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1 Argentina (and South American Partners)

One of the outstanding tasks of the Geocryology Unit of Mendoza (D. Trombotto, J. Hernández) were the thermogeomorphological monitoring campaigns at the Peteroa volcano (35°15'S and 70°35'W) in a joint research project with the Comisión Nacional de Energía Atómica (P. Penas, Buenos Aires) and the International Center for Earth Sciences (A. Ramires, Malargüe).

Daytime as well as nighttime flights with a Cessna 180 for four passengers with thermo-cameras a AGEMA TVH 550 or a sophisticated FLIR P660 made it possible to identify hot (active craters with fumaroles) and cold (with permafrost and glaciers) sites of the volcano caldera and to compare this information with former data obtained in 2009. Changes of geoforms, glaciers, permafrost and of the thermal spectrum as an alert of the eruption registered later on in September 2010 (FOTO) were detected. As part of this project in the region of the Peteroa Volcano and the upper basin of the Malargüe river, Pablo Grizas has began his doctoral thesis on periglacial hydrology under the direction of Dario Trombotto.



*Eruption of the Peteroa Volcano, September 20, 2010
(Photograph provided by Dario Trombotto).*

In 2010 Argentina had significant national and international transfer activities. In March there was a scientific exchange program with the University of Salzburg, Austria. In August Trombotto took part in the International Short Course on Permafrost Engineering as a lecturer in Santiago de Chile. The same course was then given in San Juan, Argentina. This special course on Geocryology was organized by BGC Engineering Inc. (L. Arenson, S. Pastore) from the

Argentine and South American Association of Permafrost). Other courses held were "Processes and Geodynamic Risks" at the Universidad Nacional de Cuyo, Mendoza as part of the Master program in territorial planning. Another course on Geocryology, "Permafrost and Ice in Caves" was held during a workshop on speleology in Malargüe.

There have been joint initiatives of Chile and Argentina under the international project: "Dinámica de glaciares rocosos en el Chile Semiárido" (Dynamics of rock glaciers in Semiarid Chile) in cooperation with the University of Waterloo, Ontario, Canada, the Universidad Católica de Chile, Santiago and the Geocryology Unit IANIGLA, CONICET Mendoza, Argentina. In the framework of a project funded by the Dirección General de Aguas (DGA), F. Herrera (Pontificia Universidad Católica de Chile), G. Azócar and A. Brenning, with additional help from F. Rojas and F. Lobos (Pontificia Universidad Católica de Chile) built an exhaustive inventory of rock glaciers in the Choapa, Limari and Elqui watersheds. Within the same project, P. Iribarren (DGA), A. Brenning, X. Bodin and G. Azócar set up two new permafrost monitoring sites (Tapado and Llano de la Liebre, near the Agua Negra pass, border with Argentina), including sub-surface temperature measurements, active layer temperature measurements with material and help from D. Trombotto, L. Ruiz (Geocryology, IANIGLA) and J. Hernández and GPS-based survey of surface displacements. Those sites and the equipment are part of the DGA's glacier monitoring network. Other active monitoring sites in order to create a bigger Chilean geocryological network are Laguna Negra and La Parva in the Central Andes of Santiago. They are attended mainly by the specialists mentioned above.

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2 Austria

Permafrost research in Austria was intensified substantially during the last years. As a consequence of this development, a first official meeting of permafrost scientists from Austria and South Tyrol was held in 2010. This Permafrost Workshop was organized on 14-15 October 2010 in Obergurgl (Tyrol, Austria) to bring together most scientists working on alpine permafrost in Austria and South Tyrol, and to present and discuss current research activities on alpine permafrost. In total, about 50 people from 17 different research institutions participated in this successful workshop. The first day of the meeting was focusing on research exchange and oral and poster

presentations. On the second day the participants visited the rock glacier Äusseres Hochebenkar (or Outer Hochebenkar) thereby discussing different permafrost related issues directly in the field (Figure below). This rock glacier is well known to the scientific community because of its remarkably long record of geodetic and photogrammetric measurements starting in the 1930s. The workshop was mainly organised by K. Krainer (Uni. Innsbruck) supported by H. Hausmann and E. Brückl (both TU Vienna). One of the main results of the workshop was the foundation of an informal “Austrian Permafrost Working Group”. The two main objectives of this group are, first, to improve coordination and cooperation of future research activities on alpine permafrost in Austria and South Tyrol and, second, to select “key sites” for a long-term monitoring in the Austrian Alps. Since this meeting, the national committee of IPA-Austria consists of A. Kellerer-Pirklbauer (Uni. Graz, TU Graz), G.K. Lieb (Uni. Graz), K. Krainer (Uni. Innsbruck), L. Schrott (Uni. Salzburg) and H. Hausmann (TU Vienna).



Participants of the first Austrian Permafrost Workshop with scientists from Austria and South Tyrol, held on 14-15 October 2010 in Obergurgl, Tyrol, Austria. The participants visited the famous rock glacier Äusseres Hochebenkar (Outer Hochebenkar) where geodetic and photogrammetric measurements starting already in the 1930s. (Photograph provided by Andreas Kellerer-Pirklbauer).

In 2010, the new national project *permafrost–Austrian Permafrost Research Initiative* – was launched. The project consortium consists of permafrost researchers from the University of Innsbruck (K. Krainer, H. Stötter), Graz University of Technology (A. Kellerer-Pirklbauer, M. Avian, V. Kaufmann), University of Leoben (E. Niesner), University of Salzburg (J.-C. Otto), and Vienna University of Technology (E. Brückl, H. Hausmann) and is coordinated by the Austrian Academy of Sciences (A. Borsdorf, M. Monreal). *permafrost* is a first step establishing a nationwide permafrost monitoring program in Austria with a running period of three years.

The University of Innsbruck group of K. Krainer in cooperation with the Vienna University of Technology (E. Brückl, H. Hausmann), the Central Institute for Meteorology and Geodynamics in Salzburg/ZAMG Salzburg (C. Riedl, A. Klee, M. Staudinger) and the Geological Survey of Austria (A. Römer) continued working on the project *Permafrost in Austria*. The goal of the Krainer-group in the two projects *Permafrost in Austria* and *permafrost (WP5000)* is the study of the impact of changes in the thermal regime of alpine permafrost on melting processes, discharge patterns and water chemistry at test sites in the Ötztal Alps, Samnaungruppe, Stubai Alps and Verwallgruppe by using a combination of geological, geomorphological, hydrogeological, geophysical, geochemical, meteorological and climatological methods. Within the project *PermaNET*, three ice-cores were drilled at two rock glaciers (Lazaun, Weissbrunn) in September 2010. The ice-cores are studied regarding ice content, chemical composition of the ice (anions, cations, heavy metals), palynology, age and stable isotopes. Furthermore, work on a rock glacier inventory of the Federal Province of Tyrol was continued. Geophysical investigations (E. Brückl, H. Hausmann) at the study area Krummgampental, Kaunertal (Ötztal Alps) were continued as reported last year.

The University of Innsbruck group of J. Stötter continued to carry out permafrost research within the *PermaNET* and *C4AUSTRIA* projects. Furthermore, the project *permafrost (WP6000)* was initiated focusing on the monitoring of thawing of mountain permafrost with multi-temporal airborne laser scanning (ALS) data. Botanists from the University of Innsbruck (B. Erschbamer, R. Grassmair) started to investigate the plant colonization in relation to grain size of the substrate, soil temperature, pH and flow velocity at the rock glacier Äusseres Hochebenkar. Ecologists from the University of Innsbruck (K. Koinig, R. Psenner, E. Ilyashuk, R. Lackner, G. Köck) worked on the impact of melting permafrost on water quality and aquatic organisms in alpine lakes. Impacts are ranging from rapid increases in conductivity to toxic levels in metal concentrations that can exceed drinking water standards by more than an order of magnitude. A new project investigates the impact of permafrost meltwater on aquatic organisms. In addition, they will study sediment cores in order to investigate whether the current increase in metals in permafrost melt water is unprecedented, or whether comparable increases in metal concentrations occurred during warmer periods in the past.

ZAMG Salzburg continued to work on *PermaNET* and *Permafrost in Austria* at the study area Hoher

Sonnblick (3105 m), Hohe Tauern Range. Ground temperature is monitored continuously at three boreholes (each 20 m) in the summit region (see earlier reports). At borehole 1, continuous data are available since end of 2007. Technical problems at boreholes 2 and 3 were solved and since August 2010 continuous data are also available from these two sites. Furthermore, ground surface temperature is monitored at 35 sites used for future 3D-permafrost modelling. ZAMG Vienna (W. Schöner, Ch. Kroisleitner) continued working on the project *PERSON* as another part of permafrost research in the Sonnblick area.

The University of Salzburg group (L. Schrott, J.-C. Otto, M. Rupprechter) continued their efforts to model the permafrost distribution of the Hohe Tauern Range (*permalp.at*). Two new projects were initiated in 2010: *permaFrost* (WP3000) investigates permafrost-glacier interactions in the Austrian Alps at the two test sites Kitzsteinhorn and Goldbergkees glaciers (J.-C. Otto). *MOREXP*ERT, a core project of the alpS - Centre for Climate Change Adaptation Technologies, develops an expert monitoring system for high mountain rock walls (M. Keuschnig, I. Hartmeyer). Preliminary investigations for the monitoring setup were carried out (ERT, GPR, TLS, etc.) at the study area Kitzsteinhorn. Four out of five deep boreholes in the rock face have been drilled with depths of 20-30 m. Instrumentation of boreholes and other equipment, for example a measurement device for permanent electric resistivity measurement, extensometers and temperature loggers, will follow in spring and summer 2011.



Geodetic rock glacier measurements at the rock glacier Dösen were initiated in 1995 and celebrated in 2010 its 15th birthday. Measurement team of 2010: V. Kaufmann, G. Hollinger, W. Krämer (all TU Graz), V. Schuster, G. Zechner, M. Rieckh (students of UNI Graz and TU Graz), D. Regmi and S.R. Bajracharya (both guest researcher from Nepal). (Photograph provided by V. Kaufmann).

The group of permafrost researcher in the Federal province of Styria consisted in 2010 of people from the University of Graz (A. Kellerer-Pirklbauer, G.K. Lieb, O. Sass, M. Rode), Graz University of Technology (M. Avian, V. Kaufmann, A. Kellerer-Pirklbauer), Joanneum Research, Graz (A. Bauer) and University of Leoben (E. Niesner). *ALPCHANGE* was still ongoing in 2010 and will finally terminate in June 2011.

PermaNET was successfully continued. Amongst other issues, the rock glacier inventory of Central and Eastern Austria was finalised. The new project *permaFrost* (WP4000) was launched. Field research within *ALPCHANGE*, *PermaNET* and *permaFrost* (WP4000) is carried out at seven study areas in the Hohe and Niedere Tauern Ranges. Within *permaFrost* (WP4000), the Styrian project participants aim to continue and improve research in the field of kinematics, volumetric and thermal monitoring of rock glaciers and permafrost and to understand the inner structure of three rock glaciers in the Hohe Tauern Range (Weissenkar, Hinteres Langtalkar, Dösen). The resurveying by terrestrial laser scanning/TLS of the front of the highly active rock glacier Hinteres Langtalkar is carried out now since 10 years. The annual geodetic displacement measurements at the rock glacier Dösen celebrated its 15th birthday (Fig. 2). Within the project *ROCKFROST* (application submitted to the Austrian Science Fund) it is intended to investigate the governing factors of frost weathering in alpine regions. This comprises small-scale 2D-geoelectrical monitoring of moisture levels and moisture displacement during freeze-thaw events, supplemented by datalogger-based monitoring of freeze-thaw cycles and by repeated TLS scans of rock faces to assess rock fall rates and distribution at three study sites (Gesäuse, Dachstein, Kitzsteinhorn). At the third study site, research is carried out in close cooperation with the *MOREXP*ERT project.

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3 Canada

It has been a busy year for the Canadian permafrost community. One of the major highlights of 2010, was GEO2010, which was a joint conference of the 63rd Canadian Geotechnical Conference and the 6th Canadian Permafrost Conference (CanCOP6), held in Calgary, September 2010. CanCOP6 was very successful as was jointly organized by the Canadian National Committee for the IPA (CNC-IPA) and the Canadian Geotechnical Society's Cold Regions

Division. Although the majority of participants were Canadian, there were several international participants including good representation from the USA, China and Russia. Over 70 permafrost/cold regions papers were presented and also published in the proceedings. The program included presentations on results of IPY research, northern foundations, northern pipeline design, monitoring and management, infrastructure design for northern mines, permafrost issues in the Mackenzie Delta. Two plenary papers with a permafrost theme were presented in the opening session of the joint conference, one by Dr. J. Oswell (RM Hardy keynote address) and the other by Dr. S. Kokelj (JR Mackay award recipient). Short courses on permafrost geophysics and remote sensing and permafrost were also offered.

Other Canadian scientists and their contributions to research were also recognized in 2010. Dr. J.R. Mackay was awarded the inaugural IPY lifetime achievement award at the Third European Conference on Permafrost. This award recognizes the significant contribution that Dr. Mackay has made to our understanding of the permafrost environment during a career that has spanned more than six decades. The project on the impact of climate change on permafrost conditions in Yukon and northern BC led by Dr. A. Lewkowicz (U of Ottawa) with students, C. Miceli and M. Duguay, was recognized as the 2010 Expedition of the Year by the Royal Canadian Geographical Society. Dr. L. Arenson (BGC Engineering) was awarded the Roger Brown Award by the Canadian Geotechnical Society honouring excellence in permafrost engineering.

The Canadian permafrost community has been active in providing their expertise to various initiatives to improve our understanding of the impacts of climate change on infrastructure and the development of strategies to adapt to these changes. Permafrost scientists and engineers (including D. Hayley, C. Burn, S. Smith, D. Fortier) were members of an expert working group led by the Canadian Standards Association tasked with developing guidelines for engineering design of community infrastructure for a changing climate. There was considerable interaction with various individuals from northern communities. The report was released in 2010 (available at: <http://www.shopcsa.ca/onlinestore/welcome.asp>) and there are early indications that it is being welcomed in various regions as a guide for construction in permafrost regions. The permafrost community also contributes to the Network of Expertise on Permafrost, a Transportation Association of Canada initiative.

The Thermal State of Permafrost (TSP-Canada) Project led by S. Smith, A. Lewkowicz and C. Burn was Canada's main permafrost contribution to the International Polar Year (IPY). One of the key achievements of this project was a snapshot database and map of the current thermal state of permafrost. The map was presented at the IPY Oslo Conference (June 2010) and in the special issue of Permafrost and Periglacial Processes released during the conference as well as a paper in the proceedings of CanCOP6. The database for TSP-Canada is also provided online (www.gtnp.org and <http://nsidc.org/data/g02190.html>). The current conditions were also placed in the context of the longer record and the results show that permafrost temperatures continue to increase across the Canadian north and over the last three decades the range in temperature of permafrost in Canada has decreased by about 1°C. Analysis of the data collected during IPY is continuing and additional publications are to be released and/or submitted in 2011. The results from the Canadian project were important contributions to the Arctic Council Climate and Cryosphere Project (Snow Water Ice and Permafrost in the Arctic). Scientific reports for the Federal IPY program are currently being prepared and the results of TSP-Canada will be a key contribution to the cryosphere report.

