

CLOSE TO THE STARS

HIGH ALTITUDE RESEARCH STATION
GORNERGRAT



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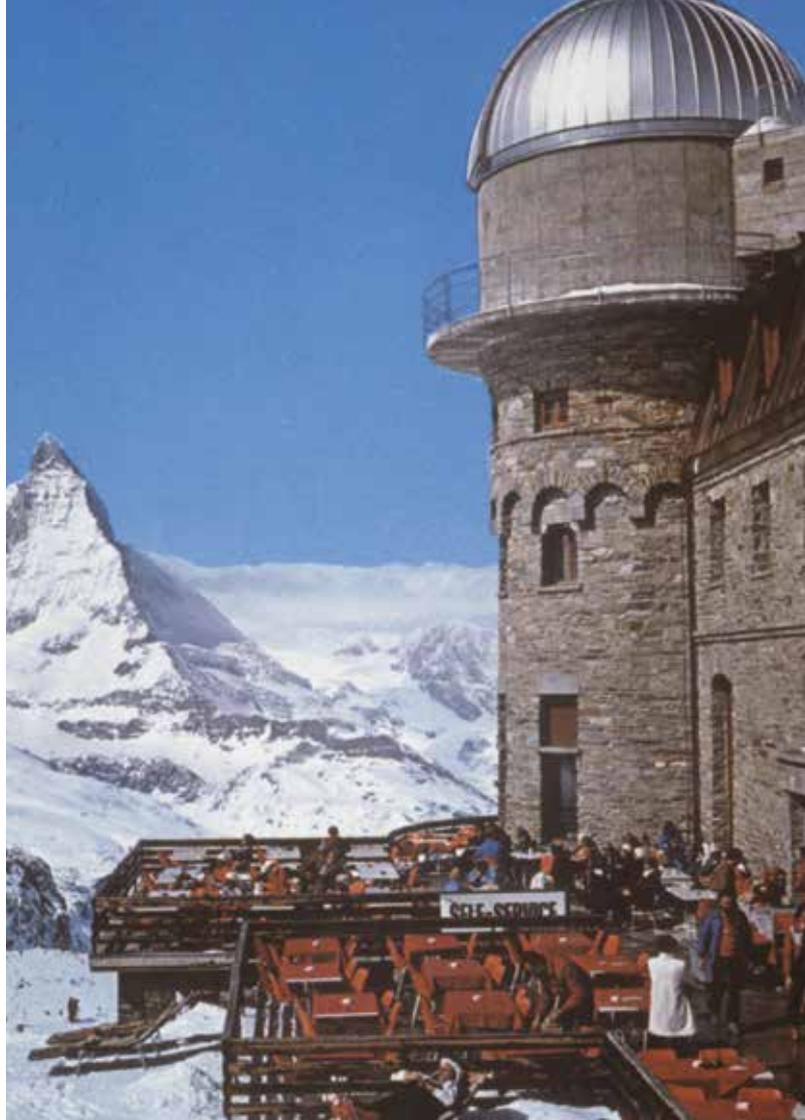
A SISTER FOR JUNGFRAUJOCH

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Research at Gornergrat and Jungfrauoch are closely related. In the early 1960's there was such a run of astronomers at Jungfrauoch that a similar research station was opened at Gornergrat. It was an ideal site at the elevation of 3100 meters above sea level along with unpolluted, dry air and favorable meteorological conditions. In addition, the Kulmhotel and the year round accessibility by rail made it a truly ideal setting for astronomical observations. In 1966/67 the two towers of the Kulmhotel were outfitted for use as astronomical domes with the support of the International Foundation (HFSJ). The foundation provided the administration of the observatories and in 1973 expanded its name to International Foundation High Altitude Research Stations Jungfrauoch and Gornergrat (HFSJG). Later, in 1979 the Gornergrat Railway and in 1991 the civic community of Zermatt became members of the foundation.

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The Kulmhotel was built between 1897–1907 and is the mountain destination of the Gornergrat Railway. The hotel is open to guests in the summer and winter seasons. (Picture: © HFSJG)





OBSERVATORY IN A HOTEL TOWER

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The high altitude and dry air at Gornergrat make it the ideal site for radio astronomy research as well as for observations in the infrared range. To make use of these advantages, the two towers of the Kulmhotel were outfitted in the 1960's for use as observatories. The south tower was transformed into an astronomical observatory used by the Observatoire de Paris, the Observatoire de Genève and the Institut d'Astrophysique de Paris for photometric studies. In the north tower the University of Oxford used a specialized spectrograph for solar observations. Later, in 1979 the Italian Consiglio Nazionale delle Ricerche installed a telescope in the north tower for observations in the infrared range. Starting in 1984, the Universität zu Köln built a radio telescope in the south tower. Although the requirements of modern research are no longer fully met with the infrastructure at Gornergrat, the universities of Bern and Geneva have been making use of the facilities with the Stellarium Project to make astronomy accessible to the general public since 2017.

