

Report of the Director

The High Altitude Research Station Jungfrauoch received the prestigious **Chemical Landmark** award from the Platform Chemistry of the Swiss Academy of Sciences manifesting the scientific and technological heritage by the awarded site, which has played a significant role in the history of chemistry in Switzerland. On this occasion, a symposium was held on April 25, 2019 at the University of Bern, highlighting the achievements of past generations of chemists. On April 26, we officially un-covered the plaque at the Jungfrauoch Research Station (Fig. 1).



Figure 1. Uncovering of the Chemical-Landmark plaque next to the entrance of the Sphinx observatory at Jungfrauoch by Prof. Dr. Christophe Copéret, president of the Platform Chemistry of the Swiss Academy of Sciences (right) and Prof. em. Dr. Silvio Decurtins, president HFSJG.



Figure 2. Participants of the Chemical-Landmark Award event.

This award – the second in 2019 besides the EPS Historic Site award – emphasizes and honors the many contributions and achievements by our national and international research communities in particular in chemistry at Jungfrauoch Thank you very much for this.

Jungfrauoch, an ICOS Class 1 station, congratulates the ICOS-CH partner Davos Seehornwald for its promotion to an ICOS Class 1 station in ecosystem monitoring by the European infrastructure network Integrated Carbon Observation System (ICOS) on November 21, 2019.

At Gornergrat, the Stellarium project is now well established and busy due to many bookings of the available remote infrastructures by school classes, in order to investigate specific space objects.

The Foundation HFSJG

The Board meeting at Zermatt was held on September 6 and 7, 2019. Silvio Decurtins, the president of the Foundation welcomed Prof. Dr. Tuukka Petäjä from the University of Helsinki as new representative of Finland. The activity report and the statement of accounts for the year 2018 have been approved by the Board Members and the HFSJG administration was given discharge.



Figure 3. Meeting of the HFSJG Board, at Zermatt 2019.



Figure 4. Excursion on the occasion of the Meeting of the HFSJG Board, at Gornergrat 2019.

The Jungfrauoch Commission of the Swiss Academy of Sciences (SKHFJ) held the annual meeting on May 17, 2019 at the House of Sciences, Bern. The president, Prof. Dr. Heinz Gäggeler, welcomed the members of the commission and excused Markus Balmer, Urs Kessler, Dr. Stefano Rimoldi and Dr. Daniel Schaerer. Prof. Dr. Hubertus Fischer informed the commission members about activities and upcoming events of the commission SKPH. Then, the president presented the ongoing and upcoming activities of the Jungfrau Railway on behalf of Markus Balmer. Prof. Dr. em. Silvio Decurtins, president of the HFSJG Foundation and Prof. Dr. Markus Leuenberger, its director, informed about activities of the HFSJG and the two research stations. The Prix de Quervain was announced in the field of High Altitude Research and was awarded to Dr. Sandra Brügger, Universität Bern for her work on *Eiskerngeschichten über vergangene Vegetations- und Landnutzungsdynamiken* and Dr. Michael Furian, Universität Zürich for his work on *Patienten mit chronisch obstruktiver Lungenerkrankung in den Bergen. Physiologische und klinische*

Veränderungen und deren Prävention. The commission is also active for the Foundation “Schweizer Jugend forscht” by offering a prize to visit the research facility of the HFSJG. The president guided the winners on a tour to Jungfrauoch and the Paul Scherrer Institute. The brochure about the Gornergrat activities was released and printed in spring 2019. Budget items of the SKHFJ for the year 2020 were discussed, among them the upcoming (meanwhile successfully organized) VAO Symposium in February 2020, the “Schweizer Jugend forscht” competition, and a Symposium planned for 2020/2021 on medical research related to the 90th anniversary of the Research Station Jungfrauoch in 2021. Elections: Prof. Heinz Gäggeler steps back as president of the SKHFJ after serving for more than two decades. On behalf of the HFSJG as well as personally, I thank him for his time and effort to support research at our two high altitude research stations. Prof. Dr. Urs Baltensperger will take over the presidency of SKHFJ from January 2020 onwards. Additionally, two new members were suggested and asked for joining our Commission, namely Prof. Dr. Matthias Erb, Biologist from the University of Bern and Dr. Timm Riesen, Astro-Physicist from the Centre for Space and Habitability, University of Bern.

The president of the Foundation HFSJG networked again successfully. As per January 2020, the University of Beijing will be a new member of our International Foundation HFSJG. We warmly welcome our new partner.

The annual HFSJG user meeting took place at the University of Bern on May 24, 2019. The director HFSJG informed participants about the infrastructural updates during the next years, i.e. the renovation of the 2nd level laboratory at the Sphinx observatory, the new heated inlet system to minimize contamination issues in particular from tourists and about planned construction work by the Jungfrau Railway. The status of the East Ridge was also discussed. Dr. Martin Steinbacher, Empa, Dr. Martin Gysel, PSI and Dr. Timm Riesen reported from the ICOS, ACTRIS and Gornergrat Stellarium projects. A science talk was given by Dr. Philipp Steinmann, BAG, on the topic ‘Radioaktivitätsmessungen in der Schweiz’.

We sadly took notice of the decease of Bernd Rathmayr who was the coordinator of Geotest for the work on the protection net above the Research Station at Jungfrauoch

The High Altitude Research Station Jungfrauoch

As already mentioned, Jungfrauoch has received additionally to the EPS Historic Site award also the Chemical Landmark recognition by the Swiss Academy of Sciences.

The High Altitude Research Station Jungfrauoch was again very attractive for researchers. In 2019, 35 (2018: 33) research institutions were active at Jungfrauoch. About 25 of 44 (2018: 43) research projects at Jungfrauoch are automated and remotely accessible by their corresponding institutions.

