# CCES News 14

## News from the CCES Office

**Workshop «Dialog between Politics and Science – Reality or Fiction?»**

Co-organized by the Swiss Academy of Sciences (SCNAT) and CCES, a workshop focusing on the science-policy interface took place at ETH Zurich on October 31, 2014. Invited were 35 personalities from politics, public administration, business, science and from the science-policy-interface. The main goal of the workshop was to identify reasons responsible for the suboptimal role of science in supporting political decisions, and to propose an action plan for improving the situation. Specific topics addressed were, a.o., the roles and tasks of the various stakeholders in the science-policy discussion, the degree of professionalization required for a successful dialog, as well as the necessary adaptations of institutional boundary conditions for strengthening the science-policy-interface. The workshop took place in a very lively atmosphere, and the participants felt unanimously happy about the opportunity of an open face-to-face exchange of their experience and opinions.

Roundtable discussion. Photo: Silvia Häfliger, CCES

During the workshop, existing dialog models of the Academy, the SNSF and ETH Zurich were presented, asserting that there is hardly any exchange about corresponding experiences or failures. However, for a successful practice and rules of conduct on both sides this would be necessary. The need of an improved dialog between science and policy in a world that cannot do anymore without science was undisputed. Nevertheless, there was unanimous confirmation that science

Plenary presentation of the results. Photo: Silvia Häfliger, CCES

must remain what it is and respect that policy may always decide against 'better' knowledge. In this relationship there is a borderline of credibility for science, which is set by the demonstration of political options and their consequences.

Furthermore, it is important that science is represented by credible and scientifically designated persons, who can speak on behalf of the thematically competent scientific community. The Academy of Science provides such professionally managed platforms e.g. by means of its fora 'ProClim-', 'Biodiversity' and 'Genetic Research'. This kind of service reduces the obstacles for scientists to distribute their messages to relevant political authorities.
The access for policy to relevant knowledge can be facilitated if all parties involved know the scientifically designated institutions which are capable of providing knowledge timely and in suitable form.
The very lively discussions at the round tables not only have brought forward this general framework for the improvement of the dialog, but have also supplied useful indications for a fruitful cooperation. The latter shall be refined in a suitable form as a basis for a continued discussion. Extending the dialog has been welcomed in principle by all sides.

**Contacts**:
Gabriela Schenk, CCES, phone: +41 44 632 85 37, info@cces.ethz.ch;
Urs Neu, SCNAT, phone: +41 31 328 23 26, urs.neu@scnat.ch



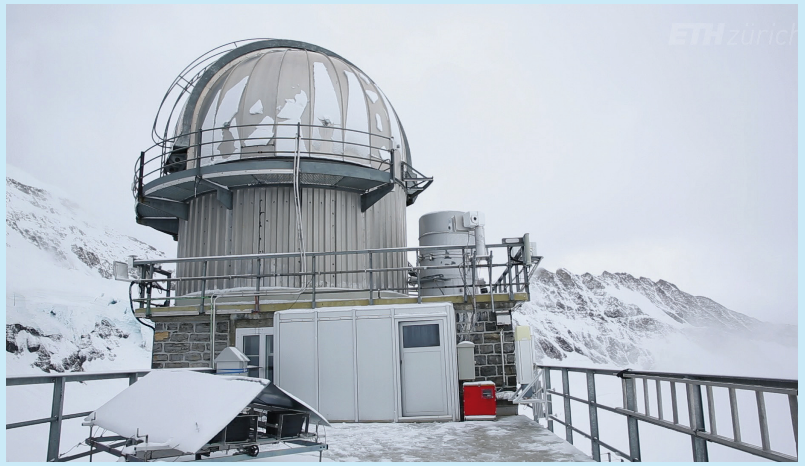
## Outreach

**«Vacuum cleaning on Jungfraujoch», ETH workshop interview with Professor Ulrike Lohmann**

Visiting the «Top of Europe», the Jungfraujoch in the Swiss Alps (3600 meters above sea level), Ulrike Lohmann, Professor for Atmospheric Physics, explains in an interview what a cloud is, how aerosols (particulate matter) interact with clouds, how rain forms and why clouds can be dangerous for airplanes in certain situations.
In a current research campaign on Jungfraujoch, a newly developed cloud chamber is tested. Lohmann and her team use that to simulate cloud processes. This «oversized vacuum cleaner» sucks ambient air and detects in the inner part of the chamber if certain aerosols form ice crystals or not. The researchers notice that humans pollute air and so affect clouds. However, aerosols not only interact with clouds, they also cool the climate like a parasol and thus mask the warming effect of greenhouse gases like $CO_2$. Lohmann explains why we still should try hard to reduce aerosol emissions: climate and health protection only work together if both aerosols and greenhouse gases will be reduced. Looking at the wonderful glaciers surrounding the Jungfraujoch, she hopes that this will be done sooner rather than later.

