

Report of the Director

In a period of continued global recession, the International Foundation High Altitude Research Stations Jungfrauoch and Gornergrat HFSJG can nevertheless again present a positive and optimistic annual report. As documented by the individual summaries that have been prepared by the respective research groups, the scientific activity at Jungfrauoch and Gornergrat during the year 2009 was impressive both by the number of projects as well as by its high international standard. The main goal of the Foundation HFSJG, i.e. providing infrastructure and support for scientific research of international significance that must be carried out at an altitude of 3000-3500 meters above sea level or for which a high alpine climate and environment are necessary, was therefore again successfully pursued.

The Foundation HFSJG

On October 23, 2009, the Board of the Foundation HFSJG met at the Hotel Victoria-Jungfrau in Interlaken for its regular meeting. The president, Prof. Hans Balsiger, had the honor to welcome the members of the board, with a special welcome to the University of Bern as the newest member of the foundation, the president and the members of the Jungfrauoch Commission of the Swiss Academy of Sciences (SCNAT), the representatives of the Astronomic Commission HFSJG, of the Swiss National Science Foundation (SNSF), of the Swiss Academy of Sciences (SCNAT), two corresponding members HFSJG, and a small number of distinguished guests. Unfortunately, as of 2009 the Istituto Nazionale per l'Astrofisica (INAF) has no longer been a member of the foundation, although it is hoped that the Italians will return to the foundation sometime in the future. In his introductory report, Prof. Balsiger informed about the proposed changes in the directorship and the presidency of the foundation in consequence of the retirement of the director as a professor at the University of Bern, and about the new role within the foundation in this context of the University of Bern and its Physikalisches Institut. In the statutory part of the meeting, the annual activity report 2008, the statement of accounts for 2008, as well as the budget for the years 2010 and 2011 were approved unanimously and with no abstentions. The extensive and excellent scientific output that resulted from the research at Jungfrauoch and Gornergrat was recognized with great pleasure and satisfaction. Markus Leuenberger, professor in the department of Climate and Environmental Physics at the Physikalisches Institut of the University of Bern was elected as the new director of the research stations as of January 1, 2010. Prof. Heinz Hugo Loosli was honoured as a new corresponding member of the foundation. In recognition of his great past and expected future merits to the foundation, Prof. Hans Balsiger was elected by acclamation as honorary president HFSJG. In the second part of the meeting Prof. Bruno Messerli, world-famous geographer and former rector of the University of Bern, presented a scientific talk entitled "Mountains of the World - Water Towers for the 21st Century?", with special emphasis on the role of high alpine research sites such as Jungfrauoch. The board meeting was followed on the next day by a visit to the High Altitude Research Station Jungfrauoch, including highly appreciated expert information about the effects of climate change on the Grosser Aletschgletscher again by Prof. Messerli. During the meeting and excursion, the generous support by the Jungfraubahnen and the warm and benevolent hospitality at the Hotel Victoria-Jungfrau in Interlaken and at Jungfrauoch's Crystal Restaurant were highly appreciated.



Figure 1: Snapshot from the meeting of the Board HFSJG in Interlaken, October 23, 2009.

Under the chairmanship of Prof. Martin C.E. Huber, the Jungfrauoch Commission of the Swiss Academy of Sciences SCNAT, which looks after the interests of Swiss research within the Foundation HFSJG, took its position within the Academy's platform "Mathematics, Astronomy and Physics" ([Platform Mathematics, Astronomy and Physics \(MAP\)](#)). Activity in 2009 included participation in the project "Jungfrau Klimaguide", a public outreach initiative in the Jungfrau region by the University of Bern on the occasion of its 175-year anniversary (<http://www.jungfrau-klimaguide.ch/de/#/home/>). Under the leadership of the chairman and significant support by members of the commission, three slide shows were produced, each one in German, French, and English, for implementation on the iPhones used as electronic guides on the climate field paths: i) History of the Research Station on the Jungfrauoch, ii) Glaciology on the Jungfrauoch, and iii) Global Atmosphere Watch on the Jungfrauoch. At its meeting on October 23, 2009, prior to the meeting of the board HFSJG, the commission discussed the budget proposal to the Academy SCNAT for 2010 and approved the long-term planning for the years 2012-2015, including the year of the centennial of the Jungfrau Railway in 2012. A special working group was formed to plan the scientific contributions to the Jungfraubahn's jubilee activities. Participation in the "Symposium on Atmospheric Chemistry and Physics at Mountain Sites", organized in June 2010 in Interlaken by the SCNAT Commission on Atmospheric Chemistry and Physics (ACP), and in the project "Eiger-Klima-Schulen" of the BKW FMB Energie AG was discussed. Erwin Flückiger was nominated for endorsement by the Swiss Academy of Sciences SCNAT for the office of president of the Foundation HFSJG as of January 1, 2010. Prof. Markus Leuenberger and Dr. Brigitte Buchmann (EMPA) were nominated as new members of the commission.

The Astronomic Commission, which acts as a users' and science advisory committee to strengthen the Foundation's internal and external communication, met on December 14, 2009, in Bern. The meeting was called by Erwin Flückiger in light of his retirement as director of the research stations and the appointment of his successor, Prof. Markus Leuenberger, as of January 1, 2010.