International programme involvement is essential and rewarding. Among many others the following examples may highlight that HFSJG is well embedded: The two programmes, Global Atmosphere Watch (GAW) and the Network of Detection of Atmospheric Composition Change (NDACC), can count on many projects conducted at Jungfrauoch. Of particular interest are the two European infrastructures ICOS (Integrated Carbon Observation System) with associated projects such as Ringo and ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network). In both networks Jungfrauoch is a central site. However,

international embedment is not restricted to these networks but extends to a large variety of programmes, listed in Table 1.

Regarding infrastructure updates, 2019 was a quiet year.

In 2019, projects with principal investigators from five different countries as displayed in Figure 5 could be welcomed and hosted at Jungfrauoch. When taking collaborations into account, the number of countries involved increases to 12 as visible in Figure 6. All this information can also be retrieved from the HFSJG Webpage:

<http://www.hfsjg.ch/jungfrauoch/researchprojects/overview.php>

From experience over the last decades, the number of working days is varying quite strongly from year to year. This is mainly due to the number of campaigns present during a year. In 2019, working days increased from 652 in 2018 to 707. Campaigns can help in this regard, it is visualised in Figure 7 with the number of working days split into different categories. The spent working days’ distribution is led by Germans followed by Swiss, Belgium and Australian organisations as seen in Figure 8.

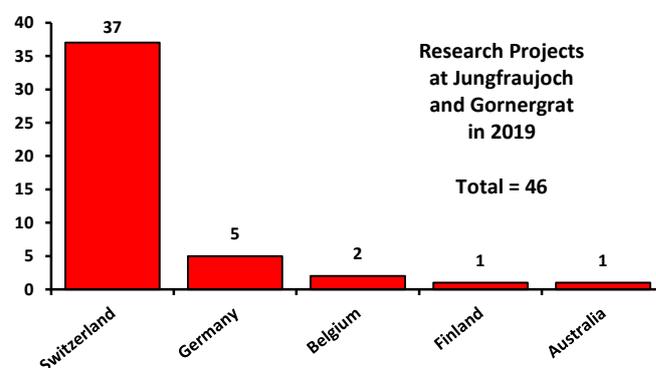


Figure 5. Number of research projects at the High Altitude Research Stations Jungfrauoch and Gornergrat in 2019 by country.

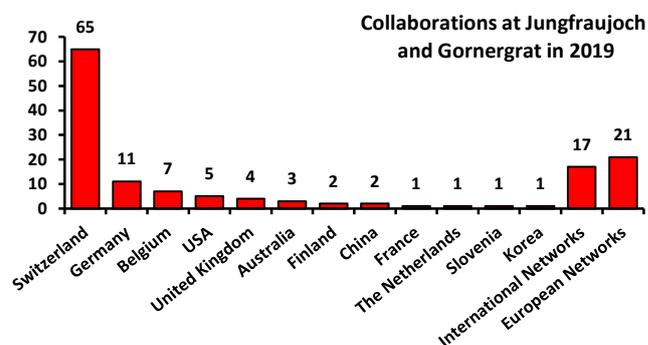


Figure 6. Number of collaborations at the High Altitude Research Stations Jungfrauoch and Gornergrat in 2019.

The research conducted at Jungfrauoch resulted in the following output in 2019:

- 24 refereed publications
- 44 conference presentations / posters
- 1 popular publications and presentations
- 11 data publications and reports
- 1 bachelor- (0), master- (1) and PhD (0) theses
- 0 book / edited books

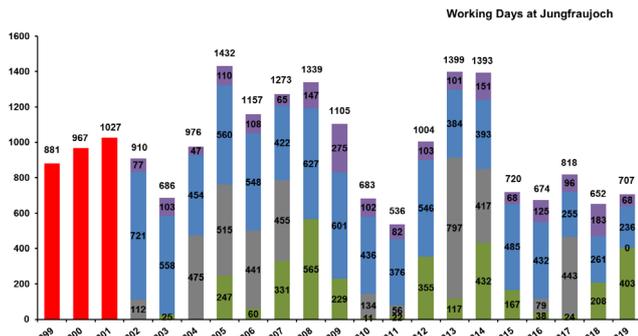


Figure 7. Number of working days spent by scientists at the High Altitude Research Station Jungfrauojch during the past years. The number is split into four categories since 2002, i.e. medical campaigns (green), CLACE campaign (grey), atmospheric research (blue), others (purple).

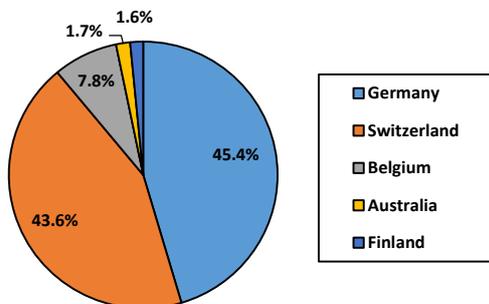


Figure 8. Percentage of person-working days in 2019 at the High Altitude Research Station Jungfrauojch per country.

