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FS 3.201
Treasures from the past

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3.201: Treasures from the past: using archival information to quantify environmental change in mountains

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Details

Full Title
FS 3.201: Treasures from the past: using archival information to quantify environmental change in mountains

Scheduled
Talks:
2025-09-17, 10:00 - 12:00 (LT), **SOWI – UR 1**

Convener
Abermann, Jakob

Co-Convener(s)
Nussbaumer, Samuel; and Skokanová, Hana

Assigned to Synthesis Workshop

Thematic Focus
#IMC25, Archaeology, Atmosphere, Cryo- & Hydrosphere, Ecosystems, History, Monitoring, Paleoperspective

Keywords
archival data, long-term environmental change

Description

Mountain regions of the world undergo drastic changes that are visible across system components. Our methods for quantifying these changes have become more complex and allow for higher resolution than ever before. While changes are drastic, they often occur at subtle rates and particularly past information is limited. Hence, long-term baseline data is crucial to set the current changes in perspective. While several very useful base resources exist, created with immense personal and financial investment, other data are stored in archives, cumbersome to digitize and not easily accessible to the public. In this session we invite contributions across disciplines that have the exploitation of hitherto un- or little used historical data in common, be it historical aerial photographs, weather observations, sketches, paintings or traditional written sources. We propose to highlight the potential of such historical datasets to improve our system understanding of vulnerable mountain environments. In addition, such data provide a diverse insight into the interaction between people and the mountain environment, which in turn allows discussions from different perspectives on the human perception of mountain environments through time. We believe that by lifting these archival treasures, by making them accessible in a standardized, state-of-the-art manner and by creating a scientific discourse across disciplinary boundaries, their use can be multiplied and their value increased.

Registered Abstracts

Search Session Abstracts

Date/time indicate the presentation; if available: the bracketed duration is added for end-of-presentation Q&A.

ID: 3.8729

SOWI – UR 1 | 2025-09-17 10:00 - 10:08 (+2min)

Müller, Lukas

Quantifying surface runoff in Alpine catchments from historical forest use data on the basis of an expert system

Müller, L.

Meißl, G.; Schrott, R.; Gröber, M.; Kohl, B.; Markart, G.; Scharr, K.; Katzensteiner, K.; Simon, A.; and Geitner, C.

ABSTRACT/DESCRIPTION

Secondary forest use practices such as removal of the forest floor for the purpose of bedding in stables (litter raking, lopping), and forest grazing not only interfered with the nutrient balance of the forest, but also influenced their rainfall-runoff reaction, possibly until today. To quantify this hydrological impact, within the HILUC (Hydrological Impact of Historical Land Use and Climate) project a hydrological modelling approach is used to reconstruct surface runoff patterns in small Alpine catchments in the time periods around1850, 1960 and 2020. Therefore, an expert-system is developed, based on the 'Code of Practice for the Assessment of Surface Runoff Coefficients' of Markart et al. (2004, 2011), data from the BFW rain-simulation experiment database, especially of experiments at about 100 forest sites in the Eastern Alps, data from literature and expert assessments in the field. With regard to historical land use, 'translation keys' have been developed for the textual description of land use practices. Land use data for the period around 1850 has been stored in archives in the form of forest descriptions and corresponding maps. The period around 1960 is characterised by the first availability of aerial photographs and local inventory data. The current situation of land use and the corresponding surface runoff disposition is essential as a basis for reconstructing the past, which is why a detailed mapping of the catchment areas in terms of relief, soil and vegetation was carried out in the field using PSINOT, the comprehensive surface runoff coefficient map for North Tyrol, as a reference. The resulting surface runoff coefficient maps taking into account the historical land use for the respective time steps are used as input parameters for rainfall-runoff modelling with the conceptual model ZEMOKOST in order to quantify the impact of the historical land use practices.

ID: 3.10364

SOWI – UR 1 | 2025-09-17 10:10 - 10:18 (+2min)

Skokanova, Hana

Historical analyses of former land uses & habitats for habitat restoration

Skokanova, H.