Figures 2-5: Hans Balsiger, new Honorary President HFSJG, Markus Leuenberger, new Director of the research stations HFSJG as of January 1, 2010, Heinz Hugo Loosli, new corresponding member HFSJG, and Rolf Bütikofer, IT specialist HFSJG (from left to right).

The meeting of the Board and the General Assembly of the Sphinx AG took place at Jungfrauoch on June 19, 2009.

As of January 1, 2009, Dr. Rolf Bütikofer joined the administration HFSJG and acts as the IT specialist of the Foundation HFSJG. In addition, he is responsible for the continued operation of the neutron monitors at Jungfrauoch and the solar neutron telescope at Gornergrat within the global network of cosmic ray detectors.

The High Altitude Research Station Jungfrauoch

As documented by the individual reports and the lists and statistics, the High Altitude Research Station Jungfrauoch continued to be a place of exceptionally lively and exciting research. In 2009, 38 (2008: 40) teams were active at Jungfrauoch. Among a total of 47(2008: 43) research projects, about 24 (2008: 22) were primarily based on automatic measurements around the clock.

All member countries of the Foundation benefited from the excellent research conditions (Figure 6). That no Austrian groups are currently working at Jungfrauoch does not mean that they have lost interest. Austrian scientists profit from many projects at Jungfrauoch, especially in connection with MeteoSwiss and the Global Atmosphere Watch GAW program.

By number of projects, Germany and Belgium were again the most frequent users after Switzerland. Of special note is the research team from the University of Tsukuba, Japan, which was present with a test project for a 30cm radio telescope.

Scientists spent a total of 1105 person-working days at Jungfrauoch. As shown in Figure 7, this is significantly less than in the previous year (2008: 1339). A reason for this change may be the increasing trend for remote operation of experiments and the smaller number of big measurement campaigns.

Figure 8 illustrates the relative number of person-working days for 2009 by country. Leading in presence at Jungfrauoch were again the Institut d'Astrophysique et Géophysique, Université de Liège (229 person-working days), and the Department of Internal Medicine, Centre Hospitalier Universitaire Vaudois CHUV, Lausanne (196), followed by the National Physical Laboratory, Middlesex (80), and the Graduate School of Pure and Applied Sciences, University of Tsukuba (75).

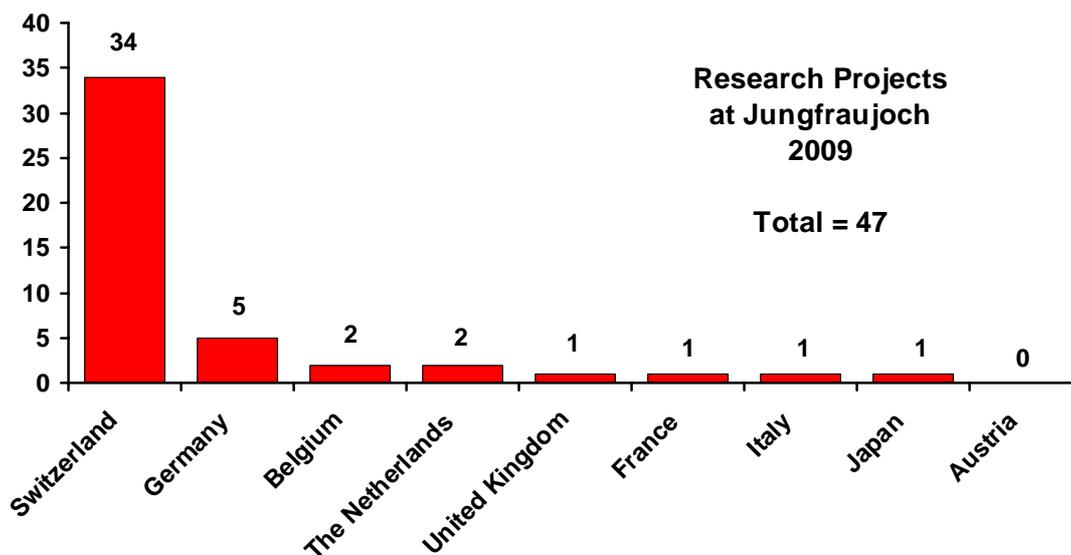


Figure 6: Number of research projects at the High Altitude Research Station Jungfrauoch in 2009 by country.