Jungfrauojch research was presented once again at many national and international conferences in 2019 including:

22nd IEEE International Pulsed Power Conference, Orlando, FL, USA, June 23-28, 2019; IPAC 2020, Caen, France; EGU General Assembly, Vienna, Austria, April 7-12, 2019 RINGO Annual Scientific Meeting, Southampton, UK, March 20-22, 2019; ICOS CH Meeting, Birmensdorf, Switzerland, September 12, 2019; GAW Landesauschuss, Dübendorf, Switzerland, November 6, 2019; 20th Swiss Global Change Day, Bern, Switzerland, February 7, 2019; 8th International Symposium on Non-CO2 Greenhouse Gases (NCGG8), Amsterdam, The Netherlands, June 12-14, 2019; IG3IS -Transcom workshop, Paris, France, October 15-18, 2019; AGAGE Meeting, Weggis, Switzerland, April 29, 2019; HFJSG Users Meeting, Bern, Switzerland, May 24, 2019; GGMT-2019, Seogwipo, Jeju-do, South Korea, September 1-5, 2019; NIES technical training course on greenhouse gases and air pollutants monitoring in Indonesia, Tsukuba, Japan, November 24 – 30, 2019; DASIM Conference - tracing Denitrification, Giessen, Germany, March 12-14, 2019; AGU Fall Meeting, San Francisco, USA, December 9-13, 2019; CFC-11 Symposium, Vienna, Austria, March 25-27, 2019; 7th International Colloquium on Scientific and Fundamental Aspects of GNSS, ETH Zürich, Switzerland, September 4-6, 2019; 27th IUGG Assembly, Montreal, Canada, July 8-18, 2019; EGVAP expert meeting, Offenbach, Germany, November 28-29, 2019; EUREF-Symposium in Tallinn, Estonia, May 22–24, 2019; EUREF LAC Workshop, Warsaw,

Russia, October 16-17, 2019; 17th Swiss Geoscience Meeting 2019, Fribourg, Switzerland, November 22-23, 2019; 15th Symposium of Zurich Center for Integrative Human Physiology (ZHIP), Zurich, Switzerland, August 23, 2019.

Regarding research, I would like to highlight three investigations: (i) Krypton-85 activity concentration as measured in air over Central Europe: Trends and relevance for dating young groundwater; (ii) Estimation of exposure durations for vitamin D production and sunburn risk in Switzerland (iii) Carbonyl sulfide (OCS).

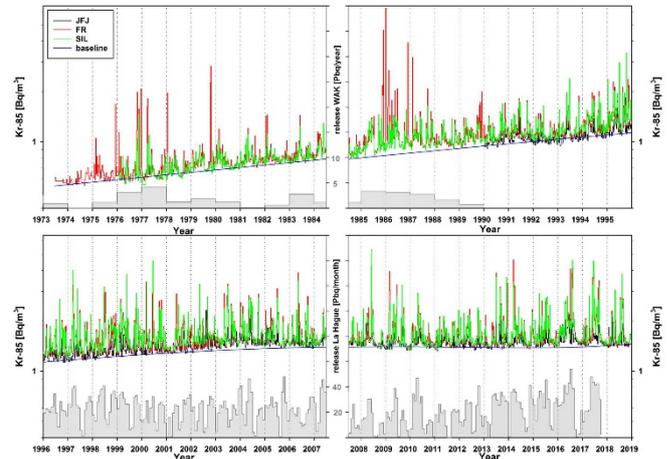


Figure 9. Krypton-85 activity concentrations (logarithmic scale) measured in air in weekly samples collected in Freiburg (from 1973), Schauinsland (from 1976) and Jungfrauojch (from 1990). The step graph in the top two panels shows the annual emissions (in PBq per year) from the WAK from 1973 to 1990 to illustrate the influence of local emissions on 85Kr measured in Freiburg. The bottom two panels show the monthly emissions from La Hague (in PBq per month). No emission data were available for La Hague from mid-2017.

(i) For almost half a century weekly samples for the measurement of krypton-85 (⁸⁵Kr) activity concentrations in surface air have been collected by the Bundesamt für Strahlenschutz (BfS), Germany. Sampling started at Freiburg (230m asl) in 1973, Mt Schauinsland (1205m asl) in 1976 and Mt Jungfrauojch in Switzerland (3454 asl) in 1990. Distinct maxima in the time series of atmospheric 85Kr activity concentration are caused by emissions from nuclear reprocessing plants in Europe, mainly the La Hague, France, and Sellafield, UK, reprocessing plants. Between 1970 and 1990 peak activity concentrations measured in winter along the Rhine Rift in Freiburg are often higher than at Mt Schauinsland, due to emissions from the operating pilot reprocessing plant in Karlsruhe - approximately 130 km to the north - and large-scale inversions that inhibit exchange of air masses within the Rhine Rift with those at higher altitudes. From the early 1990s onwards, after the shut-down of the pilot plant, differences between Freiburg and Schauinsland are much smaller. Activity concentrations measured at Jungfrauojch are generally lower and close to baseline levels, due to its location in the free troposphere. Weekly baseline and average ⁸⁵Kr activity concentration in the atmosphere in Central Europe were modelled from almost 12,000 individual measurements at 11 stations. The baseline and average have continuously increased, interrupted by a relatively stable period between 2009 and the end of 2014 with a baseline activity concentration of about 1.39 Bq/m³. Depending on the geographical location and hydrological conditions, the modelled baseline or average ⁸⁵Kr activity concentration time series can be used as input functions for the dating of young groundwater.