Havlíček, M.; Svoboda, J.; and Slach, T.

ABSTRACT/DESCRIPTION

The landscape has been changing over millenia but with increasing anthropogenic pressure, this change has accelerated, leading to a significant degradation of habitats and loss of their connectivity. Use of historical topographic maps, especially those produced from 19th century can show us how the (semi)natural habitats used to be spread and interconnected over different types of landscape. Such information can help us not only to understand what we have lost but also where we can target our efforts to preserve and restore degraded habitats and thus increase biodiversity. On the example of five diverse pilot regions from the Central Europe, we will show how the landscape has changed over the last 200 years. From seascape to highest peaks in Slovenia, from lakelands in Poland to mountains in Bavaria and Czechia, we will search what are the common traits of these changes and what are their differences.

ID: 3.10656

SOWI – UR 1 | 2025-09-17 10:20 - 10:28 (+2min)

Schrott, Roman

Combining historical data with field experiments to quantify the influence of historical forest use practices on carbon fluxes from Alpine forest ecosystems to agricultural land.

Schrott, R.

Katzensteiner, K.; Gröber, M.; Müller, L.; Simon, A.; Scharr, K.; Meißl, G.; Markart, G.; Kohl, B.; and Geitner, C.

ABSTRACT/DESCRIPTION

In the past, forests in Central Europe were used for more diverse purposes than they are today. Forest utilisation practices such as litter raking and lopping were widespread and practiced until the middle of the 20th century. Litter raking means the collection of forest litter with small iron rakes by farmers, who needed bedding for their animals. The mixture of excrements and litter was later used as fertiliser for the fields. Lopping is the chopping off of branches from living trees. Lopping of broadleaf trees was practised for animal feed, lopping of conifers for bedding material. In total, a lot of material and thus carbon and nutrients were transferred through these practices from the forest into the agricultural system.

In Tyrol, detailed inventories of the forests were carried out around 1840, containing various information about the forest condition and management. Timber stocks, annual timber increment and harvest quantities were recorded, but also the annual amounts of biomass removed through litter raking and lopping. The recordings are accompanied by corresponding maps, that enable a clear spatial allocation of this information.

In order to investigate the ecological consequences of litter raking, field experiments were carried out on two test sites in the montane and subalpine altitudinal zones in Tyrol. To enable a differentiated quantification of the carbon stocks, ground vegetation, ecto-organic layers and mineral soil were sampled on random distributed sampling points. Additionally, we conducted a onetime litter raking intervention on randomly distributed 1 m^2 plots. We determined the weight of the removed organic material in the field and took subsamples to analyse the carbon content using an elemental analyser.

Combining historical inventory data with results from the field experiments and laboratory analyses enables a quantification of the historical carbon fluxes from forest to agricultural ecosystems. This transfer of significant quantities of carbon and nutrients over centuries has strongly influenced both ecosystems for a long time with impacts persisting until today. These new data improve our understanding of the impacts of historical forest management in favour of agriculture on recent forest condition and provide background information for current sustainable forest management decisions.

ID: 3.9638

SOWI – UR 1 | 2025-09-17 10:30 - 10:38 (+2min)

Nesje, Atle

Rediscovery marks established by Johan Bernhard Rekstad around the turn of the 20th century to measure frontal variations of outlet glaciers from the Jostedalsbreen Ice Cap in western Norway

Nesje, A.

ABSTRACT/DESCRIPTION

Around the turn of the 20th century, the first state geologist at the Geological Survey of Norway, located in Kristiania (Oslo) at that time, Johan (also sometimes named John) Bernhard Rekstad (2 October 1852 – 1 April 1934) established permanent marks to be used for frontal measurements of outlet glaciers from the Jostedalsbreen Ice Cap. In total, he established 29 marks at 15 outlet glaciers from the Jostedalsbreen Ice Cap. The exact location of only a few of these marks have been known by still living local inhabitants and scientists. Therefore, the authors started a search for these marks some years ago, and at present (2025), 15 marks in front of 11 of the outlet glaciers have been found and documented by exact location (coordinates and altitude) and photos.