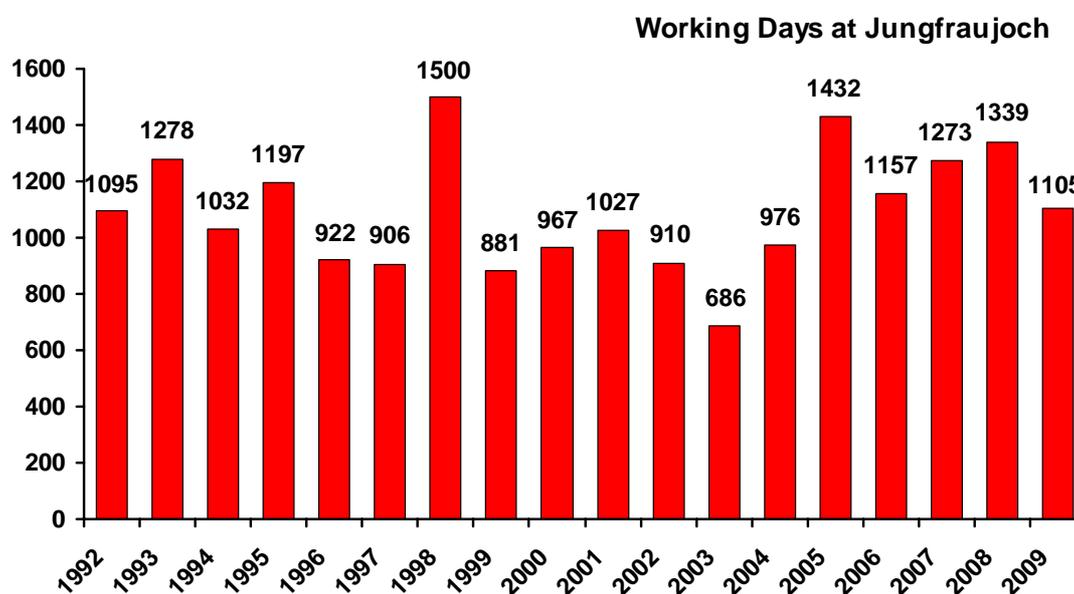


Figure 7: Number of working days spent by scientists at the High Altitude Research Station Jungfrauoch during the past years.

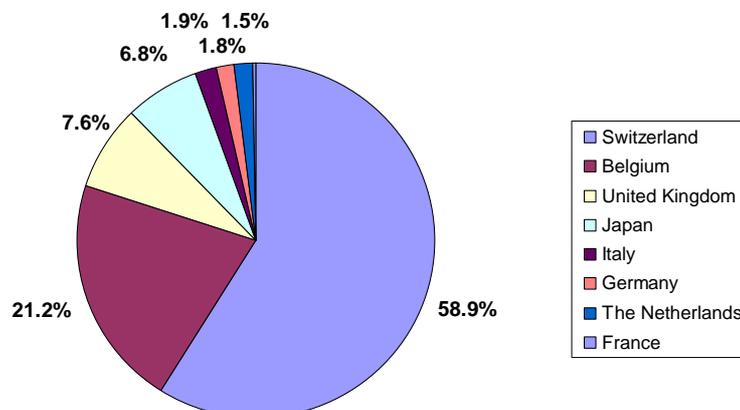


Figure 8: Relative number of person-working days in 2009 at the High Altitude Research Station Jungfrauoch by country.

The research conducted at Jungfraujoch resulted in the following output in 2009:

- 33 refereed publications,
- 65 conference presentations / posters,
- 10 data publications and reports,
- 1 book,
- 3 book sections, and
- 8 Bachelor, Master and Ph.D. theses.

Scientific results obtained at Jungfraujoch were presented by the various research groups at a number of international conferences, e.g. at the GAW 2009 Symposium in Geneva, at the European Aerosol Conference 2009 in Karlsruhe, and at the 2009 General Assembly of the European Geosciences Union EGU in Vienna.

Due to the unique location and the unspoiled environment as well as the quality of the scientific work, Jungfraujoch has maintained its role as a leading European center for environmental research. The site plays a significant role in a number of nationally and internationally coordinated research programs, many of them funded by the European Commission. Jungfraujoch is a key station in a number of major networks or projects (please see Table 1 for details). As in previous years, Jungfraujoch environmental measurements again played an important role in the validation/calibration of satellite instruments (e.g. Scanning Imaging Absorption Spectrometer for Atmospheric CHartographY SCIAMACHY onboard the ESA Environmental Satellite Envisat, the Infrared Atmospheric Sounding Interferometer IASI on the METOP series of European meteorological polar-orbit satellites, the Atmospheric Chemistry Experiment ACE onboard the Canadian satellite SCISAT-1; and the German Earth-observation satellite TerraSAR-X). Several research teams were also involved in new international project applications for Jungfraujoch within the EU FP-7 program.

Among a number of scientific highlights the following received special attention among the experts and in the news media:

- Three medical field studies, one by the Swiss Cardiovascular Centre of the University Hospital (Inselspital) in Bern about safety and tolerance of high altitude exposure in non-acclimatized patients with chronic heart failure, the other two by the Centre Hospitalier Universitaire Vaudois CHUV Lausanne, the Inselspital Bern, and the University of Basel about the prevalence of acute mountain sickness (AMS) in children and adults after rapid ascent to 3540 m.
- The photovoltaic power plant and the solar cell tests by the BKW FMB Energie AG for the Solar Impulse (around the world in a solar airplane) project (<http://www.solarimpulse.com/>).
- The findings by an international team including researchers of the Laboratory of Atmospheric Chemistry of the Paul Scherrer Institut in Villigen about the composition of the organic constituents of the fine particulates found in various regions of the world, and the identification of the original substances from which they are formed in each case. This has enabled them to explain for the first time ever how fine particulates are formed in the air.
- The new CO₂ tracker developed by EMPA, the Swiss Federal Laboratories for Materials Testing and Research, allowing for the first time the continuous measurement of the isotopic signature of CO₂ characteristic of the main sources of carbon dioxide.
- The extensive field campaign by the British National Physical Laboratory with combined ground-based and aircraft measurements of water vapor in the atmosphere.