Bollhöfer, A., C. Schlosser, S. Schmid, M. Konrad, R. Purtschert, and R. Kraiss, *Half a century of Krypton-85 activity concentration measured in air over Central Europe: Trends and relevance for dating young groundwater, Journal of environmental radioactivity, 205, 7-16, 2019.*
<https://doi.org/10.1016/j.jenvrad.2019.04.014>

(ii) Although overexposure to solar ultraviolet radiation (UVR) is responsible for cutaneous melanoma and epithelial skin cancer and can cause negative health effects such as sunburn, a “little and often” exposure regime is often suggested to produce naturally recommended vitamin D levels, being essential for skeletal health. This study aimed to quantify solar UV doses needed to trigger 1000 International Units (IU) vitamin D doses and, at the same time, producing sunburn in Switzerland. Solar UV erythema irradiance (in mW/m²) measured at four meteorological stations in Switzerland for the period 2005–2017 were used to evaluate effective solar UV radiation producing 1000 IU vitamin D doses in skin phototype II and III individuals. Daily solar UV exposure durations (in minutes) needed to produce vitamin D with limited sunburn risk were estimated while considering mean vitamin D food intake of the Swiss population and seasonal skin coverage. In summer and spring, with 22% of uncovered skin, 1000 IU vitamin D doses are synthesized in 10–15 min of sun exposure for adults. Exposure durations between erythema risk and 1000 IU vitamin D production vary between 9 and 46 min. In winter and autumn, the recommended vitamin D production without sunburn risks often unachievable, since up to 6.5 h of sun exposure might be necessary considering 8–10% of uncovered skin surface.

oral vitamin D supplementation, daily doses of vitamin D (1000 IU) are not reachable in autumn and winter months in Switzerland.

Religi, A., C. Backes, A. Chatelan, J.L. Bulliard, L. Vuilleumier, L. Moccozet, M. Bochud, and D. Vernez, *Estimation of exposure durations for vitamin D production and sunburn risk in Switzerland, Journal of Exposure Science & Environmental Epidemiology, 29 (6), 742-752, 2019.*
<https://www.nature.com/articles/s41370-019-0137-2>

(iii) Carbonyl sulfide (OCS) provides a proxy for measuring photosynthesis and is the primary background source of stratospheric aerosols. OCS emissions due to biomass burning are a variable and substantial (over 10%) part of the current OCS budget. OCS emission ratios from open burning fires, coupled with 1997–2016 data from the Global Fire Emissions Database (GFED4), yield OCS biomass burning emissions with a global average annual flux of 60 ± 37 Gg(S) year⁻¹. A global box model suggests these emissions are more consistent with observations from global atmospheric composition monitoring networks than fluxes derived from previous synthesis papers. Even after considering the uncertainty in emission factor observations for each category of emissions and the interannual variation in total burned dry matter, the total OCS emissions from open burning are insufficient to account for the large imbalance between current estimates of global OCS sources and sinks.

Stinecipher, J., P. Cameron-Smith, N. Blake, L. Kuai, B. Lejeune, E. Mahieu, I. Simpson, and J. Campbell, *Biomass Burning Unlikely to Account for Missing Source of Carbonyl Sulfide, Geophysical Research Letters, 2019.*
<https://doi.org/10.1029/2019GL085567>

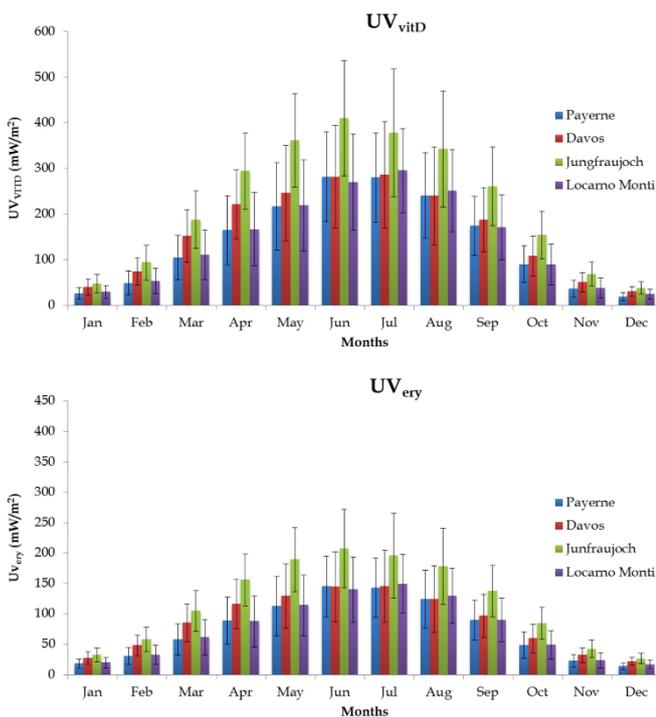


Figure 10. Mean values of daily UVvitD and UVery from 11:30 CET to 12:30 CET for each month, at 4 Swiss stations (Payerne, Davos, Jungfrauoch and Locarno-Monti).

The vitamin D food intake only represented 10% of the recommended vitamin D production and remained unchanged throughout the year. These findings might clarify why vitamin D deficiency is common in Switzerland. Moreover, exposure durations between recommended vitamin D and increased sunburn risk might only differ by few minutes. Without additional

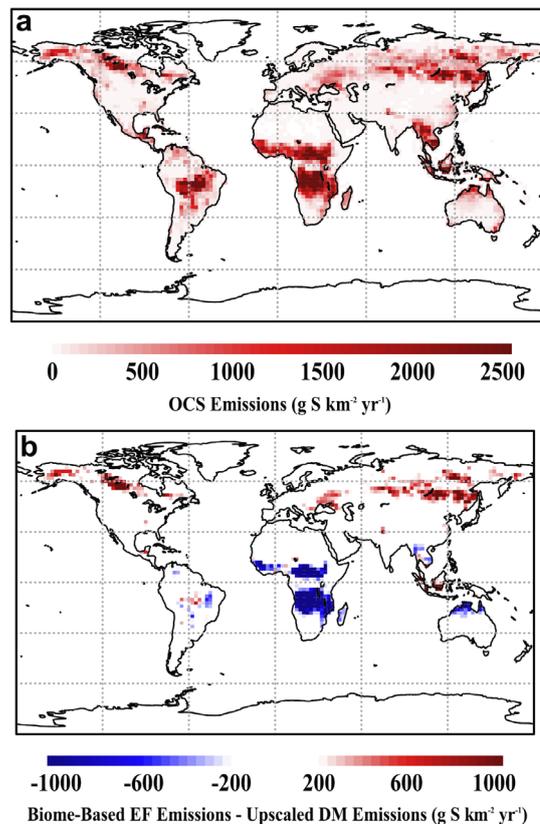


Figure 11. Maps showing (a) spatial distribution of average (1997–2016) annual OCS open burning emissions based on biome-specific emission ratios (relative to CO) presented in this work and (b) difference between the biome-specific OCS estimate and an estimate based on total burned dry matter, scaled up to the same global total (i.e., without specific scaling between biomes).

