initiated by Charles Harris, Julian Murton and Michael Davies in collaboration with Marianne Fonte and Gérard Guillemet in the cold laboratories of Laboratoire Morphodynamique Continentale et Côtière, UMR CNRS 6143 / Université de Caen, France. Two full-scale slope models have been constructed, 4 m in total length, 1.5 m in width, and constructed in identical Caen silt. Models are subject to identical air temperature freezing and thawing cycles, but a freezing plate is installed in the base of one slope, maintaining a permafrost surface beneath a 30-cm thick active layer, while the second model has a basal drainage layer and is allowed to thaw completely between freezing cycles. The research will compare solifluction processes associated with one-sided, active-layer freezing (non-permafrost) and two-sided freezing (permafrost) by measuring soil and air thermal conditions, frost heave and settlement, downslope soil movement, volumetric moisture content and pore pressures. Three, full freeze-thaw cycles have so far been completed.

Field station monitoring active-layer gelifluction processes, Endalen, Svalbard, installed in August 2005. Photograph by Charles Harris.

A second project entitled «Modelling Pre-failure Shear Strain (Solifluction) in Freezing and Thawing Soil Slopes» commenced in May 2005 at Cardiff University, with Charles Harris (Earth Sciences), Hywel Thomas and Peter Cleall (Engineering) as principal scientists, and Martina Luetschg (Earth Sciences) and Katherine Butterfield (Engineering) as Post-Doctoral Fellows. The programme will develop numerical modelling of periglacial solifluction, calibrated and validated against scaled physical modelling in the geotechnical centrifuge and field monitoring. As part of this programme a new field station was installed in Endalen, Svalbard, in collaboration with Hanne H. Christiansen of UNIS and Fraser Smith of Dundee University. The station will monitor permafrost solifluction process variables and replicate the Caen full-scale laboratory modelling experiment, measuring air and ground thermal conditions, surface frost heave and settlement, downslope displacement, volumetric moisture content and pore pressures.

The bedrock ice-segregation experiments, funded by NERC and led by Julian Murton (Sussex University), finished in the Caen cold rooms and preliminary results were presented at the Second European Permafrost Conference in June 2005. The results are currently being analysed for publication in collaboration with Rorik Peterson (University of Alaska, Fairbanks).

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United States of America

The Fall Meeting of the American Geophysical Union was held in San Francisco, California, December 5-9, 2005. More than 50 oral reports and posters were presented in two special topical sessions on permafrost, seasonally frozen ground, hydrates, hydrology, and related topics. Forty-nine reports were presented in four sessions under the general heading «Permafrost and Seasonally Frozen Ground in a Changing Climate». The sessions were organized by Stephan Gruber (France), Tingjun Zhang and F.E. Nelson. A poster session consisting of eight reports on «Gas Hydrates and Their Relationship to Geohazard and Global Climate Change» was organized by Scott Dallimore (Canada) and Tim Collett.

The U.S. Permafrost Association (USPA) continues to develop and attract new members. Visits to the USPA website exceeded 4,000 «hits» during 2005 (www.uspermafrost.org). The USPA held its annual meeting and election during the AGU. Members of the 2006-2007 Board of Directors include: President: F. E. Nelson; Past President: Vladimir Romanovsky; President Elect: Jon Zufelt; Board members David Norton, Jennifer Hardin, Michael Lilly (Treasurer), Ken Hinkel (Secretary).

The U. S. National Committee for the Ninth International Conference on Permafrost met in open session prior to the AGU. Planning for the NICOP was reviewed in preparation for the mailing of the first announcement in early 2006. The Local Organizing Committee is developing the details of the conference programme and activities. Conference plans and pre-registration information are posted at: www.nicop.org

A special session on the International Polar Year was organized by Jerry Brown and Fritz Nelson for the Annual Meeting of the Association of American Geographers (AAG) to be held in Chicago in March 2006. The IPY sessions are sponsored by the AAG's Cryosphere, Geomorphology, and Climate Specialty Groups. At its annual meeting in April 2005 in Denver, Colorado, more than 50 cryosphere-related reports and posters were presented. Several awards were presented for the best poster presentation by young investigators.