**ETH-Werkstattgespräch**
http://vimeo.com/104689819

Werkstattgespräch with Ulrike Lohmann.
Photo: Oliver Stebler, ETH Zürich



«Top of Europe», the Jungfraujoch.
Photo: Oliver Stebler, ETH

**Authors and Institutions:**
Contact: Ulrike Lohmann, ETH Zurich, phone: +41 44 633 05 14, www.iac.ethz.ch/groups/lohmann
The event was organized as part of the OPTIWARES project: www.cces.ethz.ch/projects/clench/optiwares

## Research

### New technology for detecting precursor events preceding rapid landslides

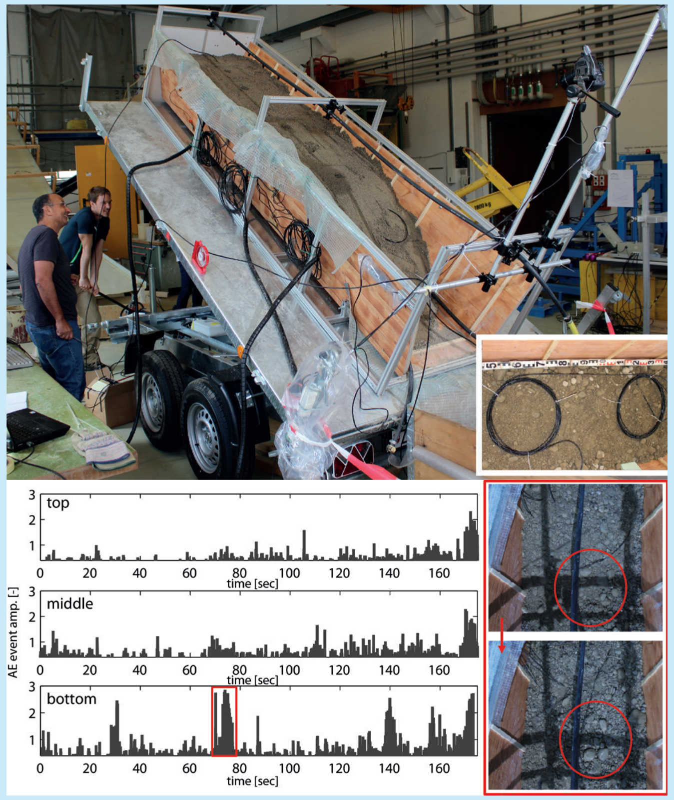
Heavy rainfall events may create conditions for abrupt release of shallow landslides often occurring with no warning or any visible precursory signs. This reality limits the potential for early warning systems based on monitoring of gradual changes. Evidence suggests that preceding catastrophic landslide release, minor events such as breaking of roots and grain rearrangement gradually contribute to damage accumulation in the soil. These small cracking events (analogous to tiny earthquakes) release elastic waves known as acoustic emissions (AE) at frequencies of 10-1000 kHz. Until recently, the practical application of AE measurements at operational scales (a hillslope or small catchment) was prohibitive by the large number of sensors required to overcome the high attenuation of AE signals in soil while providing coverage. This may change with the introduction of a novel fiber-optic technology for acquiring spatially and temporally resolved AE information over large distances (iDASTM, Silixa, UK www.silixa.com/technology/idas).

We recently evaluated the new fiber-optic distributed acoustic sensor (DAS) technology as AE detection system in a study funded by CCES (www.cces.ethz.ch/projects/hazri/tramm) and the Swiss National Science Foundation. We employed an artificial slope (soil-filled chute 3m x 0.5m x 0.5m) with embedded iDAS system alongside an array of piezoelectric point sensors. The slope was sprinkled at high rainfall rates while monitoring water content, capillary pressure, and acquiring time-lapse images. Observed «landslides» were preceded by surface deformation with increased water saturation in the soil, and concurrent elevated AE activity. The observed AE generation rates were accelerated dramatically immediately before slope failure in agreement with theory. The recorded AE signals by both AE systems (fiber-optic and piezoelectric) were consistent and provided a similar account of landslide failure dynamics.

The results of this test are encouraging and mark a small step towards addressing the challenge of monitoring precursors to catastrophic landslides in susceptible regions (along human dwelling and critical infrastructure in steep terrain). Nevertheless, the test has shown that the handling of massive data streams produced by the iDAS system, AE signal interpretation and conversion into mechanical status, and derivation of actionable hazard indices, require multidisciplinary effort to transform this new technology into landslide early warning systems.

The study makes part of the TRAMM-2 project: www.cces.ethz.ch/projects/hazri/tramm

**Contacts**:
Dani Or, dani.or@env.ethz.ch, Soil and Terrestrial Environmental Physics, ETH Zurich, phone: +41 44 633 60 15 and Gernot Michlmayr, gernot.michlmayr@env.ethz.ch




Experiment at lab of WSL to measure acoustic emission (AE) during triggering of mass release. Top: The slope of a chute filled with coarse soil was elevated to a target value (350-400) and water was subsequently added by intense sprinkling until slope failure occurred. The inset shows loops of the iDAS fiber-optic cable for detecting AE. Bottom: Time series of observed AE signals by the iDAS at three locations within the chute during the three minutes just before landslide. Images confirm that episodes of high AE activity corresponds to small precursory failure events as seen in the example with a small failure at the toe (see gravel deposited at the toe) after 70 seconds highlighted in red.



