



## Comment gérer les changements des extrêmes climatiques? Le rapport IPCC SREX

Editorial, deutsche Übersetzung anschliessend



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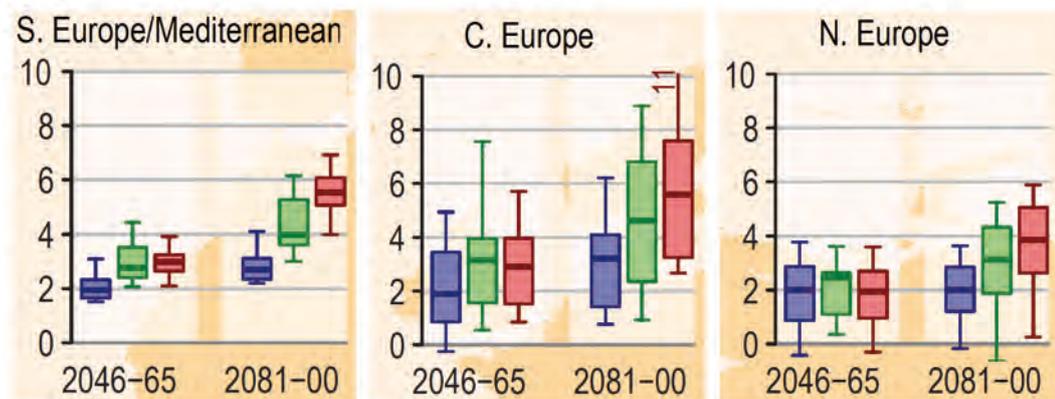
Un nouveau rapport spécial du groupe d'experts intergouvernemental sur l'évolution du climat (GIEC, en anglais: Intergovernmental Panel for Climate Change, IPCC) a été publié fin mars. La thématique de ce rapport («IPCC SREX») concerne les événements climatiques extrêmes (ou «extrêmes climatiques»), et plus particulièrement de la gestion des risques associés à ces événements sous la perspective de l'adaptation au changement climatique.

Le chapitre 3 de ce rapport [1], dont j'étais l'auteur-coordonateur principal en collaboration avec Neville Nicholls de l'Université de Monash en Australie, se consacre seulement aux aspects physiques du climat (observations and projec-

tions des extrêmes climatiques). Néanmoins, l'interaction avec les autres auteurs du rapport, en particulier dans le cadre de la préparation du résumé à l'intention des décideurs, nous a induit à évaluer la littérature physique existante en prenant plus en compte l'angle de la gestion des risques. Concrètement, notre chapitre se concentre par exemple sur une évaluation systématique des changements régionaux des extrêmes de température et précipitation, incluant des estimations de la magnitude des changements projetés (Fig. 1).

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**Fig. 1:** Changements projetés (différences) de la température journalière extrême maximale avec une période de retour de 20 ans entre le milieu (2046-2065), respectivement la fin (2081-2100) du 21ème siècle, et la fin du 20ème siècle (1981-2000) pour trois régions européennes (Europe du sud / région méditerranéenne, Europe centrale, Europe du Nord). Les analyses se basent sur des simulations climatiques globales de la 3ème expérience de modélisation climatique coordonnée (CMIP3) pour 3 scénarios climatiques (B1: bleu, A1B: vert, A2: rouge). La médiane des modèles (ligne grasse), l'écart central de 50% des modèles (écart interquartile) et les valeurs extrêmes sont indiquées. Source: Référence [1]

Cet échange avec des experts dans la gestion des risques a néanmoins aussi mis en lumière de nombreux aspects pour lesquels un avancement de la recherche actuelle est nécessaire afin de fournir de meilleurs outils aux décideurs et à la population en matière d'adaptation au changement climatique:

- Alors que des projections climatiques très poussées sont disponibles pour certaines régions (voir par exemple le récent rapport CH2011 pour la Suisse), d'autres régions parmi les plus touchées, par exemple en Afrique, disposent de peu ou très peu d'observations, ainsi que de projections régionales inexistantes ou limitées à une ou deux études.
- Certains phénomènes et leur lien au forçage anthropique sont encore relativement peu compris scientifiquement et les incertitudes restent substantielles concernant les projections s'y rapportant (par exemple pour El Niño, les cyclones tropicaux, et les sécheresses).
- Même dans certaines régions avec de bonnes données d'observations et pour des processus à première vue élémentaires tels que les changements de températures extrêmes,

la magnitude des changements peut rester relativement incertaine, même si le signe du changement n'est pas disputé (cf. Figure 1 pour l'Europe centrale). Cela peut être le cas lorsque des rétroactions contribuent à l'amplitude des changements des extrêmes climatiques [2,3]

Ces incertitudes ne questionnent en rien l'existence du changement climatique anthropique global, dont l'existence est bien établie, et ce depuis plusieurs années. Mais il est important de reconnaître que de nombreux aspects du système climatique restent incertains, soit à l'échelle régionale ou en lien avec des phénomènes spécifiques. Une meilleure compréhension dans ces domaines est essentielle pour l'adaptation au changement climatique, par exemple par le biais du développement de prévisions saisonnières pour les événements extrêmes, tels que les canicules ou les sécheresses [2,3]. Cela représente un défi important pour la recherche sur le climat, mais aussi une chance pour les chercheurs de contribuer tant aux solutions qu'à l'identification des problèmes liés au changement climatique!

#### Références:

[1] Seneviratne, S.I., N. Nicholls, D. Easterling, C.M. Goodess, S. Kanae, J. Kossin, Y. Luo, J. Marengo, K. McInnes, M. Rahimi, M. Reichstein, A. Sorteberg, C. Vera, and X. Zhang, 2012: Changes in climate extremes and their impacts on the natural physical environment. In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. (<http://ipcc-wg2.gov/SREX>)

[2] Hirschi, M., S.I. Seneviratne, V. Alexandrov, F. Boberg, C. Boroneant, O.B. Christensen, H. Formayer, B. Orłowski, and P. Stepanek, 2011: Observational evidence for soil-moisture impact on hot extremes in southeastern Europe. *Nature Geoscience*, 4, 17-21, doi:10.1038/ngeo1032.

[3] Quesada, B., R. Vautard, P. Yiou, M. Hirschi, and S.I. Seneviratne, 2012: Asymmetric European summer heat predictability from wet and dry Southern winter/springs. *Nature Climate Change*, published online, doi:10.1038/nclimate1536.

## Wie ist mit den Veränderungen der Klimaextreme umzugehen? Der IPCC-SREX-Bericht

Prof. Sonia Seneviratne, Institut für Atmosphäre und Klima (IAC), ETH Zürich

Ein neuer Sonderbericht des Weltklimarates (Intergovernmental Panel for Climate Change, IPCC) ist Ende März erschienen. Die in diesem Bericht («IPCC-SREX») behandelte Thematik ist der Zusammenhang zwischen dem Klimawandel und das Vorkommen von klimatischen Extremereignissen (oder «Klimaextremen»), und im besonderen der Umgang mit den damit verknüpften Risiken unter der Perspektive der Anpassung an den Klimawandel.

Kapitel 3 dieses Berichtes [1], wovon ich und Neville Nicholls der Monash University in Australien koordinierende Hauptautoren waren, befasst sich mit den rein physikalischen Aspekten des Klimas (Beobachtungen und Projektionen der Klimaextreme). Die Interaktion mit den anderen Autoren des Berichts – insbesondere bei der Erstellung der Zusammenfassung für die Entscheidungsträger – hat uns gleichwohl dazu geführt, die bestehende physikalische Literatur vertieft unter dem Blickwinkel des Risikomanagements zu evaluieren. Konkret befasst sich unser Kapitel beispielsweise mit einer systematischen Bewertung der regionalen Veränderungen der Temperatur- und Niederschlagsextreme unter Einbeziehung von Abschätzungen zur Grössenordnung der projizierten Veränderungen (Abb.1).

Dieser Austausch mit Experten im Bereich Risikomanagement hat aber ebenfalls zahlreiche Aspekte aufgezeigt, zu denen zusätzliche Forschung notwendig ist, um den Entscheidungsträgern und der Bevölkerung bessere Instrumente hinsichtlich einer Anpassung an den Klimawandel zur Verfügung zu stellen:

- Obwohl sehr ausführliche Klimaprojektionen für gewisse Regionen vorliegen (siehe z. B. den kürzlich erschienen Bericht CH2011 für die Schweiz), so verfügen andere, unter den am stärksten betroffene Regionen, z. B. in Afrika, über wenige bzw. sehr wenige Erhebungen sowie inexistenten bzw. auf ein oder zwei Studien begrenzte regionale Projektionen.
- Gewisse Klimaphänomene und deren Zusammenhang mit dem menschenverursachten

(anthropogenen) Klimawandel bleiben aus wissenschaftlicher Sicht noch relativ wenig verstanden, und die respektiven Projektionen können von substantieller Unsicherheit geprägt sein (z. B. für El Niño, tropische Wirbelstürme, Trockenperioden).

- Sogar in Regionen mit guten Klimabeobachtungen und scheinbar elementaren Prozessen wie den Veränderungen in Temperaturextremen, kann die Grössenordnung dieser Veränderungen recht unsicher sein, obwohl das Anzeichen der Veränderungen unbestritten ist (s. Abb. 1 für Mitteleuropa). Dies kann z. B. vorkommen, wenn Rückkopplungen einen Einfluss auf die Grössenordnung der Veränderungen der Klimaextreme haben [2,3].

Diese Unsicherheiten stellen keineswegs die Existenz des globalen anthropogenen Klimawandels, der seit etlichen Jahren hinreichend belegt ist, in Frage. Es ist aber wichtig zu erkennen, dass viele Aspekte vom Klimasystem relativ wenig verstanden bleiben, sei es auf der regionalen Skala oder im Zusammenhang mit spezifischen Klimaphänomenen. Vertieftes Wissen in den respektiven Feldern spielt eine wesentliche Rolle für die Anpassung an den Klimawandel, z. B. dank der Entwicklung von saisonalen Vorhersagen für Extremereignisse wie Hitzewellen oder Trockenperioden [2,3]. Dies stellt eine grosse Herausforderung für die Klimaforschung dar, ist jedoch auch eine Chance für die Forscher, sowohl einen Beitrag zu den Lösungen als auch zur Identifizierung der Probleme beim Klimawandel zu leisten!