On the resource development front, in late 2010 the National Energy Board of Canada released its reason for decision and conditions for approval of the Mackenzie Gas Project. This project, which would see a natural gas pipeline constructed from the Mackenzie Delta to northern Alberta, was the subject to regulatory hearings and inquiries since 2004. Full details on the reason for decision may be found at <http://www.neb-one.gc.ca/clf-nsi/rthnb/pplctnsbfrthnb/>

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4 China

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5 Denmark

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6 Finland

The activities of the Finnish permafrost community are going on both in Eurasia and Greenland. The research project "Global change impacts on sub-arctic palsa

mires and greenhouse gas feedbacks to the climate system: PALSALARM” ended in year 2010. PALSALARM was conducted during 2007-2010 and received funding through the Nordic Ministers' Cooperation Programme for the Arctic. The project was carried out by the Finnish Environment Institute (S. Fronzek and T.R. Carter) and the Universities of Copenhagen, Lund and Helsinki (M. Luoto). This project brought together research groups from four institutions in the Nordic region who have hitherto worked largely independently on different aspects of palsa mires. The central aim of the study was to estimate future changes in the distribution of palsa mires in Fennoscandia, and the implications of these changes for greenhouse gas budgets and nature conservation. The project had four specific objectives:

1. to map the current distribution of palsa mires
2. to model future changes in palsa mire distribution due to projected climate warming
3. to estimate future changes in the CH₄ and CO₂ budgets of palsa mires
4. to assess the ecosystem implications of palsa mire degradation and investigate possible conservation measures.

The results of the project provide useful information for the research community on the implications of climate change for permafrost, for ecosystems and for greenhouse gas budgets. They will naturally feed into international assessments such as IPCC, ACIA and IPY. The results may also offer an early indicator of rapid and potentially irreversible impacts of climate change in highly valued environments, which might be of interest and concern to policy makers in the Nordic region and beyond. The project published more than 20 international scientific articles, e.g. papers in journals *Geophysical Research Letters*, *Global Change Biology*, *Permafrost and Periglacial Processes* and *Climate Research*.

Finnish Environment Institute organized 14 October 2010 a scientific palsa mire workshop in Helsinki, Finland. The symposium was structured in three themes:

- * Theme 1: Spatial distribution and current status of palsa mires in Finland
- * Theme 2: Global change impacts on palsa mires
- * Theme 3: Monitoring and remote sensing of palsa mires

The Top-level Research Initiative (TRI) is the largest

joint Nordic research and innovation initiative to date. The initiative aims to involve the very best agencies and institutions in the Nordic region, and promote research and innovation of the highest level, in order to make a Nordic contribution towards solving the global climate crisis. The initiative comprises six sub-programmes, two of which will focus on climate change research. Nordic research collaboration is expected to contribute to responding to challenges in the management of climate change in northern regions. Finnish research teams are strongly represented in the new Nordic Centres of Excellence and research projects of the Top-level Research Initiative launched by the Nordic prime ministers. The Finnish teams studying permafrost in the project “Impacts of a changing cryosphere - depicting ecosystem-climate feedbacks from permafrost, snow and ice” (DEFROST)” are headed by Pertti Martikainen (University of Eastern Finland) and Timo Vesala (University of Helsinki).

Pertti Martikainen, Maija Repo, Christina Biasi (University of Eastern Finland) and Matti Seppälä have investigated nitrous oxide emissions on subarctic palsa mires in northern Finland. John Woodward (University of Northumbria, Newcastle upon Tyne, UK) and Matti Seppälä continued studies on palsa mires, particularly surface laser scanning of palsa mires in subarctic Finland.

In northern Finland, field work for Nordic project ‘Permafrost observatory in the Nordic Arctic: sensitivity and feedback mechanisms of thawing permafrost’ (2009–10) (Finnish participant J. Hjort from the Department of Geography, University of Helsinki and University of Oulu) was conducted in Vaisjeaggi palsa mire close to the Kevo research station. The main objectives of this project are to establish a permafrost monitoring network based on existing Nordic research stations and key research sites for assessing the effects of climate change on the permafrost environment and secondly to provide comparable data and new insight from these sites on the sensitivity and feedback mechanisms of thawing permafrost.

The project ‘Spatial Fmodelling of periglacial processes under environmental change’ (2008–2010) (J. Hjort and M. Luoto and M. Marmion (University of Oulu and University of Helsinki) continued. This project has focused on spatial modelling of periglacial processes based on remote sensing and GIS data. Additionally, Hjort and Luoto have investigated interaction of periglacial processes and ecologic features across altitudinal zones in subarctic landscapes.

Geological Survey of Finland (Timo Ruskeeniemi) investigated recharge of subglacial meltwaters into bedrock within the international Greenland Analogue Project (GAP) initiated by the Finnish (Posiva) and Swedish (SKB) nuclear waste management companies in collaboration with the NWMO from Canada. So far two bedrock boreholes have been drilled into the study area in western Greenland. Moreover, Geological Survey of Finland (P. Lintinen, H. Vanhala, J. Jokinen) and Mining Geological Company MIREKO continued co-operation in a field of geophysical characterisation of permafrost and talik structures in Northern part of Komi Republic and Nenets Autonomous Region.

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7 France

In the last years, several initiatives were launched to structure the French permafrost monitoring activity and the young researcher community.

Set up in 2008, the PermaFRANCE network aims at: i) providing a common framework for all the activities related to the long-term monitoring of mountain permafrost in France, ii) at improving the knowledge on mountain periglacial environments and their sensitivity to the global change, and iii) at providing the French contribution to international networks (such as the GTN-P, CALM and SCREECOS). The main activities of PermaFRANCE include the coordination of the different observation system elements (observers, instrumentation, site maintenance, protocols of data acquisition, campaigns) and the diffusion of the data collected. PermaFRANCE gathers together research teams, individual researchers, engineering departments of private companies that specifically work on mountain permafrost, public or private structures that host on their territory one or several observation sites, public or private structures that contribute to the maintenance or the operation of the observation sites and public or private structures that are interested in the data and/or that support the network. The network has edited the first report Permafrost in France in June 2010, which is freely distributed as hard copy or as numerical document (please contact philippe.schoeneich@ujf-grenoble.fr). This report contains ground surface temperature data collected since 2003, rock glacier displacement data collected since 1985 and rockface LiDAR measurements and rockfall inventories collected since 2005. The Groupement d'Intérêt Scientifique (GIS) PermaFRANCE has been created in early 2011 to formally represent the network.

Another similar initiative is the creation, in February 2010, of the PYRN France group, as part of the Permafrost Young Researchers Network. This group has grown steadily since its creation and now reaches 31 members, most of them are Master and PhD candidates, lecturers and associate professors working on low-land and mountain permafrost, with approaches ranging from in-situ monitoring to field experiment and numerical modelling. This PYRN France group essentially serves as a common platform to exchange information relative to the various sides of permafrost activities of French research teams. Please contact xavier.bodin@univ-savoie.fr for more information.

Research operations on mountain permafrost

The research activity on mountain permafrost in the French Alps is led by the members of EDYTEM (UMR 5204 CNRS / Université de Savoie) and PACTE (UMR 5194 CNRS / Institut de Géographie Alpine, Université Joseph Fourier) research laboratories.

Research on rockwall permafrost is conducted by EDYTEM. P. Deline and L. Ravanel have completed in 2009 the instrumentation of the Aiguille du Midi observation site (Mont Blanc massif) with three 10-m deep boreholes drilled on the Piton Central (3842 m a.s.l.), and equipped with 15-thermistor chains. Four ERT (Electrical Resistivity Tomography) surveys have been carried out since 2008 in collaboration with M. Krautblatter and A. Kemnas (University of Bonn). A complete high resolution Digital Elevation Model of the Piton Central has also been produced from several terrestrial LiDAR surveys and will serve, together with ground surface temperature data (managed by ARPA Valley of Aosta), to calibrate a coupled surface energy balance / ground heat flux model (collaboration with J. Noetzli, University of Zürich). In the Mont Blanc massif, monitoring of the rockfall activity at selected permafrost-affected rockwalls with annually-repeated terrestrial LiDAR surveys, and annual inventories of rockfalls through a network of observers (mainly Alpine guides) are carried on since 2005 and 2007, respectively.



Drilling of a 10-m-deep borehole in the SE face of the Piton Central of the Aiguille du Midi (3842 m a.s.l., Mont Blanc massif) in September 2009; with, down below, Glacier du Géant and Vallée Blanche (Photograph provided by EDYTEM Lab).

Research on ice-rich permafrost is conducted by a team gathering together PACTE, ADRGT (Association pour le Développement des Recherches sur les Glissements de Terrain), GIPSA-lab (UMR 5216, CNRS – Université Joseph Fourier – Grenoble INP) and CNAM (Conservatoire National des Arts et Métiers), and coordinated by P. Schoeneich. In this context, four rock glacier sites have been instrumented, two with ski infrastructures (Deux Alpes-Bellecombe and Orelle-Plan Bouchet), one with a long series of measurements (Laurichard) and one with a recently collapsed rock glacier (Bérard). On each site, the state and dynamics of the ice-rich permafrost, especially in rock glacier, was evaluated using geophysical methods (electrical resistivity, seismic-refraction, ground penetrating radar), geodetic survey (with Differential-GPS) and geomorphological mapping, mainly done by J.-M. Krysiacki (PACTE) and O. Le Roux (ADRGT). M. Vallon has simulated the potential evolution of the thermal state of those sites, with IPCC scenarii and under various initial physical conditions (ice/rock proportion, presence/absence of snow at the surface), using a 1-D ground heat flux model. M. Gay (GIPSA-lab), C. Barboux (GIPSA-lab) and T. Echelard (IGA-PACTE) have used radar interferometric techniques on satellite images (ERS-1 and ERS-2) to assess the surface movements that have affected the slopes covered with permafrost between 1993 and 2000 in the Southern French Alps. The main efforts in 2009 and 2010 were put on drillings, conducted by PACTE and ADRGT. Two shallow (13 and 14 m deep) boreholes were drilled in 2009 into a rock glacier on the Deux Alpes observation site, few meters besides a cable-car station. Data are currently analysed, but first results show that the

ice-rich permafrost is probably temperate, which may cause, in a near future, additional problem for the infrastructures. In 2010, a 100-m deep borehole was drilled in bedrock and instrumented with a thermistor chain and a fiber optic cable at the Deux Alpes observation site. This borehole, situated at exactly 45° N will permit to extend the GTN-P network to the south in the Alps.



Installation of the drilling machine on the Deux Alpes observation site for the deep (100 m) borehole, at 3065 m asl. in Sept. 2010 (Photograph provided by P. Schoeneich).

All these operations have been funded mainly by the the PermaNET project, within the EU Alpine Space transnational program (2008 to 2011; participating countries: Austria, France, Germany, Italy, Slovenia, Switzerland), by the Fondation MAIF, through the project Analyse des risques induits par la dégradation du permafrost alpin (2007-2010), and through additional funding from Rhône Alpes region (CIBLE 2008 program).

EDYTEM and IGA-PACTE are in charge of the organisation of the final conference of the PermaNET project, which will be held in Chamonix on 28-30th of June 2011.

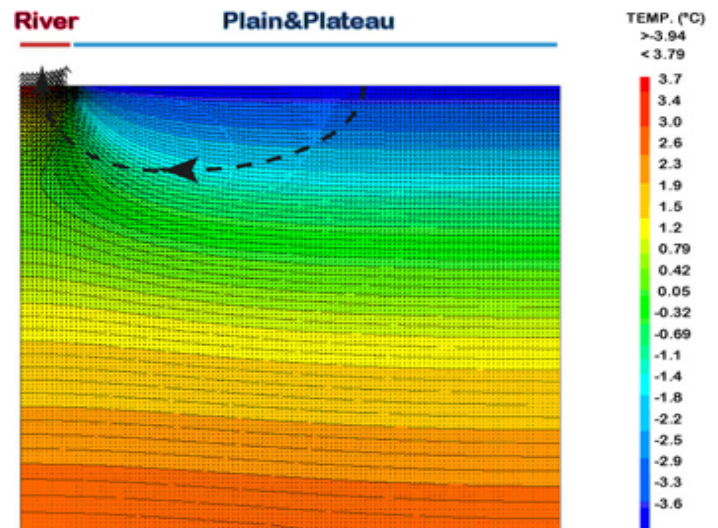
Armelle Decaulne, from CNRS Geolab in Clermont-Ferrand, worked in Northern Iceland and Western Norway on snow-avalanche rhythms during the last decades, combining geomorphic and dendrochronological methods. Most of the work is done in cooperation with the Natural Research Centre of Northwestern Iceland in Saudarkrokur.

The CLIMAFLU project (2008-2011), endorsed by the ANR program is an international cooperation between France and Russia, led by F. Costard (IDES, CNRS-Université Paris-sud XI), E. Gautier (Laboratoire de Géographie Physique CNRS UMR 8591) and A. Fedorov (Permafrost Institute, RAS,

Yakutsk). Investigations of the effect of the climate warming on the fluvial dynamic of the Lena river (Yakutia) is the topic of that project. François Costard (UMR 8148, IDES, CNRS-Université Paris-sud XI) with Emmanuèle Gautier and Daniel Brunstein (Laboratoire de Géographie Physique CNRS UMR 8591) carried out investigations on the Lena flood plain at the latitude of Yakutsk. Two expeditions took place in 2010, one in May to study the breakup phase and the second one in July after the flood season. The objective was to set up several data loggers over several islands in order to measure the thermal regime of the permafrost. This study is expected to allow a quantitative analysis of the evolution of islands in a floodplain under a periglacial environment.

Ch. Grenier, D. Régnier, E. Pons-Branchu and E. Mouche from LSCE has been developing a numerical modeling tool for permafrost issues over the past years. The coupled Thermo-Hydro (TH) module is developed within the Cast3M simulation platform (www-cast3m.cea.fr), validated against analytical solutions and benchmarked with literature cases (e.g. McKenzie et al., 2007). The model involves Mixed and Hybrid Finite Element and Finite Volume numerical schemes. It includes heat conduction, heat advection, phase change, coupled Darcy water flow. The focus was recently put on two main application domains:

- * Impact of permafrost evolution on underground flow patterns for nuclear waste storage applications. Detailed numerical study of the TH evolution of a basic landscape unit consisting of a river and a plateau (idealized 2D vertical section from the Paris Basin). In cooperation with IDES-UMR 8148 laboratory (F Costard and L Dupeyrat), a new approach investigates conditions leading to continuous or discontinuous permafrost (open talik) under a river (figure 1). In such a model, sensitivity to system parameters (e.g. medium properties, system extensions, geothermal gradient, head gradients for advection) is taken into account.
- * Improvement of temperature signal reconstruction and associated permafrost evolution for the last 120 000 years at Bure (Paris Basin in Eastern France). The approach investigates relations between climate simulations, nearby climate reconstructions from lacustrine sediments, small time scale temperature variations from Greenland and speleothem growth periods measured in the same region.



Temperature field (vertical transect) after progression of a cold signal in the depth of a River – Plain Plateau system (imposed 4°C on river and -4°C on Plain Plateau; imposed head varying linearly on Plain Plateau). Flow direction sketched with arrow

A. Rivière and A. Jost (UMR 7619 Sisyphe, University Pierre et Marie Curie Paris VI), in collaboration with J. Gonçalves (UMR 6635 CEREGE, University Paul Cézanne Aix-Marseille III), are carrying out numerical developments on permafrost dynamics. They use a coupled groundwater and heat transport model with integrated freezing and thawing processes to examine the interplay between groundwater flow and frozen ground. The relevance of the physical processes described in the numerical model is evaluated by comparing its predictions with measurements from physical modelling experiments in a cold room carried out at UMR 6143 M2C (M. Font-Ertlen, University Caen Basse-Normandie). Their research focuses on: (i) the pressure response to permafrost formation and dissipation in subpermafrost aquifers, (ii) groundwater-river exchanges in discontinuous and continuous permafrost areas in a warming context, and (iii) the long term impact of past permafrost on present-day hydrogeological conditions in large aquifer systems.

