

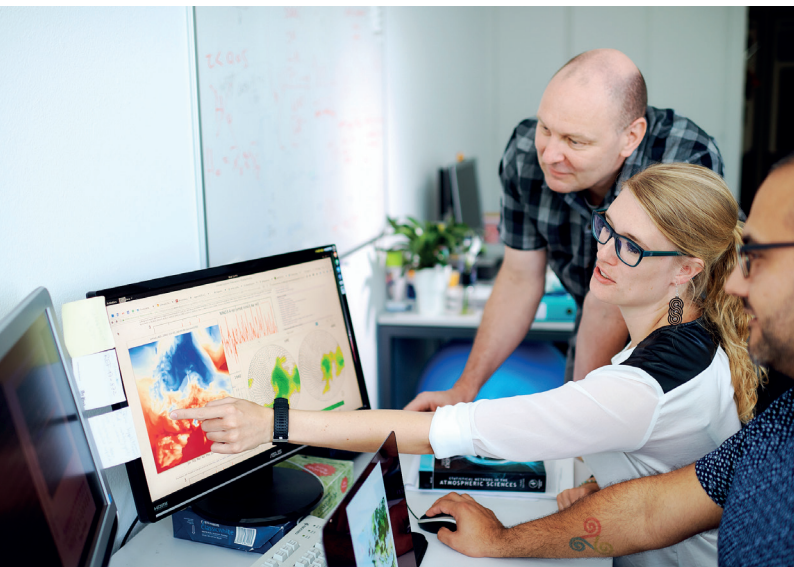
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<sup>b</sup>  
**UNIVERSITÄT  
BERN**