Jon Zufelt provided the following report on recent and continuing activities of the American Society of Civil Engineers (ASCE) and its Technical Council on Cold Regions (TCCRE) during the year:

- Completed the TCCRE publication titled «River Ice Monograph».
- Organized and sponsored «Cold Regions Symposium» with six sessions at the ASCE World Water and Environmental Resources Congress held in Anchorage, AK, May 16-19, 2005, and presented two awards: the Can-AM Civil Engineering Amity Award to Jon Zufelt of CRREL, Anchorage, and the Harold R. Peyton Award to Norbert Morgenstern, University of Alberta, Edmonton.
- TCCRE EXCOM met in San Francisco at the AGU, participated in the meeting of the USNC for NICOP and is assisting in planning the conference.
- 100 abstracts were received for the 13th International Conference on Cold Regions Engineering at Orono, Maine, July 23-26.
- Co-sponsoring with RIL and the Finnish Society of Civil Engineers, the International Society for Cold Region Development (ISCORD) Conference in Tampere, Finland, September 25-27, 2007.
- Initiated planning for the 14th International Conference on Cold Regions Engineering in Duluth, MN in 2009.
- Continued to review manuscripts and published the quarterly Journal of Cold Regions Engineering and the preparation of new Cold Regions Monographs on Field Properties and Site Investigations in Frozen Ground, Hydraulics and Hydrology, Water Treatment in Cold Regions, Specialty Foundations in Cold Regions, and Ports and Harbors in Cold Regions.

Bucky Tart is the incoming chairman of the TCCRE Executive Committee (EXCOM). David Prusak rotates off the EXCOM and John Woodworth, a structural engineer from Duluth, MN has been elected to the EXCOM.

Vladimir Romanovsky, Geophysical Institute and International Arctic Research Center, University of Alaska Fairbanks and the permafrost research group (Kenji Yoshikawa, Sergei Marchenko, Dmitri Nicolsky, Ronald Daanen, and Valeri Groshev) continued their efforts to record active layer and permafrost dynamics at our more than 60 sites within Alaska. All sites were visited in June - September along the northern portion of Alaska and some sites within the southern portion of the Alaskan transect to collect air and ground temperatures and soil moisture data from the data loggers. Active-layer depths and other environmental characteristics were also collected. Permafrost temperatures in all deeper boreholes (60 to 80 meters) were measured within the northern portion of the transect. Generally, active layer thickness was less this year compared to the last year, but it is still greater than average for the last 15 years. Temperatures in permafrost continue to increase in northern Alaska, but with lower rate compared to the 1990s. In Interior Alaska permafrost temperatures are approaching the highest level that was recorded during the mid-1990s. At many locations mean annual temperatures at the permafrost table are within several tenths of a degree C of the melting point of ice. A new near-surface, permafrost observatory was established at Isachsen (Ellef Ringnes Island, Canada) as a part of Walker's Biocomplexity project. This installation completed the Canadian Arctic transect of permafrost observatories (Banks Island, Mould Bay and Isachsen) and extended our Alaskan transect into the High Arctic. A new observatory is under development at the southern end of the transect at Gakona, Alaska.

Tom Osterkamp reports that after monitoring active layer and permafrost conditions at permafrost observatories along a north-south transect of Alaska for the last twenty five years, this project will now be continued by Vladimir Romanovsky. This database through 2004 is available on-line through NSIDC: http://nsidc.org/data/arcss034.html and http://nsidc.org/data/arcss106.html

Ken Hinkel and Wendy Eisner (University of Cincinnati) provided reports on several projects. Hinkel, Richard Beck and three graduate students were at Barrow in April to determine the elevation of the snow drift along the Cakeater Road snowfence using DGPS towed behind a snowmachine. Snow thickness was estimated by comparing these transect measurements to the high resolution IFSAR DEM. Soil warming and summer ponding has resulted in ground subsidence of about 10 cm in the past five years; the effect is maximized beneath the crest of the snow drift. In August, the team completed the Barrow Urban Heat Island study. Over four winters, the village core averaged about 3° C warmer than the tundra; on some days it was 9° C warmer. In summer, the village tends to be a bit cooler owing to the maritime effect along the coast. Wendy Eisner, Hinkel, and Chris Cuomo are involved in an interdisciplinary project studying landscape processes on the North Slope of Alaska. Native people of the North Slope have first hand knowledge of these Arctic changes. UC graduate students John Hurd and Benjamin Jones, joined the team in Barrow and Atqasuk in August. Fifteen Inupiaq Elders were interviewed and many have indicated that landscape changes are occurring at a rapid rate. They have identified lakes that have drained, areas where permafrost thaw has been extreme, and places where the sea and river bluffs are eroding. The team has been able to verify many of these observations through the use of aerial photography, satellite imagery, and radiocarbon dating. Ben Jones is now working at the U.G. Geological Survey in Anchorage.

