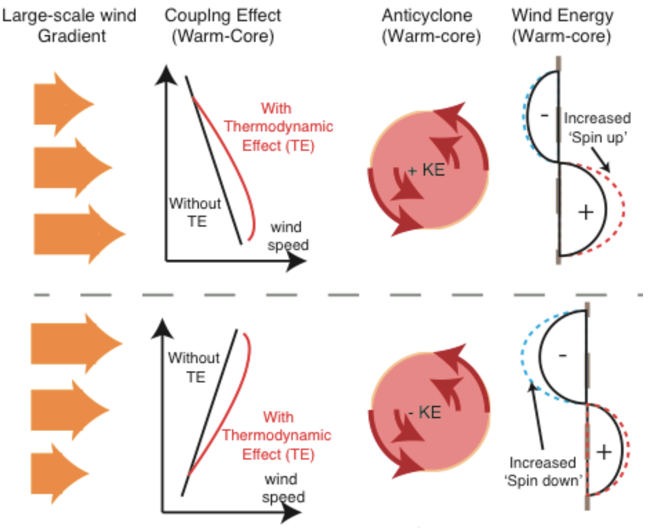

*Fig. 4: (a) Case for a negative wind gradient (increasing from north to south) depicting the thermodynamic effect (TE) for the response of the atmosphere to an underlying warm-core anticyclonic eddy. The eddy-associated anomalies in SST modify the overlying winds and hence the wind stress exerted onto the ocean (coupling effect). In this case - a negative wind gradient - this results in an enhanced the energy transfer on the southern side of the eddy, that is not compensated for on northern side. The net effect is thus an increase in the net energy transfer into the ocean. (b) Regions with a positive gradient have the opposite effect and result in a net extraction of energy from the ocean. *For full diagram including cold SST anomalies see publication.*

Combining these two effects – the large scale wind gradient and the thermodynamic response of the atmosphere to the underlying ocean SST anomalies - the net result is an increase in kinetic energy (KE) for both warm and cold core eddies that reside in a negative wind gradient and a decrease in KE when they are located in a positive wind gradient.

Utilizing a recently developed coupled atmosphere-ocean regional model (COSMO–Regional Oceanic Modeling System (ROMS)), where no spatial or temporal interpolation is used between the ocean

→

and atmosphere component models - a configuration essential to capturing the full dynamics of the air-sea interaction at these scales – we tested our hypothesized thermodynamic pathway associated with a background wind speed gradient. We show that the mechanism identified can actually increase the net energy transfer at mesoscales by up to 10-15%. Further, we show that this energy goes straight into the mesoscale kinetic energy field, thus providing for a new and direct conduit of energy from the atmosphere into the ocean. This new direct transfer shortcuts the well known main pathway via which oceanic variability at the mesoscale is powered, i.e., the large scale potential energy generation by wind (and buoyancy), followed by baroclinic instability to smaller scales.

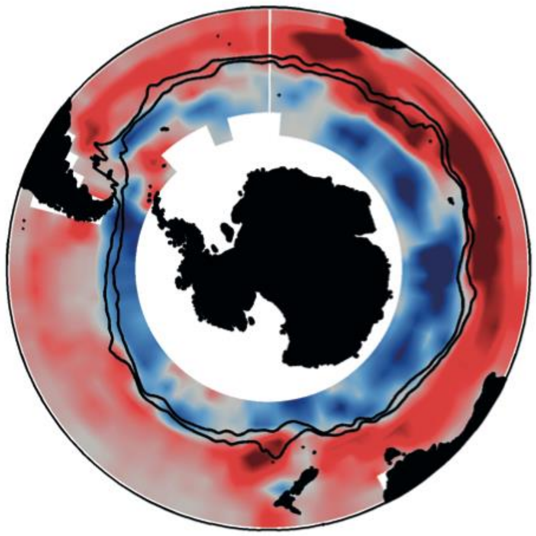

Fig. 5: Southern Ocean map of the product of the average wind stress gradient across an eddy within each 4° (longitude) times 2° (latitude) grid box and the number of eddies within this box. The wind stress was computed from SeaWinds on QuikSCAT and the eddies were identified from satellite sea surface height anomaly data (AVISO) over the period June 2002 to November 2009. The mean positions of the Subantarctic and Polar Fronts are shown as solid black lines; reddish colours show anticyclonic (negative gradient) wind shear situations, bluish colours show cyclonic (positive gradient) wind shear situations; the former represent 'spin-up' conditions with respect to the coupling effect discussed here and the latter represent 'spin-down' conditions.