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8 Germany

News from the AWI Potsdam

The 13th Russian-German-Expedition Lena Delta 2010 took place from July to November with 55 participants. The overall aims are to continue the ongoing research on carbon, water and energy cycling, coastal erosion, land-sea interaction and

paleoclimatic reconstruction, carried out on the tundra in and around the Lena Delta, the shallow coastal seas and on a N-S transect for lake studies and lake sediment sampling. The activities were concentrated on the German-Russian Samoylov station on an island in the middle of the delta. The building of a new station has started this summer on an area more inland of the island, because of increasing river shore erosion close to the old station. The visit of the Russian Prime Minister Vladimir Putin at Samoylov station on August 23, 2010, was a highlight of the expedition. During his stay on Samoylov Putin was informed about the research carried out especially the long term monitoring sites. He showed his deep interest in the permafrost studies during a long discussion with scientists and students.



Russian prime minister Vladimir Putin at Samoylov station, Lena delta (Photograph provided by Günter Stoof)

Measurements of climate, energy and water fluxes and permafrost thermal dynamics were continued at the field sites in Spitsbergen (Ny Alesund), Siberia (Lena Delta) and Canadian High Arctic in cooperation with Hamburg University and York University. Furthermore, spatial distributed mapping of arctic land cover and terrain features using ground based measurements and satellite images was carried out. The long-term studies on methane fluxes on Samoylov were continued in cooperation with the Forest Institute in Krasnoyarsk. Furthermore a global warming simulation experiment using open top chambers was started to study the effect of rising environmental temperatures on microbial community structure and stability.

The coast of the Buor Khaya Peninsula (southern Laptev Sea) was used to study permafrost degradation as well as the modern periglacial environment by a group of nine colleagues from Potsdam, Yakutsk, St. Petersburg and Tiksi in August 2010. Survey of the coastal geomorphology and stratigraphy were carried out to improve coastal classification and to establish an initial survey of coastline position for change rate determination and comparison with remote sensing products. Geoelectric methods were used to measure

the bathymetry, to detect the penetration depth of the salt front into the sediment, and the upper surface of the ice-bonded permafrost. The apparent resistivity of the sediment was measured, surface sediments were collected and the temperature and salinity at the sea bed during the summer high temperature period were logged. In addition proposed drilling sites were characterized in terms of bathymetry and permafrost depth, via inversion of observed apparent resistivity. Various permafrost profiles along the shore were studied to develop a stratigraphic differentiated carbon balance and characteristic, relating the transformation of organic matter with the permafrost dynamics during the last late Quaternary climatic cycle, as well as examining the stability and/or degradation of the organic carbon fixed in permafrost. The expected cryolithological and stratigraphical results will be used to complete and to correlate paleoenvironmental datasets around the Laptev and East Siberian seas obtained since 1998.

In the Laptev Sea, the AWI, the University of Bremen, the University of Cologne, the Otto Schmidt Laboratory (RU) and the St. Petersburg State University (RU) intensified joint hydro-biogeochemical investigations on land and in coastal to marine waters. The expedition and research activities will result in more insight into the hydrological dynamics, and the residence times, transport, and erosion of organic matter in permafrost from source to sink.

The AWI also pursued its collaboration with McGill University for the sixth year in a row. A group of four scientists from Germany travelled to Herschel Island and the Yukon Coastal Plain to conduct paleogeographical studies (a core was retrieved from the coast 14km east of the Alaska border), coastal thermokarst studies (a monitoring station was installed to quantify the sediment and nutrient release from retrogressive thaw slumps) and microbiological studies (closed chamber measurements to study the release of CH₄ and CO₂). Two scientists from the German Research Centre for Geosciences joined the group to measure atmospheric methane concentrations at ground level.

On November 8-11, 2010 a joint Russian-German workshop on research in the Laptev Sea region was organized by the Otto Schmidt Laboratory (OSL), the Arctic and Antarctic Research Institute (AARI) and the Alfred Wegener Institute (AWI) in St. Petersburg, Russia which attracted a group with broad interests. Over 60 participants registered, about half of whom were Russian and half German to foster multi-disciplinarity, to provide a venue for exchange of results and experiences and to plan and co-ordinate

future activities. The necessity for a meeting between Russian and German researchers working in the Laptev Sea Region is a direct result of the intense activity and the history of co-operative work that has occurred there over the past two decades in winter and summer months, on land, on the water and on the ice surface.



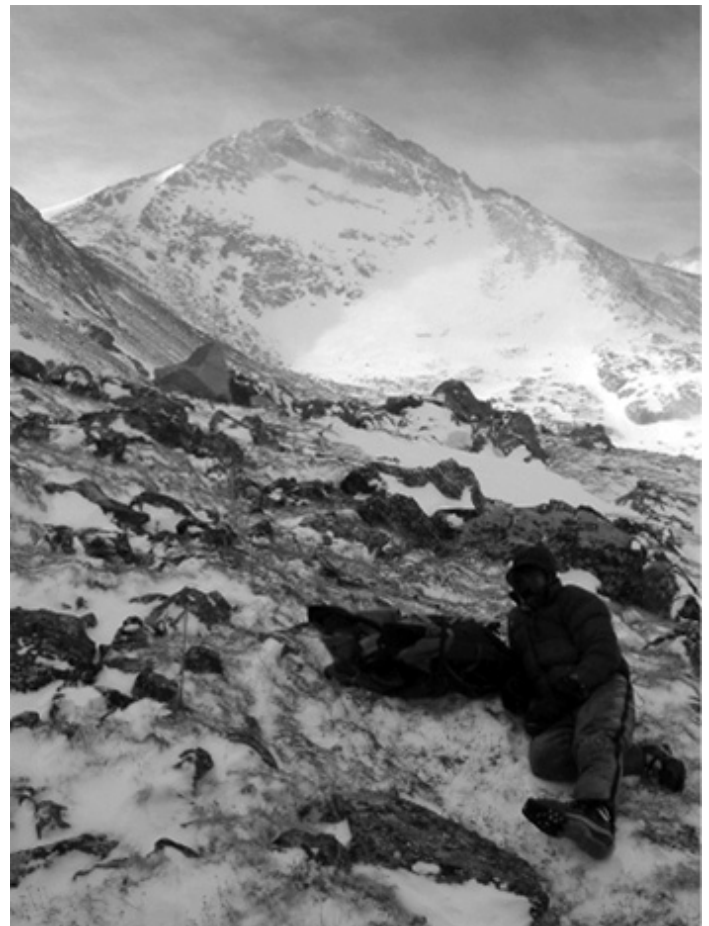
Joint fieldwork on Samoylov Island, Lena River Delta: students are sampling for hydro-biogeochemical parameters and dissolved and particulate organic carbon. (Photograph provided by Birgit Heim).

News from German universities

At the University of Giessen, S. Imbery started his dissertation on the contribution of permafrost and snow to the water balance under climate change conditions. In this DFG-funded Aksu-Tarim-Cryo project, field studies are carried out in the Aksu catchment, Central Tian Shan (China) in cooperation with CAREERI Lanzhou (Gao Qiangzhao and Li Zhongqing) a dense network of ground temperature loggers were installed to study the active layer dynamics and permafrost distribution at altitudes between 3,400 and 4,150 m a.s.l.. Similar studies were started in the Kyrgyz Tianshan by M. Duishonakunov in cooperation with the CAIAG Bishkek with joint supervision of this dissertation by R. Usualiev and L. King. Two PhD students of this Giessen periglacial working group (T. Keller, I. Polenthon) started periglacial studies on the role of frost processes for the mudflows occurring quite often along the Georgian military road, Greater Caucasus, Georgia.

At the technical university of Munich (TU, chair of geomorphology and soil science, centre of life and food sciences Weißenstephan), studies on mountain permafrost distribution and degradation were continued at Green Lakes Valley, Colorado Front Range between 3,600 to 4000 meters a.s.l.. The studies are embedded in the NSF-funded Boulder

Creek Critical Zone Observatory and Niwot Ridge Long-Term Ecological Research, and aim to understand ongoing alterations in the subsurface. M. Leopold and J. Völkel conducted geophysical surveys using electrical resistivity tomography and shallow seismic refraction together with ground penetrating radar for permafrost studies within the critical zone (CZ). Selective sites mapped with underlying permafrost in the 1970's have been re-studied in order to portray changes in the CZ: Whereas small rock glaciers seem to be rather stable, solifluction lobes transformed from permafrost to sites with annual ice lenses. Collaboration with M. Williams and N. Caine from INSTAAR at CU Boulder offers possibilities to combine observable changes in the hydrochemistry of permafrost sites outflows over the past years, in combination with long-term climate records and geophysically-based data of permafrost variations, which possibly allows new approaches in permafrost degradation prognosis.



ERT survey in winter on the rock glacier near Green Lake 5 at 3,600 m a.s.l. (Photograph provided by M. Leopold)

At the University of Würzburg, D. Schwindt continued his PhD thesis research on spatial and temporal permafrost variability regarding ground thermal regime and permafrost-humus interaction in talus slopes below the timberline (Swiss Alps) by applying a year-round refraction seismic monitoring. Repeated

geoelectrical and seismic surveys are conducted at a small glacier forefield at Piz Corvatsch (Engadin, Swiss Alps) by T. Rödder. In addition, temperature data from boreholes are analyzed to investigate and monitor changes in ground characteristics within these unconsolidated sediments. N. Roth has finished his dissertation about temperature -resistivity monitoring and thermal offset studies within the Muragl glacier forefield (Swiss Alps). Recent alpine permafrost dynamics (J. Kästli) and the geomorphological activity of different typical subarctic landforms (P. Konrad) are currently investigated within two diploma theses using a combined geophysical and photogrammetrical approach.

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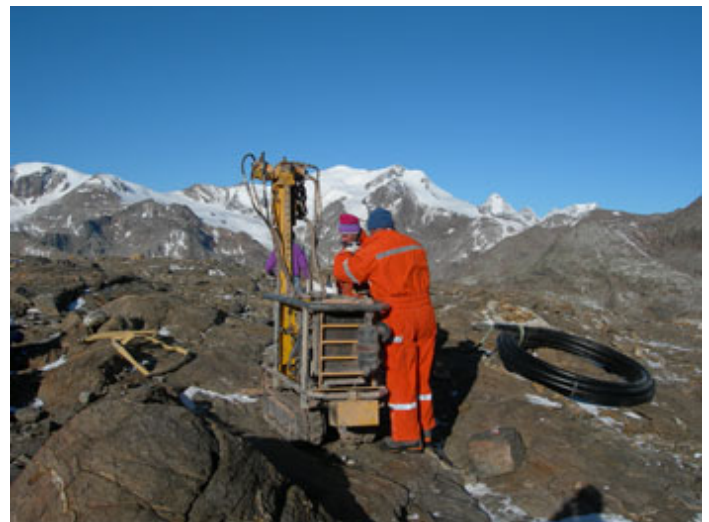
9 Italy

In 2010, the activities of Italian community of permafrost and periglacial researchers were undertaken at Universities, Research Institutes, Public bureaus (Provinces, Regions) and Foundations. These researches cover most of the Alpine arch, the central area of the Apennine chain and the Antarctic. Some of these activities were funded by European Projects (Alcotra "Glariskalp"–Glacial risk in the Western Alps", PermaNET "Permafrost long-term monitoring network", Interreg III RiskNat -activities b1- c1: "Hazards deriving from high mountain environment evolution"), other by national or local research projects (i.e. PRIN 2008 " Climate Change effects on glaciers, permafrost and derived water resource. Quantification of the ongoing variations in the Italian Alps, analysis of their impacts and modelling future projections") .

The research activities carried out by M. Chiarle, G. Mortara and M. Arattano (CNR-IRPI, Turin) regarded geomorphological processes and hazard in alpine periglacial areas of Western Alps, with a specific focus on the impacts of permafrost degradation. This activity was partly undertaken inside the European Project Alcotra (in cooperation with CNR-IGG, Turin). The results were compared with the data coming from the Canadian Cordillera thanks to the cooperation with J.J. Clague (Simon Fraser University) and M. Gertseema (British Columbia Forest Service). Among the other activities of this group, particularly interesting was the recording and analysis of acoustic emissions related to rock mass deformation at Capanna Carrel (Mt Cervino area), related to climatic factors and permafrost degradation.

Arpa Piemonte, within the European project

"Permanet", in 2009 completed the installation of permafrost monitoring stations in the Piedmont Alps: 2 sites in the northern sector, 1 site in the central and two sites in the southern one. The stations (located between 2490 m and 3020 m asl of altitude) are characterized by vertical boreholes drilled in bedrock with variable depth: 1 borehole of 3.5 m, 1 borehole of 5 m, 1 borehole of 10 m, 4 boreholes of 30 m and one borehole of 100 m. This year, during the improvement of the stations, it was necessary to solve some technical problems that have prevented a full network operation. In addition, within the same project, several indirect surveys (BTS and electrical surveys) were carried out, and it is ongoing an analysis of regional climate data in order to implement a physical model for the evaluation of the permafrost potential distribution in Piedmont Alps . In collaboration with the Regione Piemonte (Civil Protection Department), Arpa Piemonte started some studies aimed to establish a monitoring system (with thermistors and estensimeters) of the southern ridge of Mt. Rocciamelone (at about 3000 m asl of elevation) characterized by active landslide since 2006. Finally, L. Paro (ARPA Piemonte) discussed his PhD thesis in Science and High Technology (Earth Sciences, University of Turin) on "Relationship between cryotic processes and block streams evolution in the Lanzo Ultrabasic Complex (Western Alps, Italy)".



Drilling of a 50-m borehole at Cavaion (Ortles Cevedale Group), one of the permaNET monitoring sites of the Italian Alps (Photograph provided by G. Zampedri)

In the Maritime and Cothian Alps (Western Alps), A. Ribolini (University of Pisa) participated to the activities of PermaNET project, carrying out a geophysical prospecting in the areas where two boreholes were eventually drilled. The geoelectrical tomographies were placed also to verify the reliability of the permafrost modelling carried out by the University of Insubria (M. Guglielmin). Beside a general good

agreement with the modelled permafrost distribution, the result evidenced resistivities potentially consistent with permafrost presence in the bedrock, and they will be compared and contrasted with the thermal data from boreholes when available.

In the area of Altopiano della Gardetta (Cothian Alps), several 25 and 200 MHz georadar profiles were undertaken on relict protalus ramparts at about 2,300 m asl (A. Ribolini). The objectives of this prospection is to analyse the reflectors architecture in order to speculate on the internal stratigraphy and, in turn, on the mechanism of formation and evolution of these landforms. A comparison with analogue acquisition from rock glaciers and moraines in the Maritime Alps is ongoing, in order to interpreter similarity in radar facies.

The thermal monitoring of the active layer of Vei del Bouc rock glacier and the Rocca dell'Abisso block field (Maritime Alps) is continuing hourly and at different depths (A. Ribolini, M. Spagnolo).

Boulders from rock glaciers in the Maritime Alps were sampled in order to date the age of stabilization by means of the cosmogenic radionuclides methods (A. Ribolini, M. Spagnolo).

In the framework of an international project aimed at the sea-level reconstruction during the Quaternary in the Argentinean Patagonia, sand wedges intruding beach ridge deposits attributed to the Marine Isotope Stage 5 (125.000 yrs BP) were sampled to determine chemical and mineralogical composition, as well as for OSL dating (A. Ribolini).

