Fact sheet
Rio+20

Source: NASA

Fact sheet No. 1, 2012

Source: NASA

Water security for a planet under pressure – and the consequences for Switzerland

On the global level, an increasing population, economic growth and climate change will add to the pressure on freshwater resources. We cannot continue to use water as wastefully as we have in the past.

The challenge

During the past century, the global population has tripled, but the use of water has increased six-fold. At the same time, the quality of available water resources has been impacted through human activities, such as the use of agrochemicals and the release of wastewater. In addition, climate change affects water availability. Already today, around 1.2 billion people have no access to safe drinking water and adequate sanitation, which causes a lot of health problems, and one fifth of the world's population live in areas of physical water scarcity.

Water is essential to ensure food supply, but is also indispensable for industry, energy production and the domestic sector. Unless action is taken now, water insecurity is likely to become a key geopolitical issue. It will severely affect the world's health, food and energy systems, with the greatest impacts on the poorest and most vulnerable. Therefore, water management must be improved in order to ensure sustained human well-being, food security, economic growth and political stability.

Expected future developments

Population growth and dietary changes

Today, 7 billion people live on this planet. According to the United Nations, the population will reach 9.3 billion by the middle of this century and over 10 billion by 2100. This means that, in combination with dietary changes towards consuming more livestock products, the agricultural output will have to increase by 70 % by 2050 and the demand for water will grow by 70–90 %, if no efficiency measures are implemented. According to current estimates, two thirds of the world's population will live in areas of high water stress by 2025.

Climate and environmental change

Changes in temperature, precipitation patterns and snowmelt will have an impact on water availability. Higher temperatures will increase loss of water through evaporation. They will also affect the amount and duration of snow cover, which, in turn, may alter the timing of streamflow. Glaciers are expected to continue retreating. Climate change also means sea level rise, which will affect many cities and populated areas along coastlines, mainly in developing

sc | nat

Swiss Academy of Sciences
Akademie der Naturwissenschaften
Accademia di scienze naturali
Académie des sciences naturelles

This fact sheet prepared by ProClim–, KFPE and CHy is inspired by the Planet under Pressure Policy Brief series:
www.planetunderpressure2012.net/policybriefs.asp

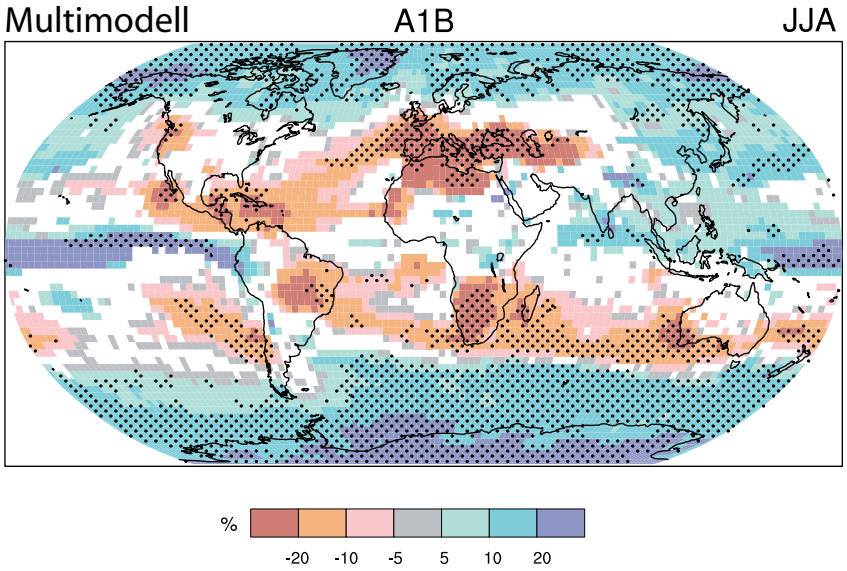

Figure 1:
Relative changes in precipitation (in per cent) for the period 2090–2099, relative to 1980–1999. Values are multi-model averages based on a medium-level emission scenario for June to August. White areas are where less than 66 % of the models agree in the sign of the change and stippled areas are where more than 90 % of the models agree in the sign of the change.
(Source: IPCC 2007 AR4 WGI)

countries: Wetlands and other low-lying lands will be inundated and beaches eroded, flooding will intensify, and the salinity of rivers, bays and groundwater tables will increase.

Rising demand and competition
Currently, around 70 % of global freshwater withdrawals are used for agriculture. It is likely that foreign direct investments in agricultural land – which are often associated with securing water rights for large-scale irrigation – will further increase the global water demand and trigger water competition and conflicts. In general, the use of water is highly inefficient today. In the future, the world needs to grow more food, using less water. In addition to agriculture, the water needs of the industrial, energy and domestic sectors are likely to increase in the coming decades.