Large wind gradients prevail over much of the Southern Ocean and flip sign North and South of the Polar Front, resulting in optimal conditions for this transfer of energy to matter over large parts of the ocean. To quantify this we analysed >600,000 eddies (with lifespans of 2 weeks or more) identified from satellite sea-surface height anomaly data (AVISO) over the period June 2002 to November 2009. Our analysis reveals that approximately 30% of the eddies (~200,000) exist in a strong gradient with an absolute value exceeding 0.01 N m−2 per eddy diameter, similar to the conditions for the average eddy in the simulations. That is, from extrapolating our simulation results, they experience across their area a change of wind stress of roughly 10% and thus provide an excellent conduit for the mesoscale exchange of energy between the atmosphere and the ocean. Indeed, spin-up conditions (red areas Fig. 5) prevail over large regions of the Southern Ocean north of the Polar Front, and that the energy transfer is likely to be the highest in the Indian Ocean sector given the high number of eddies there. In contrast, spin-down (blue areas Fig. 5) conditions are mostly located south of the Polar Front.

Until now, mesoscale atmosphere-ocean interactions were thought to play little role in energy transfer from the atmosphere to the ocean. Although it is still unclear how this newly uncovered energy pathway will affect the large-scale ocean circulation, changes resulting from this pathway will likely have far reaching effects on important ocean processes at different scales, and in-turn affect the oceanic uptake of CO2 and heat from the atmosphere.

Publication:

Byrne, D., M. Münnich, I. Frenger, N. Gruber, 2016: Mesoscale atmosphere ocean coupling enhances the transfer of wind energy into the ocean. Nat. Commun. 7:11867, doi: 10.1038/ncomms11867

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Higher order horizontal schemes in COSMO 5.0 at different resolutions

A. Will and J. Ogaja

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Recently the new full 4th order and energy conserving horizontal discretisation scheme has been optimized and implemented in COSMO 5.0. The additional computing costs could be kept below 2%. Application at 50 km to 2.8 km resolutions showed a nearly neutral behaviour with respect to mean temperature and precipitation. However, significant differences are found in comparison with the 3rd order upwind scheme with respect to small scale dynamics and extreme winds, in particular at convection permitting scales. →

Simulations

The reference (C3p2v2d0.25) and the new S4p4v2d0.00 horizontal discretisations of the Euler equations are compared at 50 km (0.44°), 18 km (0.165°), 7 km (0.0625°) and 2.8 km (0.025°) horizontal resolution. The C3p2v2d0.25 scheme is the recommended 2nd order scheme with 3rd order upwind advection differencing and a moderate horizontal numerical diffusion (hd_corr_u=0.25). The S4p4v2d0.00 is the energy conserving full 4th order horizontal scheme with no horizontal diffusion. As shown by Ogaja & Will (2016), simulations without horizontal numerical diffusion are possible due to strict conservation of the rotational part of the kinetic energy by the symmetric discretisation of the advection term.

The new scheme is implemented in COSMO_5.0_hos_1.2 (BTU Cottbus). The configurations used are basically the reference CLM-Community, COSMO-EU or COSMO-DE configuration for COSMO_5.0. A one, two and three step nesting strategy is used to downscale NCEP re-analysis over wider Europe (Δx=50km, Δx=18km), reduced Europe (Δx=7km) and Germany (Δx=2.8km). The total simulation time is 5 years for 50 and 18km horizontal resolution and 2 years for others.

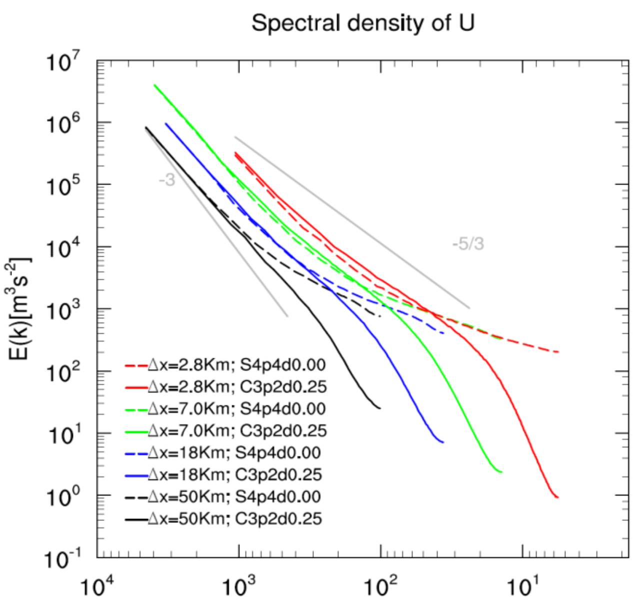

Fig. 6: Mean spectral energy density of U-velocity in July 2000, 3-8 km height and the horizontal domain without relaxation zone for C3p2v2d0.25 and S4p4v2d0.0 simulations at resolutions Δx=2.8 km, Δx=7km, Δx=18km and Δx=50km. The densities are multiplied by a factor depending on horizontal resolution for improved readability of the figure.