In the Aosta Valley Region, the monitoring and study of permafrost phenomena were carried out by the Regional Agency for Environmental Protection (www.arpa.vda.it) and Fondazione Montagna Sicura (www.fondms.org). With the Centro Funzionale of Regione Valle d'Aosta and the geoSITLab of the University of Torino they operated for the assessment of hazards related to permafrost evolution in high mountain areas and the management of the risks resulting from interactions with infrastructures located in permafrost.

The main ongoing activities are: i) maintenance and implementation (remote data transmission) of the regional monitoring network (surface boreholes in high-mountain rock walls, shallow and deep boreholes in gentle morphologies); ii) testing and validation of permafrost models; iii) the census of regional rock-glaciers (almost completed); iv) the maintenance and management of an alpine-wide collection of

permafrost evidences; v) a multi-temporal monitoring of specific high-mountain rockfalls through terrlaestrial photogrammetry.

The Regional Environment Direction is partner of PermaNET project (Interreg Alpine-Space program, started in June 2008), while some bureau of the Regional Department for Soil Protection and Water Resources are involved in RiskNat project (Interreg ALCOTRA program, started in April 2009).

In some sites, the University of Torino pursues the research focused on soil development in recently deglaciated areas, soil characteristics at low elevation permafrost sites and soil development within patterned ground (in collaboration with the Gran Paradiso National Park and the Italian Meteorological Society). Moreover the University of Torino and ARPA VdA are working in different sites on the influence of snow properties (e.g. snow depth, density, temperature, resistivity, ...) on the soil thermal regime and the snowpack evolution on permafrost and glacier substrata.

A PhD thesis in Science and High Technology (Earth Sciences, University of Turin) was completed by P. Pogliotti on "Influence of snow cover on MAGST over complex morphologies in mountain permafrost regions" (Tutors: M. Giardino, S. Gruber).

The Insubria Research group (N. Cannone, M. Guglielmin, M. Dalle Fratte, F. Malfasi, A. Valentini, D. Bufalino) on permafrost and periglacial environments still going on the activities both in the Alps and in Antarctica. Within the Framework of the project PRIN 2008 and with the support of Valdidentro (SO) municipality it has been implemented the network of minidataloggers to study the relationships between the snow, vegetation and permafrost on the Foscagno Rock Glacier. Here more than 70 points located within and outside the rock glacier between 2300 and 2650 m asl are monitored both for snow height, vegetation phenology, ground surface temperature and BTS. On the same site also the description of the soils was carried out (more than 100 points analysed) and new electric tomography were repeated in order to reconstruct the hydrogeological structure of the rock glacier that feeds an important spring. In order to monitor the characteristics of this spring a new monitoring program of the water discharge has been implemented and it will realized the next year. The two automatic stations installed to monitor the thermal regime of two boreholes were upgraded for monitor also snow height all year round. In addition is going on also the GPS monitoring of the rock glacier dynamic with the cooperation of Milan University (C. D'Agata).

At Livigno (SO) it is also started a project to monitor CO₂ fluxes in correspondence of two sites characterised by similar soils and vegetation types but with and without permafrost.

At Punta Helbronner still going on the monitoring of the permafrost thermal regime of the 64 m deep borehole in cooperation with the Funivie Monte Bianco.

In cooperation with Milano University (C. Smiraglia, C. Mihalcea and G. Diolaiuti) the thermal regime of the proglacial area of Sforzellina Glacier was monitored since 5 years ago. These data jointed with the results of the vegetation monitoring will allow to understand the recent evolution of the area that is a pilot area for the whole Central Alps. The monitoring of the rock faces thermal regime at Punta Helbronner (3430 m asl, AO) and Sforzellina Glacier (2850 m asl) was continued while a new site at Cima De Piazzzi (3460 m asl; SO, with the sponsorship of an important mineral water company) was equipped this summer extending the network.

Within the framework of Share Stelvio project (lead by G. Diolaiuti and funded by the Lombardy Region through EvK2CNR Committee) a very deep borehole (235 m) was drilled at Livrio site very close (10 m far) to the PACE project borehole (100 m deep) in order to verify the permafrost thickness calculated by thermal characteristics of the PACE borehole. This new borehole has been equipped with a new thermistors chain down to 235 m of depth confirming the permafrost presence down to the bottom of the borehole.

The Insubria group continued also to cooperate with Arpa Piemonte within Permanet Interreg project both to the management of the new network of 5 boreholes drilled last year and to the modelling of permafrost distribution and the calibration of this model through the electrical tomography and BTS measurements realized in several places distributed in all the Piemonte.

In addition, this year is started a PhD at Trieste University (Roberto Colucci) tutored by M. Guglielmin with the main objectives of verify the permafrost distribution of Friuli Venezia Giulia and to start the combined monitoring of three different types of cryosphere (Permafrost, Glacier and Ice in the cave) in the same site.

For the fourth time, the Department of Earth Sciences (University of Milan) and the Department of Environmental Sciences (University of Milan-Bicocca) (V. Maggi) participated to the organization of the International Workshop on Ice Caves (IWIC) (Obertraun, Austria, June 2010), an important appointment for the community studying the caves with ice deposits. The venue of the workshop was the

Dachstein Massif area, to celebrate the 100 years anniversary of Mammuthole cave exploration. About 70 participants, from 11 countries, provided more than 40 oral and poster communications on the main topics related to ice caves. Ice caves represent a particular environment where exist a very strong and delicate relationship between epigean climate and hypogean dynamics. The topics discussed during the workshop were meteorology, glaciology, palaeoclimatology of ice caves, as well as some socio-economic and historical aspects. Some excursions were organized in the Dachstein Massif and in 5 caves, included the Rieseneishole and the Eisreisenwelt ice caves, among the largest of Europe. For more informations about IWIC IV and the abstracts volume download please check: <http://www.iwic2010.info>. For any information please contact mbehm@mail.tuwien.ac.at.

Most of the permafrost activities in the Province of Trento are currently conducted in the framework of the permaNET project (Interreg Alpine-Space program, started in July 2008), under the coordination of the local project partner (Autonomous Province of Trento, Geological Survey), with the University of Pavia, (R. Seppi and M. Zumiani), the University of Padova, (A. Carton) and the University of Trento (M. Dall'Amico and R. Rigon). In the Ortles Cevedale Group, a 50 m borehole has been drilled in bedrock at 2900 m asl, and in late summer 2010 it will be equipped with a thermistor chain and a weather station. Two existing boreholes located at 3000 m asl are monitored to understand the relationships between the potential permafrost degradation and the observed movement of the slope. Furthermore, a) the dynamic behaviour of two active rock glaciers of the Adamello Presanella region is investigated by means of topographic surveys, b) BTS and GST measurements are carried out in several areas, c) a GIS-based rock glacier inventory of the whole Province of Trento is in progress, and d) modelling activities are performed to model the permafrost distribution in the Province.

Several activities were initiated in the framework of the PRIN 2008 project. The central-eastern Alps research unit is coordinated by the University of Padova (A. Carton, A. Bondesan, M. Meneghel, F. Ferrarese), with the collaboration of other universities and institutes (University of Pavia: R. Seppi; University of Padova: L. Carturan and G. Dalla Fontana; INOGS Trieste: R. Francese). The investigations focus on permafrost and periglacial areas of Adamello Presanella, Ortles Cevedale and Dolomite mountain groups, and include geomorphological observations, GST and geophysical measurements on rock glaciers and ice-cored moraines, and hydrological studies.

Chemical and physical analyses on high-altitude

spring waters were recently initiated in Val di Peio (Ortles Cevedale Group) by the University of Padova (L. Carturan and G. Dalla Fontana), in collaboration with the University of Pavia (R. Seppi). After an initial stage, these studies are currently carried out in the framework of the IAEA-coordinated research project "Use of environmental isotopes in assessing water resources in snow, glacier, and permafrost dominated areas under changing climatic conditions", under the coordination of D. Penna (University of Padova). The investigations are intended to detect the chemical-physical signature of spring waters in relation to permafrost and to assess the possibility to map the permafrost distribution by means of systematic sampling of springs.

The main activities in Alto Adige/South Tyrol were mostly financed by the Interreg Project PermaNET, and coordinated by the Provincia Autonoma di Bolzano (V.Mair, K Lang). The project benefitted of the cooperation of the University of Innsbruck. The activities were mainly focused on the realisation of two horizontal boreholes through the main chain of the Alps below the Grawand-Peak, and two vertical boreholes (with extraction of the frozen cores) on an active rock glacier on the Lazaun- Alpe. Both sites are located in Val Senales/ Schnals Valley.



Ice encountered during the Lazaun rockglacier drilling (Val Senales, Alto Adige) (Photograph provided by K. Lang)

The motive forces for the realisation of the boreholes through the Grawand-Peak (3.251 m s.l.m.) were problems of rockfalls on the glacier ski-trail and problems of stability of the ropewaystructures. The first borehole (B1) is 162 m long and slightly inclined regarding to the second one and is oriented perpendicular to the rock schistosity. This borehole was instrumented with 5 extensometers (in a depth of 7, 30, 40, 50 and 70 meters) in order to get information

about the thermal dilatation of the bedrock. The second borehole (B2) is oriented north-south, is 133 m long (reaching the surface on the south of the Grawand), and was instrumented with two thermistor chains. Measurement data are available since December 2009 and are visible via internet. A first evaluation of the data shows that in the north-exposed slope until a depth of 5 m temperatures fluctuate extremely: until 39°C (-26° to +13°) at the mouth of the borehole, until 12°C (-8°C to +4°C) at a depth of 1,5m and until 2°C (-3°C to -1°C) at a depth of 5m. Furthermore, it can be observed that from December 2009 to June 2010 temperature in the borehole is always below zero degrees. On the north side starting from a depth of 4 m temperature remains always below zero degrees. On the south exposed slope the permanent frozen space is much deeper at the depth of 25 m in the borehole.

The active rockglacier on the Lazaun-Alpe was drilled in the central (2,580 m asl) and in the lower part (2,538 m asl). The upper drilling reached a depth of 40 meters, and from 3 to 24 meters ice (often a mixture of ice and debris) was encountered.

The lower drilling is 32 meters deep, and from 4 to 10 meters and from 16 to 18 meters ice was encountered. The University of Innsbruck is in charge of the analysis of the frozen cores (ice chemistry, dating...) and of the spring water analysis. Both boreholes are going to be instrumented with inclinometer tubes, a coaxial cable and thermistor chains (with automatic datalogger). Logging of data will start in autumn 2010. Another drilling on an active rockglacier in the Ulten valley (Val d'Ultimo) is going to be performed.

The researches on permafrost developed in the Gran Sasso d'Italia Mountain range (Central Apennine) were guaranteed by Massimo Pecci (EIM-Italian Mountain Institute, Rome). In the area surrounding the Calderone glacier, 2 soil temperature data loggers are measuring since 2006 at elevations of about 2400 m and 2600 m a.s.l., with the aim of detecting and monitoring the possible permafrost presence and evolution. After two years of continuous measures, the confirmation of the presence of permafrost was highlighted by at least two temperature probes, constantly at a temperature below or equal to 0 °C. This interpretation is supported by geomorphological evidences of ridges and festoons, typical of an active rock-glacier.

Finally, in Antarctica (M. Guglielmin, University of Insubriae) there was not any research campaign but it was guaranteed the download of the data from the permafrost boreholes at Rothera and Signy in

Maritime Antarctica in cooperation with the British Antarctic Survey; Marble Point and Wright Valley, in cooperation with Waikato University and Mario Zucchelli Station and Boulder Clay with the PNRA support. A permafrost session (led by Mauro Guglielmin) at the XXXI SCAR (Scientific Committee of Antarctic research) was held in Buenos Aires between 3 and 6 August, with 20 posters and 7 oral presentations. A special issue on Geomorphology will be published with the best papers next year.

Rossana Raffi (Sapienza University of Roma) is the principal Italian investigator of a study of ice wedges in the northern Victoria Land (East Antarctica), funded by the Italian Antarctic National Research Program within the framework of the Project Permafrost and Climate Change in Antarctica (leader M. Guglielmin). This activity is conducted in collaboration with B. Stenni, Trieste University. The research is based on the thermal, isotopic and petrofabric characterization of ice wedges and aims to the definition of formation mechanism, dedicating particular care to associate crack processes and climate condition. 45 ice wedge and 4 sand wedges are under monitoring as regard the main environmental parameters external and internal to the ice wedges (i.e temperature, humidity, solar radiation). High temperature gradients between the ground surface and the top of ice wedge may trigger cracking. Moreover, frequent temperature inversions between the air/ground interface and ice-wedge top allow moisture condensation (with the formation of hoarfrost crystals) and sublimation in the open fracture. A strong divergence of $\delta^{18}\text{O}$ and δD from the mean precipitation ($\delta^{18}\text{O}$ and δD values more positive) was detected, along with extremely negative deuterium excess (d) values. Furthermore, a negative correlation between ice-wedge elevation and deuterium excess was observed.



Ice wedge at Mount Jackman (72°23'07" S; 163°10'49" E, 1269 m asl) (Northern Victoria Land , East Antarctica)(Photograph provided by R. Raffi)

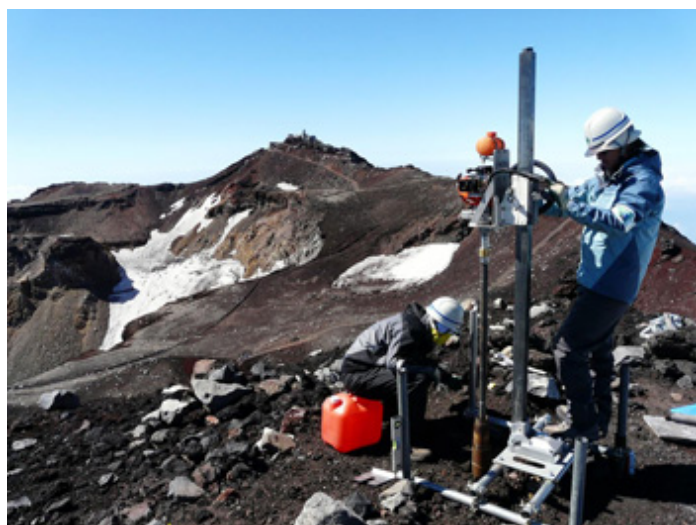
In synthesis, the analysis of the thermal regime of ice wedges over six years shows that the thermal conditions at the study sites were able to induce the thermal stress necessary to trigger frost cracking and hence that ice wedges are active under present-day climate conditions. Stable isotope analyses of ice-wedge samples indicate that sublimation processes control the formation of ice in wedges, especially at high elevations within northern Victoria Land.

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10 Japan

A joint permafrost study on the Fuji volcano (3776 m a.s.l., MAAT = -6°C), the highest mountain in Japan, has progressed (A. Ikeda, G.. Iwahana, T. Sueyoshi and R. Nishii). A 10 m-deep borehole was dug on the summit area, to monitor permafrost temperature. The ground temperature in the borehole was much lower

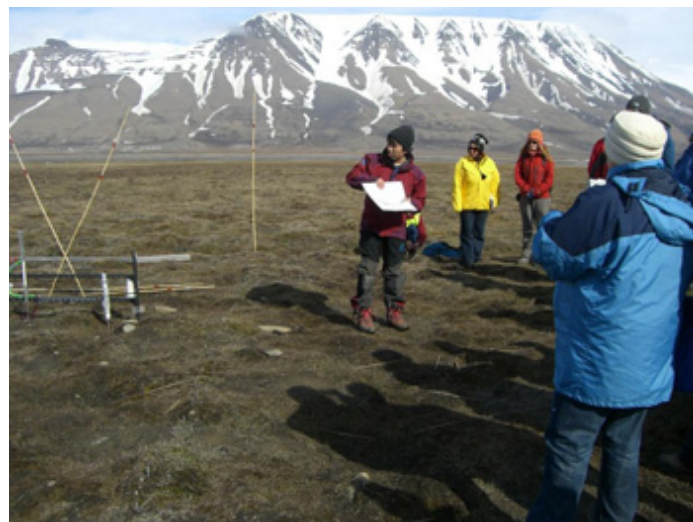
than that in the 3-m deep boreholes dug on the same summit area in 2008. On the summit area, temporal variations in ground temperature strongly depend on the local topography and composition.