ID: 3.9732

SOWI – UR 1 | 2025-09-17 10:40 - 10:48 (+2min)

Nordkvelle, Trine

Thomas Fearnley and the Frozen Giant. “The Grindelwald Glacier” (1838) as witness to climate change.

Nordkvelle, T.

ABSTRACT/DESCRIPTION

In the summer of 1835, the Norwegian artist Thomas Fearnley (1802–1842) visited the Bernese Alps. On his route he seems to have been particularly interested in the advancing glaciers in the region. After making sketches of the glaciers of Rhone and Rosenlaui, he arrived at the Upper Grindelwald Glacier on the 17 August. Here he made a pencil drawing that would serve as the basis of one of his major works, The Grindelwald Glacier, completed in 1838.

At Fearnley’s time the two glaciers of Grindelwald reached all the way down to the bottom of the valley. As previously shown by dr. Heinz Zumbühl (2016), Fearnley’s drawing and painting hereby serves as a visual document of the glacier near its greatest extension. Today the painting of the once so grandiose glacier stands at a material witness to the Little Ice Age and a symbol of the climate crisis.

In this paper I will show how Fearnley built the composition from preliminary drawing to finished work. Using drawings, oil sketches and infrared photography I will reveal his compositional choices and demonstrate the interplay between reality and artistic license. Moreover, I will discuss how the context of early 19th century geological discourse and view of nature can increase our understanding of the painting, as well as Fearnley’s perception of the Alpine glaciers as a Nordic artist. With an ecocritical approach, I will address how the value of the artwork moves beyond the role as a historical document or an image of sublime scenery, but also serves as an interlocutor to the converse of human interaction with the mountain environment 200 years later.

ID: 3.11232

SOWI – UR 1 | 2025-09-17 10:50 - 10:58 (+2min)

Nussbaumer, Samuel U.

Pictorial sources in glaciology: from the icy splendour of the Little Ice Age to the melting glaciers of today

Nussbaumer, S. U.

Frochot, A.; Holzhauser, H.; Wipf, A.; Wolf, R.; and Zumbühl, H. J.

ABSTRACT/DESCRIPTION

Alpine glaciers are precious witnesses to the Earth's climatic past. Many of them have been documented in vast collections of texts and images since the modern era, when they gradually ceased to be perceived as repulsive and hostile places, and became fields of scientific knowledge linked to the demonstration of the theory of ice ages. In the early period, the perception of glaciers was dominated by fear, but later, during the Age of Enlightenment and in the 19th century, it changed to fascination. Several decades ago, historical glaciology discovered glacier images as valid sources reconstructing past glacier extent, which can also be easily combined with geomorphological and other evidence.

Our interdisciplinary approach examines the historical attention paid by naturalists to glaciers and their visual representation from the 17th century to the present. A key element is the systematic evaluation and study of historical images, which have proved very valuable in reconstructing the extent of selected Alpine glaciers during the Little Ice Age. Such reconstructions are only possible for certain glaciers that have achieved the necessary degree of fame to attract early travellers, scientists, and artists.

For the western and central European Alps, the resulting glacier records, based on historical images, date back to the 16th century and show that the current glacier retreat is unique in historical times. Today, the global retreat of glaciers serves as a warning signal for the current climate change with its dramatic effects on humans and the environment. The visualization of glacier change through images can also help to communicate the radical warming of the climate to a wide range of people.

ID: 3.11810

SOWI – UR 1 | 2025-09-17 11:00 - 11:08 (+2min)

Abermann, Jakob

Post-war aerial imagery of the Austrian Alps from 1945 for quantifying glacier changes

Abermann, J.

Bolch, T.; and Schöner, W.