### Abb. 1 (siehe Seite 2 gegenüber):

Projizierte Veränderungen (Differenzen) der täglichen maximalen Extremtemperaturen mit einer Wiederkehrperiode von 20 Jahren zwischen der Mitte (2046-2065), respektiv dem Ende des 21. Jahrhunderts (2081-2100), und dem Ende des 20. Jahrhunderts (1981-2000) für drei europäische Regionen (Südeuropa / Mittelmeerraum, Mitteleuropa, Nordeuropa). Die Analysen basieren auf den globalen Klimasimulationen des dritten koordinierten Klimamodellexperimentes (CMIP3) für drei Klimaszenarien (B1: blau, A1B: grün, A2: rot). Angegeben sind die Mittelwerte der Modelle (fette Linie), die zentrale 50% Streuung (Interquartil-Bereich) der Modelle sowie die Extremwerte. Quelle: Referenz [1]

## News

### Future Earth: Research Program for Global Sustainability

*Will the present World Research Programs WCRP, IGBP, IHDP, DIVERSITAS and ESSC be replaced?*

Future Earth is a new 10-year initiative from ICSU which aims to deliver knowledge to enable societies to meet their sustainable development goals in the coming decades. «Future Earth» will replace the existing World Programs IGBP, IHDP, Diversitas and ESSP. WCRP will become a partner. The core projects may be adopted, if they can contribute to the new vision.

The goals of the initiative are:

- To deliver at global and regional scales the knowledge that societies need to effectively address global change while meeting economic and social goals, by answering the most pressing questions the world needs answered in the context of securing human development in an era of rapidly escalating global environmental risks;
- To coordinate and focus international scientific research to address the Grand Challenges arising from the ICSU-ISSC Visioning process and the Belmont Challenge in a fully integrated way;
- To engage a new generation of researchers in the social, economic, natural, health, and engineering sciences in global sustainability research.

Starting in June 2011, a Transition Team has been guiding the design phase and the early implementation of the initiative until a new governing body is appointed by the end of 2012. The initiative will be announced in two stages in 2012 – at the Planet Under Pressure conference in March and the UN Conference on Sustainable Development (Rio+20) in June.

Detailed information, an extended slide show and updated information can be found at the Future Earth website at:

[www.icsu.org/future-earth/home](http://www.icsu.org/future-earth/home)

### SPARC International Project Office now at ETH Zurich

The international project for atmospheric and climate research SPARC (Stratospheric Processes And their Role in Climate) relocated its coordination centre from Canada to Switzerland. On

7 February 2012, at the occasion of the SPARC Scientific Steering Group meeting held in Zurich, SPARC celebrated the inauguration of its new office at ETH Zurich and its 20th anniversary.

SPARC is a core project of the World Climate Research Programme (WCRP). It coordinates research worldwide on the stratosphere, the atmospheric layer in 15 to 50 km altitude. Founded in 1992, SPARC has significantly contributed to the present-day knowledge of chemical and physical processes in the atmosphere and, by doing so has helped to improve global prediction models for ozone and climate.

Relocating the SPARC coordination centre from Toronto to Zurich bears great opportunities for Switzerland. «Swiss scientists are at the forefront of atmospheric and climate research and have contributed to the SPARC project from the very beginning. Having the SPARC International Project Office in Zurich will help to strengthen Switzerland's role in international atmospheric research,» said Johannes Staehelin, Director of the SPARC Office and Professor at the Institute of Atmospheric and Climate Science at ETH Zurich.



Former Co-chairs, Office directors and administrative staff including the WCRP Director Dr. Asrar celebrated SPARC's 20th anniversary in Zurich.

The SPARC Office in Zurich is sponsored by ETH Zurich, the Federal Office for the Environment (FOEN), the Federal Office of Meteorology and Climatology MeteoSwiss, and WCRP. In addition, the Swiss National Science Foundation funds the position of a young researcher working at the office.

The celebrations of the SPARC 20th anniversary and inauguration of its new International Project Office took place at ETH Zurich on 7 February 2012. All attendees from the steering group meeting were invited as well as former directors and staff from previous SPARC Office locations

in Paris and Toronto. Addresses were held by: Prof. R. Eichler, President of ETH Zurich; Prof. P. Edwards, Head of Department of Environmental Systems Science, ETH Zurich; Dr. A. Rubli, Head International Affairs Division, Federal Office of Meteorology and Climatology MeteoSwiss; Dr. P. Filliger, Head of Section Climate, Federal Office for the Environment; Dr. G. Asrar, Director, World Climate Research Programme.

Find information on the SPARC project at:

[www.sparc-climate.org](http://www.sparc-climate.org)

Find the 20-year anniversary brochure at:

[www.sparc-climate.org/publications/brochures](http://www.sparc-climate.org/publications/brochures)

By Carolin Arndt, Science Communication Manager, SPARC Office, [carolin.arndt@sparc-climate.org](mailto:carolin.arndt@sparc-climate.org)

### Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) launched

*UN establishes a biodiversity panel similar to IPCC for Climate Change*

After several years of international negotiations, the final operational design of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) was agreed in Panama in April 2012. Over 90 governments successfully established the science-policy interface for all countries. IPBES will produce Assessment Reports similar to the Reports of the Intergovernmental Panel on Climate Change (IPCC).

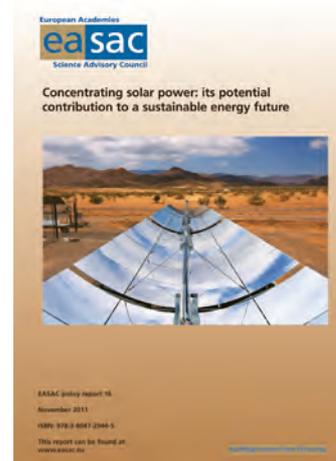
The core functions of IPBES will be:

- To identify and prioritise key scientific information needed for policymakers and to catalyse efforts to generate new knowledge;
- To perform regular and timely assessments of knowledge on biodiversity and ecosystem services and their interlinkages;
- To support policy formulation and implementation by identifying policy-relevant tools and methodologies; and
- To prioritise key capacity-building needs to improve the science-policy interface, and to provide and call for financial and other support for the highest-priority needs related directly to its activities.

One of the key players over the last years to establish IPBES was the international research program on biodiversity (DIVERSITAS). The secretariat of IPBES will be hosted in Bonn, Germany. Website of IPBES at: [www.ipbes.net](http://www.ipbes.net)

### European academies: policy advice on climate change and energy security

The mission of the European Academies Science Advisory Council (EASAC) is to provide science-based advice to European policy institutions, above all the Commission. For this purpose, it enables collaboration among its academies from the EU member states, including Norway and Switzerland. This reflects the recognition that the scientific dimension is a prerequisite to good policy-making, and that the scope of the academies' national advisory functions needs to extend beyond to cover also the European level due to the growing importance of the EU as a policy arena. Relevant in this context is a Memorandum of Understanding EASAC concluded with the Joint Research Centres (JRC), which advise the EU Commission in scientific matters.



A recent EASAC report examines the potential of solar energy in Europe, concluding that it could play an important role in the transformation to renewable energies.

To implement its task, EASAC Working Groups composed of scientific experts nominated by member academies investigate specific issues related to the three programmes Biosciences, Energy and Environment. Their final reports are fed into the policy-making process. Topics covered in several recent reports and current working groups concern issues related to climate change and energy security for Europe. At present, experts nominated by the Swiss Academies of Arts and Sciences serve in the working groups on «Impacts of extreme weather» and «Carbon capture and storage», scheduled to produce their work later this year.

The Swiss Academies continue their engagement in EASAC by providing expertise and suggesting themes for new working groups. Proposals from the Swiss science community are welcome.

Further information: [www.easac.eu](http://www.easac.eu)

By Roger Pfister, Swiss Academies of Arts and Sciences, [roger.pfister@scnat.ch](mailto:roger.pfister@scnat.ch)

### Launch of European Climate Adaptation Platform

The European Climate Adaptation Platform ([climate-adapt.eea.europa.eu](http://climate-adapt.eea.europa.eu)) is a publicly accessible, web-based platform designed to support policy-makers at EU, national, regional and local levels in the development of climate change adaptation measures and policies. CLIMATE-ADAPT will be hosted and managed by the European Environment Agency in Copenhagen. It will support the generation of the knowledge-base required to support the development of evidence-based adaptation policies. Its contribution will inform the development of a comprehensive EU Adaptation Strategy that the Commission plans to adopt in the beginning of 2013.

More than 25 countries voluntarily submitted information on their national strategies and plans, assessments, climate services, and priority actions. The site features a continuously-updated database of adaptation strategies and actions at the transnational and country level. There are also case studies on initial adaptation actions at local and sub-national level.

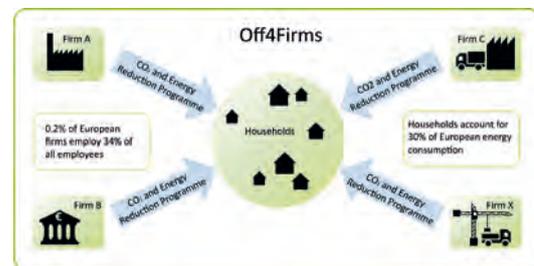
It will help users to access, disseminate and integrate information on:

- Expected climate change in Europe
- The vulnerability of regions, countries and sectors now and in the future
- Information on national, regional and transnational adaptation activities and strategies
- Case studies of adaptation and potential future adaptation options
- Online tools that support adaptation planning
- Adaptation-related research projects, guideline documents, reports information sources, links, news & events.

Source: European Environment Agency

### Off4Firms – an innovative project for tackling household emissions

Households are among the world's largest energy users and CO<sub>2</sub> emitters. An effective way of triggering change in households' energy related behaviour is through household members' employers – a great, yet unexploited lever. Off4Firms will use this lever to create a «win-win» situation for both households and firms: both will profit from employees saving energy and reducing CO<sub>2</sub> in their households.



Off4Firms is a project initiated by Prof. Renate Schubert, IED, ETH Zurich. Off4Firms will compile and evaluate existing voluntary measures aimed at reductions in energy use and CO<sub>2</sub> emission in employees' private lives. Evaluation criteria are the environmental impact, cost efficiency, and the measurability of emission reductions. Surveys among employees of several companies will reveal the attractiveness of different measures. A Tool Kit for the implementation of successful measures will be established. The role of social networks in firms – which strongly influence individual decisions – will be investigated. Off4Firms will tailor programmes to company-specific contexts and needs.