Drilling a 10-m deep borehole on the top of Fuji volcano.

Several overseas projects are also going on. In Alaska, a project named '2004 Forest Fire Impacts to Hydrological Cycles, Permafrost and Eco Systems in Central Alaska' has progressed since 2005 in order to monitor permafrost conditions after a severe wildfire (K. Harada, K. Narita and K. Saito). In summer 2010, observations were carried out at the Kougarak site near Nome, Alaska in August, and thaw depths were measured from the ground surface. Measurements of surface roughness were also conducted to compare with the satellite data. Ground temperatures have been measured with data loggers since 2007. Vegetation surveys were also made in order to clarify the recovery after wildfire at burned sites. Continuous data of thaw depth and ground temperature could be obtained and the effect of the wildfire to permafrost condition and vegetation recovery will be clarified.

In Svalbard, a monitoring campaign has continued in order to understand the dynamics of patterned ground (including ice-wedge polygons, mudboils and hummocks) and a polar rock glacier with a variety of methods (N. Matsuoka and T. Watanabe), collaborated with UNIS (H.H. Christiansen) and University of Oslo (O. Humlum). Detailed (2D and 3D) geophysical sounding was applied to illustrate subsurface structures under the patterned ground and temporal variation in the subsurface moisture regime (T. Watanabe). The study sites were demonstrated to the EUCOPIII attendants during the half-day excursion in Adventdalen.



Tatsuya Watanabe presents his observations on mudboil dynamics during the EUCOPIII half-day excursion in Adventdalen.

The Japanese Permafrost Association had a two-day annual meeting in January 2011 in Sapporo. About 30 scientists and students participated and presented their newest results. The meeting involved a memorial lecture on 'Glacial and periglacial studies over 20 years' by Prof. Kazuomi Hirakawa, who is officially retiring from Hokkaido University in March 2011, and closed with discussion on an interdisciplinary project on Arctic permafrost.

Compiled by Norikazu Matsuoka
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11 Mongolia

Long-term monitoring of permafrost temperatures (TSP) in 46 boreholes in Mongolia is continued within the framework of CALM and GTN-P program. Meanwhile, this year three 15 m deep boreholes were re-drilled at Baganuur site near Ulaanbaatar where old destroyed monitoring ones were. In addition, 100 m and 200 m long permanent strings with thermistors were installed in the Burenkhan and Ardag boreholes of Hovsgol region, respectively.

In order to outreach to students to share knowledge and experience in conducting permafrost study and monitoring, Sharkhuu is collaborating with teachers of Hatgal High school in Hovsgol province which is one of the oldest schools in Mongolia. Currently ground temperature in 10 m deep borehole is recorded by dataloggers. Experimental observations for estimating thermal insulation effect of grass (with different biomass) and snow (with different thickness and density) cover are conducted using dataloggers at fenced observation site near school house. In addition,

temperature underneath of a new school building which was built on the pillars to prevent conduction of heat to ground was monitored using dataloggers to see how effective the structure was. Sharkhuu and Anarmaa prepared a poster on introduction of permafrost, and its studies in Hövsgöl lake area for the school. In early September of 2008 Drs. Romanovsky and Yoshikawa from University of Alaska Fairbanks visited the school. During this visit Yoshikawa gave a talk about permafrost to students, and Romanovsky provided one 4-channel HOBO U12 data logger as a present to the school.



Front row: K. Yoshikawa (UAF researcher), N. Sharkhuu, V. Romanovskii (UAF researcher), Serdamba (English teacher); back row: Byambadulam (Hatgal school principle) and best students of the 10th grade. (Photograph provided by N. Sharkhuu)

N. Sharkhuu (sharkhuu_n@yahoo.com)

In June and July by financial supports of Ministry of Nature, Environment and Tourism, Mongolia shallow deep 13 boreholes were drilled in Hentii, Hangai, and Altay mountain regions of Mongolia. These boreholes lie on different altitude and in different geocryological zones of Mongolia. All these boreholes were instrumented by HOBO U12 dataloggers by financial support from Ministry of Nature, Environment and Tourism, Mongolia, Research institute for Global Change, Japan Agency for the Marine-Earth Science and Technology, and Hokkaido University (HU). Sensors of HOBO U12 dataloggers were installed inside of plastic casing tube of these boreholes.

In framework of project of Integrated Field Environmental Science–Global Center of Excellence a short summer field course was organized under the topic of Sustainable ecosystem usage of Eurasian ecotone in July 2010. Mongolia has different ecosystems within the short distance. This summer

course divided into 6 groups with different themes. One of theme was changing permafrost & its related landform modification.

In august six boreholes with depth of 10 – 35 m were drilled in Darhad depression by fully financial support from Research institute for Global Change, Japan Agency for the Marine-Earth Science and Technology (RIGC/JAMSTEC) and Hokkaido university, Japan.

By financial support from RIGC/JAMSTEC and Hokkaido university from middle of august to middle of September group of researchers and students from Geography institute, Mongolia and from Hokkaido university conducted field survey to getting data from boreholes over Mongolia. Most of these boreholes are shallow boreholes with depth of 10 m. In 2009 we installed HOBO U12 dataloggers in these boreholes. Some of these boreholes have a historical data getting in 1980s. By the initial results of temperature records these boreholes with historical data have different changes of temperature depending on altitude and on geographical location. In some areas, usually in southern fringe of Mongolian permafrost region some of these boreholes have no permafrost until to 10 m by temperature data. Within this field survey we have made a geophysical sounding (ERT) and a ground penetration radar (GPR) near the boreholes.

The observational study of cryosphere continues in Nalaikh and Terelj areas, near Ulaanbaatar within the ongoing northern hemisphere cryosphere program of the Research Institute for Global Change of the Japan Agency for the Marine-Earth Science and Technology (RIGC/JAMSTEC) and the institute of geography, Mongolia on the Cooperative Study of Hydrological Circulation and Climate Variability over Mongolian Region.

We organized first international symposium on mountain and arid land permafrost in 2001 (see report on FG25). In August 2011 we are planning to organize the second international symposium on mountain and arid land permafrost. You can obtain detailed information on website www.geography.mn. Welcome to beautiful blue country.

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12 The Netherlands

Carbon and exchange from permafrost soils and ecosystems in Siberia

Research in the taiga and tundra ecosystems in eastern Siberia is performed in cooperative projects of the Institute for Biological Problems Cryolithozone (IBPC) of the Siberian Division of the Russian Academy of Sciences in Yakutsk and the Vrije

Universiteit (VU) in Amsterdam (Department of Hydrology and Geo-Environmental Sciences) and Wageningen University (Nature Conservation and Plant Ecology).

In a larch/birch forest near Yakutsk (Spasskaya Pad Field Station) and on a tundra site near Chokurdakh in the Indigirka lowlands (Kytalyk reserve) CO₂ and CH₄ flux measurements have been made with eddy correlation towers since respectively 2000 and 2003. The aim is to estimate the annual exchange rates and their interannual variability, and to determine the sensitivity to environmental factors and permafrost degradation. Currently, four publications resulting from this research are under review.

Finance for continuation of the research work at Chokurdakh until 2013 has been secured with new research grants from NWO (Dutch Organization of Scientific Research) and Darwin Center. This will focus specifically on the effects of permafrost degradation on the carbon balance, effects of hydrological changes and vegetation-permafrost interactions. Research cooperation has been established with Japanese (Hokkaido University, Dr Iwahana) and German (AWI, Wetterich) research groups.

In November 2010, Wageningen University, IBPC, VU successfully organized the 5th International Workshop on 'C/H₂O/Energy balance and climate over boreal and arctic regions with special emphasis on eastern Eurasia', with contributions from Russia, Japan, Europe and USA.

The Willem Barentsz Polar legacy

When Willem Barentsz discovered Spitsbergen in 1596 he could never have imagined that more than 400 years later a Dutch Arctic research station would be established. This is the result of a research cooperation in the shape of the Willem Barentsz Polar Institute (WBPI), an institute for Arctic and Antarctic research. The WBPI wants to be a clear Dutch identity in the international field, enhance the co-operation between Dutch polar researchers and contribute to polar education and outreach activities. The WBPI has given a positive boost to new initiatives from the Netherlands in the polar areas, and serves a contact point of Dutch research in polar areas. More information you will find on our website: www.wbpolar.nl. For any information you want to communicate with the Dutch polar network, or any questions, please do not hesitate to contact the co-ordinator of the Willem Barentsz Polar Institute, Annette Scheepstra.

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13 New Zealand

14 Norway

Third European Conference on Permafrost, EUCOP III

In 2010 the Norwegian permafrost researchers and engineers focussed on getting the Third European Conference on Permafrost, EUCOP III held at 78°N in Longyearbyen in Svalbard. In addition to the organisation of the conference, the Norwegian contribution to EUCOP III was 42 scientific abstracts, 12 oral presentations and 25 posters. There was 35 scientists and engineers from Norwegian institutions participating in EUCOP III, of which several were master and Ph.D. students from University of Oslo and UNIS. The strong field focus of the conference, being hosted in an area with continuous permafrost, proved to be valuable. Unfortunately we did not manage to organise a longer multi-day excursion, mainly due to missing funding, but all the announced one-day field trips were very well attended. We hope this concept may be further developed at coming permafrost conferences. We want to thank our international colleagues for their assistance with EUCOP III through their contributions in the International Organising Committee, and we wish Portugal all the best with organising EUCOP IV. A full report has been published in the journal *Permafrost and Periglacial Processes* by H.H. Christiansen and B. Etzel Müller.



EUCOP2010 participants on field excursion to Gruvefjellet above Longyearbyen. Stephan Vogel (to the right) is lecturing on snow avalanches. (Photograph provided by O. Humlum)

TSP Norway IPY project activities

The Permafrost Observatory project: A contribution to

the Thermal State of Permafrost in Norway and Svalbard (TSP Norway) was formally terminated in 2010, although the new installations will enable us to continue observations by operating the Nordenskiöldland Permafrost Observatory for the years to come. We have now downloaded the first two year data from all our TSP boreholes from different landforms in Svalbard and northern Norway, and data are on their way into NORPERM, the Norwegian online permafrost database. This database was launched spring 2009, and contains TSP Norway data and other permafrost data from Norway and Svalbard. The database may be accessed from www.ngu.no/kart/permafrost/?lang=English and www.ngu.no/kart/permafrost_svalbard/?lang=English, respectively.

Geology Department, UNIS

Permafrost and periglacial studies were continued by H.H. Christiansen, H. Juliussen and M. Eckersdorfer, partly within the TSP Norway project. Markus Eckerstorfer continued his Ph.D. study on snow avalanches and meteorological control in Svalbard, working also with the CRYOSLOPE Svalbard (2007-2009) research project data, and partly continuing some key CRYOSLOPE activity.

In 2010 we joined the DEFROST Nordic Centre of Excellence in research network, which is going to focus on impacts of a changing cryosphere - depicting ecosystem-climate feedbacks from permafrost, snow and ice, starting mainly in 2011. We participated in the CryoEx project together with the Universities of Oslo, Ottawa and Carleton.

Physical Geography, Department of Geosciences, University of Oslo

TheCRYOLINKproject

(www.geo.uio.no/english/cryolink/about/) has been continued by B. Etzelmüller, H. Farbrod, O. Humlum, K.S. Lilleøren, T. Hipp and K. Gislås, together with K. Isaksen (met.no) and R. Ødegård (HiG), focussed upon 15 shallow permafrost boreholes in southern Norway, and with a permanent geoelectrical monitoring station was established at Juvvasshøe in Jotunheimen. In connection with the CRYOLINK project both a permafrost equilibrium and transient model was implemented for Norway, driven by gridded daily air temperature and precipitation data provided by the Norwegian Meteorological Institute and the Norwegian Water and Energy Directorate.

The project on mountain meteorology, snow cover, vegetation, ground temperatures and interaction between permafrost and glaciers in southern Norway continues (O. Humlum), and now covers winters with

very different meteorological characteristics.

In 2010 the University of Oslo in collaboration with UNIS received funding for student and faculty member exchange with the University of Ottawa (A. Lewkowicz) and Carleton University (C. Burn) from SIU (Norwegian Center for International Cooperation in Higher Education). The project (CryoEX) facilitates exchange of faculty members and students. At University of Oslo a special field course (GEO9411 - Field course in glacial and periglacial geomorphology/geocryology, 5 ECTS) open for CryoEX students was held by B. Etzelmüller and O. Humlum in August-September.



GEO9411 participants walking towards the firn Juvvassfonn at Juvvasshøe, Jotunheimen, Norway. Juvvassfonn is resting on permafrost and the participants are going to visit a tunnel excavated into the firn surface, extending almost to the base. (Photograph provided by O. Humlum)

Department of Geography, NTNU

On Prins Karls Forland and Kvadehuksletta, Svalbard, data on soil organic carbon contents and age, sorted circle dynamics and rock glacier displacements have been collected for the Dynamics of Carbon Pools in High Arctic Permafrost (CAPP-dyn) project by I. Berthling/A. Peters (NTNU) together with B. Hallet and R. Sletten (University of Washington) and T. Urke (University of Oslo), funded by The Research Council of Norway (RCN). As part of the ESF SedyMONT project led by A. Beylich (NGU/NTNU) and funded by RCN, ground surface temperature monitoring of steep rock walls in the Nordfjord area has started. Monitoring of ground temperatures and thaw consolidation processes continues within the watershed of Vekve in Oppdal, Central Norway (I. Berthling, G. Vatne, W. Larsen, L. Sellevoll). Data on morphometry of solifluction landforms have been collected by I. Berthling/F. Høgaas/P.G. Kielland.

University College at Narvik (NUC), Sintef and engineering companies

Longyearbyen, Svalbard, contains several buildings constructed at around 1950. Several of these buildings

are now experiencing severe settlement damages. The settlements are often caused by foundation designs not suited for permafrost areas, by deviations from the original design criterions, or simply that the buildings have exceeded their original life expectancy. One such building is "Sysselmannsgården", the residence of the governor of Svalbard. The building is managed by Statsbygg, who acts on behalf of the Norwegian government as property manager and advisor in construction and property affairs. Sweco Norge evaluated the cause of the settlements of Sysselmannsgården and proposed to keep the ground thawed around and beneath the building, and reconstruct the building's foundation as a pile foundation. The construction work was carried out in 2010.

The Cold Climate Technology Research Centre (CCTRC) in Narvik established a Frost in Ground laboratory (FiG-lab) in 2007. The FiG-lab is the base for the empirical part of an ongoing PhD project at NUC regarding artificial thawing of seasonally frozen ground. The FiG-lab was re-established at a new location during autumn 2010, at the same time implementing new functionality in order to ensure more versatile scientific experiments on frozen ground in the near future.

Geotechnical investigation performed by Sintef at Svalbard, revealed significant growth of ice inside a coarse grained fill. An investigation including sampling and sounding found that eight years after backfill of material on a site in permafrost region, showed the ice layer between active layer and permafrost to grow from an initial thickness of 0 cm to a thickness of 200 cm. This is a result of melt water passing through the 1,5 -2,0 meter thick permeable top layer without any drainage system.

