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United States Permafrost Association – Formed in 2001

Cool Bits From Those Who Do It In the Tundra!

During 2002 the U.S. Arctic Research Commission (US ARC) organized a task force on *Climate Change, Permafrost and Infrastructure Impacts*. The objective was to identify key issues and research needs to foster an understanding of global change impacts on permafrost in the Arctic and their relevance to natural and human systems. The task force findings include: requirements for a dedicated, visible U.S. permafrost research program, data management needs, baseline permafrost mapping requirements in Alaska, basic permafrost research focused on process studies and modeling, and, applied permafrost research on design criteria and contaminants in permafrost environments. The report will be available from the Commission in Spring 2003.

The U.S. National Science Foundation supports several programmes and numerous projects that examine permafrost dynamics and influence on ecosystem processes and their response to climatic variability. Larry Hinzman (University of Alaska Fairbanks) reports on the organization and funding of a new NSF program that has a substantial permafrost-oriented involvement: The Hydrologic Cycle and its Role in Arctic and Global Environmental Change: A Rationale and Strategy for Synthesis Study (CHAMP)**.** The primary aim of CHAMP is to catalyze and coordinate interdisciplinary research with the goal of constructing a holistic understanding of arctic hydrology through integration of routine observations, process-based field studies, and modeling. A number of projects were funded starting in summer 2002. The CHAMP strategy is available on the internet (see address at end of report). F. Stuart Chapin (University of Alaska Fairbanks) reports that the NSF-funded Arctic Transitions in the Land-Atmosphere System (ATLAS), a coordinated programme to examine the geographical patterns and controls over climate-land surface exchange and develop reasonable scenarios of future change in the Arctic, is in its final synthesis stage.

NSF-LTER studies by Tom Osterkamp, Vladimir Romanovsky and Kenji Yoshikawa (University of Alaska Fairbanks) at the Bonanza Creek Experimental Forest and Caribou Poker Creeks Research Watershed (CPCRW) documented warming and degradation of permafrost over the last 20 to 80 years. Larry Hinzman, Douglas Kane and Kenji Yoshikawa continued their investigations in CPCRW and on the Seward Peninsula that relate changes in hydrologic processes and permafrost to climatic dynamics. Graduate dissertations by Kevin Petrone and William Bolton demonstrated the strong controls of permafrost extent upon hydrologic processes (baseflow, peak discharge, recession rates) and chemical exports (NO_3, DOC, and essential cations). Kane and Hinzman have upgraded the remote meteorological and hydrological stations operated by the UAF Water and Environmental Research Center to provide near-real time continuous monitoring of field conditions via the internet.

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Individual Reports

(compiled by Lynn R. Everett, Everett.2@osu.edu)

Effect of Changes in Climate, Snow Pack, Glaciers, and Permafrost on River Runoff and Hydrochemistry in the Northwest of U.S.A. and Tien Shan (Central Asia)

Vladimir Aizen[1], Elena Aizen[1], Scott Wood[1], DeWayne Cecil[2], Sergei Marchenko[3] and Valeriy Kuzmichenok[4]
[1] University of Idaho
[2] USGS, Idaho Falls
[3] Kazakhstan Permafrost Laboratory, Almaty, Kazakhstan
[4] Institute of Water Problem and Hydropower, Bishkek, Kyrgyzstan

Watersheds monitoring at Salmon River basin (Rocky Mountains, U.S.A.) and Narin River basin (Akshiyrak Mt. Massif, Kyrgyzstan) to compile meteorological, hydrological, soil boreholes temperature, heat balance snow pack measurements and aqueous geochemistry within nested watersheds evaluating the role and long-term changes of water balance components such as type and quantity of precipitation, snow accumulation, evaporation, total runoff and snow/permafrost river runoff to discover the controls on the water chemistry (deposition, rock weathering, changes in snow, and permafrost river runoff). For more information contact Professor Vladimir Aizen at aizen@uidaho.edu or phone 208-885-5888.