The Off4Firms project team comprises both academic and business partners. In addition to ETH Zurich, Wageningen University (The Netherlands) and South Pole Carbon are core project partners. Swiss Re and ewz are business project partners. Off4Firms officially started on April 1, 2012. It is supported financially by Climate-KIC.

The Off4Firms team is still looking for additional project partners from the national and international business world. If you are interested in collaboration, please get into touch.

Contact: Katja S. Halbritter, Institute for Environmental Decisions, ETH Zurich, [halbritter@econ.gess.ethz.ch](mailto:halbritter@econ.gess.ethz.ch)

### Plattform PhaenoNet lanciert

Treiben die Buchenblätter wegen der warmen Temperaturen im März früher aus als sonst? Solche Informationen sind sowohl für kurzfristige Pollenprognosen als auch für langfristige Klimaforschung nützlich. Damit Interessierte ihre wertvollen Beobachtungen auf einfache



Schüler beteiligen sich am Forschungsnetzwerk PhaenoNet. Sie beobachten die jahreszeitliche Entwicklung von Bäumen und Sträuchern (Bild: GLOBE)

Weise melden können, haben das Bundesamt für Meteorologie und Klimatologie MeteoSchweiz, die ETH Zürich und das Schulbildungsprogramm GLOBE Schweiz die Internetplattform PhaenoNet lanciert. Erwachsene, Schüler, Studierende und Forschende bilden auf der Plattform ein Netzwerk, das gemeinsam Daten für die Forschung sammelt. [www.phaeno.ethz.ch/globe](http://www.phaeno.ethz.ch/globe)

*Quelle: Medienmitteilung MeteoSchweiz*

### Schweizer Preis für Phänologie- und Saisonalitätsforschung

Die 2010 gegründete Schweizerische Kommission für Phänologie und Saisonalität KPS hat sich die Förderung herausragender Nachwuchsforscher auf ihrem Gebiet zum Ziel gesetzt. In diesem Sinn lanciert sie den Nachwuchsforscher Wettbewerb «Schweizer Preis für Phänologie- und Saisonalitätsforschung».

Der Preis wird jährlich ausgeschrieben. Er ist an junge Forschende gerichtet, die zum Thema Phänologie und Saisonalität arbeiten oder gearbeitet haben. Es können sich sowohl Forschende mit laufenden wie mit bereits vor maximal zwei Jahren abgeschlossenen Arbeiten bewerben.

Berücksichtigt werden Bachelor-, Master- oder Diplomarbeiten, Dissertationen oder andere Forschungsarbeiten (z.B. Post-Doc). Das Preisgeld beträgt CHF 2'000.- und kann je nach Qualität der eingereichten Arbeiten in toto verliehen oder aufgeteilt werden.

Die Preisverleihung findet dieses Jahr im Herbst am Swiss Geoscience Meeting vom 17. November 2012 in Bern statt. Die Preisträger erhalten die Gelegenheit, die Ergebnisse ihrer prämierten Arbeiten im Rahmen eines öffentlichen Symposiums mit namhaften Referenten einem interdisziplinären Publikum vorzustellen.

Ausschreibung und Anmeldeformular können aus dem Web entnommen werden: [kps.scnat.ch](http://kps.scnat.ch)

Die Unterlagen der Kandidaten müssen bis am 15. September 2012 bei der KPS eingereicht werden (per email an: [rixen@slf.ch](mailto:rixen@slf.ch)). Für weitere Fragen, Formulare oder zusätzliche Informationen steht Ihnen Christian Rixen ([rixen@slf.ch](mailto:rixen@slf.ch)) gerne zur Verfügung.

### Atmospheric Chemistry and Physics (ACP) Award 2012

Die Schweizerische Kommission für Atmosphären-Chemie und -Physik vergibt wie jedes Jahr den Atmosphären-Chemie und -Physik Preis (ACP Award). Der Preis wird an eine junge Wissenschaftlerin oder an einen jungen Wissenschaftler (MasterstudentIn oder DoktorandIn) für eine aussergewöhnliche Forschungsarbeit im Bereich Atmosphären-Chemie oder -Physik vergeben.

Den Jungforschenden (Bewerbungen werden bis maximal ein Jahr nach abgeschlossener Dissertation angenommen) winkt eine Prämie von 1000 CHF – gestiftet von der Firma Meteotest, Bern – und zudem wird er/sie eingeladen, die prämierte Arbeit am Swiss Geosciences Meeting (SGM) vom 17. Nov. 2012 in Bern im Rahmen des Symposiums für Atmosphärenchemie und -physik zu präsentieren.

Das Antragsformular sowie weitere Informationen über die Modalitäten findet man unter:

[acp.scnat.ch/e/ACP\\_Award](http://acp.scnat.ch/e/ACP_Award)

Kandidaturen für den ACP-Preis senden Sie bitte mit dem dafür vorgesehenen Antragsformular bis 31. August 2012 an das ACP- Sekretariat ([isabella.geissbuehler@giub.unibe.ch](mailto:isabella.geissbuehler@giub.unibe.ch)), wo auch weitere Auskünfte eingeholt werden können.

## Publications

### Factsheets Rio+20



In view of the United Nations Conference on Sustainable Development Rio+20, ProClim- Forum for Climate and Global Change of the Swiss Academy of Sciences initiated factsheets on the sustainability topics water, mountain areas, biodiversity and ecosystems as well as food security. These factsheets are edited in collaboration with the Swiss research community. They are based on the Policy Briefs of the Global Change Research Programmes (WCRP, IGBP, IHDP, DIVERSITAS, ESSP). The factsheets summarize both the most important global aspects, include the Swiss perspective and provide links to the relevant academic bodies and scientific experts. The single issues of the factsheet series listed below are available in PDF for downloading in English, German and French at:

[www.proclim.ch/News?2274](http://www.proclim.ch/News?2274)

- «Water security for a planet under pressure»
- «Mountains, a priority for a planet under pressure»
- «Biodiversity and ecosystem services»
- «Food security for a planet under pressure»

### Environmental Indicator Report 2012

*Ecosystems Resilience and Resource Efficiency in a Green Economy in Europe*

Reliable, relevant and targeted environmental information is an essential element in implementing environmental policy and management

processes. Such information can come in many formats – with indicators being a long-established approach to distilling detailed information into trends that are robust and easily understandable by a broad audience.

The 'Environmental indicator report 2012' presents established indicators that illustrate progress towards improving resource efficiency, and indicators that depict the risk of passing environmental thresholds. Jointly, they enable policy-makers and the public to reflect on where Europe stands vis-à-vis some aspects of a green economy. Several of the indicators presented in this report show encouraging trends, while others point to issues that require urgent attention.

The following six environmental themes are discussed:

- Carbon emissions and climate change: domestic greenhouse gas emissions have decreased substantially across the European Union but continue to rise on the global level. Rising temperatures threaten ecosystem resilience.
- Nitrogen emissions and threats to biodiversity
- Air pollution and air quality
- The marine environment
- Stress on water resources
- Use of material resources

Download of the EEA report at:

[www.proclim.ch/News?2321](http://www.proclim.ch/News?2321)

Source: European Environment Agency EEA

### Urban adaptation to climate change in Europe

*Challenges and opportunities for cities*

Around three quarters of Europeans live in cities. Most of Europe's wealth is generated in cities, and urban areas are particularly at risk due to climate change. Europe should seize the opportunity of improving quality of life while adapting to climate change in cities, according to a report from the European Environment Agency (EEA). The report also warns that delaying adaptation will be much more costly in the long-term.

The report is the first Europe-wide assessment of urban vulnerability to climate change. It argues that the distinct design and composition of urban areas compared to rural areas alters climate change impacts in cities, leading to many diverse challenges for cities within Europe. For example,

a lot of artificial surfaces and little vegetation exacerbates heatwaves in cities. This so-called 'urban heat island' effect leads to much higher temperatures in cities than in the surrounding area. The report also provides generic advice for adapting cities to climate change and examples of best practice.

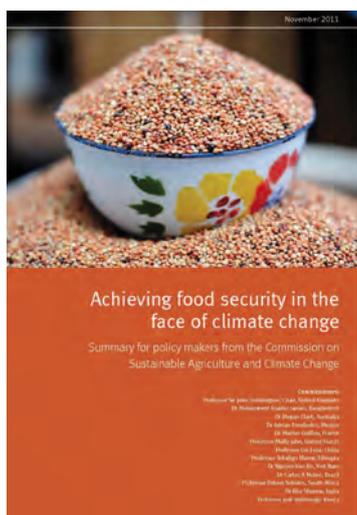
Download of the EEA Report No 2/2012 at:

[www.proclim.ch/News?2322](http://www.proclim.ch/News?2322)

Source: European Environment Agency

### Achieving food security in the face of climate change

Final report from the Commission on Sustainable Agriculture and Climate Change



The transition to a global food system that satisfies human needs, reduces its carbon footprint, adapts to climate change and is in balance with planetary resources thus requires concrete and coordinated actions, implemented at scale, simultaneously and with urgency. Based on robust scientific evidence, the Commission on Sustainable Agriculture and Climate Change has identified critical leverage points and high-priority policy actions.

The Commission has reviewed the scientific evidence to identify a pathway to achieving food security in the context of climate change. Food systems must shift to better meet human needs and, in the long term, balance with planetary resources. This will demand major interventions, at local to global scales, to transform current patterns of food production, distribution and con-

sumption. Investment, innovation, and deliberate effort to empower the world's most vulnerable populations will be required.

Some key recommendations of the report:

- Integrate food security and sustainable agriculture into global and national policies
- Significantly raise the level of global investment in sustainable agriculture and food systems in the next decade
- Sustainably intensify agricultural production while reducing greenhouse gas emissions and other negative environmental impacts of agriculture
- Target populations and sectors that are most vulnerable to climate change and food insecurity
- Reshape food access and consumption patterns to ensure basic nutritional needs are met and to foster healthy and sustainable eating habits worldwide
- Reduce loss and waste in food systems, particularly from infrastructure, farming practices, processing, distribution and household habits
- Create comprehensive, shared, integrated information systems that encompass human and ecological dimensions

Download of the full report at:

[www.proclim.ch/News?2301](http://www.proclim.ch/News?2301)

### Switzerland's International Environmental Policy 2012

State and Outlook

The report «Switzerland's International Environmental Policy 2012» provides an analysis of the international environmental regime (negotiations, agreements, institutions and instruments), detailing Switzerland's strategic interests and pinpointing its opportunities to exercise influence. It reaches the conclusion that, given the challenges that must be faced, Switzerland will have to make considerable efforts if it is to achieve its policy goals and maintain its international standing in the environment sector. The report, which is primarily aimed at decision-makers, is structured methodically in the form of an analysis of the various policy fields.