15 Poland

In the summer of 2010 the geologists from the Polish Geological Institute – National Research Institute made a very important and interesting discovery on permafrost: Boreholes drilled in the north-eastern part of Poland in the vicinity of Suwałki (sites borehole in Udyń and Szypliszki) near the Polish-Lithuanian border showed that at the depth of 356 metres there was a layer which temperature was only +0.07°C!

This was probably (until recently) permafrost which has survived since the Pleistocene. According to information given by Prof. Jerzy Nawrocki, the Director of Polish Geological Institute (PGI) and Prof. Jan Szewczyk who heads the research project the

thickness of the layer was of several metres. This potentially recently thawed permafrost probably dates back to 13000 years BP. This discovery is of significant importance. This is the only place in Central Europe where such permafrost was found. The investigations are currently being carried out to understand more on the origin of the permafrost layer. This discovery was the subject of a press conference and information about it is published at the website of Polish Geological Institute: <http://www.pgi.gov.pl/archiwum-aktualnosci-instytutu/>

The activity of Polish researchers of permafrost and periglacial processes in the polar zone focused on several issues in 2010. Monitoring of permafrost active layer and periglacial processes was continued on Spitsbergen close to the Polish Polar Station of the Geophysics Institute of Polish Academy of Sciences in Hornsund and at the seasonal bases in other parts of Spitsbergen used by the explorers from the Polish universities (Nicolaus Copernicus University in Torun, Maria Curie-Skłodowska University in Lublin, Adam Mickiewicz University in Poznan, University of Wrocław and University of Silesia).

The results linked to investigations of permafrost and periglacial phenomena were presented at several conferences:

- * III European Conference on Permafrost (EUCOP III), June 13-17, 2010, Svalbard, Norway (R.Przybylak, A.Arazny, M.Kejna: „Diversity of ground temperatures of the Kaffiöyra Plain, NW Spitsbergen in the Summer period (1975-2009)“
- * XXXIII Polar Symposium of the Polar Club and Committee for Polar Research, Polish Academy of Sciences, June 18-19, 2010, which was held at University of Lodz, organized by the Department of Invertebrate Zoology and Hydrobiology, Faculty of Biology and Environmental Protection (summaries of the papers are on the website: <http://invertebrates.uni.lodz.pl/?p+2185>)

In October 2010, very interesting conference took place in Lublin „International Collaboration and Competition in the Arctic Region at the Beginning of the XXI Century”, which brought together a large number of scientists representing both social and natural sciences. The organizer of this conference was the Department of International Relations, Faculty of Political Sciences, Maria Curie-Skłodowska University in Lublin and the Association of Polar Early Career Scientists.

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16 Portugal

Research activities on Antarctic permafrost are framed within the projects Permantar and Permantar-2 (Permafrost and Climate Change in the Maritime Antarctic) coordinated by the University of Lisbon (CEG/IGOT-UL). The projects also count with the participation of the Centre of Geophysics of the University of Évora and Centre of Geophysics of the University of Lisbon, as well as with several foreign institutions: Bulgarian Antarctic Institute, Federal University of Viçosa (Brazil), University of Alcalá de Henares (Spain), University of Buenos Aires (Argentina) and University of Wisconsin-Madison (USA). In 2010 Antarctic permafrost research took place in Deception and Livingston Islands (South Shetlands), with a focus on permafrost and active layer monitoring and modelling, snow cover monitoring and geomorphodynamics research.

Two new ESA category-1 projects based on SAR remote sensing are under way. Snowantar is a collaboration between CEG/IGOT-UL and the University of Alcalá (Spain), aiming at mapping snow cover dynamics as a major controlling factor on permafrost thermal regime. TidefInSAR is a collaboration between CEG/IGOT-UL and LATTEX aiming at DInSAR analysis of permafrost terrain deformation in the South Shetlands. More detailed information on these projects can be found at <http://www.antecc.org>.

Researchers from the Research Group on Antarctic Environments and Climate Change (ANTECC) have been awarded the following prizes in 2010: Vanessa Batista received the "Outstanding Presentation for Early Career Scientists" at the Oslo IPY Science Conference, in the category 2: "Past, Present and Future Changes in Polar Regions", for her work on active layer monitoring in Deception Island; Marc Oliva was awarded the PYRN Best International Oral Presentation at EUCOP III, for his talk on "Long-term solifluction response to increasingly arid conditions in Sierra Nevada, Southern Spain"; and Gonçalo Vieira was awarded the National Prize "Seeds of Science 2010" on Earth, Atmosphere and Marine Sciences, as a recognition of the effort on the coordination and consolidation of Portuguese Antarctic Research during the IPY. Since the SCAR Open Science Conference, Gonçalo Vieira is Co-Chair of the SCAR Expert Group on Antarctic Permafrost and Periglacial Environments. ANTECC started publishing quarterly newsletters on permafrost research which are downloadable at the group's website.

The CERENA team, at Instituto Superior Técnico, is

studying in detail polygonal terrains using Earth analogues to improve the knowledge of the abundant Martian networks. In the summer of 2010, a field campaign in Adventdalen (Svalbard) was conducted together with CEG/IGOT-UL, the Centre of Geophysics of the University of Coimbra and UNIS (Norway), to gather polygonal pattern features for comparison with Martian analogues. The field survey, enabled to collect accurate data on the geometry and topology of the polygons, on the characteristics of the vegetation and on the depth of the active layer. The in-situ measured features are being integrated with two sets of remotely sensed imagery with very high spatial resolution and confronted with those of Mars to evaluate where do Adventdalen polygons stand in relation to quantitatively characterized Martian networks. More information about ongoing activities can be found at <http://planetsci-cerena.weebly.com>.

Permafrost research at IPIMAR mainly focussed in the environmental consequences of thawing and thermokarst lake formation. The research has been done in the Canadian Arctic, through a collaboration with Environment Canada and the University of Ottawa. The main objectives were: i) to understand the role of thermokarst lakes in the regional and global carbon cycle, mainly focusing on the emission of greenhouse gases (carbon dioxide and methane), ii) to improve the knowledge on the fate and biogeochemical processes of trace elements (mainly contaminants) due to the formation and drainage of thermokarst water into the Arctic aquatic systems. Research done in 2010 showed that thermokarst lakes are important sources of greenhouse gases to the atmosphere and also that the drainage of their lake water presents a serious impact in water quality of the surrounding aquatic systems.

Gonçalo Vieira, Pedro Pina and João Canário

17 Romania

The activities of the members of Romanian Permafrost and Periglacial Research Group in 2010 were carried out by an increasing number of experienced and younger scientists.

At the Department of Geography, West University of Timișoara, P. Urdea and his team (M. Ardelean, F. Ardelean, A. Onaca) are continuing frost heaving and depth of frost monitoring program in the Muntele Mic area, and have implemented a program using thermal photography and infrared cameras, magnetic susceptibility meter and thermal characteristic meter (conductivity, diffusivity) in the investigation of

periglacial forms (earth hummocks, solifluctional forms). Our team and several undergraduate and graduate students undertook additional new data at several test sites -Valea Doamnei, Văiuga cirque, Paltina (Făgăraș Mountains), Bucura (Retezat Mountains, Detunata Goală (Apuseni Mts.) - by geophysical investigations (ERT, GPR), ground temperature sensors on rock glaciers, scree slopes and rock walls, solifluction lobes, small sorted nets. In addition, detailed 2D electrical resistivity tomography was used to detect subsurface frost structures of patterned ground in Căleanu Mountain (2190 m a.s.l.; Țarcu Mts.), or of morainic complex and fossil palsa in Soarbele Valley (Godeanu Mts.). Using GIS technology, a series of digital maps of various scales have been realized for the alpine area of the Transylvanian Alps by M. Török-Oance and F. Ardelean (West University of Timișoara) on natural environment of Yakutia (IMZ SB RAS).

ground Căleanu Mountain (Țarcu Mountains). (Photograph provided by Petru Urdea).

During 2010, the Bucharest University team (A. Vespremeanu-Stroe, R. Popescu, M. Vasile) extended the investigation of rock glacier permafrost in the Parâng Mountains, where BTS measurements were conducted and commenced the thermal monitoring of a low altitude permafrost at Detunata Goală in Apuseni Mountains. Continuous GST measurements using digital data loggers continued at the existing sites in Făgăraș and Retezat Mountains and the monitoring of other rock glaciers was initiated. Also, temperature sensors have been placed within debris cones and debris slopes in order to determine their thermal regime and possible permafrost conditions. Preliminary results concerning rock freeze-thaw regime and effectiveness were obtained for the alpine sector of the Southern Carpathians (Bucegi and Retezat Mountains). Frost processes are currently analyzed on different altitudinal floors and exposures in order to establish the impact of frost weathering on present and past debris production. Miniature temperature sensors placed at different depths in rock are intended to give the dimension of frost penetration in the periglacial area of the Southern Carpathians.

Aurel Perșoiu and Bogdan Onac (Speological Institute "E. Racovitza", Department of Geology Cluj-Napoca) continued the research in ice caves in Romania throughout 2010, mainly in Scarisoara Ice Cave. Stable isotope analysis have been carried out on ice and water samples from the cave in order to elucidate the mechanisms by which the climatic signal recorded in the stable isotope composition of precipitation is transferred to the ice. The results are promising, as they show that it is possible to extract a climatic signal from ice affected by complex melting and freezing processes, despite previous concerns on the matter. Further, ice mass balance measurements and radiocarbon dating allowed us to (partly) reconstruct the genesis and past history of the ice block, over the last ca. 1000 years.

M. Dumitrescu (Bucharest) started his investigations on glacial and periglacial landforms in the upper part of Bratia basin (south slope of Făgăraș Mountains) and R. Putan (West University of Timișoara) has started his master project investigating the earth hummocks and ploughing blocks from alpine area of Șureanu Mountains.

Finally, M. Ardelean (West University of Timișoara) successfully finalized in December 2010 his PhD dissertation „Piule-Iorgovanu Mountains - Geomorphological Study", with a consistent part



Magnetic susceptibility measurement on solifluction lobe Paltina (Făgăraș Mountains). (Photograph provided by Petru Urdea).



DC resistivity investigations on the fossil patterned

dedicated of the glacial and periglacial landforms. Also O. Pop („Babeş-Bolyai” University Cluj-Napoca) have been finalized PhD thesis „Etude comparative des processus géomorphologiques contemporains dans les massifs volcaniques du Sancy (France) et du Călimani (Roumanie)”.

A special volume „Dendrogéomorphologie et dendroclimatologie-méthodes de reconstitution des milieux géomorphologiques et climatiques des régions montagneuses” edited by V. Surdeanu (Cluj-Napoca) Markus Stoffel (Berne), O. Pop (Cluj-Napoca), Edit. Presa Universitară Clujeană, 159 p. 2010, containing a collection of papers which present the first major synthesis of current knowledge on Romanian dendrogeomorphology and dendrochronology, main dedicated on mountain area.

Petru Urdea (urdea@cbg.uvt.ro)

18 Russia

In 2010 the scientific investigations on the spatial-temporal regularities of cryosphere, the heterogeneous reaction of cryosphere on the global and regional climate changes, the geoecology and the engineering-cryolithological peculiarities of the northern regions have been proceeded by Russian geocryologists.

The fundamental researches are kept on the following lines: “Natural and technogenic systems in Earth’s cryosphere and their interactions” (coordinator – Melnikov, V.P., the academician of RAS), “Permafrost of shelf and coastal zones” (includes the assessment of the geocryological history and contemporary cryolithozone’s state, the explorations of regularities of the dynamics and transformation of the frozen and cryotic rocks, the emanation of carbohydrates) (Earth Cryosphere Institute SB RAS).

The preparation of the new edition of the “Geocryological map” of the Russian territory is carried out (the corresponding problem is posed in the plan of subjects of Earth Cryosphere Institute SB RAS).

The “climate-permafrost-space-time” dependence during the last 20-100 years, the parameters of cyclicity of the changes of natural complexes under the technogenic impact are studied (Earth Cryosphere Institute SB RAS).

The investigations of the coastal-shelf permafrost in Russian Arctic are held on using the seismic hydro-technique and hydro-technologies. The GIS of Russian Arctic regions including shelf are worked out (Earth Cryosphere Institute SB RAS).

In 2010 the department of the cryolithology and glaciology of the geographical faculty of the Lomonosov Moscow State University has carried out the following investigations.

The phenomena of northward increase of thickness of the intermediate layer (layer with 1 higher relative ice content) and its protective role has been studied. It has been determined that the coast of the Western Taymir peninsula is the westernmost areas where not typical sediments of the “ice complex” are found. The underground ice is situated on the host grounds.

The fact that 2/3 of failures of objects in cryolithozone are caused by the development of dangerous engineering-geocryological processes has been determined. A significant increase (20-30% in the last 10-15 years) in shear forces caused by frost heave is observed. It explains the failure of the pipeline supporting piles of all kinds. This demands an intensive labour on cutting off about 5-8 thousands of piles supporting long distant and in-facility pipelines annually.

The main reason of high rate of breakdown and catastrophically fast wear out of materials in underground water collecting systems of engineering communication facilities in cities situated in the cryolithozone is uneven in time and area thawing in host permafrost grounds. This leads to uneven settlement of constructions and fast wear down of them. These processes are very hard to predict and do not match the expected rates of deformations estimated according to national standards and procedures. In the region of Norilsk city about 70% of water collecting systems are deformed. The situation is furthermore complicated by frost weathering of steel concrete used for building.

A decrease of area of glaciers of the Central Caucasus by 16% in the last 40 years is reported. Along with this, the glaciers of the Polar Ural Mountains are experiencing transition to stationary conditions after a period of fast retreat in 1990-2000.

During 2010 the interdisciplinary field expeditions were carried out in order to study the permafrost and mountainous regions and glaciations in the Elbrus region. Expeditions for study of ice complex on the north of Taymir were run in cooperation with Earth Cryosphere Institute. Expeditions for estimation of the engineering-geocryological conditions, geotechnical, ecological, landscape and permafrost conditions in Igarka and Norilsk regions on the north of Siberia were carried out. Study of dynamics of seasonal freezing processes in the Moscow-city region was fulfilled. Participation of students and PhD students was an

important part of all expeditions.

In Sergeev Institute of Environmental Geoscience RAS (Moscow) the permafrost hazard evaluation for Yamal's gas field recultivation territories was completed. The complete geocryological survey of East Siberia-Pacific Petrol Pipeline was started to estimate the exploitation risks in conditions of climate change.

Geological Research Institute for Constructions carried out the geotechnical monitoring of the railway roadbed Obkaya-Bovanenkovo to the gas fields on the Yamal Peninsula in the north of Western Siberia.

The road was built in an extremely complicated engineering and permafrost conditions. The results of monitoring observations are following:

- * the dynamics of technogenic disturbance of area, the thermal state of the embankment and the development of dangerous cryogenic processes during the construction and the maintaining of the railway road were determined;
- * the simulation of the temperature regime of soils in the embankment for different variants of design solutions was made;
- * the potential danger of anthropogenic cryogenic processes was assessed and the recommendations on the engineering protection of the area and the railway embankment were provided;
- * the proposals for improving the design of embankment and the technology of its filling for an accident-free maintaining of the railway road were developed.

Due to the international cooperation and especially under the aegis of IPA, the geocryologists succeeded in carrying out the expedition researches, maintaining the observations on stations and communicating during the international meetings. Russian geocryologists kept on close contacts with their colleagues from Canada, Germany, Japan, Norway USA and other countries.

On the 5-6 of July, 2010, the international workshop under the chairmanship of academician V.P.Melnikov was held in Tyumen, the priority lines of the geogryology were discussed.