Table 1: List of major nationally and internationally coordinated networks and/or research programs where Jungfraujoch is a key station

NDACC	Network for the Detection of Atmospheric Composition Change Primary Site (http://www.ndacc.org/)
GAW, GAW-CH	Global Atmosphere Watch, Global GAW Station (http://www.wmo.int/pages/prog/arep/gaw/gaw_home_en.html), and (http://www.meteoschweiz.admin.ch/web/de/klima/klima_international/gaw-ch.html)
GAW-PFR	GAW Aerosol Optical Depth (AOD) Network (http://www.pmodwrc.ch/worcc/pmod.php?topic=gawpfr_aod_network_menu)
SOGE	System for Observation of Halogenated Greenhouse Gases in Europe (http://www.nilu.no/soge/)
EARLINET-ASOS	European Aerosol Research Lidar Network - Advanced Sustainable Observation System (http://www.earlinetasos.org/)
GEOMON	Global Earth Observation and Monitoring of the Atmosphere (http://geomon.ipsl.jussieu.fr/)
HYMN	Hydrogen, Methane and Nitrous oxide: Trend variability, budgets and interactions with the biosphere (http://www.knmi.nl/samenw/hymn/)
AGAGE	Advanced Global Atmospheric Gases Experiment Collaborative Sampling Station (http://agage.eas.gatech.edu/)
NADIR/NILU	NILU's Atmospheric Database for Interactive Retrieval (http://www.nilu.no/nadir/)
EUROHYDROS	European Network for Atmospheric Hydrogen Observations and Studies (http://www.meteor.uni-frankfurt.de/eurohydros/)
CarboEuro-IP	Assessment of the European Terrestrial Carbon Balance (http://www.carboeurope.org/)
IMECC	Infrastructure for Measurements of the European Carbon Cycle (http://imecc.ipsl.jussieu.fr/index.html)
EUMETNET	Network of European Meteorological Services (http://www.eumetnet.eu/)
SwissMetNet	Automatic Measuring Network of MeteoSwiss (http://www.meteoschweiz.admin.ch/web/de/klima/messsysteme/boden/swissmetnet.html)
RADAIR	Swiss Automatic Network for Air Radioactivity Monitoring (http://www.bag.admin.ch/themen/strahlung/00045/02372/02374/index.html?lang=de)
ICOS	Integrated Carbon Observation System (http://www.icos-infrastructure.eu/)
NADAM	Netz für automatische Dosis-Alarmierung und -Meldung (https://www.naz.ch/de/aktuell/tagesmittelwerte.shtml)
NABEL	Nationales Beobachtungsnetz für Luftfremdstoffe - National Air Pollution Monitoring Network (http://www.empa.ch/plugin/template/empa/699/*/--/1=1)
AGNES	Automated GPS Network for Switzerland (http://www.swisstopo.admin.ch/swisstopo/geodesy/pnac/html/en/statjujo.html)
NCCR Climate	Swiss Climate Research (http://www.nccr-climate.unibe.ch/)
PERMASENSE	Wireless Sensing in High Alpine Environments (http://www.permasense.ch/)
PERMOS	Permafrost Monitoring Switzerland (http://www.permos.ch/)
NMDB	Real-Time Database for High Resolution Neutron Monitor Measurements (http://www.nmdb.eu)
E-GVAP I + II	The EUMETNET GPS Water Vapour Programme (http://egvap.dmi.dk/)
EUSAAR	European Supersites for Atmospheric Aerosol Research (http://www.eusaar.net/files/activities/transnat_act.cfm)
EUCAARI	European Integrated project on Aerosol Cloud Climate and Air Quality Interactions (http://www.atm.helsinki.fi/eucaari/)
COST 726	Long term changes and climatology of UV radiation over Europe (http://www.cost726.org/)
Swiss Glacier Monitoring Network	, Federal Office for the Environment (BAFU) (http://glaciology.ethz.ch/messnetz/?locale=en)
CAVIAR	Continuum Absorption at Visible and Infrared wavelengths and its Atmospheric Relevance (http://www.met.reading.ac.uk/caviar/)
As in previous years environmental research at Jungfraujoch was in 2009 again supported by	
INTROP	Interdisciplinary Tropospheric Research: from the Laboratory to Global Change (http://www.esf.org/index.php?id=518)
ACCENT	Atmospheric Composition Change, The European Network of Excellence (http://www.accent-network.org/)

Most of the measurements made at Jungfraujoch are publicly available via the respective databases, many of them in real or near real-time.

For studies on climate change and the consequences of global warming for the high alpine environment in general and in particular for the region of the UNESCO World Heritage Swiss Alps Jungfrau Aletsch (<http://www.jungfraualetsch.ch/>), Jungfrauoch continues to be a research site of utmost importance. Therefore, the projects PERMASENSE (<http://www.permasense.ch/>) and PERMOS (Permafrost Monitoring Switzerland, <http://www.permos.ch/>) were diligently continued. Since February 2009 the PermaSense wireless sensor network on Jungfrauoch has been operational. Complementing the high-resolution time series of temperature and electrical resistivity measured in sensor rods, two permanent 2D geoelectrical profiles were installed at the southern rock face at Jungfrauoch in September 2009 to monitor the small-scale evolution of the permafrost. Several electrical resistivity tomography (ERT) measurements were conducted between September and December, allowing first insights into the spatial pattern of seasonal freezing.

As in previous years, the High Altitude Research Station Jungfrauoch served as a base for scientific expeditions to the glacier area of the Jungfrau region. Within the Swiss Glacier Monitoring Network of the Federal Office for the Environment (BAFU), the Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie VAW of ETH Zürich has continued its world-famous long-term observations of the Grosser Aletschgletscher. These observations have been carried out to document variations of Grosser Aletschgletscher and include annual length change measurements since 1880, accumulation and mass balance measurements starting in 1918, repeated map or arial photograph surveys, and are complemented by stream runoff data of the Massa river since 1922. In an ongoing project the length, area, volume, and mass changes are continuously observed applying modern remote sensing techniques as well as direct field measurements.