Download of the FOEN report at:

[www.proclim.ch/News?2297](http://www.proclim.ch/News?2297)

Source: Federal Office for the Environment FOEN

## Meeting reports

### 13th Swiss Global Change Day

#### *Meeting Report*

On 4th April 2012 the Swiss global change research community met for the 13th time on the Swiss Global Change Day in Bern. About 270 participants attended the event and about 80 posters were presented, giving an overview of global change research activities in Switzerland. Following the introduction by **Heinz Gutscher**, chair of the ProClim-steering committee, six key note speakers presented highlights and challenges in the broad field of global environmental research:

**Gerhard Schmitt** from the Singapore ETH Centre talked about future cities in a future climate. He gave an overview of past and present city building and pointed out the impacts of cities on the environment, in particular the heat island effect. Since by 2030 the world's urban population will increase to 5 billion out of a world total of 8.1 billion, the city scale and city planning will be crucial. Thus, the various research modules of the Future Cities Laboratory focus on the question of how the sustainable performance of cities can be increased.

**Hermann Held** from the University of Hamburg examined the question of how to decide on cost-efficient investments under uncertainty. He introduced two possibilities for establishing climate targets: (1) Climate targets may be defined according to the projected impacts of global warming, and (2) Climate targets may be defined according to the precautionary principle. Held argued that neither of the two approaches works and proposed a hybrid approach of cost benefit and cost-effectiveness analysis.

**Martin Grosjean** from the University of Bern asked the question of whether the past might help us to predict the future. By means of the examples of summer heat waves and floods he showed how laminated lake sediments could be used as meteorological archives. The paleo-data confirmed the multi-decadal variability of extreme events. Grosjean underlined the value of paleo-data and suggested using them more systematically for improving the understanding of the present and future climate.

**Anette Reenberg** from the University of Copenhagen focused on land use in developing countries. She showed the problems related to land as an increasingly scarce resource using the

example of the Sahel in West Africa. Reenberg showed the complex interactions between man and the environment, i.e. climate change, globalization and population pressure, that lead to land use changes. Based on her research, Reenberg concluded that sustainable development would require transformation, which therefore should be an area of concern in global change research.

**Sonia Seneviratne** from the ETH Zurich examined the variable soil moisture as a thermostat for climate extremes. According to modelling and observation results, feedbacks between soil moisture and temperature are associated with important regulating mechanisms, in particular relevant for hot extremes. Seneviratne showed that the percentage of hot summer days is particularly high under two preconditions: (1) a dry winter/spring season and (2) a anticyclonic summer weather regime.

**Jochem Marotzke** from the Max Planck Institute for Meteorology, Hamburg, talked about the feasibility of multi-year climate predictions. Whereas surface temperature anomalies can be modelled very well for one year, the model performs poorly in predicting global mean surface temperatures for the coming decade, independent of the initialisation procedures. On the other hand, the model predicts well the surface temperatures for the North Atlantic sector, provided it is initialised, that is the initial state of the model is based on observations of slow climate components. For small-scale regions, no skill has been demonstrated yet.

In the poster session the best posters in each of the fields of WCRP, IGBP and IHDP were selected by a jury and honoured with a travel award of 1000 Swiss francs each. The following posters were awarded:

**WCRP** (awards were sponsored by the ACP, the Commission for Atmospheric Chemistry and Physics, SCNAT):

- Achille Mauri: The influence of atmospheric circulation on the Mid-Holocene (6000 yrs. BP) climate of Europe
- Giuliana Turi: The Carbon Budget of the California Upwelling System

**IGBP** (awards were sponsored by the Swiss IGBP Committee, SCNAT):

- Martin Hirschi: High-resolution climate change scenarios for impact studies: Pests in a future climate as an example



This year's surprise in the field of culture at the Swiss Global Change Day in Bern was Ania Losinger and Mats Eser alias «Xala».

- Christoph Schwörer: Holocene climate, fire and vegetation dynamics at the treeline in the Northwestern Swiss Alps

**IHDP** (awards were sponsored by the SAGW):

- Mirjam Pfeiffer: Simulating anthropogenic fire over the Holocene using an updated fire module in the LPJ-DGVM
- Martin Soland: «Relax..., greentech will solve the problem!»

**DIVERSITAS:**

- Sarah Burg: Observer bias and its causes in botanical records on summits

You can download all presentations of invited speakers as well as the awarded posters at:

[www.proclim.ch/News?2294](http://www.proclim.ch/News?2294)

## 2. Rundtisch der Schweizer Agrarforschungspartner landwirtschaftliche Treibhausgasemissionen

Am 2. Mai 2012 fand der 2. Rundtisch der Schweizer Agrarforschung im Zusammenhang mit landwirtschaftlichen Treibhausgasen beim Bundesamt für Landwirtschaft (BLW) in Bern statt. Knapp 20 Vertreter verschiedener Partnerinstitutionen vorwiegend aus Wissenschaft und Verwaltung nahmen teil. Das Treffen diente dazu, Informationen über die Fortschritte in der globalen Forschungsallianz (global research alliance on agricultural greenhouse gases – GRAAGG) und die Folgearbeiten aus der Klimastrategie Landwirtschaft auszutauschen und Aktualitäten aus den Forschungsinstitutionen in Erfahrung zu bringen.

**Dominique Kohli**, Vizedirektor des BLW und politische Vertretung in der GRAAGG eröffnete den

runden Tisch und betonte die Wichtigkeit des Austauschs zwischen Forschung und Verwaltung.

**Michael Kreuzer**, Professor für Tierernährung an der ETH Zürich und wissenschaftliche Vertretung in der GRAAGG, stellte die Aktivitäten der Allianz, insbesondere im Bereich 'Livestock' vor. Er wies darauf hin, dass die Beteiligung der Entwicklungsländer in der GRAAGG, welche aktuell 33 Mitgliederländer umfasst, nach wie vor schwach ist. Es ist weiter unklar, wie wichtige länderübergreifende Akteure eingebunden werden können. Innerhalb der livestock Gruppe wurde im November 2011 unter seiner Leitung ein Netzwerk zu 'Feed and Nutrition' ins Leben gerufen. Inhalt sind die Methanemissionen und N-Ausscheidungen der Wiederkäuer. Ein erstes Treffen des Netzwerks von aktuell 23 Ländern soll vom 1.–3. September 2012 in der Schweiz stattfinden. Es wird Gelegenheit geben, in einer Swiss Session Forschungsergebnisse präsentieren zu können und an einer Exkursion wichtige Forschungsstätten zu zeigen.

**Daniel Felder**, Projektleiter der Klimastrategie Landwirtschaft beim BLW, stellte den Stand der Überlegungen bei den Folgearbeiten mit Fokus auf die Forschung vor. Er erwähnte, dass die Bedürfnisse an die Wissenschaft vielfältig sind und sowohl die Politikberatung (z.B. klimafreundliches Produktionssystem erarbeiten, Emissionsrisikokarte für Kohlenstoff als Grundlage für die Festlegung gezielter Massnahmen erstellen) als auch die praktische Umsetzung (z.B. Entscheidungshilfen wie Klima-Check für Betriebe oder Klimateignungskarte bereitstellen) betreffen. Im Hinblick auf die Eingabe der Bedürfnisse an die Forschung für die Leistungskontrakte 2014–17 wird das BLW die wichtigsten offenen Fragen aus den Handlungsfeldern der Klimastrategie zusammentragen.

Danach fand ein Karussell zu den Themen Forschungsaktivitäten, Projektdatenbank und Koordination statt. Es zeigte sich, dass eine Vielzahl von relevanten Projekten in der Forschung laufen. Lücken bestehen bezüglich der Aktivitäten, die an Fachhochschulen, in den Bereichen KMU/KTI, Beratung und Praxisversuche stattfinden. Eine Übersicht über diese Tätigkeiten zu haben stellt ein grosses Bedürfnis dar. Allenfalls können bestehende Datenbanken dahingehend angepasst werden. Bezüglich Koordination wird ein regelmässiger Austausch gewünscht.

Der nächste runde Tisch wird in einem Jahr stattfinden.

Bei Fragen geben die genannten Personen gerne Auskunft. Weiterführende Informationen zur GRAAGG finden Sie unter:

[www.globalresearchalliance.org](http://www.globalresearchalliance.org)

# Human Dimensions of Global Change Research

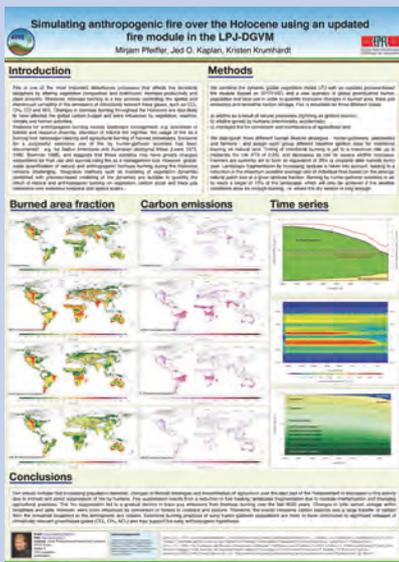
## Winners of the IHDP poster awards 2012

The poster session at the Swiss Global Change Day is an opportunity to stay in touch with current Swiss research activities. Every year the best two posters in the field of IHDP are selected by a jury. The Swiss Academy of Humanities and Social Sciences SAGW sponsors the travel award of 1000 Swiss francs each.

The following two posters were awarded:

### Simulating anthropogenic fire over the Holocene using an updated fire module in the LPJ-DGVM

Mirjam Pfeiffer, Jed O. Kaplan, Kristen Krumhardt, EPFL Lausanne



Increasing population densities, changes in lifestyle strategies and intensification of agriculture over the later part of the Holocene led to decreases in fire activity due to indirect and direct suppression of fire by humans. This suppression led to a gradual decline in trace gas emissions from biomass burning over the last 8000 years. Changes in total carbon storage within biosphere and soils, however, were more influenced by conversion of forests to cropland and pasture. Therefore, the overall Holocene carbon balance was a large transfer of carbon from the terrestrial biosphere to the atmosphere and oceans. Extensive burning practices of early hunter-gatherer populations are

likely to have contributed to significant releases of climatically relevant greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, NO<sub>x</sub>) and may support the early anthropogenic hypothesis.