Russian geocryologists took part in the International Congress on engineering geology held on 5-11 of September, 2020 in Auckland (New Zealand). During the Congress, the protocol on the expansion of the engineering-geological mapping in the cold regions has been accepted.

The results of the geocryological researches have

been widely published as monographs, articles in the scientific journals and material of conferences.

In 2009-2010 the monographs by V.V.Rogov "Foundations of cryogenesis" (Lomonosov Moscow State University, Geographical Department), Yu.B.Badu "Cryolithology" (Lomonosov Moscow State University, Geographical Department), L.N.Kritsuk "Ground ices of Western Siberia" (VSEGINGEO) have been published.

The monograph by L.N.Chrustalev, S.Yu.Parmusin, L.V.Emelyanova "Reliability of northern infrastructure under the climate change conditions" (Lomonosov Moscow State University, Geological Department) has been prepared for publication.

The fruitful activity of the journal "Earth's Cryosphere" ought to be especially marked out. The subjects of the journal embrace all the variety of researches on earth's and planets' cryosphere. Since 1997, 4 issues of the journal "Earth's Cryosphere" have been published annually.

Recently the conception of the complex researches of Earth's and planets' cryosphere developed by academician V.P.Melnikov has obtained the recognition. It is significant to mark the effectiveness of the interdisciplinary contacts in the view of the enrichment with ideas and methods of the adjacent sciences and the determination of the perspective lines of the scientific and practical activity.

In 2010, the Melnikov Permafrost Institute at Yakutsk (MPI) celebrated the 50th anniversary of its foundation. Celebration events held on November 25-26, 2010 included the scientific session "History, Results and Future Prospects of Geocryological Science". Sixty three MPI members were awarded various national and regional awards for their significant contribution to the field of geocryology.

In August 2010, Russian Prime Minister Vladimir Putin visited Samoylov Island in Arctic Yakutia, where the Permafrost Institute in cooperation with the German partners conducts joint field studies on climate, permafrost and ground ice interactions as part of the intergovernmental program "Laptev Sea System". As a result of this visit, a decision was taken on the federal level to construct a new international research station on Samoylov Island.

MPI members took part in 20 international meetings during 2010. The Forum for Young Permafrost Scientists was held in August 2010, which consisted of the conference on geocryology at Yakutsk and the field trip in central Yakutia focusing on ground ice, thermokarst and thaw depressions (alases). The Forum was attended by young researchers and students from Russia, China, Japan, and France.

Two issues of "Science and Technology in Yakutia"

were published in 2010. This popular scientific journal is receiving increasing attention from both the researchers and the general public. Books published by MPI in 2010 include:

- * Zhang, R.V., Shepelev, V.V. (eds.). The Yakutian School of Geocryological Science (Research Scope, Results, and People). Novosibirsk: GEO Academic Publ., 236 pp.
- * Neradovsky, L.G. Methodological Manual on Permafrost Investigation with the Dynamic Georadar Method. Moscow: Russian Academy of Sciences.
- * Alekseev, V.R. In the Land of Eternal Frost, Notes of the Geographer and Permafrost Researcher. Novosibirsk: GEO Academic Publ., 394 pp.
- * Makarov, V.N. Nitrogen in the Yakutian Environment. Yakutsk: Permafrost Institute, 68 pp.
- * Gorbunov, A.P., Gorbunova, I.A. Geography of the World's Rock Glaciers. Moscow: KMK Partnership, 131 pp.

The main research results of MPI in 2010 are summarized below:

1. The concept of "cryogenic resource" was introduced to refer to any material or natural force, the origin and development of which are related to the sphere of cold (temperature below 0°C). The classification of cryogenic resources was elaborated, the important class being that of cryogenic construction materials (snow, ice, frozen ground).
2. A glacier inventory 2010 for the Trans-Ili - Kungei glacier system (Central Asia) was compiled based on satellite images. This is the fifth in the series of glacier inventories developed during the period from 1955 to 2010. The inventory provides information important for effective cross-border water management.
3. MPI took part in a fundamental national program to create a digital 1:2,500,000-scale engineering geology map of Russia. The Institute compiled the 12th block of the map covering Central Siberia and North-Eastern Russia. This electronic ArcGIS-based map provides data on soils and rocks, permafrost, and dynamic conditions. The map data can be used to analyze geotechnical parameters individually or in combination, for sites or for the entire mapped area.
4. A physico-mathematical model for permafrost degradation following the Holocene transgression of the Polar basin was developed for variable climatic and hydrologic conditions. The effects of seawater heat and salts on permafrost degradation at subzero temperatures were

determined. The modelling results indicate that on the Siberian shelf the subaqueous sediments with temperatures between -1.0° and -1.5°C could have persisted in a frozen state for a long time, as much as tens of thousands of years, due to the significant decrease in the permafrost warming trend over several centuries after the marine transgression and the subzero mean annual temperature of bottom water at depths of 6 m and more.

5. Long-term observations of the ground temperature and moisture regimes were continued at the MPI's monitoring sites. Observations in the eastern Russian Arctic indicate that the maximum erosion rates of ice-rich coasts along the Kara, Laptev and East Siberian seas are up to 20 m/yr.
6. Permafrost research programs were undertaken in support of major industrial developments in Yakutia and adjoining areas, such as the East Siberia-Pacific Ocean pipeline system, the Amur-Yakutsk railway, the South Yakutian hydropower complex, the Elkon uranium mining project, and the Tazhnoe, Dues, Tarynnakh and Gorkit iron mining projects. These investigations resulted in the construction of permafrost, terrain and ecological maps of various scales, the compilation of data sets and data bases on permafrost characteristics, and the development of permafrost impact assessments and control measures.

19 Spain

In 2010, studies of cryosphere have been carried out by Spaniard research groups in Polar Regions of the Arctic and Antarctic and the high mountain of Andes and Africa. Also they have worked on Martian permafrost and the Iberian Peninsula (Pyrenees, Cantabrian Mountains, Sierra Nevada and Central System) where the studies have focused mainly on mountain permafrost degradation, periglacial process and their spatial distribution, and nival processes and landforms. The different working Groups collaborate with several International groups of USA, UK, Portugal, New Zealand, Argentine, Perú, Brazil, Mexico, France and Switzerland. The Spanish researches have consolidated the activity after IPY, with the continuity of groups and researches supported by National funds. During the last IPA Regional Conference (III EUCOP) held in Longyearbyen (Svalbard) six Spanish researchers representing to six research group participate in the meeting. It is a little but active community and we celebrate each two years a 2-3 days meeting, joint to the Portuguese association. The meeting of 2011 (III IPA-Iberian Meeting) will take

place in Galicia, 21-24 June, organized by Marcos Valcárcel (University of Santiago de Compostela). In 2010 two publications related to periglacial subjects have been edited in Spanish language. A monographic number of the review *Cuadernos de Investigación Geográfica* (Geographical Research Papers) (36-1 and 2, 2010) edited by J.M. García-Ruiz and J. Arnáez on snow at the Iberian mountains, avalanches, hydrological and geomorphological issues, (<http://www.unirioja.es/servicios/sp/ej/cig/cig.shtml>) with papers in English and Spanish. The monographic edited by J.J. Blanco, M.A. de Pablo and M. Ramos, *Ambientes periglaciares, permafrost y variabilidad climática* (Periglacial environments, permafrost and climatic variability), published by the University Press of the University of Alcalá de Henares, include the contributions made by Iberian IPA community to the II IPA-Iberian meeting.

The Research group of the Universidad de Barcelona and Universidad de Extremadura, led by Antonio Gómez-Ortiz, work at Sierra Nevada (37°LN/3°LW) studying the continuous and progressive fossil ice and relict permafrost degradation in the Corral del Veleta cirque (3150 m). Between 1998 and 2009, an important loss of ice mass has been found by geomatic techniques. The ice melt is related to the temperature increase in the active layer. The tomographic researches point out that the ice masses in the Corral del Veleta are organized in patches, not in continuous sheets as until 1998. The research group also studies the genesis and dynamics of patterned ground located on summit planes of Sierra Nevada. The main goal is to establish interrelations between the morphotopographical characters, slope and thermal regime of soils. Works to determine cold environments in altitude during the Little Ice Age have been begun. Complementary information on natural proxy (sedimentology and palinology) and documental sources (historical documents since X century) are being used by research.

PERMAMODEL project is primarily run by the Department of Physics of Alcalá University in collaboration with the Centro de Estudos Geográficos – University of Lisbon. This project focuses on the study of the evolution of the thermal active layer in polar permafrost and it is led by Dr. Miguel Ramos. The field experiments are developed in Livingston (62°39'S, 60°21'W) and Deception (62°43'S, 60°57'W) islands in the maritime Antarctic. These islands have significant areas with ice-free terrain underlain by permafrost. The location of these islands close to the mean annual temperature isotherm of -1°C, and their position in the Antarctic Peninsula region, results in a very high sensitivity to climate change. The goal of this

project is the monitoring of the temperature gradient of the active layer, as an approach for the calculation of the energy balance of the ground and therefore for the study of climate change, being complementary to the standard meteorological observations. Furthermore, monitoring of the temperature gradient and thermal fluxes of the permafrost in boreholes down to the zero annual amplitude depth, allow the application of inverse modelling techniques for the detection of climate change in decadal, and even centennial, time scales. The monitoring stations will be integrated in the international networks CALM-S (Circum-polar Active Layer Monitoring) and GTN-P (Global Terrestrial Network – Permafrost / WMO, FAO and IPA) in order to attain long-term data series (10-25 years). This action is linked to the IPY projects TST (Thermal State of Permafrost) and ANTPAS (Antarctic and sub-Antarctic Permafrost, Periglacial and Soil Environments).

The research group with members of University of Valladolid, University of Extremadura, University of Basque Country, University of Cantabria, Saint Louis University and Alfa Speleological Studies Centre, led by Enrique Serrano (University of Valladolid) and J.J. Sanjosé (University of Extremadura) continue works on the cryosphere in the northern mountains of Iberian Peninsula. A new project with eleven researchers and six research institutions, supported by National Funds (MMARM and MICINN) and the Picos de Europa National Park, is developed on the cryosphere as environmental geosindicator, slope processes related to ice and snow at the mountains of North Iberian peninsula (Pyrenees and Cantabrian Mountains). The focus is to complete the systematic observations through the application of DGPS and Laser-Scanner on proglacial lobe, rock glaciers, lobes, cones and ice-patches, soil thermal regimes (soils monitoring and BTS), data analysis of new mountain weather stations and geophysical techniques to relate slope geomorphological activity, thermal conditions and ice conservation and degradation. The final objective is to establish cryogenic landforms and processes as geosindicators and to develop methodologies for the control of geosindicators as a complementary method for monitoring Climate Change to local scales.

From the Research Group on High Mountain Physical Geography of Universidad Complutense de Madrid, led by Prof. David Palacios, researches on climate change and hydrological resources in the Andes, including permafrost, have been made. The project on Impact of Climate Change on solid hydrological reserves and natural risk related to tropical strato-volcanoes, is developed on the high mountains

of Sud-América and Africa. The group continues studies on the distribution of permafrost in the Andes, rock glaciers and recession of glaciers, as well as the interrelation with volcanic activity. In the Iberian Peninsula, the research group works on nival and periglacial processes in the Central System.

The research group of University of Santiago de Compostela, leaded by Augusto Pérez-Alberti and Marcos Valcárcel continues its researches on different places of Andes and Iberian Peninsula. Works at Southern (Tierra de Fuego) and central Andes are focused on the active layer dynamic, thermal regime of soils and periglacial processes. At the Iberian Peninsula the research Group are working on nival processes and environments in the North-western Mountains (Cantabrian and Galician Mountains). The Research Group on Geosciences and Antarctica, leaded by Jerónimo López-Martínez (Universidad Autónoma de Madrid), is actively involved in the study of connections between hydrology, soils, permafrost and periglacial processes in the Northern Antarctic Peninsula developed by fieldwork including geophysical techniques and remote sensing in collaboration with Universities and Research Centres of Argentina and New Zealand.

New researches have been began by researcher collaborating with national and international groups at the Arctic and Antarctic. Marc Oliva , postdoc researcher at AntECC (The Antarctic Environments and Climate Change Research Group implemented by Centre for Geographical Studies at the University of Lisbon –Portugal- and leaded by Gonzalo Vieira), is the Spanish representative member of PYRN. From 2010 collaborate with AntECC research with a project to study sedimentological properties of natural archives (lakes, ponds, lobes) in the Antarctic islands and establish a chronostratigraphy for slope activity during the Late Holocene in the South Shetlands. The research combines monitoring of slope dynamics with a new palaeogeographical approach. The main goals are to know dynamics of Earth surface processes in an extremely sensitive climate environment, and connect the role of climate variability in slope processes with permafrost evolution. Also collaborate in the Portuguese funded Project ANAPOLIS, whose rationale is the study of High Arctic icewedge polygonal networks in order to better understand the geometric diversity of Martian polygonal networks and he has participate in the fieldwork in Antarctica. Raúl Martín (StLouis University-Madrid), working on arctic geomorphology from 2002, is carrying out new researches on nivation and periglacial processes on Little Ice Age moraine complex in Svalbard (Norway), with focus on periglacial processes and historical

retreat of glaciers in Arctic environments. Field works have been developed in June 2010.

Other Spanish groups continue researcher began several years ago, and connected with IPY. The research group of University of Santiago de Compostela, leaded by Augusto Pérez-Alberti and Marcos Valcárcel continues its researches on several places of Andes and Iberian Peninsula. Works at Southern Andes (Tierra de Fuego) and central Andes, are focused on the active layer dynamic, thermal regime of soils and periglacial processes. At the Iberian Peninsula the research Group are working on nival processes and environments in the North-western mountains (Cantabrian and Galician Mountains) of Iberian Peninsula. The Research Group on Geosciences and Antarctica, leaded by Jerónimo López-Martínez (Universidad Autónoma de Madrid), is actively involved in the study of connections between hydrology, soils, permafrost and periglacial processes in the Northern Antarctic Peninsula developed by fieldwork including geophysical techniques and remote sensing in collaboration with Universities and Research Centres of Argentina and New Zealand.

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20 Sweden

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21 Switzerland

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22 United Kingdom

Periglacial and Glacial Engineering Geology Working Party

Following on from the success of the Tropical Residual Soils and the Hot Deserts Working Parties, the Engineering Group of the Geological Society of London is proposing to form a new Working Party on 'Periglacial and Glacial Engineering Geology' (working title). The aim of the Working Party is to produce a report that will act as an essential reference handbook for professionals working in relict periglacial and glacial ground conditions, as well as a valuable textbook for students and others.

A Steering Group has recently been established to draft the Terms of Reference for the proposed Working Party; develop the publication contents and structure;

identify key authors and contributors; and develop the publication budget and programme. The Steering Group comprises John Charman (Chair), Chris Martin (Secretary), Dave Giles, Julian Murton, Kevin Privett and Mike Winter. The Steering Group aims to complete these activities and report back at the Engineering Group Forum on 'Quaternary Engineering Geology,' to be held at the premises of the Royal Geographical Society on 23rd November 2011.

Please contact Chris Martin (chris.martin@arup.com) if you would like to find out more or contribute to the Working Party.

Experiments on consolidation and comminution of sand during freeze-thaw cycles were carried out in a collaborative project between Imperial College London and the University of Sussex. The experiments were undertaken by Vincent Blanchet as part of his MSc thesis in Soil Mechanics, supervised by Dr Catherine O'Sullivan and Dr Clark Fenton (Imperial) in collaboration with Julian Murton (Sussex). Oedometers installed in the Sussex Permafrost Laboratory measured sand consolidation, while sand grains subjected to repeated freeze-thaw cycles in climate cabinets were monitored in terms of surface microstructures.