The big spark chamber, built by the Laboratory of High Energy Physics, Physikalisches Institut, University of Bern (Prof. K. Pretzl and Prof. A. Ereditato and team), in collaboration with CERN, and installed with support by the Jungfraubahn AG in the tourist area of the Sphinx during the Einstein Year, continued operation throughout 2009.

Complementing the automatic meteorological measurements within SwissMetNet, our custodians continued the daily visual weather observations for the Federal Office of Meteorology and Climatology (MeteoSwiss). The custodians also provide the updates for the internet weather report of the Jungfraubahnen. In the fall of 2009 Mrs. and Mr. Fischer, Mrs. and Mr. Seiler as well as Mr. Staub were invited by MeteoSwiss to attend a two-day national meeting of all Swiss weather observers either in Payerne or Kloten. During 2009 planning started for a significant extension of the “meteo bridge” on the lower Sphinx terrace.

The Research Station, the scientific activity, and the unique environment of the UNESCO World Heritage Jungfrau-Aletsch-Bietschhorn attracted a number of visitors throughout the year. Several organizations initiated meetings of national and international scientific committees in the Jungfrau region and combined these meetings with an excursion to Jungfrauoch. The research station was also visited by a large number of student groups as part of their lectures or training school. Examples of the more than 82 individual and group visitors in 2009 are:

- ACCENT Management Committee; 15.01.2009; Prof. E. Schüpbach
- Media Event solar cell tests for the Solar Impulse project; 16.01.2009; BKW FMB Energie AG

- ETH Zürich, Glaciology students; 04.04.2009
- University Mainz; Fachbereich Physik, Mathematik und Informatik; student group; 16.04.2009
- ABC-Labor, Spiez; 04.05.2009
- University Bern, Klima-und Umweltphysik, Glaciology students; 06.05.2009
- Kantonsschule Büelrain, Winterthur; student group; 27.05.2009
- ETH Zürich; Aerosol II students; 03.06.2009
- Stiftung Science et Cité; participants BaseCamp 09; 26.06.2009
- Federal Department of Defence, Civil Protection and Sport; Military Delegation; 01.07.2009
- Mrs. Christine Häslar, Grossrätin Kanton Bern; 24.07.2009
- Federal Department of Foreign Affairs; Indian Press Delegation; 18.08.2009
- Max Planck Institut für extraterrestrische Physik, Garching; group of scientists; 09.09.2009
- Ambassadors of 27 EU countries in Switzerland; 21.09.2009
- Federal Department of Foreign Affairs; Indian TV-Team; 13.10.2009
- Prof. Shixiao YU, Associated Partner in ACCENT, Sun-Yat Sen University, Mr. Zhi WANG; 30.10.2009
- ISSI Workshop Group; 02.11.2009

The management HFSJG was particularly honoured to welcome the following official delegations:

- Paul Scherrer Institut PSI, Directorate and Executive Staff; 21.03.2009
- University of Bern; Rector and Board of Directors; 14.08.2009
- Ambassadors of 27 EU countries in Switzerland; 21.09.2009
- Mme. Sabine Laruelle, Ministre des PME; Gouvernement fédéral Belgique; 17.11.2009



Figures 9-12: Distinguished guests visiting the High Altitude Research Station Jungfrauoch: The rector of the University of Bern with his staff and members of the HFSJG executive, the ambassadors of the European Union member countries, a group of enthusiastic students from UCLA, and Mme. Sabine Laruelle, Ministre des PME du Gouvernement fédéral Belgique (from top left to bottom right).

In addition to the large number of requests for visits of the research station at Jungfrauoch, there was an unbroken intense interest by print media and TV, with more than forty contributions in 2009. A trip to Jungfrauoch with a visit of the research station was also offered to the winner of the Photo Award of the Paul Scherrer Institute.

In order to provide the researchers with optimal working conditions, continuous effort is made to adapt the infrastructure to the changing needs of the researchers and to adequate standards. Maintenance of the entire infrastructure is executed in accordance with the 10-year plan that was set up with our architect, Mr. Hans Boss, Zweilütschinen. Unfortunately, due to unfavorable weather conditions, the new coating of the flat roof of the Sphinx terrace could not be fully completed, and the realization of the protection against falling rocks above the research station has a delay of about one year. However, damage to the concrete of the Sphinx building that was a risk for tourists was repaired. In December 2009 a contract was signed with SWITCH, the networking organization of Swiss academia, for connecting the research station via a 1 Gbps link with SWITCHlan, the Swiss Education and Research Network. The new high-speed connection to the Jungfrauoch will be ready for use in spring 2010. The support in this matter by the Jungfrau Railway Holding AG and the University of Bern are gratefully acknowledged.

As in previous years, several coordination discussions took place with the management of the Jungfraubahnen. The annual coordination meeting at Jungfrauoch, a platform for the discussion of items of common concern, took place on December 8, 2009, and was attended by the director of the research stations and Mr. Felix Seiler. Prime topics from our point of view remain the continued efforts to avoid or minimize disturbances of the scientific measurements by emissions in connection with construction work or defect apparatus. In contrast to earlier findings, the measures taken to stabilize the temperature in the Sphinx laboratory turned out to be still unsatisfactory. A subject of common concern is the increasing risk of falling rocks.