Additional scientific highlights were published in several peer-reviewed journals:

- Biskaborn, B.K. et al., Permafrost is warming at a global scale, *Nature Communications*, 10, 1, 264, doi: 10.1038/s41467-018-08240-4, 2019. <https://www.nature.com/articles/s41467-018-08240-4>
- Boleti, E. et al., Trends of surface maximum ozone concentrations in Switzerland based on meteorological adjustment for the period 1990–2014, *Atmospheric Environment*, 213, 326-336, 2019. <https://doi.org/10.1016/j.atmosenv.2019.05.018>
- Creamean, J.M. et al., Using freezing spectra characteristics to identify ice-nucleating particle populations during the winter in the Alps, *Atmos. Chem. Phys.*, 19, 8123-8140, doi: 10.5194/acp-19-8123-2019, 2019.
- Cuevas, E. et al., Aerosol optical depth comparison between GAW-PFR and AERONET-Cimel radiometers from long-term (2005–2015) 1 min synchronous measurements, *Atmos. Meas. Tech.*, 12, 4309–4337, 2019. <https://doi.org/10.5194/amt-12-4309-2019>
- Fanourgakis, G.S. et al., Evaluation of global simulations of aerosol particle and cloud condensation nuclei number, with implications for cloud droplet formation, *Atmos. Chem. Phys.*, 19, 8591-8617, 2019. <https://doi.org/10.5194/acp-19-8591-2019>
- Gute, E. et al., Field evaluation of a Portable Fine Particle Concentrator (PFPC) for ice nucleating particle measurements, *Aerosol Science and Technology*, 53, 9, 1067-1078, 2019. <https://doi.org/10.1080/02786826.2019.1626346>
- Harris, S.J. et al., N₂O isotopocule measurements using laser spectroscopy: analyzer characterization and intercomparison, *Atmos. Meas. Tech. Discuss.*, 1–84, 2019. <https://doi.org/10.5194/amt-2019-451>
- Hossaini, R. et al., Recent trends in stratospheric chlorine from very short-lived substances, *J. Geophys Res*, 124, 2318–2335, doi: 10.1029/2018JD029400, 2019. <https://doi.org/10.1029/2018JD029400>
- Li, J. et al., Differing toxicity of ambient particulate matter (PM) in global cities, *Atmospheric Environment*, 212, 305-315, 2019. <https://www.sciencedirect.com/science/article/abs/pii/S135223101930353X>
<https://link.springer.com/article/10.1007/s11426-019-9488-3>
- Mahieu, E. et al., Surveillance à long terme de l’atmosphère terrestre à la station du Jungfraujoch, *Bull. Soc. R. Sci. Liège*, 88, 31–41, doi: 10.25518/0037-9565.9136, 2019. <https://popups.uliege.be/0037-9565/index.php?id=9136>
- Mignani, C. et al., New type of evidence for secondary ice formation at around -15 °C in mixed-phase clouds, *Atmos. Chem. Phys.*, 19, 877-886, doi: 10.5194/acp-19-877-2019, 2019. <https://doi.org/10.5194/acp-19-877-2019>
<https://doi.org/10.5194/acp-19-8123-2019>
- Motos, G. et al., Cloud droplet activation properties and scavenged fraction of black carbon in liquid-phase clouds at the high-alpine research station Jungfraujoch (3580 m a.s.l.), *Atmos. Chem. Phys.*, 19, 3833-3855, 2019. <https://doi.org/10.5194/acp-19-3833-2019>
- Mühle, J. et al., Perfluorocyclobutane (PFC-318, c-C4F8) in the global atmosphere, *Atmos. Chem. Phys.*, 19, 10335–10359, doi: 10.5194/acp-19-10335-2019, 2019. <https://doi.org/10.5194/acp-19-10335-2019>
- Nyeki, S. et al., Trends in surface radiation and cloud radiative effect at four Swiss sites for the 1996–2015 period, *Atmos. Chem. Phys.*, 19, 13227–13241, doi: 10.5194/acp-19-13227-2019, 2019. <https://doi.org/10.5194/acp-19-13227-2019>
- Prignon, M. et al., Improved FTIR retrieval strategy for HCFC-22 (CHClF₂), comparisons with in situ and satellite datasets with the support of models, and determination of its long-term trend above Jungfraujoch, *Atmos. Chem. Phys.*, 19, 12309–12324, doi: 10.5194/acp-19-12309-2019, 2019. <https://orbi.uliege.be/handle/2268/233951>
- Rigby, M. et al., Increase in CFC-11 emissions from eastern China based on atmospheric observations, *Nature*, 569, 546–552, doi: 10.1038/s41586-019-1193-4, 2019. <https://www.nature.com/articles/s41586-019-1193-4>
- Stinecipher, J.R. et al. Biomass burning unlikely to account for missing source of carbonyl sulfide, *Geophys. Res. Lett.*, 46, 24, 14912-14920 doi: 10.1029/2019GL085567, 2019. <https://doi.org/10.1029/2019GL085567>
- Tarasick, D., et al., Tropospheric Ozone Assessment Report: Tropospheric ozone from 1877 to 2016, observed levels, trends and uncertainties, *Elementa*, 7, 39, 2019. <https://doi.org/10.1525/elementa.376>
- Thiersch, M., and E.R. Swenson, Cancer at high altitude, *High Altitude Medicine & Biology*, 19, 2, 116-123, doi: 10.1089/ham.2017.0061, 2018. <https://doi.org/10.1089/ham.2017.0061>
- Tzompa-Sosa, Z.A. et al. Atmospheric Implications of Large C₂-C₅ Alkane Emissions From the U.S. Oil and Gas Industry, *J. Geophys. Res. Atmos.*, 2013, 1–22, doi: 10.1029/2018JD028955, 2019. <https://orbi.uliege.be/handle/2268/230483>
- Vollmer, M.K. et al., Abundances, emissions, and loss processes of the long-lived and potent greenhouse gas octafluorooxolane (octafluoro-tetrahydrofuran, c-C₄F₈O) in the atmosphere, *Atmos. Chem. Phys.*, 19, 3481–3492, doi: 10.5194/acp-19-3481-2019, 2019. <https://doi.org/10.5194/acp-19-3481-2019>
- Walter, F. et al., Direct observations of a three million cubic meter rock-slope collapse with almost immediate initiation of ensuing debris flows, *Geomorphology*, 351, 106933, 2020. <https://doi.org/10.1016/j.geomorph.2019.106933>
- Yu, L. et al., The isotopic composition of atmospheric nitrous oxide observed at the high-altitude research station Jungfraujoch, Switzerland, *Atmos. Chem. Phys. Discuss.*, 2019. <https://www.atmos-chem-phys-discuss.net/acp-2019-829/>
- Zellweger, C. et al., Recent advances in measurement techniques for atmospheric carbon monoxide and nitrous oxide observations, *Atmospheric Measurement Techniques*, 12, 5863–5878, 2019. <https://doi.org/10.5194/amt-12-5863-2019>
- Zhang, T. et al., Time-resolved spread of antibiotic resistance genes in highly polluted air, *Environment international*, 127, 333-339, 2019. <https://www.sciencedirect.com/science/article/pii/S0160412019302089>
- Zhang, T. et al., Microbial aerosol chemistry characteristics in highly polluted air, *Science China Chemistry*, 62, 8, 1051-1063, 2019.