Land degradation
Today, more than half of the earth's land surface is used for agriculture, and estimates suggest that 40 % of this area is moderately degraded, while another 9 % is strongly degraded. Degradation is expected to be further aggravated by intensified land use and unadapted land management, with negative impacts on water availability, storage capacity and water quality.

Virtual water trade
As part of globalisation of the world economy, water is increasingly traded over long distances, altering the local patterns of use. Currently, about 40 % of global water consumption is related to virtual forms, namely agricultural (80 %) and industrial commodities (20 %). Although this virtual water trade has a certain potential to mitigate water stress in dry regions if products are imported from regions with water surplus, this is a highly sensitive geopolitical issue and there is a considerable risk of externalising resource depletion and degradation to production areas.

Urbanisation and water degradation
In about two decades, two thirds of the global population will live in towns and cities. In dense settlements, degradation of water resources due to human and industrial waste poses a severe threat to health and economic development. On the other hand, concentrations of people may enable the deployment of cost-effective technical solutions that are unaffordable elsewhere (e.g. wastewater treatment).

How to attain water security

- The entire water cycle and the various uses of water need to be considered when dealing with water issues, including groundwater management. Integrated water resources management as well as cross-sectoral negotiation and decision-making from local to global levels will become vital.
- Sustainable land management practices are the most effective way for enhancing water availability, by reducing floods and increasing low flows while boosting primary production. For this purpose, farmers and companies must be given incentives for more water-efficient production approaches and technologies.
- The global food trade has a potential for mitigating water scarcity and enhancing food security. However, fair water-pricing measures for internalising the costs of virtual water trade must become an integral part of international trade agreements.
- In the climate debate, the water issue must be taken into account: No climate adaptation plan should be drafted without explicit consideration of water.
- Water management plans require the integration of all stakeholders. This is particularly important when considering downstream and upstream water users and transboundary water resources.

Water security in Switzerland

Water tower of Europe

Water is probably the most valuable natural resource in Switzerland. Apart from its use for domestic and industrial purposes, water is Switzerland's most important domestic energy source. In principle, there is enough water available in Switzerland. Currently, domestic water resources amount to 5,000 m^3 water per inhabitant and year. There will also be enough water in the future, in spite of the impact of climate change. At certain times, however, different water users will compete for less abundant water resources, which will make it necessary to manage water and water quality more carefully.

Expected future developments

Precipitation

Mean precipitation amounts will decrease in summer all over Switzerland as a result of climate change. Winter precipitation will probably increase in southern Switzerland. Experts assume that heavy precipitation events will become more frequent and more intense due to the higher temperatures and the related increase in relative humidity. However, there is still much uncertainty with regard to these changes. It is possible that flood events will be more frequent during the winter months in the Swiss midlands and in the Jura as a result of increasing winter precipitation and higher temperatures.

Heat waves

The number of heat waves and related droughts has increased in the past decades. This trend will continue or even become stronger. By 2100, every second summer could be as hot as the one in 2003.

Glaciers

By 2100, a large part of the Swiss glaciers will have melted. As a result, new lakes will form. These may provide opportunities for energy production, but may also enhance the risk of natural hazards.

Hydropower

Hydropower is the most important domestic energy source. Water is also used for cooling the nuclear power plants. Moreover, a decrease in runoff will affect the use of water for cooling purposes in industry. Generally, the annual discharge is expected to increase temporarily due to glacier melt, but will decrease in the long run.

Agriculture

Dry periods may result in production loss in agriculture. For instance, the hot summer of 2003 caused financial damage of about 500 million Swiss francs. The increasing demand for irrigation water during dry periods may lead to competitive situations between different uses and users (agriculture, ecological demands, energy production, shipping, etc.).