On December 4, 2009, the annual meeting of the “Alpenfeuerwehr”, the fire brigade responsible for the High Altitude Research Station Jungfrauoch, took place. Unfortunately, no one from the HFSJG directorate was able to attend.

The High Altitude Research Station Gornergrat

Due to its unique location, its clean environment, and the good infrastructure, the High Altitude Research Station Gornergrat, which at present includes the astronomical observatory Gornergrat South and a container laboratory, continues to be an excellent basis for astrophysical research.

The Observatory Gornergrat South is subleased to the Universität zu Köln. Here, the I. Physikalisches Institut der Universität zu Köln has installed the 3m radio telescope KOSMA (Kölner Observatorium für Submillimeter und Millimeter Astronomie). The central topic of the research with KOSMA, conducted jointly with the Radioastronomisches Institut, Universität Bonn, is the spectrally resolved observation of the global distribution of interstellar matter in the Milky Way and nearby external galaxies, using the important mm-, submm-lines of CO, and atomic carbon. The most advanced technical equipment combined with the excellent observing conditions at Gornergrat allows astronomical observations up to the highest frequencies accessible to ground-based instruments.

Figure 13 shows the statistics for the use of the Gornergrat South Observatory during 2009. Compared to 2008, the number of 381 working days at Gornergrat was significantly larger in 2009. The Observatory was again used by a number of guest observers.

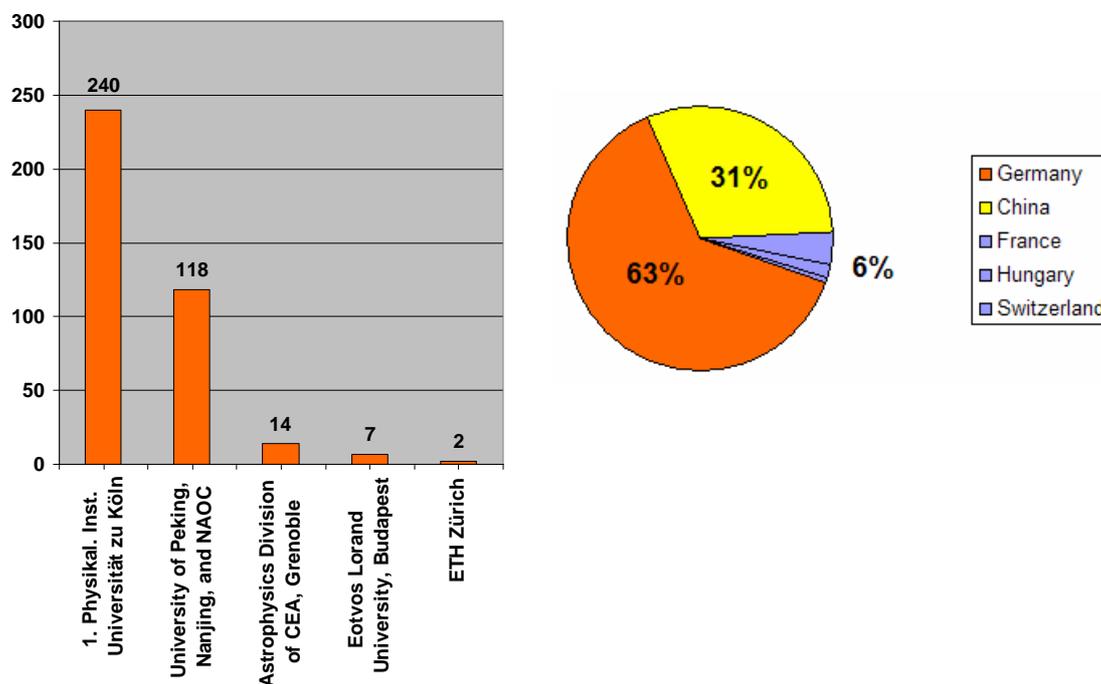


Figure 13: Statistics of the person-working days at the Astronomical Observatory Gornergrat South.

Unfortunately, after almost 25 years of successful research work, the I. Physikalisches Institut der Universität zu Köln will stop KOSMA at Gornergrat in 2010. During the last couple of years, the colleagues from Germany increased their involvement in the NANTEN2 project with a 4m submm telescope in the Atacama desert in Chile at 4865 m altitude. Much to our regret they decided that this would be the prime site for their future activities. Within a collaboration with the National Astronomical Observatory of China (NAOC) the KOSMA telescope will be transferred to Tibet.

As already stated in previous reports, the termination of the TIRGO era in 2005 by the Italians left the future of Gornergrat North open. The Burgergemeinde Zermatt would like the Foundation HFSJG to use Gornergrat North to embed science in public outreach and tourism. Unfortunately, the project for a robotic telescope worked out by a team of astronomers under the lead of the president of the Schweizerische Astronomische Gesellschaft, Dr. Max Hubmann, made no progress. Alternatives are still under investigation. In the meantime the Observatory Gornergrat North continues to be used by an experienced amateur astronomer for astrophotography and astronomical lectures to the public (Figure 14).



Starlight Dinner

Your hosts at the 3100 Kulmhotel Gornergrat look forward to serving you an exquisite buffet dinner. In the course of the evening, you will also have a chance to visit one of the observatories which are housed under the domes of the Kulmhotel visible for miles around.