Most of the measurements made at Jungfraujoch are publicly available via the respective databases, many of them in real or near real-time. Further information can be found at www.hfsjg.ch.

We were happy to welcome many visitors in our research infrastructures at Jungfraujoch and Gornergrat.

In June 2019, a delegation of the Embassy of People's Republic of China in Bern, visited the research station at Jungfrauoch. The delegation was accompanied by Dr. Martin Gysel, Paul Scherrer Institute, Prof. Markus Leuenberger, Director HFSJG and Prof. em. Silvio Decurtins, President HFSJG (Figure 12).



Figure 12. The delegation of the Embassy of People's Republic of China in Bern.



Figure 13. The European Southern Observatory (ESO) is Europe's foremost organisation for astronomical research. Within the frame of a meeting of the ESO Council in Bern, the State Secretariat for Education, Research and Innovation SERI organised for the participants a visit of the research station on the Gornergrat and a tour through the Stellarium Gornergrat. Photo: © SBFI

A selection of additional individual and group visitors in 2019 is given in the following:

- Bethel College, USA, Prof. Rollin King with students, 11.01.2019
- European Physical Society Award: Jungfrauoch as Historic Site, Celebration HFSJG with EPS and guests, 08.02.2019
- International Space Science Institute ISSI, 13.02.2019
- ESO (European Southern Observatory) council, 04.03.2019
- Kanti Burggraben, St. Gallen, 21.03.2019
- New York Times Student Journeys, 23.03.2019
- University of Bern, Climate and Environmental Physics, Prof. Hubertus Fischer and students, 10.04.2019
- Chemical Landmark 2019 Award. Celebration HFSJG with SCNAT and guests, 26.04.2019
- Schweizerischer Nationalfonds SNF, Abteilung InterCo, Sinergia, 01.05.2019
- Empa with guests, 04.05.2019
- University of Maryland, USA, 13.05.2019
- University of Fribourg, Prof. Frank Scheffold, 25.05.2019
- University of Padova, Prof. Andrea Pitacco with students, 30.05.2019

- Delegation of the Embassy of People's Republic of China in Bern, Switzerland, 11.06.2019
- Participants of the CLOUD Summer School of the Paul Scherrer Institute, 15.06.2019
- Delegation of ICOS-CH, 18.06.2019
- Eidgenössische Ausgleichskasse EAK, 21.06.2019
- Delegation of the Mountain Research Initiative (MRI), 26.06.2019
- Hilti AG, 05.07.2019
- New York Times Student Journeys, 14.07.2019
- Students of the Berner Fachhochschule and the Shenzhen Technology University, China, 07.08.2019
- Participants of the International Bachelor Summer School for Climate Change Research, University of Bern, 09.08.2019
- Participants of the Summer PhD School Mont-Soleil, 17.08.2019
- Empa, Division Advanced Materials Processing, 19.08.2019
- Hokkaido University, Japan, Shin Sugiyama with students, 28.08.2019
- Verwaltung Gemeinde Grindelwald, 04.09.2019
- Board members HFSJG and guests, 07.09.2019
- ETH Zürich, Advanced Power Semiconductor Lab, 09.09.2019
- Department of Environmental Sciences, University of Basel, Dr. Nicolas Bukowiecki with students, 04.10.2019
- GAWG / IRWG Meeting, participants, 11.10.2019
- Bundesamt für Umwelt, Sektion Rutschung, Lawinen und Schutzwald, 15.10.2019
- Stiftung Valendas Impuls, 16.11.2019
- Geschäftsstelle Schweizer Jugend forscht sowie Preisträger von Schweizer Jugend forscht zusammen mit Prof. Heinz Gäggeler, 25.11.2019
- ETH Zürich, VAW-Glaziologie, Dr. Andreas Bauder mit Studenten, 04.12.2019

In 2019, a significantly increased media attention was observed due to the two awards the Jungfrauoch Research Station received. In 2019 55 (2018: 21) reports featuring our activities were available through television (8) and radio (8) broadcasts as well as printed articles (15) and reports on the internet (24). See section "The International Foundation HFSJG in the News".