ABSTRACT/DESCRIPTION

During summer 1945, the US Army Airforce used fighter planes adapted for then state-of-the-art photogrammetry to capture aerial imagery for most of Europe under the project 'Casey Jones'. In the Austrian Alps this was done in August 1945, coinciding with the timing of minimal seasonal snow coverage. While the imagery of other countries has been processed already, the one from the Austrian Alps remains undigitized, waiting in archives to be unveiled. Within the presented project we aim at processing the historical imagery for the Austrian Alps applying modern georeferencing techniques and providing both imagery and DEMs for the public. With this dataset we aim at refining our understanding of post-little ice age (LIA) glacier changes comparing the derived glacier extent from 1945 with a series of glacier inventories that exist for Austria (LIA, 1969, 1998, 2006) and further archival information. Rates of area and volume change will be assessed, and spatial modelling used to determine performance on a regional scale. Further topics such as snow distribution, river network, infrastructural changes and tree-line evolution can lead to a wider application of the dataset. In this contribution we will present the current challenges and future perspectives of this recently launched project.

ID: 3.11871

SOWI – UR 1 | 2025-09-17 11:10 - 11:18 (+2min)

Chakraborty, Elora

Use of multi-proxy dating approach in defining the timelines of post-LLGM glacial and periglacial processes in the Higher Himalayan Miyar watershed, Chandrabhaga Basin

Chakraborty, E.

Das, S.; Manna, I.; Sharma, M. C.; Kumar, P.; Singh, A. K.; and Rathore, M. K.

ABSTRACT/DESCRIPTION

Located between the Pir Panjal towards the south and the Greater Himalaya to the north, the high altitude mountain region of the Chandrabhaga basin reflects average elevations of ~4000 m asl and the highest peaks at ~5500-6000 m asl. The region has historically experienced a transitory climate with periods of intensification of the Mid Latitude Westerlies (MLW) and the Indian Summer Monsoon (ISM). The region presently bears 845 glaciers of varying sizes. Paleoclimatic studies using OSL and CRN 10Be dating techniques, suggest of several episodes of glacial expansion since LLGM. The basin, majorly composed of Higher Himalayan Crystalline rocks, preserves evidences of the continuum of glacial, paraglacial and periglacial processes. Preliminary studies relied heavily upon geomorphological mapping and discrete OSL dating from a Lacustrine formation, which placed Khanjar stage of glacial expansion at early Holocene ~8-6 ka. The dates also suggested of glacial expansion in the Gumba-Chaturdhani glacier complex between ~8-6 ka and subsequent proglacial lake formation. Adoption of OSL dating approach from sampling location ~250 m apart, reveals the longevity of the lacustrine formation on the trunk valley between ~30-6 ka, post LLGM (~35 ka), presumably due to glacial blockade. The disparity in the dates from largely the same location can be explained through the processes active on the landscape, selection of sampling sites and nature of zeroing of Quartz before deposition. However, the revelation of older Radiocarbon (14C AMS) dates calibrated for age depth from an identified thermokarst lake, formed on water-vacated lacustrine sediment section at the same site on a higher elevation; reveals the initiation of periglacial activities at ~22,000-23,000 cal yrs BP from a section ~1 m from the top and continuation until recent times with periods of lull in between. These periods of quiescence in periglacial sedimentation rates indicate onset of weaker glaciations, not potent enough to wipe out the sediment assemblage. The Gumba thermokarst lake has been continuously fed by permafrost melt-waters from Turf Bank Lobe type Solifuction lobes, making the chronological reconstruction of the succession of glacial-postglacial and periglacial Quaternary processes possible.

ID: 3.11332

SOWI – UR 1 | 2025-09-17 11:20 - 11:28 (+2min)

Vollmer, Isabel

Precious Ice. Commercial Ice Harvesting on the Grindelwald Glaciers

Vollmer, I.

ABSTRACT/DESCRIPTION

Before the development and spread of artificial ice and technical refrigeration, natural ice was used for cooling purposes. The ice from lakes, pounds and glaciers was not only used to cool food and beverages, but also for medical and even representative purposes. At the Lower and Upper Grindelwald Glacier in the Swiss Bernese Alps the commercial ice harvesting began in the second half of the 19th century and lasted until around 1930. It was not only the easy access to the ice masses that fostered the industry, but also tourism and the associated development of the infrastructure. One of the main features of the Grindelwald ice trade is its focus on exporting ice, not only to Swiss cities but also abroad.