### Modeling spatio-temporal dynamics of global wetlands

Natural wetlands represent one of the largest sources of biogenic methane to the atmosphere. A better understanding of the trends and interannual variability of wetland extent and methane production is needed to interpret the dynamics of atmospheric methane concentrations. The CCES MAIOLICA-2 project was designed to improve our understanding of these key aspects by using diverse modeling techniques. Here, we present our progress on estimating the spatio-temporal dynamics of global wetland extent for the globe.

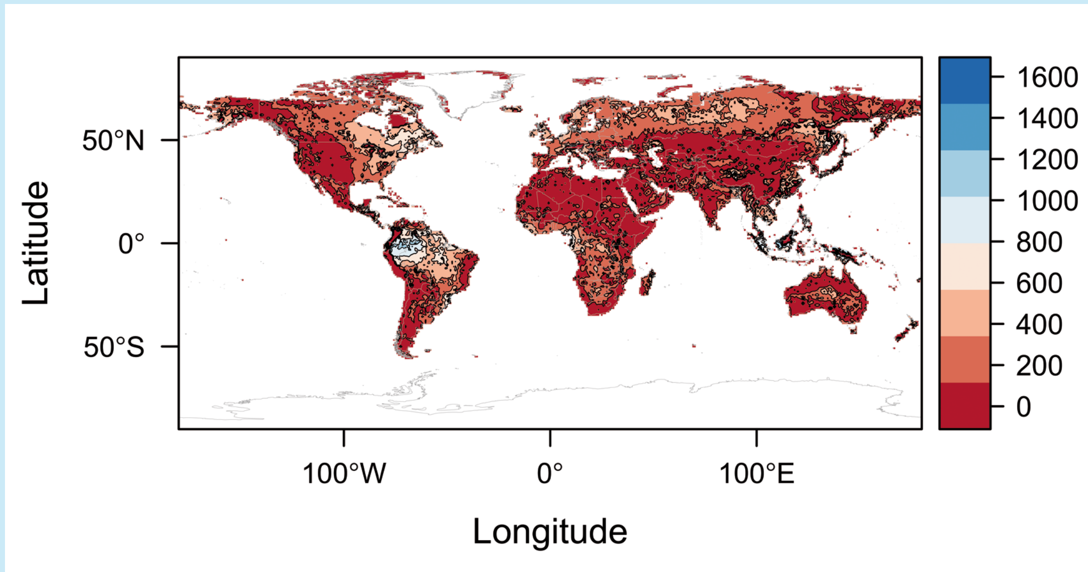
To balance the computational cost of representing the fine sub-grid hydrological characteristics at global scale, we investigated a relatively new approach using TOPMODEL. The TOPMODEL approach describes the wetness of each grid by using the so-called «Compound Topographic Index» (CTI) and is a cost-efficient hydrological framework coupled with fine sub-grid land topography, surface water processes, and an optimized algorithm. We used a hydrologically correct, state-of-art DEM from the Global Multi-resolution Terrain Elevation Data (GMTED), in order to derive CTI.

We modify TOPMODEL to include an up-scaling approach that approximates the distribution of CTI values within a global grid (0.5°) by using an improved exponential function, which links the wetland fraction directly to a hydrological predictor of water table depth (WTD) at the sub-grid scale of 1km². This new framework was implemented within the dynamic global vegetation model LPJ-WSL with preliminary results showing that the major distribution of seasonally varying wetland and peatland areas can be well approximated, with mean annual average of 12.1 ± 0.9 million km² wetlands, while a satellite inventory suggests 12.6 ± 0.8 million km².

The coupled LPJ-WSL TOPMODEL approach is being further developed to predict the spatial distribution of wetland across major temperate, tropical and boreal wetland complexes. In addition to an improved methane emission dynamics also under development as part of MAIOLICA, this approach provides a new opportunity to investigate the mechanisms of carbon cycle feedbacks between wetland/peatland and the atmosphere under future climate projections.

The study makes part of the MAIOLICA-2 project: www.cces.ethz.ch/projects/clench/MAIOLICA-2

**Contacts**:
Zhen Zhang, Swiss Federal Research Institute WSL & Montana State University, zhen.zhang@wsl.ch;
Niklaus E. Zimmermann, Swiss Federal Research Institute WSL, niklaus.zimmermann@wsl.ch;
Benjamin Poulter, Montana State University, benjamin.poulter@montana.edu




LPJ-WSL TOPMODEL simulated mean annual wetland area (unit: km²) at 0.5°×0.5° resolution for 1993-2013.