Regarding Jungfrau East Ridge (JER), the measurements are ongoing. Presently, we are in the process of finalizing the installation of the Meteostation that was suggested some years back. It will include 2D and 3D wind sensors as well as temperature, pressure and relative humidity sensors.

The annual coordination meeting for all institutions working at Jungfrauoch took place on October 15, 2019 at Jungfrauoch. It was attended by the director of the Research Station and the custodian Mr. Martin Fischer. The following information are relevant for our Foundation and the researchers: (i) the director mentioned that he was approached by several researchers that lately there were some irritating restrictions at Kleine Scheidegg to enter the train for researchers despite having an agreement with the Jungfrau Railway. This obviously became better since no additional complaint was obtained; (ii) emissions increased again, mainly associated with the continuous constructional work performed at Jungfrauoch. In particular, emissions from diesel engines are harmful for our sensitive analysis systems and their corresponding records. The director repeated that if ever-possible electric engines are requested to be used; (iii) an offer for decoupling the air conditioning units of the Jungfrau Railway and the HFSJG at the

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 (https://www.ndsc.ncep.noaa.gov/)
GAW, GAW-CH	Global Atmosphere Watch, Global GAW Station (https://community.wmo.int/activity-areas/gaw), and http://www.meteoschweiz.admin.ch/home/forschung-und-zusammenarbeit/internationale-zusammenarbeit/gaw.html)
GAW-PFR	GAW Aerosol Optical Depth (AOD) Network (https://www.pmodwrc.ch/weltstrahlungszentrum/worcc/gaw-pfr-network/)
GCOS	Global Climate Observing System (http://www.wmo.int/pages/prog/gcos/)
GCOS-CH	Swiss GCOS office (http://www.meteoschweiz.admin.ch/home/forschung-und-zusammenarbeit/internationale-zusammenarbeit/gcos.html)
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/)
EUMETNET	Network of European Meteorological Services (http://www.eumetnet.eu/)
SwissMetNet	Automatic Measuring Network of MeteoSwiss (http://www.meteoschweiz.admin.ch/home/mess-und-prognoseysteme/bodenstationen/automatisches-messnetz.html)
RADAIR	Swiss Automatic Network for Air Radioactivity Monitoring (https://www.naz.ch/en/themen/messnetze.html)
ICOS	Integrated Carbon Observation System (https://www.icos-ri.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.bafu.admin.ch/luft/00612/00625/index.html?lang=de)
AGNES	Automated GPS Network for Switzerland (http://www.swisstopo.ch/pnac)
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://eumetnet.eu/)
ACTRIS	ACTRIS is the European Research Infrastructure for the observation of Aerosol, Clouds, and Trace gases (http://www.actris.eu/)
Swiss Glacier Monitoring Network	Federal Office for the Environment (BAFU) (https://www.glamos.ch/)
EARLINET-ASOS	European Aerosol Research Lidar Network – Advanced Sustainable Observation System (http://www.earlinetasos.org)
IngOS	Integrated non-CO ₂ Greenhouse Gas Observing System (http://www.ingos-infrastructure.eu)
NORS	Network of Remote Sensing (http://nors.aeronomie.be)
AGACC-II	Advanced exploitation of Ground based measurements, Atmospheric Chemistry and Climate applications (http://agacc.aeronomie.be)
EMEP	European Monitoring and Evaluation Programme (http://www.emep.int)
GAIA-CLIM	Gap Analysis for Integrated Atmospheric ECV CLimate Monitoring (http://www.gaia-clim.eu/)
QA4ECV	Quality Assurance for Essential Climate Variables (http://www.qa4ecv.eu/)
Ringo	Readiness of ICOS for Necessities of integrated Global Observations (https://www.icos-ri.eu/ringo)

Sphinx location was received, exhibiting extremely high costs. A re-evaluation was initiated; (iv) the participants were informed about the two awards that the Research Station obtained and about the VAO symposium that will be organized by the Foundation in 2020.

The High Altitude Research Station Gornergrat

At Gornergrat two projects were conducted in 2019, i.e. “Stellarium Gornergrat” and glacier monitoring. A total of 88 working days was spent at Gornergrat (Figure 14). An incredible high number of 776 visitors were attending tours, professionally guided by Dr. Timm Riesen at the Gornergrat Observatory. Again Stellarium Gornergrat – the public outreach project – is performing well. More about observation and pedagogical activities can be found in the report about “Stellarium Gornergrat”.

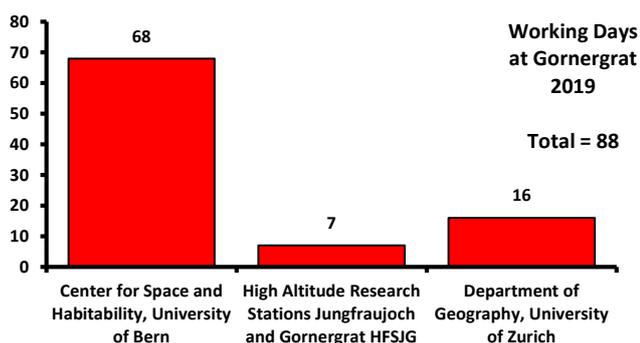


Figure 14. Number of working days at the High Altitude Research Station Gornergrat in 2019 by research groups.