How the ice harvesting took place in Grindelwald is at the centre of this contribution. The analysis is based not only on written sources and various photographs, but also on traditional tools. These provide information on how the large blocks of ice were detached from the glaciers. However, commercial ice harvesting on the Grindelwald Glaciers also had an impact on the environment. This led to concerns by some residents that ice harvesting could have a negative impact on the view of the glaciers, which would also have negative consequences for the important tourism industry. In addition, various transport systems were constructed between the Lower Grindelwald Glacier and the village of Grindelwald in order to transport the ice blocks more quickly. These left marks on the landscape, some of which are still visible today.

With the retreat of the glaciers into areas that were difficult to access as well as the spread of artificial ice and technical refrigeration, the commercial ice harvesting on the Grindelwald Glaciers came to an end.

ID: 3.13495

SOWI – UR 1 | 2025-09-17 11:30 - 11:38 (+2min)

Ravanel, Ludovic

Shifting uses of three French natural ice caves over centuries

Ravanel, L.

Gauchon, C.; and Flinois, G.

ABSTRACT/DESCRIPTION

Ice caves are underground cavities whose morphology creates microclimatic conditions that favor the development or maintenance of perennial ice accumulations (glacial ice or water ice). While primarily found in mountainous regions, they are often located in areas where the average surface air temperature is positive. As such, they are considered 'periglacial' phenomena situated beyond the typical boundaries of the cryosphere, with ice caves acting as natural cold traps. Historically, the ice from many ice caves was harvested to supply dispensaries and inns, sometimes located dozens or even hundreds of kilometers from the original cave. Although this practice continued until the early 20th century, the use of ice caves, as highlighted by various historical accounts, has often evolved in response to new demands, influenced by the accessibility and characteristics of the sites. This presentation examines how the use of three French ice caves has changed over the past few centuries: the Grotte de la Glacière in Chaux-lès-Passavant (Jura Massif, Doubs), the Grande Glacière du Parmelan (Bornes Massif, Haute-Savoie), and the Cave à Glace d'Anterne (Fiz Massif, Haute-Savoie). Their varying altitudes and degrees of accessibility have led to very distinct historical trajectories.

ID: 3.13510

SOWI – UR 1 | 2025-09-17 11:40 - 11:48 (+2min)

Sanseverino, Mary

The Mountain Legacy Voices Project: Past and present mountain voices speak to the future

Sanseverino, M.

Higgs, E.; Robinson, Z.; and Walsh, K.

ABSTRACT/DESCRIPTION

For almost 30 years the Mountain Legacy Project (MLP) has been using repeat photography to examine landscape level change in the Canadian mountain west. Working with Library and Archives Canada, provincial archives, museums, and individuals to uncover historical mountain images, MLP teams seek to determine the location they were taken from, go to the same place, and rephotograph them as accurately as possible. The historic and modern images are then aligned, analyzed, and made available for use by scholars, students, government agencies, the public at large – in fact, anyone interested in exploring Canada's mountain heights.

MLP repeat photography has been used in many forms, most of which have been well placed in academic and land-management venues. But as climate change overtakes us we need to tell mountain stories that reflect the awe of experiences in mountains, and reminds us what is at stake in a rapidly warming world.

We will unveil for the first time our Mountain Voices project, a book-length tribute to the mountains of western Canada. Fifty authors are matched to fifty pairs of historic and repeat images to create compelling narratives of change. The "head" (the science of Mountain Legacy repeat photography) is joined to the "heart" (personal essays on the transformative power of mountains). The result is a compelling new work which directly lifts and connects extensive mountain archival imagery with a diverse range of personal mountain interactions.

The themes unlocked through these historic/modern images pairs include: Indigenous ways of knowing the land, national history, forest ecology, glaciology, wildfire science, geology, anthropology, spirituality – to name just a few. Through the lens of several "head + heart" themes this session will lay out the processes, digital assets, and networks behind each. It will end with a call to the challenging task of reaching out to those who care deeply about mountain homelands and environments.