Julian Murton (j.b.murton@sussex.ac.uk)

23 United States of America

The 2010 Fall Meeting of the American Geophysical Union took place in San Francisco, California, December 13–17. Approximately 235 talks and posters dealt with frozen ground, presented across many AGU sections and focus groups. Presentations covered geochemical, geophysical, and geomorphic aspects of permafrost, remote sensing and modeling techniques, permafrost's relationship to the ecohydrology of Arctic and sub-Arctic ecosystems, climate feedbacks and interactions, environmental change, and many other topics.

The USPA Annual Meeting was also held on 15 December during the 2010 AGU Fall Meeting. Torre Jorgenson succeeded Jim Rooney as President. Margaret Cysewski was appointed as the new USPA-PYRN liaison, a position formerly held by Anna Liljedahl who was elected USPA secretary. Oliver Frauenfeld took over as president-elect, and Michael Lilly re-joined the Board of Directors as an at-large member.

The 2010 Annual Meeting of the Association of

American Geographers took place April 14–18 in Washington, D.C. The AAG's Cryosphere Specialty Group (CrSG) sponsored and co-sponsored 11 sessions. These included a session specifically on frozen ground and periglacial environments, as well as sessions on glaciers and changing environments, interactions between the cryosphere and atmospheric circulation, and hydroclimatology. The annual CrSG awards were presented and former USPA board member and president Ken Hinkel was recognized with the 2010 *Francois Emile Matthews Lifetime Achievement Award*. The *R. S. Tarr Illustrated Student Paper Award* went to Ms. Rachel Bernstein with her poster "Southern Ocean Sea Ice Volume Transport using NIC Chart-Derived Thickness Distributions."

2010 education and outreach activities between the USPA and the Permafrost Young Researcher's Network (PYRN) consisted of a travel grant competition for the Fall Meeting of the American Geophysical Union. Jessica Cable (University of Alaska Fairbanks), Sarah Godsey (Pennsylvania State University), and Louise Farquharson (University of Alaska Fairbanks) each received \$500 during the Annual USPA Meeting in San Francisco. Prior to the 2010 Fall AGU meeting, PYRN and the Association of Polar Early Career Scientists (APECS) held a one-day career development workshop on Sunday 12 December 2010. The workshop provided a great opportunity for young researchers working in the Polar Regions and the cryosphere to meet new colleagues and mentors, and develop skills not often taught during graduate education programs. Eight invited speakers represented NSF, NASA, various universities, and a Polar-TREK teacher.

The 2010 IARC summer school entitled "*Arctic in a changing climate: Connection to permafrost*" built upon the successful field trip along the Dalton Highway offered during the 2008 Ninth International Conference on Permafrost. Of the nearly ninety applicants from across the globe (41 from U.S.), 17 students were competitively selected to attend the two-week long intensive course lead by Ronald Daanen and Skip Walker at UAF. The event began with lectures given in Fairbanks by over 15 experts in permafrost sciences and other disciplines with ties to permafrost (engineering, biology, ecosystem modeling, disturbance, climate modeling, social sciences, and hydrology). The following week was spent along the Dalton highway and offered an in-depth view of the landscapes and research along one of the most remote and scenic highways in North America. All students were provided a full scholarship that covered travel and living expenses. The USPA co-sponsored

the summer school with \$5500.

Jerry Brown reports that his early-career permafrost colleague, John B. O'Sullivan, died in December. They published papers on the geochemistry of permafrost in the early 1960s (see the [Proceedings of the First International Conference on Permafrost](#)). Brown also reports that during the Oslo International Polar Year conference, 12 U.S. reports were presented during the nine oral and one poster sessions under the theme "Permafrost on a Warming Planet." In May, the University of Alaska Fairbanks honored Brown by bestowing upon him an honorary Doctor of Science degree.

The Geophysical Institute Permafrost Laboratory research team (now 6 researchers, 1 research technician, several graduate students) in collaboration with Russian and Mongolian researchers continued the establishment of the observation borehole network for the thermal state of permafrost monitoring in Alaska, Russia, and Central Asia as part of the Arctic Observing Network project. The work included data collection and maintenance of existing boreholes, instrumentation of new or recovered boreholes, and gathering of historical data. Results of measurements have been submitted to the AON Cooperative Arctic Data and Information Service portal. S. Marchenko and V. Romanovsky, in collaboration with European scientists within the CARBO-North project, worked on quantifying the carbon budget in northeast European Russia across temporal and spatial scales by using permafrost dynamics modeling driven with HIRHAM5 at an unprecedented horizontal resolution of only 4 km. G. Grosse continued work within NASA Carbon Cycle Sciences and NSF ARC projects on thermokarst lake dynamics and related carbon cycling, including fieldwork on the Alaska North Slope and the Seward Peninsula. Both projects involve several students as well as collaborations with U.S., Russian, Canadian, British, and German researchers. A new project supported by the U.S. FWS was started to estimate probabilities of thermokarst lake drainage in a portion of the NPRA to support Fish and Wildlife habitat management tasks. R. Muskett continues permafrost research work funded by NASA, NSF, and State of Alaska. He continues applications of satellite geodetic methods for permafrost change detection and assessment over the northern hemisphere. During 2010 he organized and chaired permafrost sessions at the American Geophysical Union Fall Meeting 2010 in San Francisco, California, and the European Geosciences General Assembly 2010, Vienna, Austria. R. P. Daanen, although still associated with the GIPL, started working in early 2011 for the Water and Environmental Research Center in the Institute of

Northern Engineering. He is currently working on a DOE funded project Arctic Transportation Network. The task as part of the project is to predict changes in soil temperature. New funding from the Alaska University Transportation Center will develop deeper understanding of groundwater interaction with highway embankments on permafrost.

Hannele Zubeck, a Professor and Chair of Arctic Engineering Graduate Program at the University of Alaska Anchorage (UAA), reports that students can now achieve a Master's of Science in Arctic Engineering from UAA entirely through distance education, most courses being online and some taught via Smart Classrooms. The program offers courses, imperative to engineers working in or for the Arctic, in Frozen Ground and Pavement Engineering, Arctic Hydrology and Hydraulic Engineering, Ice and Snow Engineering, and Arctic Utility Distribution. Courses are available to international students (contact Dr. Zubeck at afhkz@uaa.alaska.edu for more information). Ben Still, an Arctic Engineering graduate student, was awarded URS Fellowship for his Masters Studies and to research how to complement visual classification of frozen soils with index tests. The aim is to revise ASTM International standard D4083. Hannele will chair an ASTM International Symposium on Mechanical Properties of Frozen Soils to be held in Jacksonville, Florida on January 31, 2013 with a web option. The objective of the symposium is to provide a forum for the exchange of ideas on current research on testing of mechanical properties of frozen ground. A further goal is to provide a rationale for the various details within a new standard for triaxial testing of



frozen soils.

Nenana High school students visiting Fox permafrost tunnel (photo: K. Yoshikawa).

Kenji Yoshikawa (Water and Environmental Research Center, University of Alaska) has established 161 communities in the permafrost outreach network, now

including almost all of the Alaskan permafrost-occupied communities and Little Diomed, St. Lawrence Islands. All results will be published as a ground temperature resource book in 2011 and delivered to the communities. As part of this program, K–12 class lessons are developed for permafrost education including the series of **TunnelMan**.

Yoshikawa revisited Mt. Kilimanjaro, Tanzania, to retrieve data and obtain new measurements. This expedition was part of the GLOBE program, which included teenage students (including Alaskans and Native Americans) and Alaskan teachers. As in 2009, all of the participants successfully reached the summit. Two additional boreholes were drilled and instrumented with dataloggers at the summit crater, and data were retrieved from five boreholes including the summit (5800 m) glacier site. Permafrost is present 3 m below the ground surface near the summit, where the glacier has retreated. Yoshikawa and a group from the Universidad Complutense Madrid (including D. Palacios) drilled in the Peruvian Andes (Nevado Chachani) and at a Mexican volcano (Iztaccíhuatl). Permafrost was found, and dataloggers were installed at Nevado Chachani (5350 m) and at Iztaccíhuatl (4700 m).



Drilling at Nevado Chachani (5350 m), Peru (photo: K. Yoshikawa).

Beth Astley reports that in 2010, the Cold Regions Research and Engineering Lab (CRREL) collected ground resistivity, GPR, and helicopter frequency domain electromagnetic (HFEM) data from a geophysical test area on Fort Wainwright, Alaska, and modeled the permafrost in three dimensions. The HFEM survey was completed over two test lines in conjunction with Fugro Airborne Surveys Corp and the USGS in order to assess HFEM for permafrost mapping. The results of these efforts will be presented at the Symposium on the Application of Geophysics to Environmental and Engineering Problems (SAGEEP)

in April 2011. Contact Beth Astley, Beth.Astley@us.army.mil for more information. Kevin Bjella reports that in December 2010, tests were conducted to determine the feasibility of underground excavation in fine grain permafrost in Fairbanks, Alaska. In February and March of 2011, an underground horizontal excavation was initiated at the CRREL Permafrost Tunnel in Fox, Alaska. This new passage runs parallel to the existing adit, is 60 m distant with a cross-section of 4.5 m x 4.5 m, and the length was terminated at 29 m. This new adit passes primarily through late Pleistocene Yedoma and encounters very large wedge ice, supra-wedge ice, many distinct organic horizons, and many woody fragments. Further excavation is planned for the winter of 2011–2012. Ground penetrating radar surveys, capacitively coupled resistivity surveys, and boreholes were conducted at the Great Kobuk Sand Dunes in northwest Alaska. The studies were conducted during a NASA funded project lead by the Southwest Research Institute to determine the applicability of the dunes as an analogue for Martian dune mobility. Temperature instrumented test embankments were installed at Thule Air Force Base in Greenland to study the effect of varying thickness of buried insulation on the depth of the permafrost table in coarse grain fill. This information will help maximize planned reconstruction efforts at the Air Base.

The U.S. Geological Survey (J. Abraham, M. Walvoord, B. Minsley, and B. Smith, USGS-Denver; J. Cannia USGS-Lincoln) undertook a helicopter frequency domain electromagnetic (HFEM) survey in July 2010 of the area of Fort Yukon, Alaska, for the purpose of mapping the distribution of permafrost. This study maps the distribution of permafrost in selected areas near Fort Yukon in order to develop hydrogeologic information and interpretation for development of a groundwater model in the Yukon Basin. An additional benefit is the collection of an anchor dataset of 3D permafrost distribution, which can be compared to future similar data collections to determine a volumetric change over time, which in turn can be correlated to climate change. Approximately 1800 line kilometers of data were acquired in typical block style near Ft. Yukon and in long reconnaissance lines along the Yukon River flood plain and the Porcupine River tributary. Such surveys conducted in other parts of the Arctic region will enable comparisons and contrasts of permafrost distribution on a worldwide scale.

Nikolay Shiklomanov (George Washington University) reports on the GWU/UD—CALM III activities in Alaska. The 2010 field team consisted of Dima Streletskiy (GWU), Anna Klene (University of Montana), Fritz

Nelson (University of Delaware), Cathy Seybold (USDA), three GWU students (E. Hatleberg, K. Nyland, and E. Upin), and Josh Dugat, a teacher from New Orleans who participated through the PolarTREC program. The GWU/UD team measured active-layer thickness and ground temperature at a series of CALM sites representative of the diverse climatic and landscape conditions on the North Slope of Alaska and the Seward Peninsula. Ground subsidence monitoring by means of differential GPS was conducted at several sites. Marianne Okal (UNAVO) worked with the team to create a high-resolution survey of polygonal tundra in Barrow, using ground based LIDAR. In April 2011, Jim Doolittle (NRCS), Fritz Nelson, John Kimble (NRCS) and Ken Hinkel (University of Cincinnati) completed a ground-penetrating radar survey of the same area. Together, these data sets will facilitate construction of a three-dimensional, high-resolution representation of polygonal terrain underlain by active ice wedges.

Fritz Nelson (University of Delaware) reports that Melanie Schimek completed her MS thesis, "Topoclimatic Influences on Active-Layer Thickness in Northern Alaska." Dima Streletskiy completed and defended his PhD dissertation, "Spatial and Temporal Variability of Active-Layer Thickness at Regional and Global Scales" and is currently working as a postdoctoral scientist at George Washington University. He will assist several GWU students in conducting a variety of permafrost-related activities as a part of the continuation of IPY permafrost courses in Russia organized by Department of Cryolithology and Glaciology of Faculty of Geography, Moscow State University. Mark Demitroff continues study of periglacial features in the Mid-Atlantic region, and plans to finish his doctorate in early 2012.

Tingjun Zhang at the National Snow and Ice Data Center of the University of Colorado at Boulder and Oliver Frauenfeld from Texas A&M Geography continue jointly to investigate changes in permafrost temperatures, active layer thickness, and talik formation using historical Russian soil temperature data. Zhang, Lin Liu, and J. Wahr (Cooperative Institute for Research in Environmental Sciences) investigated the possible changes in active layer thickness on the North Slope of Alaska by detecting surface deformation using InSAR data. Their results indicate that ground surface might have settled down about 1 to 4 cm from 1992 through 2000 over the lower Kuparuk River basin, equivalent of approximately 2 to 8 cm increase in active layer thickness over the same period. Zhang is supported by Chinese Natural Science Foundation to investigate frozen ground and hydrological processes over the upper reaches of

Heihe Basin in Qilian Mountains in western China. Zhang continues to serve as a lead author for the IPCC 5th Assessment Report due in 2013. He is in charge of changes in frozen ground for chapter 4 and changes in soil temperatures in chapter 2. K. Schaefer (NSIDC) reports on new research, published in *Tellus*, indicating that rising temperatures may result in the thaw Arctic permafrost and release 190 ± 64 Gt of carbon to the atmosphere by 2200, amplifying warming due to the burning of fossil fuels and influencing global emission reduction strategies. This release of carbon will amplify warming due to fossil fuel emissions, accelerating permafrost thaw and initiating a positive Permafrost Carbon Feedback (PCF) on climate. By 2200, a 29–59% decrease in permafrost area and a 53–97 cm increase in active layer thickness is predicted. By 2200, the PCF strength in terms of cumulative permafrost carbon flux to the atmosphere is 190 ± 64 Gt C. Schaefer et al. predict that the PCF would irreversibly change the Arctic from a carbon sink to a source after the mid 2020s and is strong enough to cancel 42–88% of the total global land sin.

Teams lead by Ken Hinkel (University of Cincinnati), Yongwei Sheng (UCLA) and John Lenters (University of Nebraska-Lincoln) continued their work on thermokarst lakes on the Arctic Coastal Plain of northern Alaska. Water temperature profile measurements were collected from 12 Arctic lakes in summer 2010 as part of a network of lakes being studied. The lakes are underlain by permafrost and extend inland across some 150 km—from the Arctic coast near Barrow southward to the foothills of the Brooks Range. Regionally, lake water temperature patterns over the area are concordant and demonstrate rapid warming in late June and mid-August, with significant synoptic-scale cooling in the second week of August. Locally, ice meltout occurs about 2–4 weeks later on lakes near the coast due to lower temperatures and cloudy conditions associated with maritime conditions. Developed in flat-lying marine silts, the coastal lake basins tend to be shallow (2–3 m) and of uniform depth; strong and persistent winds limit thermal stratification, and mid-summer (1 July–15 Aug) near-surface water temperature averages 6.8°C . About 100 km further inland, in the sandy rolling topography near Atkasuk, lakes are characterized by broad shelves and deeper (2–4 m) central pools. Temperature stratification is minor (

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