### «Relax..., greentech will solve the problem!»

Martin Soland, Lehrstuhl für Sozialpsychologie, University of Zurich



In the media and in advertising green technologies (greentech) are often presented as a panacea for the solution of environmental problems. However, according to qualitative research findings such optimism can lead to the belief that environmentally responsible behaviour on an individual level is not of particular importance. The goal of the study is to model the underlying psychological mechanisms of this phenomenon on a quantitative and theoretically integrated basis.

The results show that feelings of guilt towards the environment have a positive influence on feelings of personal responsibility to act. However, the more a person is optimistic towards the problem solving capacity of greentech, the less his/her feelings of guilt urge him/her to act in an environmentally responsible way.

You can download both posters at: [www.proclim.ch/News2294](http://www.proclim.ch/News2294)

## NCCR Climate Update

The NCCR Climate is slowly coming to an end. To celebrate the completion of the program we organize a public event on 12 October 2012 in Bern. In the future, new structures should make sure that major achievements of the NCCR mainly in the field of education would survive its end.

### Highlights of NCCR activities

#### *The NCCR Climate crosses the Finish Line*

To celebrate the closing of our programme – it officially ends in March 2013 – we invite the climate research community and the general public to a festive event called *Finish Line*. This conference to mark the end of the NCCR Climate takes place on Friday, 12 October 2012 from 8.30 to 17.00 at the University of Bern. Speakers include NCCR researchers and members of the NCCR Review Panel. For the detailed program and registration see [www.nccr-climate.unibe.ch/conferences/finish\\_line](http://www.nccr-climate.unibe.ch/conferences/finish_line)

#### *Young Researchers Meeting discusses the future role of climate research*

More than 40 PhDs and PostDocs met at the annual Young Researchers Meeting of the NCCR Climate in June. The title of the event – «Shaping



The Loewenberg Centre of the SBB is a conference venue in an idyllic setting near Murten. It hosted the NCCR Young Researchers Meeting over the last years.

the future of (your) climate research» – hinted both at the career planning of the young scientists and at their vision of the future of their discipline. «Which climate science is relevant to society?» was one of the questions discussed during the two-day get-together. The outcome of this discussion will be presented at the NCCR Climate Finish Line event in October 2012.

### *Keep the achievements of the NCCR Climate*

In May representatives of the C2SM (ETH Zurich), OCCR (University of Bern), MeteoSwiss and ProClim- met to discuss ways to make sure that major accomplishments of the NCCR network will endure. They agreed on forming a new body that will keep joint activities alive mainly in the field of education. The main focus is put on the International NCCR Climate Summer School that is now in its 12<sup>th</sup> edition and has become a trademark of our programme.

[www.nccr-climate.unibe.ch/summer\\_school](http://www.nccr-climate.unibe.ch/summer_school)

### Research Highlights (a selection)

#### *Quantifying uncertainties in projections of extremes*

Erich M. Fischer (NCCR project *Operational Climate Prediction and Risk Analysis*) et al. quantify uncertainties in the climate response to a doubling of atmospheric CO<sub>2</sub> concentrations in a perturbed land surface parameter experiment. The land surface parameters induce small uncertainties at global scale, substantial uncertainties at regional and seasonal scale and very large uncertainties in the tails of the distribution, the climate extremes. Land surface parameters are revealed to control the response not only of the mean but also of the variability of temperature. The uncertainty across the ensemble of 108 members regionally exceeds the CMIP3 multi-model range. Regarding summer hot extremes, the uncertainties are larger than for mean summer warming but smaller than in multi-model experiments. The summer precipitation response to a doubling of CO<sub>2</sub> is not robust over many regions. Land surface parameter perturbations and natural variability alter the sign of the response even over sub-tropical regions. (*Climate Dynamics*, 2011)



### **Atmospheric dynamics and precipitation in the North Atlantic**

Dominik Hofer and Christoph Raible (NCCR project *Modelling and Reconstruction of the North Atlantic-Climate System Variability*) et al. use a highly resolved atmospheric general circulation model to investigate the impact of different glacial boundary conditions on precipitation and atmospheric dynamics in the North Atlantic region. They compare time slices during the Last Glacial Maximum (21 ka ago) and of a less pronounced glacial state – the Middle Weichselian (65 ka ago). The strongest differences are found for simulations with different heights of the Laurentide ice sheet. A large altitude of this ice sheet leads to a southward displacement of the jet stream and the storm track in the North Atlantic region. These changes in the atmospheric dynamics generate a band of increased precipitation in the mid-latitudes across the Atlantic to southern Europe in winter, while the precipitation pattern in summer is only marginally affected.

(*Climate of the Past Discussion*, 2012)

### **Extreme winds at northern mid-latitudes since 1871**

Stefan Brönimann (NCCR project *Paleoclimate Variability and Extreme Events*) et al. present examples of extremes of winds at northern hemisphere mid-latitudes in a new data set (Twentieth Century Reanalysis) to illustrate challenges and opportunities for analysing extremes over a longer period than previously possible. For four representative storms from Europe and North America, the data provide a relatively good depiction of the synoptic-scale meteorological development, although it misses smaller scale features as well as local effects due to orography. For analysing trends of extreme winds, it is shown that the individual ensemble members should be used, rather than the ensemble mean, which appears to be biased towards lower wind speeds early in the record.

(*Meteorologische Zeitschrift*, 2012)

### **Drought-induced building damages**

Thierry Corti (*associated*) Sonia Seneviratne (NCCR project *Impacts of Changing Drought Conditions on Catchment Ecology and Water Cycle*) et al. present a model computing damage costs from drought-induced soil subsidence related to shrinking and swelling soils. The model uses an indicator applicable across different climate regimes. The influence of geology and land use on regional damage levels is taken into account. Simulation results are evaluated at departmental scale, showing a good representation of the regions affected by drought-induced soil subsidence. Substantial differences between simulated and observed damages are however found in some departments.

(*Natural Hazards and Earth System Sciences*, 2011)

### **9'400 years of cosmic radiation and solar activity**

Friedhelm Steinhilber, Jürg Beer (NCCR project *Solar Forcing and Climate Change of the Last 1000 Years*) et al. combine different  $^{10}\text{Be}$  ice core records from Greenland and Antarctica with the global  $^{14}\text{C}$  tree ring record using principal component analysis. This approach is only possible due to a new high-resolution  $^{10}\text{Be}$  record from Dronning Maud Land obtained within the European Project for Ice Coring in Antarctica. The new cosmic radiation record allows for deriving total solar irradiance, which is then used as a proxy of solar activity to identify the solar imprint in an Asian climate record. Though generally the agreement between solar forcing and Asian climate is good, there are also periods without any coherence, pointing to other forcings like volcanoes and greenhouse gases and their corresponding feedbacks. The newly derived records have the potential to improve the understanding of the solar dynamics and to quantify the solar influence on climate.

(*Proceedings of the National Academy of Sciences*, 2012)

For a complete overview on the recent NCCR Climate publications consult:

[www.nccr-climate.unibe.ch/research\\_articles](http://www.nccr-climate.unibe.ch/research_articles)

# Drought Effects in Swiss Grassland Systems under Changing Climate

## Background information on NCCR publications



Clearly visible drought effect under a rain shelter at Chamau, one of the three sites studied in the PLANT/SOIL project.

The recent CH2011 report highlights that future summers in Switzerland are expected to be considerably drier than at present. However, to date, only a limited number of experiments on drought effects exist, especially in the more humid regions of Central Europe, including Switzerland. Thus, a drought manipulation experiment was initiated as part of the NCCR Climate at three Swiss grassland sites in 2005 (Project *Drought Effects on Plant Water Uptake and Water Use as well as Soil Carbon Dynamics in Swiss Grassland Systems under Changing Climate*). Experimental plots were established in three grasslands at different elevations (393, 982 and 1978 m a.s.l.) differing in management intensities. Half of the plots were equipped with rain shelters during spring/summer while the other half received ambient precipitation. Over the past seven years, process- and system-oriented data on plant and community C and H<sub>2</sub>O relations were collected, which also served as the basis for an economic assessment of drought effects in Swiss grasslands. Aboveground biomass production was reduced by drought at the lowland and the sub-alpine sites, while no or rather a positive effect was found at the wettest site in the pre-Alps. This was consistent throughout the years. Although the reduction of forage yield was highest at the sub-alpine site, the economic loss was highest for the lowland, most intensively managed site, due to lowest direct payments and strongest dependence on actual costs.

Using a stable isotope approach, shifts in plant water niches in response to drought were studied.

Surprisingly, plants shifted their water uptake to more shallow soil layers under drought, at least in lowland grasslands. Supporting this finding, the majority of new roots was found in the top soil under drought. Moreover, root responses to changing soil moisture were highly dynamic (e.g., in the recovery phase after the imposed drought), thus, no drought effect on belowground production was observed at an annual time scale.

Leaf gas exchange was reduced under drier conditions, but plants tended to use the available water more efficiently, thus increased their water use efficiency. This response was less pronounced in grasses than in forbs. Grasses were more vulnerable to drought. Chronic damage to the photosystem II was detected only at the high elevation site, indicating non-stomatal drought effects.

Despite fast and significant responses to drought, no major memory effects were seen in plant ecophysiology or soil physical and chemical properties after six years of treatment, indicating a high resilience of Swiss grassland systems to summer drought.

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Project website: [www.botany.unibe.ch/nccr/index.php](http://www.botany.unibe.ch/nccr/index.php)

### Publications referred to in this article:

- Gilgen, A. K., and Buchmann, N. 2009: Response of temperate grasslands at different altitudes to simulated summer drought differed but scaled with annual precipitation. *Biogeosciences* 6:2525–2539.
- Signarbieux, C., and Feller, U. 2012: Effects of an extended drought period on physiological properties of grassland species in the field. *J. Plant Res.* 125:251–261.
- Signarbieux, C., and Feller, U. 2011: Non-stomatal limitations of photosynthesis in grassland species under artificial drought in the field. *Environ. Exp. Bot.* 71:192–197.

