C2SM Newsletter October 2016 **Vol. 22**

New activities in scientific visualization

One of the first C2SM SciViz projects, *NWP and climate model fields as Google Earth layer* together with Michael Sprenger and Urs Beyerle at ETH, has been successfully completed. Tools are now available to include images of meteorological fields as additional layers on Google Earth and animate them. As a part of outreach for the MAIOLICA-2 project, demo animations were uploaded on the OmniGlobe (the spherical display at FocusTerra). Two animations for this project will soon be made available on the OmniGlobe. In a third project, a tool to animate winds/flow patterns using Lagrangian particle tracking is in its final stages of development and will be soon made available to the C2SM community. Additionally, work on the C2SM visualization wiki has also begun. We encourage C2SM members to contact Tarun Chadha if they wish to have any specific topics on the wiki. More info on these activities can be found on our scientific visualization page.

Swiss Climate Scenarios CH2018

The CH2018 project, in which new climate change scenarios for Switzerland are currently being developed, is entering its production phase. First preliminary results regarding changes in seasonal means, extremes, and climate indices based on the state-of-the-art CORDEX simulations over Europe are to be expected in the upcoming months. CH2018 involves the C2SM partners MeteoSwiss and ETH as well as the University of Bern. The scenarios are planned to be released in 2018. To ensure the applicability of the scenarios for a broad user community, a sounding board with participants from different sectors has been established. A first meeting with the sounding board discussing the general plans of CH2018 has recently taken place.

Changes in the project management of CH2018: Kuno Strassmann will take over the project coordination at ETH side starting in October 2016. He succeeds Elias Zubler, who joins MeteoSwiss at the beginning of November. Further, Curdin Spirig joined the project as data manager and analyst in mid-September. We wish Kuno, Curdin and Elias a good start in their new positions!

Paper CH2018: Testing the quantile mapping approach for bias correcting and downscaling climate model output over the Swiss territory

A recent publication by Martin Ivanov and C2SM member Sven Kotlarski explores the suitability of quantile mapping (QM) as climate model bias correction and downscaling technique over the complex Swiss terrain. Originating from the Swiss ELAPSE project (*Enhancing local and regional climate change projections for Switzerland*) the study finds a satisfying performance of a large number of QM implementations in both a historical cross validation and a future pseudo reality setting, and suggests a further exploitation of this technique. Indeed, QM is foreseen to be used as the main statistical downscaling method in the upcoming CH2018 climate scenarios.

Ivanov, M. A. and Kotlarski, S., 2016: Assessing distribution-based climate model bias correction methods over an alpine domain: added value and limitations. *Int. J. Climatol.*, doi:10.1002/joc.4870.

New climate science webcasts: building the future and more

Oliver Stebler, part of Reto Knutti's Climate Physics Group at ETH, helps to communicate climate science in his science webcasts ("Werkstattgespräche"), where he interviews leading experts in climate research and climate related practice and industry. His most recent webcasts include: 1: "Die Zukunft bauen" (Gerhard Schmitt) about future cities, urbanisation and future challenges related to climate change. It also introduces the Singapore-ETH Centre for Global Environmental Sustainability; 2: "Visionär und Macher" where science meets practice, and climate scientist, Reto Knutti, debates with energy expert, Anton Gunzinger; 3: "Schweizer Gemüse und Espresso" (various guests): The best-of from the last 15 webcasts. More climate science webcasts (in German) can be found on the Climate Physics Group's Werkstattgespräche page, or Oliver Stebler's page for climate science communication tools and multimedia productions.

MAIOLICA-2: Global methane variability in a changing climate

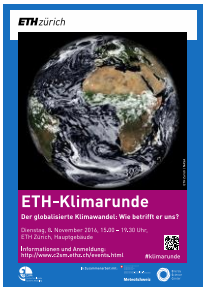
The MAIOLICA-2 project, funded within the ETH Competence Center Environment and Sustainability (CCES), led into its final phase with the successful PhD defense of Ancelin Coulon (group of T. Peter, ETH) in May 2016. During the past 4 years, partners from C2SM, Empa, ETH and WSL combined process-oriented emission and atmospheric modeling in an unprecedented way to investigate the drivers of the variability of atmospheric methane growth rates and to provide improved data sets for anthropogenic and wetland emission fluxes for the past. Estimates of future permafrost extents and methane emissions from wetlands under different climate scenarios have also been developed, e.g. as input for climate models. More on the project and final data products (available soon) can be found on the website.