**OESCHGER CENTRE**  
CLIMATE CHANGE RESEARCH

# Oeschger Centre for Climate Change Research



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Cutting-edge research

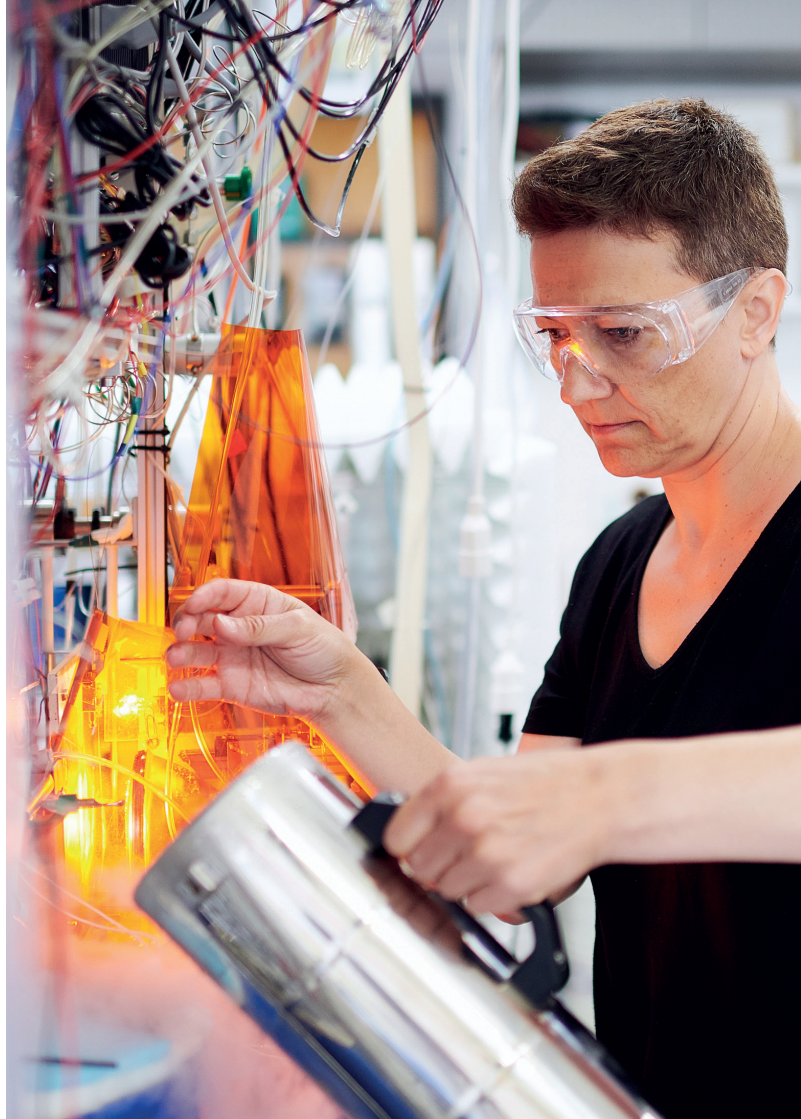
## ONE STEP AHEAD

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The Oeschger Centre for Climate Research (OCCR) pursues science with a global reach. Interdisciplinary in its orientation, it forms the umbrella under which some 250 climate scientists cooperate at the University of Bern. They carry out research in a wide variety of areas such as reconstructing past climate, modelling the future carbon cycle in the atmosphere, on continents and in the ocean, and analyzing flood risks and political processes.

The OCCR research groups publish their results in renowned journals and are successful at raising funds both nationally and internationally. OCCR members regularly receive coveted scholarships from the European Research Commission (ERC). In 2018, for example, researchers at the Oeschger Centre were awarded an ERC "Synergy Grant", an "Advanced Grant" and two "Consolidator Grants".

Founded in 2007, the OCCR is named after Hans Oeschger (1927–1998), a Bernese pioneer of modern climate research. OCCR researchers have played a leading role in all the reports published by the UN Intergovernmental Panel on Climate Change (IPCC).  
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The OCCR is a world leader in examining ice cores. New analysis and measurement technologies are constantly being developed for this purpose.



## TRULY INTERDISCIPLINARY

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The Oeschger Centre doesn't just talk about interdisciplinary cooperation, it lives it. With researchers from 14 institutes and four faculties, the Oeschger Centre's structure is geared towards interdisciplinary work. Scholars work together at the interfaces of physics, geography, biology, chemistry, history, economics, preventive medicine and political science.

For example, OCCR members from very different backgrounds are involved in a project that uses archaeological and paleoecological methods to investigate how the environment, climate and agriculture have influenced each other over the past 10,000 years. In another example of interdisciplinary cooperation, two dozen researchers from various OCCR groups created a joint publication on how the 1868 Alpine flood disaster happened, how the event left its mark on modern Switzerland, and what lessons can be learned from it.

Another example of the OCCR's work was a symposium entitled "The Human Fingerprint on the Earth System". Speakers from various disciplines discussed the evidence of human influence on the climate, as well as the ethical and legal consequences.

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For researchers, the OCCR is attractive not least because of its interdisciplinary orientation. This exchange with other fields promotes new ideas and approaches.







## ON THE INTERNATIONAL STAGE

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Within the global scientific community, the Oeschger Centre has a leading role in international assessment processes such as the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), which OCCR members have been chosen to co-chair. OCCR members also play a central role in initiatives such as WCRP Grand Challenges, Future Earth and the Oldest Ice project. In Switzerland, the OCCR was the headquarters of the National Centre of Competence in Research on Climate, and its members shape ProClim, the Swiss Academy of Sciences' Forum for Climate and Global Change. OCCR researchers have been instrumental in developing various generations of Swiss climate scenarios and have coordinated reports on the quantitative consequences of climate change in Switzerland.

The OCCR is also in constant dialogue with politics and society – whether in the field of education or as an event partner or organizer. An example is "Container<sup>3</sup>", a travelling exhibition on climate research, energy and mobility – housed in shipping containers. Another example is the development of an educational concept on climate change commissioned by the Federal Office for the Environment.

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OCCR researchers cause an international stir not only with their articles in leading scientific journals, but also through participation in committees such as the UN climate council, IPCC.