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## CCES News 7

**CCES goes into its second phase. Large multi- and transdisciplinary research projects on complex environmental systems and sustainability issues continue to form the backbone of the competence center. Many participants of the first round projects expressed their enthusiasm about this format offering a unique opportunity for scientific collaboration with partners from other ETH Domain institutions which otherwise would not have taken place, and at the same time, resulting in valuable scientific findings of high societal relevance. It is this particular setting of CCES that motivated researchers to submit research proposals for the second phase in spite of the sometimes cumbersome task to run such multi- and transdisciplinary projects.**

### News from the CCES office

#### Six new research projects approved

In its meeting of April 2, 2012 the CCES Steering Board approved the work plans of the following six new research projects for the period 2012 to 2016: The OPTIWARES project ('OPTImization of the use of Wood As a Renewable Energy Source') aims at improving the quantitative understanding of the impact of aerosols from wood combustion on air quality and climate and develop improved strategies for encouraging the use of more appropriate wood combustion facilities.

The goal of the MAIOLICA-II project ('Modeling And experIments On Land-surface Interactions with atmospheric Chemistry and climAte') is to increase our understanding of fundamental processes that contribute to the observed variability of atmospheric CH<sub>4</sub> concentrations in the recent past, focusing on natural CH<sub>4</sub> emissions from wetlands and wildfires. Furthermore, atmospheric CH<sub>4</sub> in a changing climate including feedbacks among the terrestrial biosphere, atmospheric composition, and climate will be investigated.

The TRAMM-II initiative ('Triggering of Rapid Mass Movements in Steep Terrain') is connecting seven teams from the ETH Domain with complementary expertise towards developing models and observational strategies for linking measurable variables such as precipitation and hydro-mechanical material properties with dynamic mechanical events leading to hazardous failures in snow and soil.

The RECORD Catchment project ('Coupled Ecological, Hydrological and Social Dynamics in Restored and Channelized Corridors of a River at the Catchment Scale') investigates what measures are most effective to influence the river corridor so that river restoration and groundwater flow systems can help to mitigate the effects of floods and droughts, in particular in the context of climate and global change.



Collaborative research forms the backbone also in the 2012 to 2016 period. Photo: RECORD project

GeneMig ('Genetic variation and species Migration under environmental change: views of science, environmental management, and the general public') is an inter- and transdisciplinary research project assessing the challenges of migration (i.e. species and their genes) in a changing environment for society and environmental management.

Finally, the MOUNTLAND-II project ('Prioritization for adaption to climate and socio-economic changes – Backcasting tolerable future states to match supply and demand for ecosystem services in mountainous areas') will provide management and policy options that support society, including policymakers and ecosystem managers, to make choices in order to promote and improve sustainable development.

### Scientific Events

#### CCES projects organized session at the 'Planet under Pressure' Conference

At the end of March 2012, the 'Planet Under Pressure' Conference united scientists and stakeholders in London. Plenary and parallel scientific sessions explored solutions to the global sustainability challenge. The first 'State of the Planet Declaration' is a major outcome of this event and can be downloaded at [www.planetunderpressure2012.net](http://www.planetunderpressure2012.net).

The CCES projects RECORD and ENHANCE organized a session on 'Managing River Corridors under the Prospect of Climate Change' ([www.planunderpressure2012.net/pup\\_session.asp?19087](http://www.planunderpressure2012.net/pup_session.asp?19087)). The take-home message from three keynote lectures and a lively panel discussion was that the ongoing climate change and increasing demands on river corridors in terms of ecosystem services require a constant adaptation of strategies and visions for their management. In particular, the sole restoration of a historic natural situation is not a successful recipe.

Jörg Luster and Irmi Seidl, Swiss Federal Research Institute WSL; Marco Baumann, Office for the Environment, Canton of Thurgau; Klement Tockner, Leibniz-Institute of Freshwater Ecology and Inland Fisheries IGB, Germany; Mario Schirmer, Eawag aquatic research  
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## Education

### Apply now for the CCES Winter School 2013 'Science Meets Practice'

"I got to know interesting and knowledgeable people, had some personal experience of the work "between" the spheres of science and practice, and can profit from that in my PhD and afterwards" – this is how one of the participants of the CCES Winter School 2012 describes the benefits of having gone through an intensive two weeks program with conceptual inputs, individual and group work, reflection, stakeholder meetings, and media training.



Stakeholder meeting during the second Winter School 2012.  
Photo: C. Zingerli, CCES.

After the success of the first two editions, the CCES Winter School will take place again in 2013. It is designed for PhD students from environmental and natural sciences, engineering, and social

sciences working in the fields of sustainability and sustainable development. Its main goal is to enhance the capability to create interactions beyond the scientific community and to show ways to create and manage fruitful dialogue with stakeholders outside science.

The CCES Winter School 2013 will take place from January 7 to 10 and from February 4 to 7, 2013 at 'Propstei Wislikofen' (to be reached by public transportation from Zurich in 50 minutes). The application deadline is October 31, 2012. Flyer, application form, and further information are available at [www.cces.ethz.ch/winterschool](http://www.cces.ethz.ch/winterschool).

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phone: 044 632 49 07.

### Winter school on landscape genetics

Landscape genetics amalgamates the fields of landscape ecology and population genetics. While landscape ecology assesses the configuration and composition of landscapes, population genetics uses various genetic techniques to measure how organisms (and their genes) move across landscapes and to study interactions between the environment and adaptive genetic variation. Landscape genetics is a new scientific field with great potential for conservation management, as it provides assessments of landscape barriers or corridors for movement or studies the effects of translocation or artificial seed mixes on the genetic variation of natural populations. Recently, adaptive genetic variation has become affordable through molecular techniques, which allow analyzing interactions between adaptive genetic variation and the environment (landscape genomics).

ETH Zurich is now offering a one-week winter school on landscape genetics on a yearly basis. The course location is at WSL, Birmensdorf ZH. The winter school was initiated by members of two CCES projects, ENHANCE and BioChange. The course is free of charge and structured into lectures and hands-on exercises for about ten Master and PhD students.

Information available at [www.vvz.ethz.ch/Vorlesungsverzeichnis/lerneinheitPre.do?lerneinheitId=73870&semkez=2011W&lang=de](http://www.vvz.ethz.ch/Vorlesungsverzeichnis/lerneinheitPre.do?lerneinheitId=73870&semkez=2011W&lang=de).

Janine Bolliger, Rolf Holderegger, Felix Gugerli, Swiss Federal Research Institute WSL  
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## Research

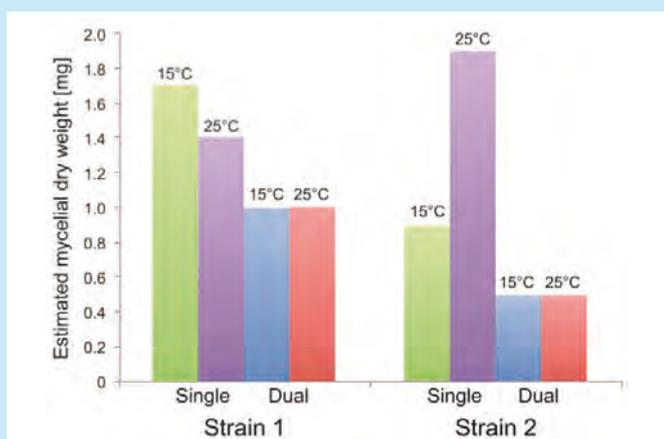
### High genotypic diversity of fungal root-endophyte communities is leveling out global warming effects on growth of endophytic mycelia

Plants do not only have mycorrhizae, they also have "endophyte-roots", i.e. symbioses between roots and non-mycorrhizal fungi. One group of such symbionts are ascomycetes of the *Phialocephala fortinii* s.l. – *Acephala applanata* species complex (PAC) which comprises more than 20 closely related species. PAC are abundant root endophytes of woody plants in the Northern hemisphere. They can behave as commensals, mutualists, or opportunistic pathogens depending on genetic traits and environment according to the literature. However, mutualistic behavior in terms of growth promotion was not exhibited by any PAC strain (genotype) during a recent study that included more than 30 strains from Europe and North America (Tellenbach et al., 2011). All strains reduced the host's growth increment, and a few strains were virulent leading to high mortality. "PAC husbandry" is costly, but PAC fungi provide protection against serious root pathogens (Tellenbach, 2011). Moreover, there is "self control" among PAC genotypes, i.e. pathogenic strains are controlled by non-pathogenic strains as demonstrated recently by Reininger et al. (2012). Interestingly, plant biomass correlated negatively with the amount of endophytic PAC biomass in the roots of plants inoculated with a single PAC strain, whereas biomass of plants inoculated with two strains did not correlate, indicating that non-pathogenic PAC strains successfully compete with pathogenic strains probably by space occupation, thereby keeping endophytic biomass of pathogenic strains below the threshold above which plant growth is inhibited significantly (Sieber, 2007). PAC self-control *in planta* seems to work independently on temperature (Reininger et al., 2011a; Reininger et al., 2012), an important finding particularly with regard to global warming. This opens up new questions: Is the PAC-PAC or the PAC-plant interaction or both responsible for this effect?

The temperature effect on the PAC-PAC interaction was tested in a plant-free system on an artificial nutrient medium (malt extract agar; MEA) to exclude plant effects (Hugentobler, 2011). MEA was inoculated with constant amounts of blended PAC mycelium originating either from one single strain (single-strain inoculation) or two different strains (dual-strain inoculation) and incubated at 15°C and 25°C. Approximately 1-mm-high 1x2 cm areas of MEA completely colonized with PAC mycelium were collected after eight weeks and the amount of mycelium of each strain determined adapting a previously developed micro-satellite-based quantification method (Reininger et al., 2011b). Preliminary results indicate that without competition (single-strain inoculations), strains reacted differently to temperature with some having the growth optimum closer to 15°C than 25°C and others with an optimum closer to 25°C than 15°C (figure). In contrast, temperature had no differential effect on biomass accumulation of strains exposed to competition with another strain (dual-strain inoculations), i.e. fungal biomass was the same independently on the temperature, indicating that PAC-PAC interaction is leveling out temperature effects. In the field, genotypic diversity of PAC is high even within small root fragments. The effects of global warming on PAC are probably limited due to competition among PAC strains, mitigating the adverse effects on plant growth.

References available from the authors.