Project: AWE-GEN-2d: a new high spatial and temporal resolution stochastic weather generator

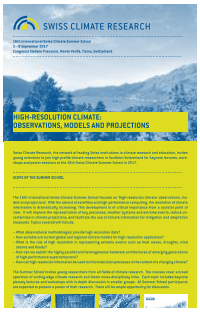
A new weather generator, AWE-GEN-2d (Advanced WEather GENerator for 2-Dimensional grid) was developed (as part of SCCER-SoE). It combines physical and stochastic approaches to simulate meteorological variables at high space-time resolution, such as 2x2 km and 5′ for precipitation and 100x100 m and 1h for other variables (e.g. temperature). The model is rather parsimonious in terms of computational demand and allows fast and efficient generation of multiple stochastic realizations. The model is particularly suitable for all applications where exploring internal climatic variability at multiple spatial and temporal scales is fundamental and can be reparametrized to downscale climate scenarios.

Project members: Nadav Peleg, Simone Fatichi and Paolo Burlando, Institute of Environmental Engineering, ETH. For more information, contact Nadav Peleg.

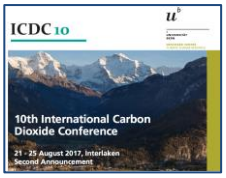
Upcoming events of interest for the C2SM Community



Klimarunde 2016: This year's Klimarunde, "Der globalisierte Klimawandel: Wie betrifft er uns?" will take place on Tuesday, 8 November 2016, organized jointly by C2SM, MeteoSwiss and the Energy Science Center at ETH. This year's topic will address external and internal risks and opportunities for Switzerland related to both weather and climate. Registration and a detailed program can be found on the website.



Summer School 2017: The Swiss Climate Summer School 2017 will take place from 3 - 8 September 2017 at the Centro Stefano Franscini (CSF) on Monte Verità (Ascona, Southern Switzerland) with the topic "High-Resolution Climate: Observations, Models and Projections". The Summer School is open to young researchers (PhD students and Postdocs) worldwide and will be limited to a maximum of 70. Deadline for applications is 31 December 2016. Please visit the website for more information and application submission.

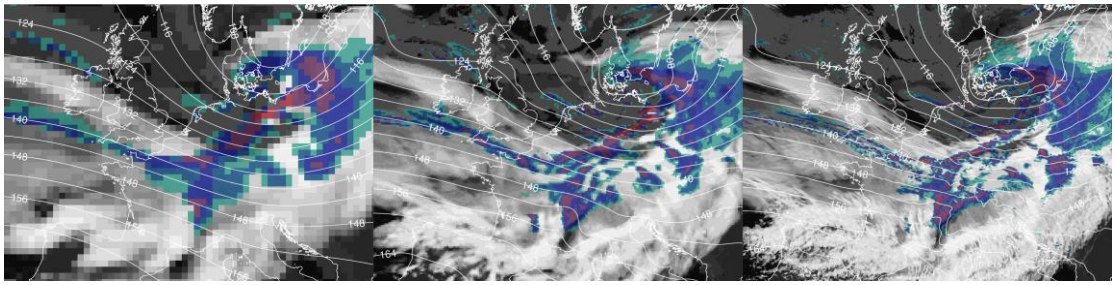


Registration and abstract submission is now open for the 10th International Carbon Dioxide Conference (ICDC10), to be held on 21-25 August 2017, in Interlaken, Switzerland. Please visit the conference website to check out the program, see the list of invited keynote speakers, submit your abstract and registration, and to note down the important deadlines for this event. Abstracts due February 28, 2017.

The Oeschger Centre for Climate Research is organizing a special Hans Sigrist Symposium on 2 December 2016 entitled "The Human Fingerprint on the Earth System". The deadline for registration is 10 November 2016. More information, and registration can be found on the website.

Forum für Wissen 2016: Wald und Klimawandel, Resultate und Schlussfolgerungen aus dem gleichnamigen Forschungsprogramm: WSL and BAFU are organizing this one-day event (in German) on 29 November in Uitikon-Waldegg (close to WSL). Please see the website for more information and registration.