Frederick Nelson (University of Delaware) reported that with the appointment of Hugh French as an affiliate of the University of Delaware's Center for Climatic Research, the UD Permafrost Group (UDPG) now consists of 13 students, affiliates, and faculty. With masters student Mark Demitroff, H. French is examining the landscapes of southern New Jersey and the Delmarva Peninsula for traces of Pleistocene permafrost and periglacial features. The Appalachian Mountains and Mid-Atlantic coastal plain are becoming a focus for much of UDPG's work: Mike Walegur is analyzing the lengthy records from his network of air- and ground-temperature stations in

the Appalachian Highlands. Andrea Wedo is completing her study of the Hickory Run Boulder Field in Pennsylvania, and Kim Gregg's masters thesis on blockfield distribution in the Appalachians is being readied for publication. Other news includes the arrival of Meixue Yang, a cold-regions specialist from Lanzhou China, who will be a visiting Research Associate for the next two years. Anarmaa Sharkhuu from the Mongolian Academy of Sciences spent several weeks in residence with UDPG during the fall semester of 2005. Other new UDPG personnel include masters student Melanie Schimek and doctoral student Dmitri (Dima) Streletskiy. Dima completed his masters program in geocryology at Moscow State University in June. Anna Klene defended her doctoral dissertation in May 2005 and is now Assistant Professor of Geography at the University of Montana in Missoula. Research Associate Kolia Shiklomanov spent August 2005 assessing CALM sites in Siberia. Silvia Cruzatt installed a series of stations at high elevation (~5000 m) in the Peruvian Andes in late 2004. Heath Sandall and Jon Little are completing masters theses on their CALM-related fieldwork in northern Alaska. The 2005 CALM field crew in Alaska consisted of Nelson, Klene, Streletskiy, Schimek, Sandall, and Cathy Seybold (U.S. Natural Resources Conservation Service).

Skip Walker (University of Alaska Fairbanks) reported on the fourth expedition conducted under the NSF-funded project «Biocomplexity of patterned ground». The primary goal of the project is to better understand the complex linkages between patterned ground formation, biogeochemical cycles, vegetation, disturbance, and climate across the full Arctic summer temperature gradient in order to better predict Arctic ecosystem responses to changing climate. The 2005 expedition to Isachsen, Ellef Ringnes Island in the Canadian Archipelago was logistically the most difficult because of the size of the group (25 scientists, students, and support staff), and remoteness of Ellef Ringnes Island. Isachsen is near the extreme cold end of the summer temperature gradient in Canada. It was the site of a joint U.S.-Canadian climate station from 1948 to 1971 and is characterized by very low summer temperatures and low biological diversity and productivity (mean July temperature 3° C). The Biocomplexity project now has 10 locations along an 1800-km North American Arctic (NAA) transect starting in the northern boreal forest and passing through all five Arctic bioclimate subzones of Alaska and Canada. Participants came from Canada, France, Germany, Puerto Rico, Switzerland, and the United States and included five students who participated in the Arctic Field Ecology course taught by Bill Gould and Grizelle Gonzalez through the University of Minnesota.

Chien-Lu Ping, University of Alaska Fairbanks, and Torre Jorgenson, ABR, Inc., Fairbanks, initiated their new three-year, collaborative project «Flux and transformation of organic carbon across the eroding coastline of northern Alaska» under the NSF Study of Northern Alaska Coastal Systems (SNACS) program.

The 2005 field season started at Barrow and ended on the Colville River Delta, with 24 sites along the Beaufort Sea coast studied and sampled. The sites included coastal marshes/tidal flats, and bluffs with elevation up to four meter. Community-based monitoring sites were established with schools at Barrow, Nuiqsut and Kaktovik. This year's international team consisted in addition to Ping and Jorgenson of Fugen Dou (post-doc, UAF), Sabine Fiedler, (Soil Scientist, University of Hohenheim, Germany), Mikhail Kanevskiy (UAF post-doc fellow from the Russian Earth Cryosphere Institute), Prathap Kodial (graduate student, UAF), Gary Michaelson (Palmer Research Center, UAF), Yuri Shur (Civil Engineering, UAF), Vladimir Tumskoy (Moscow State University) and Jerry Brown (IPA).

Torre Jorgenson, Yuri Shur and Tom Osterkamp initiated a new NSF-project on «Effects of ground ice on the evolution of permafrost-dominated landscapes under a changing climate». The research addresses the effects of ice aggradation and degradation on terrain evolution, and the current extent and rate of thermokarst development in Alaska. Data from the first summer of field work are currently being examined.