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The Gornergrat south observatory has a cupola with a radius of 7.5 meters and a control room. It currently houses the telescope of the Stellarium Gornergrat public outreach project. (Picture: © Michael Affolter)

CLIMATE CHANGE AND PREVENTION OF NATURAL HAZARDS

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The Stockhorn is on the east end of Gornergrat, part of the high alpine area surrounding Zermatt. This area is known for its slopes of rock and debris that are permanently frozen, a condition called permafrost when the ground temperature is always below 0 °C. Since 2000 the PERMOS network has systematically studied permafrost at several locations in Switzerland with various measurements, such as the ground temperature in deep boreholes, the ice content of the ground or the speed of crawling permafrost. Two boreholes below the Stockhorn at an altitude of 3415 meters above sea level with depths of 17 and 98 meters have been used since 2002 to measure the ground temperature. Since then a continuous increase of more than 0.5 °C has been registered at a depth of 20 meters. Permafrost measurements document climate change and provide information for protection against natural hazards. Moreover, these measurements are invaluable for monitoring the stability of rock and stone formations.

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The Stockhorn measurement station east of Gornergrat is one of 14 sites operated by PERMOS (Permafrost Monitoring Switzerland), which coordinates permafrost measurements in Switzerland. (Picture: © Martin Hoelzle)



GLOBAL CHANGE AND ALPINE BIODIVERSITY

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Climate and land use changes are impacting biodiversity at high elevation in the Alps. Organisms living at high elevation suffer not only from climate warming but also from the abandonment of traditional farming practices that lead to progressive encroachment of alpine grasslands by woody vegetation. Summer and winter recreation activities, notably skiing, are also negatively affecting Alpine wildlife. It is of paramount importance to differentiate between these various factors at play in order to draw meaningful predictions of responses to environmental change and to develop sound conservation action plans for this invaluable flora and fauna. The Division of Conservation Biology of the University of Bern is carrying out studies of endangered species of birds from the timberline to the high alpine zone, as illustrated here by the white-winged snow finch in the Gornergrat area. During the reproduction period, the parents provision prey to their chicks that is mostly picked up at the front of the melting snow patches. If snow cover and phenology dramatically change, the survival of this emblematic species may be compromised in the Alps.

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The white-winged snow finch shows several adaptations to harsh conditions. (Picture: © Stéphane Mettaz, University of Bern)



PROFESSIONAL OBSERVATORY FOR HOBBY ASTRONOMERS

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At the Stellarium Gornergrat researchers share their enthusiasm and knowledge of astronomy, space research and natural sciences with the general public. The observatory is set up for educational purposes in the south tower of Kulmhotel Gornergrat and has been in operation since 2017. Its goal is to give children of school age, as well as a wider public a greater understanding of these fascinating subjects. The Stellarium was made possible by the universities of Bern and Geneva and is financially supported by the Foundation HFSJG and the civic community of Zermatt. The unique site at 3100 meters above sea level, combined with high quality equipment, make the Stellarium one of the best observatories open to the public in central Europe. In cooperation with other institutions, various interesting activities and attractions have been created and are available for interested visitors at Gornergrat. To top it all, the Stellarium can be visited via web portal for use in the classroom.

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With the reflecting telescopes at the Stellarium Gornergrat observations can be on site or via web portal. Observation of planets, the Moon or even larger astronomical objects, such as galaxies, is possible.
(Picture: © Stellarium Gornergrat)





ATTRACTIONS ON SITE AT GORNERGRAT

“Dining with the Stars”: Every Thursday evening, from January to March a starlight dinner is served followed by a visit to the observatory cupola and observation of visible constellations.

“Space Trip”: During one week in autumn, guided tours are offered twice a day. The late afternoon tour is a visit to the observatory and control room. In the evening, there is laser-guided viewing of the sky followed by observation with the telescope in the cupola.

Tours led by scientific experts can be organized upon request for groups of 10 or more.