Summary and Acknowledgements

The last year, 2019, was exceptional. Exceptional because two awards were handed out in February and April 2019 by the European Physical Society and the Platform Chemistry of the Swiss Academy of Sciences to honor the research achievements done at the Research Station Jungfrauoch. This has led to numerous media attentions, helping to transfer what is being done in the infrastructures run by our Foundation HFSJG. I sincerely thank the committees for granting these awards, namely the European Physical Society as well as the Swiss Academy of Sciences. Similarly, I like to thank everyone who made these two events successful, all the invited speakers at the two symposia, the numerous participants, the catering companies, the organizing committee and in particular Claudine Frieden our secretary.

Furthermore, both Research Stations Jungfrauoch and Gornergrat were selected as excursion sites for the World Science Journalist Conference that was held in Lausanne, Switzerland in July 2019. It led to a couple of reports, among them “The pollution detectives” by Jane Palmer in the journal ‘Nature’.

Regarding infrastructure updates it was a rather quiet year with evaluations, discussions and preparations for renovating the laboratory at Sphinx level 2 as well as the installation of the new heated inlet system line in order to circumvent contamination faced by the inlet system (NABEL) presently in use.

As every year so far, I am very happy to report about an impressive amount of outcomes from the two Research Stations Jungfrauoch and Gornergrat. From a high number of peer-reviewed publications, over conference contributions to public outreach activities including public lectures, guided tours etc. Congratulations to all the contributors. I very much like this

tremendous and efficient use of our infrastructure and it makes me happy. Thank you very much.

For the fourth time in its history, in 2019 the Jungfrau Railways has attracted over a million visitors to the Jungfrauoch - Top of Europe, as stated by the Jungfrau Holding AG. I congratulate the Jungfrau Holding AG (Prof. Thomas Bieger, president of the Board and Mr. Urs Kessler, Chief Executive Officer) for this continued success. A first milestone has already been achieved regarding the V-Bahn by opening the new easy access to Männlichen. Congratulations on this after such a short construction time. The opening to Eigergletscher is awaited towards the end of 2020. I hope that the ongoing construction work will take place without any major accidents and delays. Constructions are often associated with emissions that interfere with our sensitive instruments, this requires a steady interaction between our two organisations.

We are very thankful to receive support from many different sections at Jungfrauoch to run our infrastructures, namely Mr. Markus Balmer (Head of Jungfrau – Top of Europe), Stefan Würzler (Head of operations), the Jungfrau Holding AG, the technical services (Mr. Andreas Wyss and his team). Thank you very much. So far, we had not much of interaction with the new responsible crew of the restaurants at the Top of Europe, but the change runs rather smoothly. At least I did not receive any complaints.

“Stellarium Gornergrat” has grown up and has become an attractive place to be for many visitors, besides the splendid environment. In particular, the excellently guided tours by the managing director Dr. Timm Riesen, are very much appreciated. He writes in his report that the “Stellarium Gornergrat” supported 9 matura theses and that many classes booked in to investigate the space objects using the remotely available infrastructure. Congratulations to the “Stellarium Gornergrat” team. As mostly, the success is based on collaborations for which I express my sincere thanks: to the Matterhorn Gotthard Railway (Jean-Pierre Schmid, president and Fernando Lehner, Chief Executive Officer and his representative in the HFSJG Board, Mr. Marcel Mooser and Mr. René Bayard) and the Gornergrat Railway for their support regarding person and material transport.

The long-lasting and continued support and engagement of the Burgergemeinde Zermatt in the Foundation’s activities is very much appreciated. I cordially thank Mr. Andreas Biner, president and Mr. Fernando Clemenz and Mr. Leo Schuler of the Burgergemeinde Zermatt. The success of the “Dining with the stars” and previous events would not have been possible without the dedicated promotion by Mrs. Nicole Marbach and Mr. Thomas Marbach at the Kulmhotel Gornergrat. Hospitality is a key part of success, as nicely demonstrated at Gornergrat.

This year our administrative staff at Bern once again topped their performance with the many organizational work load they had to deal with besides every-day work. Thank you very much. Claudine Frieden (secretary), Dr. Rolf Bütikofer (IT responsible person) and Dr. Stéphane Affolter (responsible person for East Ridge Station) guaranteed a smooth operation of the Foundation. I also would like to thank Mr. Karl Martin Wyss for his competent services as our treasurer, Mrs. Theres Trachsel for the bookkeeping, and the CORE Treuhand Cotting AG, Bern (Mr. Harro Lüdi) for the professional auditing.

The University of Bern is not only a member of our Foundation but supports us in many ways, for instance when organizing symposia as done in the last year twice. Therefore, I express my sincere thanks to its Rector Prof. Dr. Christian Leumann for the continued support of our Foundation, for the hospitality and for the support of our administration. I like to thank the Physics Institute for hosting the office of Stellarium Gornergrat within their Centre for Space and Habitability.

Finally, I would particularly like to thank Prof. Silvio Decurtins for his prospective and committed work as president of our Foundation. He consequently and convincingly promotes our Foundation. It is thanks to his effort that the member countries are increasing and that the Foundation is getting global with our new member China, represented by the University of Beijing. Thank you very much Silvio for your precious work.

I conclude by saying come and visit us, in particular to view the new plaques for our received awards. On behalf of the Directorate HFSJG, best regards to all of you.



Bern, March 5, 2020

Markus Leuenberger