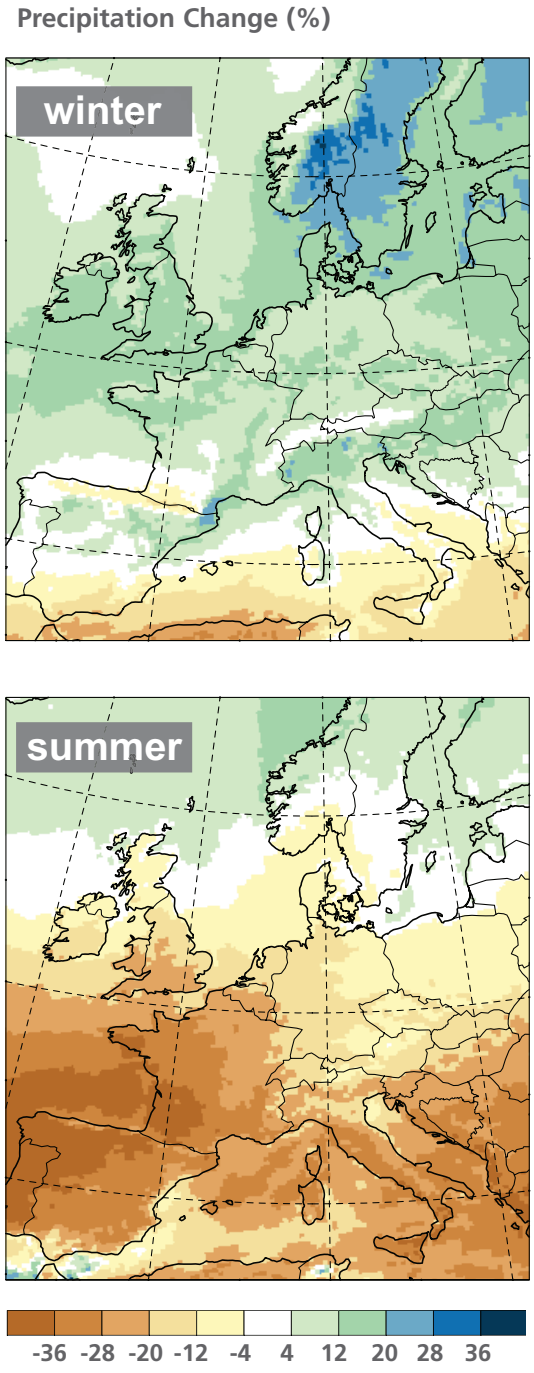

Figure 2: Change in precipitation for winter and summer as simulated by climate models. The figure shows the multi-model mean change for 2070–2099 relative to 1980–2009, for an intermediate (A1B) greenhouse gas emission scenario.
(Source: Swiss Climate Change Scenarios CH2011)

Rhine shipping
15 % of foreign trade goods are processed in Rhine ports. It is expected that Rhine shipping will experience limitations in summer and autumn in the future.

How to maintain water security in Switzerland

- According to climate change scenarios, both heat and dry periods will increase in Switzerland. As a result, water availability may be locally limited in summer. The competitive situation between the demands of water conservation and water use, especially for agriculture, energy production and in the domestic sector, calls for an enhanced management of water resources.
- On the demand side, in particular with regard to process and drinking water and in agriculture, measures need to be taken. The use of more efficient irrigation technologies and suitable crops will enable irrigation to be reduced.
- Water security is not just a question of water quantity but also concerns water quality, which may be affected by climate change as well. The consequences on groundwater recharge, particles and substances in groundwater, microbial problems, etc. are still subject to many uncertainties and need to be explored more extensively.
- Water evidently is a vital resource; however, it is also a potential natural hazard. The possible increase in the frequency of floods must be counteracted by adopting appropriate strategies. These include spatial planning measures, protection for existing buildings as well as structural protection measures.

Bibliography

Water security for a planet under pressure. RIO+20 Policy Brief #1. One of nine policy briefs produced by the scientific community to inform the United Nations Conference on Sustainable Development (Rio+20). 2011.

CH2011, Swiss Climate Change Scenarios CH2011, published by C2SM, MeteoSwiss, ETH, NCCR Climate, and OcCC, Zurich, Switzerland. 2011.

Schweizerische Gesellschaft für Hydrologie und Limnologie (SGHL) und Hydrologische Kommission (CHy) (Hrsg.): Auswirkungen der Klimaänderung auf die Wasserkraftnutzung – Synthesebericht. Beiträge zur Hydrologie der Schweiz, Nr. 38, Bern. 2011.

OcCC/ProClim- (Editor). Climate Change and Switzerland 2050. Expected Impacts on Environment, Society and Economy. Bern. 2007.

The Grimselsee with a volume of 95 million m³ is the largest reservoir lake in the Grimsel area. (Photo: KWO)

Contact persons (global aspects):
Dr. Thomas Breu, thomas.breu@cde.unibe.ch
NCCR North-South, Centre for Development and Environment (CDE), Institute of Geography
Hallerstrasse 10, CH-3012 Bern

Christian Zurbrügg, christian.zurbruegg@eawag.ch
Water and Sanitation in Developing Countries, Sandec
Eawag, Überlandstrasse 133, CH-8600 Dübendorf

Contact persons (Switzerland):
Prof. Martin Beniston, martin.beniston@unige.ch
Institute for Environmental Sciences
Climate Research Group, University of Geneva
Site de Batelle, Bat. D, 7 route de Drize,
CH-1227 Carouge

Dr. Bruno Schädler, bruno.schaedler@giub.unibe.ch
Swiss Hydrological Commission CHy
Hydrology Group, Institute of Geography
University of Bern, Hallerstrasse 12, CH-3012 Bern

Dr. Rolf Kipfer, rolf.kipfer@eawag.ch
Department Water Resources and Drinking Water, Eawag
Überlandstr, 133, P.O. Box 611, CH-8600 Dübendorf

Fact sheets dealing with other topics can be downloaded at: www.scnat.ch/e/Publikationen/rio+20/index.php?

Editor: Esther Volken, ProClim–, Forum for Climate and Global Change, Schwarztorstr. 9, CH-3007 Bern, www.proclim.ch