Through a grant from the NSF EPSCoR program, University of Alaska Fairbanks (UAF) researchers are bringing permafrost studies to schools around Alaska. Kenji Yoshikawa, Yuri Shur and Douglas Goering are installing instrumented boreholes near schools in Nome, Fairbanks, Noatak, Beaver, Galena, and Barrow that will permit students to participate in installing instruments, measuring temperatures and join discussions of the role of permafrost in Alaskan ecosystems.

UAF researchers Kenji Yoshikawa, Douglas Kane, and Larry Hinzman are investigating groundwater dynamics in the continuous permafrost regions of the North Slope of Alaska by examining the physical and chemical properties of groundwater springs and aufeis fields. While some of the aufeis have very local sources of water, it appears that many springs derive their water from the south side of the Brooks Range, releasing water that is at least 2000 years old. Daniel White and Larry Hinzman are studying the degradation of permafrost on the Seward Peninsula of Alaska to understand the consequent effect to hydrological processes and communities.

Douglas Kane and Larry Hinzman continue various projects related to permafrost hydrology in the Kuparuk Watershed on the North Slope of Alaska. This research program has operated continuously since 1985, maintaining nearly continuous hydrological and meteorological observations at many stations for 20 years. These data are available via: http://www.uaf.edu/water/projects/NorthSlope/introduction.html

Kenji Yoshikawa collected spring water and ice core samples from frost blisters at Sukakpak Mountain (Brooks Range), North Folk Pass (Yukon, Canada) to compare with previous studies. The isotopic signals of the spring water has not changed since the 1980s. Other drilling was carried out at the Alpha pingo (near Fairbanks), Cripple Creek

pingo, Maclaren River palsa, Copper River Basin, and a broad base mound on the North Slope.

Horacio Toniolo (UAF) continues permafrost degradation and sedimentation studies at Caribou Poker Creeks Research Watershed. This research watershed was established in 1968 by CRREL and has been an active study site for numerous studies over the years. Half of this watershed was burned in a wildfire in 2004, and now presents opportunities to monitor the fire impacts. Numerous thermokarsts are now evident in CPCRW, some in response to fire, others related to a flood event, and others probably forming in response to a warming climate.

Gary Clow and Frank Urban (U.S. Geological Survey) continued development of the U.S. Department of the Interior's contribution to the GTN-P monitoring program. The primary focus during 2005 was adding radio telemetry capability to several of the active-layer monitoring stations in the eastern portion of the National Petroleum Reserve (NPRA) in northern Alaska. This is being done in collaboration with Michael Lilly (GW Scientific) and the U.S. Bureau of Land Management. The total number of stations in the DOI/GTN-P active layer network is now 15. Repairs and upgrades were made to several of the wells in the DOI/GTN-P deep borehole array in preparation for the TSP campaign. A major effort was initiated to quantify the uncertainties in TSP borehole temperature measurements. The USGS' polar temperature logging system is being upgraded in response to this analysis.

Larry Hinzman reported on «An Evolving Arctic Workshop: Hydrologic Responses to Degrading Permafrost», August 9-12, 2005, at the University of Alaska Fairbanks. The purpose of the workshop was to examine how the warming climate will impact the hydrological regime and the resulting impacts to local ecology and surface energy balance through degrading permafrost. The primary focus was upon the influence of permafrost warming and thawing to elucidate further influence through feedback processes. This workshop included local field trips in the Fairbanks area to observe and photograph evidence of permafrost degradation. Workshop attendees observed various permafrost features that characterize the interdependence among the dynamic thermal and hydrological processes. Hydrologic processes impacted by degrading permafrost include increased winter stream flows, decreased summer peak flows, changes in stream water chemistry, and other fluvial geomorphological processes. Several changes in local hydrology have already been witnessed including drying of thermokarst ponds, the increasing importance of groundwater in the local water balance, and differences in the surface energy balance. As our climate continues to change, it becomes paramount to understand and predict changes in hydrological processes. A workshop report is in preparation.

At the University of Washington, Ron Sletten, Bernard Hallet and Birgit Hagedorn completed the third year of a NSF study «Biocomplexity of Carbon Cycling in the High Arctic» at the Thule Air Base, Greenland. The multi-institutional project includes Jeff Welker and Paddy Sullivan (University of Alaska, Anchorage), Heidi Seltzer (Colorado State University) and Josh Schimel (the University of California, Santa Barbara). Physical, chemical, and biological interactions and feedbacks on carbon flux, weathering, and ecosystem dynamics are being investigated. This past summer was our most extensive field season with 28 participants. In addition, we held a 3-week field course with 12 international students, two NSF-supported teachers, John Sota (U.S.) and Jane Buss Sorensen (Nuuk, Greenland). The course was designed to provide students with hands-on experience in ecology, soils, hydrology and periglacial processes. Jennifer Horwath, a PhD student, completed her final field season on soil organic carbon. Three members of our group spent 10 days in the Kangerlussuaq region to collect lake core samples that PhD student Heather Heuser is using to analyze ^{18}O in diatoms. We continued our studies of contraction crack dynamics and formation of ice-rich permafrost in the Dry Valleys. A new project to investigate salt diffusion is planned for the coming year. For further information, see: http://depts.washington.edu/icylands