**PUTTING RESEARCH INTO PRACTICE**

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Research at the Oeschger Centre focuses on the effects of climate change on humans, the economy and ecosystems. The link between research and practice is particularly pronounced in the Mobiliar Lab for Natural Risks, which is part of the OCCR. The lab investigates and quantifies regional climate risks as well as natural hazards and their consequences. It also investigates the processes involved in the formation of hail, storms, floods and mass movements. The Mobiliar Lab works at the interface between science and practice, and strives to achieve results with a direct benefit for the general public.

Both in Switzerland and worldwide, hail regularly causes major damage and is therefore an important issue for insurance companies, among others. However, there are still gaps in the knowledge of hail's origins and its risks. For example, it is unclear how climate change will affect the probability of hail.

Switzerland is a perfect laboratory for hail research thanks to its complex topography and excellent local data on hail events and damage. Among other things, the Mobiliar Lab is working to improve hail warnings to reduce hail damage in the long term – using a globally unique combination of radar data, citizen observations and data from hail sensors.

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The OCCR's Mobiliar Lab operates a network of 80 automatic hail sensors. The measurements are used to improve hail prediction and to better understand meteorological processes.







## HOTSPOT FOR YOUNG SCIENTISTS

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The Oeschger Centre supports young researchers. Its members include about 100 doctoral students and over 80 postdocs. On their career path, they benefit from the excellent networking opportunities within the OCCR research groups. At the annual “Young Researchers Meeting”, the Oeschger Centre provides young scientists with background knowledge and skills that go far beyond their scientific education. Topics include “Science and Society”, “Career Planning” and “Communication”. The popular two-day events are open to all young climate researchers based in Switzerland.

Together with the C2SM at ETH Zurich, the Oeschger Centre runs the Swiss Climate Summer School. Since its first sessions in 2002, it has become an internationally popular event for sharing scientific ideas and networking across disciplines. The aim is to promote an exchange between doctoral students, postdocs and leading climate scientists. The summer school always takes place in a Swiss mountain resort and is open to young researchers from all over the world. Awarded to the most qualified applicants, the 70 seats – maximum – are highly coveted.

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OCCR doctoral students don’t just pursue academic careers; they’re also in demand in business, government institutions and non-governmental organizations.

**MADE-TO-MEASURE MASTER'S**

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In addition to conducting research, the Oeschger Centre offers high-level academic training. The Master of Climate Sciences program brings together students with different skills and scientific backgrounds. Applicants for this unique, interdisciplinary degree program must be specially qualified. Students can choose from a wide range of options when tailoring their personal course schedules. In addition to the events at the University of Bern, they can also attend selected courses at ETH Zurich. Students have access to various fields of research and specialization: climate and earth system sciences, atmospheric science, ecology and agricultural sciences, climate and environmental economics, social sciences as well as humanities.

With this offer, the Climate Sciences program promotes collaboration and encourages students to engage with other fields of knowledge. The “MSc in Climate Sciences” has an international focus: Around one third of the students have been educated outside of Switzerland, and the course language is English. Besides striving for scientific careers, graduates work in the private sector, in government environmental departments and for non-governmental organizations.

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The master’s program at the OCCR is broad-based. For example, its curriculum could include a simulation of an international climate conference.







## CONFERENCES WITH CHARISMA

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The Oeschger Centre plays an active role in the international scientific community. In cooperation with partner organizations, it cultivates scientific exchange in a wide variety of formats: from workshops for a handful of specialists to large-scale conferences with hundreds of participants. The OCCR also encourages early career researchers to set up their own events and provides organizational support. Among the conferences co-organized by the OCCR were the "XVIII INQUA Congress" of the International Union for Quaternary Research, the "10th International Carbon Dioxide Conference", the "Bicentenary of the Great Tambora Eruption" – a congress marking the 200th anniversary of the Tambora volcanic eruption, and "Climate and Beyond: Knowledge Production about Planet Earth and the Global Environment as Indicators of Social Change" – an international conference of scientific and environmental historians. Events on a smaller scale dealt with topics such as storms, risk-based natural hazard management, the importance of water and carbon isotopes for palaeoclimate research, and the coldest decade of the past millennium. Many of these events have given rise to joint research publications.