Results

Fig. 6 shows the July 2000, latitudinal and vertical (3km-8km) mean of zonal spectral kinetic energy density (power spectra) for the simulations C3p2v2d0.25 or S4p4v2d0.00 at 50km, 18km, 7km and 2.8km horizontal resolution. Each pair of simulations is using the same reference configuration developed for that domain and resolution together with one of the numerical schemes. At large scales each pair of simulations exhibits a different energy density due to small differences in the domain size and/or vertical position of the layers selected. The much higher energy density found in the 2.8km simulations reflects the different energy density in the domain Germany (see Fig. 7). All C3p2v2d0.25 simulations exhibit a drop of energy density at scales smaller than 8Δx due to horizontal numerical diffusion. At these scales the S4p4v2d0.00 simulations show an increasing slope of kinetic energy density with increasing resolution: $e_k \sim k^{-1.2}$ in the range 500km>λ>100km and $e_k \sim k^{-0.8}$ in the range 50km>λ>6km. The S4p4v2d0.00 scheme exhibits an increased intensity of kinetic energy density at weakly resolved and a decreased intensity at well resolved scales, which is up to 100% at 100km scale in the Δx=2.8km simulation. However, a deeper understanding of the differences between the spectra remains for future work.

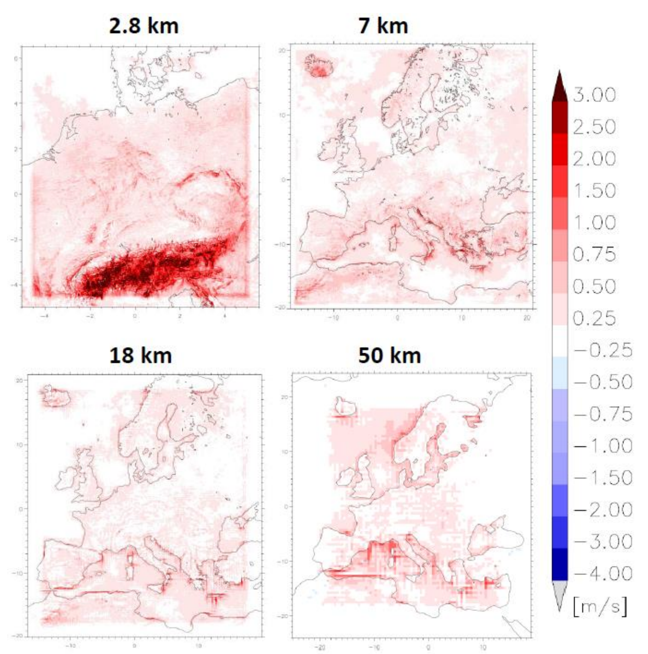

Fig. 7: VMAX_10M mean differences 2000-2001 (2.8km, 7km) and 2000-2004 (18km, 50km) between S4p4v2d0.00 and C3p2v2d0.25 simulations.

Fig. 7 shows mean differences of 10m daily maximum wind speed (VMAX_10M) between S4p4v2d0.00 and C3p2v2d0.25 simulations for different resolutions. The non-diffusive scheme increases the maximum wind speed by 0.25 m/s at 50km resolution and by 0.5 m/s at 7km and 2.8km resolution. →

Interestingly, the 2.8km resolution simulation exhibits an increase of 1.75m/s over the Alps. An increase of 1.2m/s is found for Δx=5km (without deep convection parameterization) and an increase of 0.4m/s for Δx=7km (with deep convection parameterization). It demonstrates that the numerics and the physical parameterizations are significantly affecting the dynamics in the planetary boundary layer.

Conclusions

The symmetric higher order horizontal scheme shows a consistent increase of the intensity of small scale dynamics at coarse to very high resolutions accompanied by a decreased intensity of dynamics at well resolved scales. The much higher intensity of meso-scale dynamics over the Alps in the S4p4 simulation indicates a high potential of non-dissipative higher order numerical schemes for improved simulation of extreme events, in particular if the deep convection is switched off.

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28/02 – 03/03	ICON-LAM Training, Langen, Germany
06/03 – 10/03	COSMO/CLM/ICON/ART User Seminar, Offenbach, Germany
27/03 – 04/04	COSMO/CLM/ART Training, Langen, Germany
23/04 – 28/04	EGU, Vienna, Austria
27/06 – 29/06	ICEM, Bari, Italy
04/09 – 08/09	EMS, Dublin, Ireland
19/09 – 22/09	CLM-Community Assembly, Graz, Austria

Contribute to the Newsletter and Feedback

We would be very happy to receive *YOUR contribution* to any topic of this newsletter, as well as any comments which could help us to improve.

Please send an email to clm.coordination[at]dwd.de in order to match the next issue of the Newsletter ***until June 15th, 2017*.**

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