Edwin Clarke (Soils Alaska) reported on a geotechnical investigation of a 40 acre subdivision that occupies a patchwork of thin, discontinuous permafrost consisting of silts and sands underlain by gravels. Recommendations were made as to which portion of the subdivision could be developed now and which portion should be cleared to increase the depth of thaw. We are designing structurally enhanced and adjustable foundations for use on frozen sands and gravel with excessive differential thaw strain. We also participated in the design of a 12,000 square foot building with an adjustable foundation on frozen silt.

Jack Hebert and John Davies report that the Cold Climate Housing Research Center (CCHRC, University of Alaska Fairbanks lower campus), started construction on its new Research and Test Facility (RTF) this summer. An extensive monitoring system was installed, in partnership with GW Scientific (Michael Lilly) and Campbell Scientific (Austin McHugh) to help monitor permafrost and active layer conditions, groundwater conditions on top of permafrost, and thermal and unfrozen soil-moisture conditions in the subgrade portions of the basement. The CCHRC RTF will help provide valuable information for building construction techniques in permafrost conditions (www.cchrc.org).

W. Berry Lyons (Byrd Polar Research Center, Ohio State University) reported on an investigation sub-surface seeps in Taylor Valley, Antarctica, as part of the McMurdo Dry Valleys Long-Term Ecological Research (MCM-LTER). They did a walking reconnaissance of the valley and sampled seeps for their isotopic and geochemical compositions. The work was a research project of Kate Harris (University of North Carolina at Chapel Hill) and involved collaboration with Andrew Fountain (Portland State University) and Anne Carey (Department of Geological Sciences, OSU). This investigation is part of the MCM-LTER's long-term research dealing with the overall hydrologic cycle in Taylor Valley.

Nicole Mölders (University of Alaska Fairbanks), with colleague Narapusetty evaluated the hydro-thermody-

namic soil-vegetation model that is used in various community-climate and weather forecast models by means of data from the BALTEX data bank, the ATLAS project, and the IARC permafrost observatory, as well as, by use of a theoretically advanced numerical scheme. Currently the soil model is being implemented into CCSM 3.0.

Patrick Webber became Professor Emeritus of Plant Biology at Michigan State University, and will complete his tenure as President of IASC (International Arctic Science Committee) in April 2006. He remains active in several projects, especially ITEX (International Tundra Experiment, BAID (Barrow Arctic Information and Data project, CEON (CircumArctic Environmental Observatories Network) and several IPY projects.

Many other projects reported in Frozen Ground 28 continued and information can be obtained directly from the investigators or from the U.S. Permafrost Association web site (www.uspermafrost.org).

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Associate Member : Portugal

Research on periglacial processes and landforms in the Serra da Estrela is being carried out by the University of Lisbon group. Current focus is on the study of the Pleistocene permafrost and periglacial landforms, their relationship to the glacial landforms and palaeoenvironmental significance. In the Limestone Massif of Estremadura the group is studying relict stratified slope deposits. The University of Coimbra group is studying the Serra do Caramulo area with a focus on relict periglacial slope deposits.

During the past year the investigations of Antarctic permafrost by the University of Lisbon group have developed further. A collaborative project with the Universities of Alcalá de Henares (Spain) and Zurich (Switzerland) was funded by the Spanish Antarctic Programme. This project is within the framework of the International Polar Year projects on *Thermal State of Permafrost* (TSP) and *Antarctic Permafrost and Soils* (ANTPAS). Field work focusing on geophysical and geomorphological survey in order to define the sites for borehole drilling is planned for January - February 2006. A project focusing on the installation of CALM-S sites in Livingston and Deception Islands is under preparation.

A proposal for a national committee for the International Polar Year is under evaluation and permafrost is planned to be a major theme in the Portuguese IPY.

Results of Portuguese research on periglacial environments have been presented in several international meetings in 2005, namely in the EGU conference in Vienna, EUCOP II in Potsdam and IAG conference in Zaragoza.

2005 was a especially significant year with Portugal being accepted as Associate Member of the IPA.

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