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Whether via public lectures or scientific conferences, the OCCR is committed to fostering exchange within the research community and sparking dialogue between science and society.

## FOCUS ON FLOOD DAMAGE

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In Switzerland, flooding causes almost half of all natural hazard-related damage to buildings. Four out of five Swiss municipalities have been affected by floods in the past 40 years. The replacement value of all buildings in danger areas is around CHF 500 billion. For these reasons, the Mobiliar Lab for Natural Risks at the Oeschger Centre has made better management of flood risks one of its priorities. Until now, research has mainly focused on the development of floods. The Mobiliar Lab combines this approach with investigations into the effects of floods and the damage they cause. Among other things, web-based tools are being developed to improve flood risk management. These tools can be used throughout Switzerland to determine and present the value of residential buildings, workplaces, hospitals and schools that could be affected by floods. This information helps the authorities setting priorities for protective measures.

How vulnerable buildings are depends not least on how they were built. Using data mining techniques, researchers at the Mobiliar Lab use insurance data on the tens of thousands of flood-related claims to search for patterns linking the damage, the value of the buildings and the flood characteristics. This should make it easier to estimate the potential damage of future flood events.

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The Mobiliar Lab models floods, among other things. The first step is to measure the cross section of rivers. These basics then flow into a digital terrain model.







## WELL EQUIPPED

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The OCCR has first-class research infrastructure, for example an age-determining C-14 laboratory equipped with a MICADAS (MIni CARbon DAting System) unit. With MICADAS, it is possible to date the smallest material samples – even in the microgram range. The facility, which includes an accelerator mass spectrometer, is shared by numerous OCCR research groups and is also open to external researchers. In addition to using state-of-the-art technology, such as X-ray fluorescence scanners for sediment nuclei analysis, OCCR researchers also develop their own unique measuring instruments and technologies. These include, for example, a non-destructive method by which the greenhouse gases trapped in an ice core can all be identified with a single measurement. The device is based on quantum cascade laser technology. The OCCR also goes its own way in the development of climate models. The Bern3D Earth System Model of Intermediate Complexity can be used to model the carbon cycle quickly and cost-effectively. Also connected to the OCCR is the High Altitude Research Station on the Jungfrauoch, located 3,500 metres above sea level in the Bernese Oberland. It is part of a global monitoring network that provides data for a better understanding of the global carbon cycle and how it is influenced by human activities.

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The OCCR is up to date when it comes to technology. For example, X-ray fluorescence scanners for the analysis of sediment cores are used in geology as well as paleolimnology.

## PIONEERING BERNESE RESEARCH

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Climate research at the University of Bern is internationally known for its analysis of ice cores, especially through the reconstruction of greenhouse gas concentrations from over the past 800 000 years – a world record. Today, OCCR researchers are world leaders in many fields, but ice core research is still of particular importance. For example, the OCCR plays a central role in the European research project Oldest Ice – an international initiative to drill a core in Antarctica from the oldest ice on Earth. The goal is to obtain climate information from the past 1.5 million years.

The University of Bern has been advancing climate research for over 150 years. Some of its pioneers who played an outstanding international role were Eduard Brückner in the field of ice age theory, Rudolf Wolf with his sunspot research, and Heinrich Wild, the first president of the International Meteorological Organization, the predecessor of today's WMO (World Meteorological Organization). The physicist Hans Oeschger, after whom the Oeschger Centre is named, also did ground-breaking work in climate and environmental physics. Among other things, he succeeded in proving that the atmosphere's increasing concentrations of greenhouse gases are the result of the combustion of fossil fuels.

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Among other things, OCCR researchers are pioneers in the analysis of ice cores, which are processed in a special ice laboratory.





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