Vanessa Reininger, Ivo Hugentobler & Thomas N. Sieber, ETH Zurich, Institute of Integrative Biology (IBZ), Forest Pathology & Dendrology Group  
Contact: [vanessa.reininger@usys.ethz.ch](mailto:vanessa.reininger@usys.ethz.ch)  
This study forms part of the GEDIHAP project: [www.cces.ethz.ch/projects/feh/gedihap](http://www.cces.ethz.ch/projects/feh/gedihap)



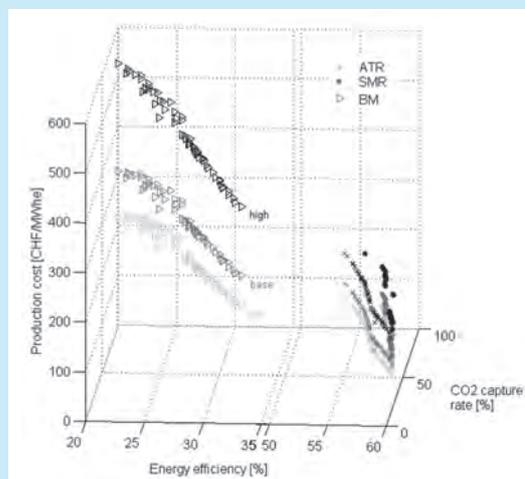
Effects of temperature and presence (Dual) / absence (Single) of a competing PAC strain on the biomass of two different PAC strains.  
Source: data: Hugentobler, 2011;  
diagram: TN Sieber

## Pre-combustion CO<sub>2</sub> capture modeling, analysis and optimization

Within the global challenge of energy supply and greenhouse gas mitigation, carbon capture and storage (CCS) is considered a promising technological alternative to reduce CO<sub>2</sub> emissions on the way to achieve global CO<sub>2</sub> reduction targets. In power plants, CO<sub>2</sub> can be captured by three different ways: post-combustion (end-of-pipe CO<sub>2</sub> separation), oxy-fuel combustion (pure O<sub>2</sub> combustion), and pre-combustion (syngas intermediate). The pre-combustion process, H<sub>2</sub> route, generating power and/or hydrogen from natural gas, coal or renewable biomass is modeled, analyzed, and optimized at the Industrial Energy Systems Laboratory (LENI) at EPFL in the frame of the CCEM/CCES CARMA project.

The different technological options for the conceptual pre-combustion process design are summarized in Figure 1. These process configurations are compared systematically with regard to energy efficiency, cost and environmental impacts by applying flowsheeting, energy integration techniques, life-cycle assessment, and multi-objective optimization. Through optimization the trade-offs are assessed and optimal process configurations with regard to the polygeneration of H<sub>2</sub>, electricity, and captured CO<sub>2</sub> are identified. The system's performance is improved by introducing process integration maximizing the heat recovery and valorizing the waste heat, and optimizing the polygeneration of hydrogen, captured CO<sub>2</sub>, heat and electricity. The potential for greenhouse gas mitigation is assessed based on the CO<sub>2</sub> capture rate and the CO<sub>2</sub> avoidance cost. The trade-off between efficiency, CO<sub>2</sub> capture rate, and production cost is illustrated in Figure 2 for the power generation with CO<sub>2</sub> capture by chemical absorption with amines using natural gas steam reforming, autothermal reforming, and biomass gasification.

It is shown that the competitiveness strongly depends on the resource price, the imposed CO<sub>2</sub> taxes, and the technology's development. Considering



**Figure 2:** Trade-off between efficiency, CO<sub>2</sub> capture rate, and production cost for pre-combustion processes using natural gas steam reforming (ATR), autothermal reforming (ATR), or biomass gasification (BM) for syngas generation and chemical absorption with amines for CO<sub>2</sub> capture. Economic scenarios: Operation 7500 h/y, lifetime 25 years, interest rate 6%, resource price 8.8 CHF/GJ (base), 5 CHF/GJ (low), 18 CHF/GJ (high). Source: LENI EPFL

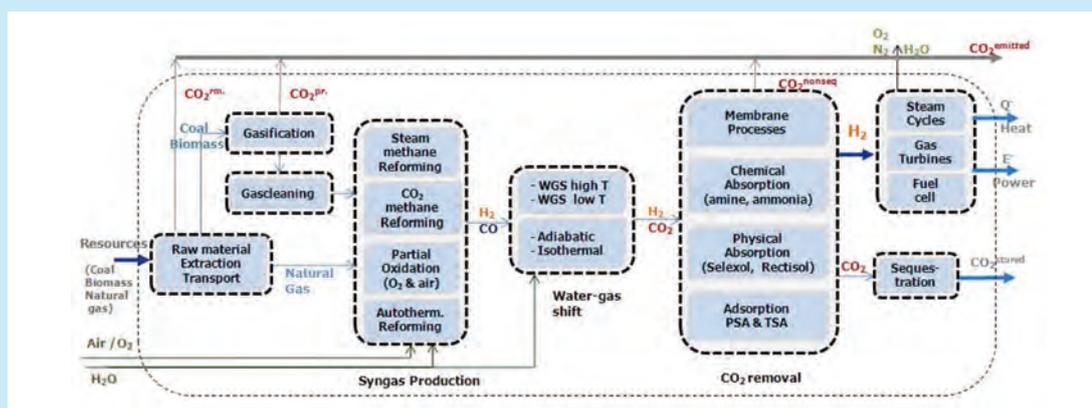
resource price variations between 5 and 18 CHF/GJ, efficiencies up to 56%, production costs of 71-162 CHF/MWhe and CO<sub>2</sub> avoidance cost of 12-276 CHF/CO<sub>2,avoided</sub> are computed for 90% CO<sub>2</sub> capture in pre-combustion power generation using natural gas resources, compared to 28% efficiency, 149-312 CHF/MWhe and 65-198 CHF/tCO<sub>2,avoided</sub> for biomass processes with 65% CO<sub>2</sub> capture. Comparing these results with post-combustion and oxy-fuel processes' performance, no clear decision in favor of one specific technology can be made at this point. References available from the authors.

Laurence Tock, François Maréchal, Industrial Energy Systems Laboratory, EPFL

Contact: francois.marechal@epfl.ch

This study forms part of the CARMA project:

[www.cces.ethz.ch/projects/nature/carma](http://www.cces.ethz.ch/projects/nature/carma)



**Figure 1:** Pre-combustion process superstructure including the different technological options. Source: LENI EPFL

## C2SM News

### C2SM enters its second phase

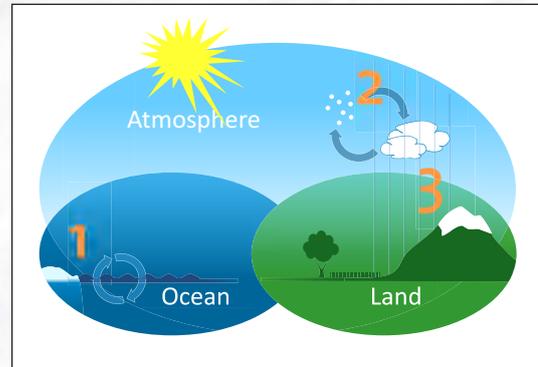
Because the future climate lacks an observed analogue in the past, climate models have become indispensable tools in climate research. While these models have seen an impressive development since about 40 years ago, many key questions have remained unresolved. In response to these challenges, the Center for Climate Systems Modeling (C2SM) was established in 2008.

The primary objectives of C2SM are to improve the understanding of the climate system, and our ability to predict it. C2SM involves more than 400 scientists among its partners (ETH, MeteoSwiss, Empa and ART). It serves as a central platform, and supports the development, application and exploitation of climate models and climate data sets. A particular highlight of the last years is the development and dissemination of the Swiss Climate Change Scenarios (CH2011). C2SM also successfully acquired scientific initiatives funded by third parties.

The successful development of C2SM during the first phase of its existence was a key in securing funding for the second phase, which will start in July 2012 and run until the end of 2016. All partners have renewed their financial support for the Center, providing a secure base for the next years and enabling C2SM to further strengthen the strategy and services to the benefit of its members and the whole climate research community in Switzerland.

### Scientific results from CHIRP1

Climate and weather result from a large number of interlinked processes operating over a wide range of spatial and temporal scales. The CHIRP1 project, a major source of funding for the C2SM's first phase, tackled the issue of multi-scale interactions within the climate system. We report here on two project components involving variations of the regional climate model COSMO (2 and 3 in the Figure). Current climate models operate at grid spacings of 20-300 km, a scale at which many processes cannot explicitly be resolved and have to be parameterized. Wolfgang Langhans and colleagues at ETH Zurich employed the COSMO model to perform cloud-resolving simulations, in which parameterizations of moist convection are replaced by an explicit representation. The simulation results show a realistic representation of the diurnal cycle at a grid spacing of 1-2 km.



**CHIRP1 components:** 1) The potential role of eddies in the oceanic CO<sub>2</sub> uptake, 2) Chemistry-aerosol-climate interactions in a regional climate model, 3) Towards kilometer-scale climate modeling.

In contrast, the convection-parameterizing model with a resolution of about 7 km is plagued by a considerable phase shift. It is also shown that further grid refinements do not overly affect the results, provided the convection is explicitly represented. Overall, these results strengthen the validity of the cloud-resolving approach and encourage its use for weather and climate applications.

C2SM partner Empa has adopted and further developed the online-coupled chemistry-transport model COSMO-ART to simulate the complete lifecycle of atmospheric gases and aerosols at a regional scale. Christoph Knöte and colleagues have comprehensively evaluated the model and found good agreement with measurements in general, but highlighted problems in representing aerosols which are released by a complex mixture of sources and formed secondarily in the atmosphere. By improving the representation of chemistry within clouds they were able to remedy part of the deficiencies for two major aerosol components, nitrates and sulfates. They also quantified to what extent the decrease in pollutant emissions in Europe over the last 20 years has affected aerosol characteristics and identified counter-intuitive effects of nitrogen oxides (NO<sub>x</sub>) emission reductions, illustrating the complex and non-linear interactions between gases and aerosols.

[www.c2sm.ethz.ch/research/chirp1](http://www.c2sm.ethz.ch/research/chirp1)

Knöte et al. (2011) [dx.doi.org/10.5194/gmd-4-1077-2011](https://doi.org/10.5194/gmd-4-1077-2011)

Langhans et al. (2011)

[dx.doi.org/10.1175/2011MWR3650.1](https://doi.org/10.1175/2011MWR3650.1)

Langhans et al. (2012)

[dx.doi.org/10.1175/JAS-D-11-0252.1](https://doi.org/10.1175/JAS-D-11-0252.1)

## OCCR Flash – News from the Oeschger Centre

The *Oeschger Centre for Climate Change Research* puts a focus on interdisciplinary research beyond natural sciences. The two researcher who last joined the OCCR are Philippe Thalmann, an economist and Karin Ingold, a political scientist.