Paper: Towards European-scale convection-resolving climate simulations with GPUs
The representation of moist convection (thunderstorms and rain showers) in climate models represents a major challenge, as this process is usually parameterized. Weather and climate simulations using horizontal resolution on the order of 1 km allow deep convection to be explicitly resolved and thus allow for an improved representation of the water cycle. In the C2SM project crClim, these modeling capabilities are further developed to allow convection-resolving climate simulations on continental-scales and over extended time periods. In the study, a set of such simulations is presented. The results illustrate how the approach allows the interactions between atmospheric circulations at scales ranging from 1000 to 10 km to be represented. This includes the formation of sharp cold frontal structures and narrow cold frontal rain bands, convection embedded in fronts and small vortices, or the formation and organization of propagating cold pools. The study also finds substantial performance gains on the Piz Daint supercomputer from using a new COSMO version, capable of exploiting hardware equipped with Graphics Processing Units (GPUs). This new version is the result of a continued effort by MeteoSwiss, IAC, CSCS, and C2SM.



Snapshots of winter strom Kyrill on 18 January 2007 18 UTC in three simulations with refined model resolution. (Left) 50 km, (middle) 12 km and (right) 2.2 km.

Leutwyler, D., Fuhrer, O., Lapillonne, X., Lüthi, D., and Schär, C., 2016: Towards European-scale convection-resolving climate simulations with GPUs: a study with COSMO 4.19, Geosci. Model Dev., 9, 3393-3412, doi:10.5194/gmd-9-3393-2016.

Paper: Sea-ice transport drives freshening of the Southern Ocean
Over the past decades, the northward drift of sea ice surrounding Antarctica has strengthened. This has not only increased the extent of the sea ice, but has also freshened the sea water around the sea-ice edge — with as yet indeterminate consequences for the global climate system and Antarctica's ecosystem.

Snow covered sea ice in the Southern Ocean in late summer. Credit: K. Leonard

Long-term measurements of salinity in the Southern Ocean have revealed a strong freshening signal over the past decades. The source of these salinity changes however has remained a conundrum. A newly published study in *Nature* by Alex Haumann, C2SM chair Niki Gruber and colleagues, now describes a possible reason for this freshening of the Southern Ocean waters. The authors show that the sea-ice conveyor belt around Antarctica has strengthened substantially, and that the associated freshwater fluxes to the open Southern Ocean can explain the Southern Ocean salinity distribution and its recent changes. Using satellite observations supplemented with sea-ice reconstructions, the authors estimated that the transport of freshwater by the sea ice has increased by up to 20 percent over the period 1982 to 2008. This would have caused a freshening of the sea water in the melt zone by as much as 0.02 grams per

kilogramme of sea water per decade, a figure that is compatible with long-term records. These salinity observations have revealed a strong freshening in open ocean regions, as well as in Antarctic Intermediate Water; a signal that cannot be explained by an increase in rainfall, as was previously thought. A much more likely explanation is the increased northward transport of freshwater by the sea ice into this region, as found in this study.

Haumann, F.A., N. Gruber, M. Münnich, I. Frenger, S. Kern, 2016: Sea-ice transport driving Southern Ocean salinity and its recent trends, *Nature*, doi.org/10.1038/nature19101.

Paper: Topography modifies summer precipitation response to climate change

Past studies of European climate change have projected a large-scale drying for the summer season. A recent ensemble of high-resolution regional climate models confirms these results for Europe, but also projects increases in mean Alpine precipitation. In addition, the tendency towards heavier thunderstorms is confirmed. In their recent *Nature Geoscience* article, Christoph Schär, Nikolina Ban and colleagues show that topography modulates the summer precipitation response to climate change. Analysis of summer precipitation in high-resolution regional climate model simulations reveals an increase in mean Alpine precipitation that is not present in the global simulations. This finding is associated with increased convective rainfall (i.e., thunderstorms and rain showers), and is consistent across regional and convection-resolving climate models.

Giorgi F., C. Torma, E. Coppola, N. Ban, C. Schär and S. Somot, 2016: Enhanced summer convective rainfall at Alpine high elevations in response to climate warming, *Nature Geoscience,* doi:10.1038/ngeo2761.

Contact: info.c2sm@env.ethz.ch