

NCCR Climate Update 31

Climate Change, no doubt, is a global phenomenon, but its impacts differ strongly on regional and local scales. Hence the NCCR Climate has a strong focus on regional topics. Be it the development of the CH2011 Scenarios, or recent publications on climate impacts on Alpine vegetation.

Highlights of NCCR activities

New Scenarios for Climate Change in Switzerland

On 28 September the results of the Climate Change Scenarios initiative CH2011, which was initiated and substantially sponsored by the NCCR Climate, were presented at ETH Zurich. The project, a joint initiative of C2SM, ETH, MeteoSwiss, OccC and the NCCR Climate, lasted several years. The new findings confirm that Swiss climate will get warmer and dryer in summer. Moreover an increase of extremes such as more frequent and longer heat waves and dry spells in summer are expected. The full report in English, including summaries in German, French and Italian, can be accessed on www.ch2011.ch.



More frequent heat waves to come in Switzerland – on 11 August 2003 the temperature in Grono (GR), the site of a forest fire, rose to a record 41.5 °C.

Economists and lawyers gather to tackle climate change

The NCCR Climate examines climate change and its impact on society in an interdisciplinary manner. Thus the main question raised at the Climate Economics and Law Conference organised by the NCCR Climate was: How can we address climate change from an economic and legal point of view?

At the conference, which took place at the University of Bern on 16 and 17 June 2011, 27 economists and lawyers presented their research findings and discussed them during a number of workshops with topics ranging from mitigation, adaptation and technological change to the role of trade regulations and unilateral climate policies. In addition to fostering and exchange of knowledge, the successful conference also fuelled interdisciplinary dialogue. The keynote speakers: Shardul Agrawala (OECD, Paris, France), Peter Holmes (University of Sussex, U.K.), Matthias Ruth (University of Maryland, U.S.) and Peter Wooders (IISD, Geneva, Switzerland) were responsible for the programme's highlights.

For Keynote presentations and papers see:

www.nccr-climate.unibe.ch/conferences/climate_economics_law

Research Highlights (a selection)

Alpine climate during the Holocene

Friedheim Steinhilber, Petra Breitenmoser, Jürg Beer, Martin Grosjean, Heinz Wanner et al. (NCCR projects *Solar Forcing and Climate Change of the Last 1000 Years and Paleoclimate Variability and Extreme Events*) compare records of glaciers, lake sediments and solar activity.

Recent improvements in Alpine glacier length records and climate reconstructions from annually laminated sediments of Alpine Lake Silvaplana enables the authors to investigate the relationship between these two data sets of Alpine climate. Two different time frames are considered: the last 500–1000 years as well as the last 7400 years. A first result shows that the variability recorded by the two proxy archives agrees reasonably well during the past millennium. Then the records were compared with temporally highly resolved data of solar activity. The Sun has had a major impact on the Alpine climate variations in



the long term, i.e. several centuries to millennia. On shorter timescales, however, the influence of the Sun cannot be as easily detected in Alpine climate change, indicating that in addition to solar forcing, volcanic influence and internal climate variations have played an important role.

(*Journal of Quaternary Science*, 2011)

Non-stomatal limitations of photosynthesis in grassland under artificial drought

Urs Feller et al. (NCCR project *Drought Effects on Plant Water Uptake and Water Use as well as Soil Carbon Dynamics in Swiss Grassland Systems under Changing Climate*) explain that, as drought stress is expected to occur more frequently in future climate in central Europe, survival and productivity of grassland species are an important issue.

In their study non-stomatal limitation processes related to the drought-stress inhibition of photosynthesis of selected grassland species were analysed at three locations using leaf gas exchange and chlorophyll fluorescence. The effect of an artificial drought on the non-stomatal limitations differed considerably between species present in the same grassland plot. In some species strong limitations were detected. Metabolic restrictions are relevant for pastures under reduced water availability. The relative effects on grasses and legumes/forbs differed for the three field sites. Frequent drought periods in the future may affect productivity and species composition.

(*Environmental and Experimental Botany*, 2011)

Spectral representation of the annual cycle in the climate change signal

Thomas Bosshard, Sven Kotlarski, Christoph Schär et al. (NCCR project *Intensification of the Water Cycle: Scenarios, Processes and Extremes*) explain that the annual cycle of temperature and precipitation changes, as projected by climate models, is of fundamental interest in climate impact studies. Its estimation is, however, impaired by natural variability.