### Successful Symposium on Documentary Data

The symposium *The Relevance of Historical Documentary Data for the Debate about Climate and Natural Hazards* on 3 May 2012 at the University of Bern caused much interest with researchers and practitioners involved in the management of natural risks. More than 70 persons attended the lectures and workshops organized by the OCCR and the Swiss GCOS (Global Climate Observing System) office. The event provided the platform for the public launch of Euro-Clim-Hist ([www.euroclimhist.ch](http://www.euroclimhist.ch)), an online database developed at



Using this painting of a flood in Basel in 1852 climate historians were able to reconstruct the magnitude of floods in preinstrumental times.

the OCCR by Christian Pfister and colleagues. This unique tool allows the interested public to access 120'000 entries on past climate and extreme events since 1550 which were gathered from historical documents.

For the presentations given at the symposium see: [www.oeschger.unibe.ch/events/conferences/euroclimhist/presentations\\_de.html](http://www.oeschger.unibe.ch/events/conferences/euroclimhist/presentations_de.html)

### New researchers join the OCCR

Philippe Thalmann is the OCCR's first Adjunct Researcher. He is a professor of economy and works at the Economics and Environmental Management Laboratory of ETH Lausanne. His research focuses on economics and costs of climate change, economic instruments and its acceptance as well as mitigation and adaptation. Karin Ingold

heads the OCCR's group for Environmental Policy Analysis. She is a political scientist and works as an assistant professor at the Institute of Political Science at the University of Bern. She is interested in the analysis and design of policy processes and instruments.

### OCCR publications provide important new insight

The transition from a glacial to an interglacial state is governed by a complex system of feedbacks such as the change in the atmospheric CO<sub>2</sub>. OCCR researchers Jochen Schmitt et al., in a Science publication, provide important new carbon isotopic data that help to explain these changes. The primary challenge the researchers of the division for Climate and Environmental Physics at the University of Bern had to overcome were technical. Samples from ice cores are small, making it difficult to make precise measurements. Jochen Schmitt and colleagues refined the existing technique of sublimating ice and coupled it with a sensitive mass spectrometer to measure isotope ratios. They have thus created what a comment in Science calls the «best record to date of the glacial to interglacial variations in stable carbon isotopes of CO<sub>2</sub>».

Climate change could profoundly influence the hydrosphere of mountain ecosystems. OCCR researcher Ole Rössler, in a recent publication, analyses the potential drought stress in a Swiss mountain catchment. The forecasting of high mountain soil moisture reveals a drastic decrease, despite major uncertainties. The study by Ole Rössler of the Institute of Geography at the University of Bern, which was published in the renowned journal *Water Resources Research* analyses the impact of the climate on soil moisture in a high mountain catchment in order to facilitate the development of mitigation and adaptation strategies.

For an overview of OCCR activities and events see [www.oeschger.unibe.ch](http://www.oeschger.unibe.ch)

Contact: Kaspar Meuli [meuli@oeschger.unibe.ch](mailto:meuli@oeschger.unibe.ch)

## Conferences and Events in Switzerland

20–22 August 2012

### **Research for Global Transformation – ICRD 2012**

3rd International Conference on Research for  
Development

Location: UniS, Bern

Info: [www.icrd.ch](http://www.icrd.ch)

Registration: 20 July 2012

26–30 August 2012

### **Integrative Risk Management in a Changing World**

4th International Disaster and Risk Conference  
IDRC Davos 2012

Location: Congress Centre in Davos

Info: [www.idrc.info](http://www.idrc.info)

29–31 August 2012

### **Strategies for Sustainability: Institutional and Organisational Challenges**

Third International Sustainability Conference  
ISC 2012

Location: University of Basel, Kollegiengebäude,  
Petersplatz 1, Basel

Info: [www.sustainabilityconference.ch](http://www.sustainabilityconference.ch)

3–5 September 2012

### **Synthesis Workshop on Qualities, Vulnerabilities, and Management of Ecosystem Services in Mountain Regions**

Location: Möschberg

Info: [mri.scnatweb.ch](http://mri.scnatweb.ch)

5–7 September 2012

### **Traits, Niches and Climate as common coinage**

Location: WSL Birmensdorf

Info: [www.wsl.ch/dienstleistungen/veranstaltungen/veranstaltungskalender/iCCB/index\\_EN](http://www.wsl.ch/dienstleistungen/veranstaltungen/veranstaltungskalender/iCCB/index_EN)

5–8 September 2012

### **AlpWeek 2012: Renewable Alps**

The Alps reinvent themselves

Location: Valposchiavo, Kt. Graubünden

Info: [www.alpweek.org](http://www.alpweek.org)

12 September 2012

### **ETH Zürich Wind Energy Forum**

Preannouncement

Location: Zürich

Info: [www.lec.ethz.ch](http://www.lec.ethz.ch)

21 September 2012

### **4. Symposium Anpassung an den Klimawandel**

Location: UniS, Bern

Info: [www.occc.ch](http://www.occc.ch)

13–14 September 2012

### **Forschen für den Bau im Kontext von Energie und Umwelt**

17. Schweizerische Status-Seminar

Location: Zürich

Info: [www.brenet.ch/statusseminar.php](http://www.brenet.ch/statusseminar.php)

14 September 2012

### **Herausforderungen einer nachhaltigen Wasserwirtschaft**

Location: Dübendorf

Info: [www.eawag.ch/lehre/peak/kurse/programm.pdf](http://www.eawag.ch/lehre/peak/kurse/programm.pdf)

27 September 2012

### **Fahrzeuge für die neue CO<sub>2</sub>-Gesetzgebung ab 2015 und 2020**

Location: Sursee

Info: Christian Bach (Präsident TK SSM), Empa,  
Überlandstrasse 129, 8600 Dübendorf,

Tel: 058 765 11 11, E-Mail: [Contact@empa.ch](mailto:Contact@empa.ch)

7 October–11 October 2012

### **5th International Workshop on Soil and Sedimentary Organic Matter Stabilization and Destabilization**

Location: Centro Stefano Franscini, Monte Verità,  
Ascona, TI

Info: [www.som5.ethz.ch](http://www.som5.ethz.ch)

Registration: 7 August 2012

12 October 2012

### **Finish Line – the closing symposium of the NCCR Climate**

Location: UniS, Bern

Info: [www.nccr-climate.unibe.ch/conferences/finish\\_line](http://www.nccr-climate.unibe.ch/conferences/finish_line)

16–17 November 2012

### **10th Swiss Geoscience Meeting 2012**

Location: Hauptgebäude der Universität Bern

Info: [www.geoscience-meeting.scnatweb.ch](http://www.geoscience-meeting.scnatweb.ch)

27 November 2012, 19.30

**Methan als wichtiges Treibhausgas**

Emission in der Vergangenheit, Gegenwart und Zukunft

Location: Vortragssaal Universitätsbibliothek,  
Zentralbibliothek, Münsterergasse 63, 3011 Bern  
Info: [www.ngbe.ch/content/default.asp?mid=3&rid=0&verid=1158&action=detail&view=bietkarte](http://www.ngbe.ch/content/default.asp?mid=3&rid=0&verid=1158&action=detail&view=bietkarte)

23–25 January 2013

**Knowledge production about planet earth and the global environment as indicators of social change**

Location: University of Bern  
Info: [www.hist.unibe.ch/content/neuigkeiten/index\\_ger.html](http://www.hist.unibe.ch/content/neuigkeiten/index_ger.html)

14 February 2013

**ICT for Sustainability Conference**

The Challenge of making it real

Location: ETH Zurich

Info: [www.ict4s.org](http://www.ict4s.org)

16 April 2013

**14th Swiss Global Change Day**

Preannouncement

Location: Freies Gymnasium, Beaulieustr. 55,  
Bern

Info: [www.proclim.ch/4dcgi/proclim/all/Event?2268](http://www.proclim.ch/4dcgi/proclim/all/Event?2268)

## IGBP, IHDP, WCRP, DIVERSITAS related Conferences

17–21 September 2012

**12th IGAC Open Science Conference: Atmospheric Chemistry in the Anthropocene**

Location: Beijing, China

Info: [www.igac2012.org/dct/page/1](http://www.igac2012.org/dct/page/1)

Registration: 30 June 2012

1–4 October 2012

**Abrupt Climate Changes and Environmental Responses in tropical South America**

Location: Medellin, Colombia

Info: [www.pages-igbp.org/calendar/upcoming/1-pages-sponsored/237-abruptchange](http://www.pages-igbp.org/calendar/upcoming/1-pages-sponsored/237-abruptchange)

24–27 September 2012

**Third Symposium on the Ocean in a High CO<sub>2</sub> World**

Location: Monterey, California, USA

Info: [www.highco2-iii.org/main.cfm?cid=2259](http://www.highco2-iii.org/main.cfm?cid=2259)

5–6 October 2012

**2012 Berlin Conference on Human Dimensions of Global Environmental Change**

Evidence for Sustainable Development

Location: Berlin

Info: [www.berlinconference.org/2012](http://www.berlinconference.org/2012)

1–5 October 2012

**International Partnerships in Ice Core Sciences**

First Open Science Conference

Location: Presqu'île de Giens, Côte d'Azur, France

Info: [www.ipics2012.org](http://www.ipics2012.org)

Registration: 10 July 2012

4–8 November 2012

**Workshop on African climate-vegetation interactions 2012**

Location: Bremen

Info: [www.marum.de/en/Workshop\\_on\\_African\\_climate-vegetation\\_interactions\\_2012.html](http://www.marum.de/en/Workshop_on_African_climate-vegetation_interactions_2012.html)

## Exhibitions

14 June–21 October 2012, Zürich

**Sonderausstellung «Quer durchs Grönlands – 100 Jahre Schweizer Grönlandforschung»**

Location: Zurich

Info: [www.focusterra.ethz.ch](http://www.focusterra.ethz.ch)

8 November 2012

**18. Herbstseminar «Wege zur Energiewende»**  
Im Rahmen der Schweizer Bau- und Energie-Messe

14–16 November 2012

**Geoprotecta**

3. Schweizer Fachmesse für integrales Risikomanagement von Naturgefahren und Klimafolgen

Location: St. Gallen

Info: [www.geoprotecta.ch](http://www.geoprotecta.ch)

8–11 November 2012

**11. Schweizer Bau- und Energie-Messe**

Location: Bern

Info: [www.bauenergiemesse.ch](http://www.bauenergiemesse.ch)

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