[» continue](#)

Figure 14: Excerpt from the website of the Kulmhotel Gornergrat (<http://www.matterhorn-group.ch/de/kulmhotel-gornergrat/>) advertising the “Starlight Dinner” with the possibility to visit the astronomical observatory in the North tower.

Since 1998, the Space Research and Planetary Sciences Division of the University of Bern has been operating a solar neutron telescope (SONTEL) on the Belvedere plateau. This detector is the European cornerstone of a worldwide network initiated by the Solar-Terrestrial Environment Laboratory of the Nagoya University for the study of high-energy neutrons produced in energetic processes at the Sun. During 2009, continuous operation of SONTEL was ongoing.

During the last several years, the region of the Gorner glacier has become of increasing interest to the glaciologists of the Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie (VAW) of the Swiss Federal Institute of Technology in Zurich (ETHZ). In 2009, the teams under the leadership of Prof. Martin Funk spent about 20 working days at the Gornersee in order to study the processes controlling the drainage of glacier-dammed lakes. Within the computer and geosciences project PermaSense (<http://www.permasense.ch/>), a wireless sensor network for measuring permafrost related parameters has been deployed in the Matterhorn area. The media gave special attention to the construction of the world's highest solar power plant at Klein Matterhorn (3883 asl) by the Zermatt Bergbahnen AG and the sol-E Suisse AG, as well as to the new Monte Rosa alpine hut due to its advanced energy concept developed under the assistance of ETH Zürich, Hochschule Luzern - Technik & Architektur, and EMPA.

In 2009, three (2008: 7) scientific papers and one conference poster were published based on work at Gornergrat. Details can be found in the individual reports. The Gornergrat site with its observatories was also again a demanded topic for media reports.

Summary and Acknowledgements

As documented by the individual activity reports, the large number of publications, and the feedback from meetings, scientific work at the High Altitude Research Stations Jungfrauoch and Gornergrat during the report period 2009 continued to be extensive and of high international standard. Due to the unique observational and measuring conditions, the Jungfrauoch station has maintained its position as a key station in a number of European and global measuring networks for climate and environmental studies. For the same reasons, Gornergrat continued to be a prime site for astronomical and astrophysical research. However, due to the increasing competition with the world leading high altitude sites for astrophysical research in Chile and Tibet, the future of the astronomical observatories at Gornergrat is still open. Nevertheless, the Foundation HFSJG confirmed its role as a provider of excellent research infrastructure. The hard work and the efforts of all who contributed to this success are highly appreciated and gratefully acknowledged. We also thank all members of the Foundation and their representatives for their support. In particular, we thank the Swiss National Science Foundation for the most significant funding of the Swiss contribution, and in particular Prof. Christian Leumann and Dr. Hans-Ulrich Blaser (President Div. II), as well as Dr. Paul Burkhard (Head Division II), for the excellent and benevolent collaboration.

Operation of the High Altitude Research Stations Jungfrauoch and Gornergrat would not be possible without the help and support of many individuals and organizations.

For the Research Station Jungfrauoch, our thanks go to our custodians, Mr. and Mrs. Fischer, Mr. and Mrs. Seiler, as well as to Mr. and Mrs. Staub who again served HFSJG on a temporary basis. With their devotion to duty, their competence, and their

ability to create a comfortable atmosphere in the station, they are providing the basis for all scientists to do good research work. Special thanks go to the Jungfrau Railway Holding AG and to the Jungfrau Railways. Without their goodwill and their substantial support the Research Station at Jungfraujoch could hardly be operated. The Board of the Jungfrau Railway Holding AG under its president Prof. Thomas Bieger, the management and personnel of the Jungfraubahnen under Chief Executive Officer Urs Kessler, as well as the Board of the Sphinx AG under its chairman Jürg Lauper are always open and positive toward our needs, which quite often conflict with touristic objectives. We gratefully acknowledge the generous direct and indirect support and appreciate the continued interest in the research activity and the scientific output. At Jungfraujoch we are particularly grateful to Mr. Jürg Lauper, head of infrastructure, and his deputy, Mr. Heinz Schindler, to Mr. Gabriel Roth, head of Zugförderung und Werkstätte (ZfW/JB), to Mr. Andreas Wyss, chief of technical services and maintenance division, and his team, and to Mr. Fritz Jost, ZfW. Our thanks also include Mr. and Mrs. Urs and Elsbeth Zumbrunn, their successors Mr. and Mrs. Martin and Brigitte Soche, and the personnel of the Restaurant Top of Europe.

For Gornergrat our thanks go first to the Brig-Visp-Zermatt Bahn (BVZ Holding AG) and, in particular, its representative in the board HFSJG, Mr. René Bayard. The substantial continuous support provided by the Gornergrat Bahn, by its Chief Executive Officer Hans-Rudolf Mooser as well as the entire crew, has been essential for the success of the scientific work. Finally, we are extremely grateful to the Burgergemeinde Zermatt under the presidency of Mr. Andreas Biner, the members of the Burgerrat, to Mrs. Fabienne Clemenz and Mr. Fernando Clemenz as the directors of the Kulm Hotel, and their crew. Without their goodwill and support it would not be possible to operate a world-famous astrophysical observatory at Gornergrat.