Using a simple form of the delta change method, their study shows that on regional scales relevant for hydrological impact models, the projected changes in the annual cycle are prone to sam-

pling artefacts. For precipitation at station locations, these artefacts may have amplitudes that are comparable to the climate change signal itself. Therefore, the annual cycle of the climate change signal should be filtered when generating climate change scenarios. A spectral smoothing method to remove the artificial fluctuations was tested. Comparison against moving monthly averages shows that sampling artefacts in the climate change signal can successfully be removed by spectral smoothing. This study forms part of the scientific bases of the CH2011 scenarios.

(*Hydrology and Earth System Sciences Discuss.*, 2011)

Soil microbial communities in alpine grasslands

Jürg Fuhrer et al. (NCCR project *Climate Change and Agricultural Production Risks*) state that a change in environmental conditions may result in altered soil microbial communities in alpine grasslands but that the extent and direction of the change is largely unknown.

In their study they hypothesized that microbial communities in soil cores, which were translocated from a higher to a lower elevation site, would differ, due to warming, from the ones at the original site after more than a decade. Results from soil phospholipid fatty acid (PLFA) analysis confirm significant differences in microbial communities between sites and a shift in total microbial biomass (TMB) and proportional distribution of structural groups in the translocated cores towards the lower elevation community. However, soil microbial communities showed only a moderate shift in composition 11 years after warming. (Sub)alpine soil microbial group proportions indicate trends which may be temperature related. In contrast subalpine soil microbial content indicated strong influence of factors other than temperature.

(*Soil Biology and Biochemistry*, 2011)

For a complete overview on the recent NCCR Climate publications consult

www.nccr-climate.unibe.ch/research_articles

Buying Greenhouse Gas Insurance: International Trade and the Adaptation to Climate Change and Variability

Background information on NCCR publications

There are different reasons why countries trade. The most important one, economists typically refer to, is that trade is a source of wealth. There is, however, a further reason, which usually is not mentioned explicitly, and this reason is a topic of research within the NCCR Climate. Since the direct impact of global warming varies across regions, trade is a kind of insurance against the risks of climate change. For example, if because of weather extremes regional food supply is reduced, imports can replace the domestic shortfall. Over the long-run production could even shift to regions, which have the comparative advantage of being less vulnerable.



Trade transports both goods and damages. After six years of drought Australia's rice production almost collapsed in 2008. This was one of several factors contributing to a doubling of the world market price of rice.

Moderating climate change impacts is one aspect. A second, generally neglected one is that trade transports both goods and damages. Here is a recent example. After six years of drought Australia's rice production almost collapsed in 2008. This was one of several factors contributing to a doubling of the world market price of rice, which led to panicked hoarding and violent protests. Generally, losses in one region might cause higher world market prices and the resulting terms-of-trade effects will then pertain to real income losses in almost any country. These effects are non-negligible, as our analysis reveals.

In North America and parts of the former Soviet Union, for example, direct impacts are expected to be low, but spillover effects will account to one third of total costs of climate change.

Both direct impacts and trade effects of global warming depend on the societies' vulnerability. The less sensitive export-oriented sectors are to climate change, the less dependent a country is on imports of vulnerable goods, the lower will be the terms-of-trade effect. Consequently, self-interest suggests reducing the vulnerability of the regional societies through mitigation as well as adaptation. Part of the adaptation is done automatically, but an important part will require strategic investment into local public goods. Many poor countries, however, lack the capability to adapt because of limited resources and weak institutions. Without support by the developed world through for example funding adaptation, climate change could pronounce the already existing inequalities between industrialized and developing countries. Game theory analyses typically argue that funding adaptation is in the interest of the donor only, if the recipients extend mitigation. However, if trade aspects are included there is a further argument, why industrialized countries should fund adaptation in the developing world: Adaptation reduces the regional impact of climate change and hence, reduces potential terms-of-trade impacts, from which all, donors and recipients, can profit.

By Gunter Stephan, NCCR Climate, University of Bern, Department of Economics, CH-3012 Bern, Switzerland, gunter.stephan@vwi.unibe.ch

The studies referred to in this article:

Schenker, O., Stephan, G.: (2011): Buying Greenhouse Gas Insurance: International Trade and the Adaptation to Climate Change and Variability. NCCR Climate working paper, 2011/3.
Buob, S., Stephan, G. (2011): On the Incentive Compatibility of Funding Adaptation. NCCR Climate working paper, 2011/2.

Contact:

Kaspar Meuli meuli@oeschger.unibe.ch