The web portal to Stellarium Gornergrat is open year round, especially for teachers, students and pupils, as well as to all interested persons in Switzerland. Educational activities are available through a user account, such as drawing up observation plans for the starry heavens that can be carried out automatically. In the process, spectacular pictures appear that can be downloaded on the user’s computer.

www.stellarium-gornergrat.ch

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Gornergrat is an ideal site for astronomical observations, thanks to the high altitude and the clean, dry air, as well as to favorable meteorological conditions. (Picture: © Stellarium Gornergrat)

ALPINE ICE CORES AS AN ARCHIVE OF THE ENVIRONMENT

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The oldest ice ever found in the Alps originates from the Colle Gnifetti glacier. Its plateau at 4450 meters above sea level forms the upper end of the Grenzgletscher, which flowed into the Gornergletscher up until a few years ago. Since the middle of the 1970's, various research groups have drilled ice cores of about 100 m in length to examine atmospheric impurities trapped inside. These studies show that the oldest ice near the subglacial bedrock dates back to the last ice age. The measurements provide the basis for constructing a chronology of various atmospheric pollutants, such as sulfate, which was considered to be the cause of acid rain in the 1980's. Lead, a heavy metal, is another example of a substance that was released into the atmosphere when leaded gasoline was in use. Even emissions from atomic bomb tests or the accident in Chernobyl leave evidence of such events in this environmental archive. Analysis of the ice can also be used to estimate the temperature in past times.

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Ice cores are a unique archive of the climate and environment. For instance, the so-called isotopic composition of water molecules in ice can be used to reconstruct the temperature in the past.

(Picture: © Paul Scherrer Institute/ Beat Gerber)





ICE MEASUREMENTS ON FINDELENGLETSCHER

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Findelengletscher, located a few kilometers east of Gornergrat, is a typical valley glacier with a large accumulation zone and a distinct glacier tongue. Detailed studies on the influence of water on the flow behavior of the ice were started in the 1980's and 1990's. Since 2004 the mass balance of Findelengletscher has been monitored by the Swiss glacier monitoring network (GLAMOS). The amount of snow in April of every year and the melting over the entire glacier in late autumn are measured. This data confirms that Alpine glaciers are presently losing mass at an accelerated pace due to climate change. In extreme years, up to 10 meters of ice melt at the glacier terminus. In addition to measurements of the mass balance, changes in the length of Findelengletscher have been observed since 1885. The measurements indicate that the glacier has receded almost three kilometers since then, whereby half of the loss occurred during the last 30 years.

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Measurements on Findelengletscher began in 1885. Since then it has receded three kilometers. In total, the area of all Swiss glaciers has shrunk by one third during the last 40 years. (Picture: © Matthias Huss)

TOURIST MAGNET HIGH ABOVE THE OTHERS

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Zermatt had always been a secluded village until it became an upcoming summer resort town around the end of the 19th century. A milestone in this development was the construction of the Gornergrat railway. After two years of work, the railway was opened on August 20, 1898 with a length of nine kilometers between Zermatt and Gornergrat via Riffelalp and Riffelberg. The difference in altitude is almost 1'500 meters. In the early years the danger of avalanches allowed operation only during the summer months, but starting in 1928 the railway brought guests up to Riffelalp, opening Zermatt for winter sport. The Gornergrat railway was the first electric cogwheel train in Switzerland, and today it is the second highest railway in Europe, surpassed only by the Jungfrau railway. The exceptionally attractive destination Gornergrat led to the construction of the Kulmhotel, which is the highest in Switzerland and offers a breathtaking view of 29 mountain peaks that surpass 4000 meters in altitude.

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Summer or winter, Gornergrat attracts guests from all over the world. At 3100 meters above sea level they feel they can touch the sky. (Picture: © Roland P. Poschung (mua.ch/kulturonline.ch))





20/21

Civic community of Zermatt

PROMOTING TOURISM IN THE MOUNTAIN REGION OF ZERMATT

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The civic community of Zermatt is an association of the long-established families of the village and has around 1500 members. Zermatt itself became a municipality in 1969 with a population of 5700. The civic community contributes greatly to touristic, social and cultural development in Zermatt. Among other property, it owns the Kulmhotel Gornergrat with the two towers that are leased to the Foundation HFSJG. The Stellarium Gornergrat project is one of many projects significantly supported by the civic community to promote tourism in Zermatt. As early as 1864 the civic community purchased Hotel Riffelberg, which had been built by three clergymen. It was the first hotel in a series that continued with the construction of the Grand Hotel Zermatterhof 15 years later, built with voluntary work by members of the civic community. Today the civic community is the largest employer in Zermatt with over 300 employees during the peak season.

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This idyllic scene is misleading. The days are long gone when Zermatt was just a mountain village. Today it is one of the most popular destinations in Switzerland. No other location accommodates so many tourists per capita as the village at the foot of the Matterhorn.

(Picture: © Pascal Gertschen)

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