The great efforts of all these individuals and institutions would, however, be worthless if the research facilities would not be used adequately. We therefore would like to express our sincere gratitude to all scientists for their dedicated work and good collaboration, demonstrating through the excellence of their research that the High Altitude Research Station Jungfraujoch continues to fulfill an undisputed need of the scientific community, especially in environmental research. For Gornergrat we thank in particular the I. Physikalisches Institut der Universität zu Köln (Prof. Jürgen Stutzki, Dr. Martin Miller) and the Max-Planck-Institute for Radio Astronomy in Bonn, the University of Bern, and all collaborating institutions. We are also grateful to the Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie (VAW) of the Swiss Federal Institute of Technology in Zurich (ETHZ).

At the administrative office in Bern I would like to thank Dr. Rolf Bütikofer, the IT assistant HFSJG for his proficient work. Continued assistance by the Informatikdienste of the University of Bern in networking and data transfer, in particular by Mr. Christian Heim and Mr. Fritz Bütikofer, is also gratefully acknowledged. We have greatly appreciated the competent services of our treasurer, Mr. Karl Martin Wyss, the knowledgeable support and bookkeeping by Mr. Christian Gasser, and the professional auditing by Treuhand Cotting AG, Bern (Mr. Harro Lüdi). I am especially grateful to the University of Bern, its Rector Prof. Urs Würgler and the Administrative Director, Dr. Daniel Odermatt, and in particular the Director of its Physikalisches Institut, Prof. Willy Benz, for the hospitality and support of our administration.

This report is the 10th in the series initiated in the year 2000, and it is the last one under my directorship. I therefore take the liberty to add in the following a few personal thoughts in retrospect.

Since 2000 I have been serving the International Foundation High Altitude Research Stations Jungfrauoch and Gornergrat HFSJG as Director. At the end of 2009 I stepped down, a natural follow-up after my retirement at the University of Bern last February, and handed the office over to Markus Leuenberger from the Physikalisches Institut of the University of Bern. I gratefully acknowledge the nice words and thoughtful gifts that were presented to me during the small farewell party at Jungfrauoch on December 29, 2009.



Figures 15&16: *Erwin Flückiger, Director of the research stations HFSJG from 2000-2009, symbolically hands over the keys to the High Altitude Research Station Jungfrauoch to his successor, Markus Leuenberger, on occasion of a small ceremony amidst distinguished guests and friends at the library of the scientific station on December 29, 2009 (left). The “old” and new directors’ couples (right).*

On April 1st, 1968, I made my first trip to Jungfrauoch, just after having started my physics diploma work that included the operation of the cosmic ray detectors at this high altitude research site. I do not know how many times I have been at Jungfrauoch since, but every time it was a unique, enjoyable event, an experience that made my life richer and very special. The same feelings are true for Gornergrat, where my first visit took place in the 1970s. In the following years, as a scientist and close collaborator of Hermann Debrunner, the former Director of the research stations and President HFSJG, I had the opportunity to intensify the contacts with both sites and with the people behind them. During the last ten years as the Director of the research stations HFSJG, I fully enjoyed the privilege of meeting scientists, visitors, and local people at the two really unique locations, and having the opportunity to serve the scientific community on an international scale. In retrospect, all these years have been hard work, but at the same time they have been extremely enjoyable and hopefully even successful. The success is due to the scientists working with enthusiasm and taking full advantage of the two sites, Jungfrauoch and Gornergrat. But it is also thanks to all the people who work at the infrastructures on site or remotely in the administration, doing an outstanding job in offering the researchers the best possible working conditions, and all that in a spirit of mutual respect and friendship.

It was a privilege and great pleasure to work together with three Presidents of the Board HFSJG, Prof. Hermann Debrunner, Prof. Gustav Andreas Tammann, and Prof. Hans Balsiger. While the collaboration with all of them was extremely enjoyable and

productive, the last years with Hans Balsiger, including the 75th anniversary of the Jungfrauoch scientific station as well as important challenges within the Board HFSJG, were especially intense and rewarding. I would like to thank Hans Balsiger and his predecessors for all the support and the highly appreciated friendship.

Two persons, however, that were closer to me than everybody else in everyday life during the last ten years, deserve very special thanks at the end. As the reader can imagine, these are two ladies. One of them is Mrs. Louise Wilson, the secretary HFSJG. It was to a great deal due to Mrs. Wilson's competence and flexibility in running the administrative affairs, to her kindness in the daily contacts with staff and scientists, and to her devotion to the Foundation HFSJG that we could successfully pursue our goal in supporting top-level research. But she also made it possible for me to ideally combine the duties of the Director HFSJG with the challenges of the head of a research team. And it was only thanks to her running the office so perfectly that I could enjoy what some colleagues name "extensive traveling". Thank you, Louise, for a wonderful time! The other lady is my wife Rosmarie. Having served the Foundation HFSJG herself more than 30 years ago, the two unique research sites Jungfrauoch and Gornergrat and their history are part of her life as well. Rosmarie therefore not only accepted my frequent absences due to travels to the mountains without making me feel bad, but she also had a realistic knowledge of what the challenges of my job were. Thank you so much, Rosmarie, for sharing your interest in my work, your never-ending support, and for being on my side with your love all the time!

I conclude this report with my very best wishes for a successful future of the High Altitude Research Stations Jungfrauoch and Gornergrat, and to my successor, Markus Leuenberger.



Bern, April 10, 2010

Erwin O. Flückiger