Thaw-Stability of Granular Soils in Fairbanks, Alaska

Thomas Berglin
Soils Alaska, PC

My name is Thomas Berglin. I am an EIT (I sit for the PE in October) and I work at a small (three-man) arctic civil, geotechnical engineering firm in Fairbanks, Alaska. The name of the firm is Soils Alaska, PC (a professional corporation) and it is currently owned by Ed Clarke, PE. We provide arctic soil testing and analysis services. (www.permafrostalaska.com)

For the past 30 years or so, precious little data has accumulated regarding the thaw-stability (or instability) of frozen granular soils. The Fairbanks North Star Borough consists of both uplands and lowlands. Most of the lowland area is underlain by alluvium (3-inch minus) several hundred feet deep, much of which is perennially frozen. The thaw behavior of this soil is critical to construction practices, particularly to those involving heated buildings. It is difficult and expensive to conduct research on the thaw-settlement characteristics of this soil. At Soils Alaska, we are in the process of undertaking just this. We are perfecting sampling procedures and will begin thaw-testing both fine-grained (micaceous silt) and coarse-grained (very sandy gravel) soils early in 2003.

Anyhoo, this is what we have been up to in 2002... Thanks so much. For more information contact Tom Berglin at soilsalaska@gci.net

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Arctic Transitions in the Land Atmosphere System (Seward Peninsula and North Slope of Alaska)

F. Stuart Chapin
University of Alaska Fairbanks

Initiated in 1998 as a logical outgrowth of prior FLUX studies, the NSF funded Arctic Transitions in the Land-Atmosphere System (ATLAS) is a coordinated program to examine the geographical patterns and controls over climate-land surface exchange and develop reasonable scenarios of future change in the Arctic. The overall goal of ATLAS is to better understand the role of the arctic terrestrial system in global climate change by studying the interactions and feedbacks in the land-atmosphere system that govern ecologically and socially important impacts. The more immediate research objective is to determine the geographical patterns and controls over climate-land surface exchange (mass and energy) and to develop reasonable scenarios of future change in the arctic system. This research is important because it provides the first comprehensive analysis of feedbacks to climate from arctic terrestrial ecosystems at the pan-arctic scale. It is accomplished by expanding the geographic range of the research program to all of arctic Alaska and to the eastern Russian Arctic, and by promoting international collaboration and synthesis with arctic research programs in other countries. In addition, the research provides the first set of scenarios of the future arctic system, beginning with scenarios for arctic Alaska, and extending these to the circumpolar Arctic. Detailed information is available via http://www.laii.uaf.edu/ATLAS/atlas.cfm.

Russo-American Construction Practices for Heated Buildings on Frozen Sand and Gravel

Ed Clarke
State of Alaska

I am a registered Professional Engineer in the State of Alaska. I am the President of a small civil/geotechnical engineering firm in Fairbanks, Alaska. I recently attended the Fifth International Symposium on Permafrost Engineering in Yakutsk, Russia. The topics included thawing of permafrost soils and engineered structures on permafrost soils. We spent three days listening to papers presented by our Russian and Chinese colleagues. These resulted in some interesting discussions on the difference between Russian and Chinese practices. The conference was followed by a three day field trip to Aldan and Nerungi. This trip gave us a chance to interact with our colleagues and observe the Russian techniques for solving frozen ground problems.

At the conference I presented a paper, which was co-authored by Thomas J. Berglin, EIT on some of the construction techniques we are using in frozen granular soils. Of particular interest to our practice are the Russian techniques utilized in the construction of heated buildings founded on frozen granular soil. While attending the Symposium I met with Ms. Anastasiya N. Tseeva, Chief of the Department of Bases and Foundations for the Republic of Sakha in the City of Yakutsk. Her work deals primarily with heavy multistory masonry buildings, some of which are supported on spread footings as well as piles. Some of her work involves foundations for single-family dwellings.

We observed builders in the City of Yakutsk constructing strip-footings for single family dwellings on high-moisture (>30%) content frozen sand. The footings and foundation wall are poured together and function as a grade beam. Fairbanks is underlain in many places by similar soil. Some buildings sustain damage if the foundation system is not properly designed. In Fairbanks, construction costs involved are considerably higher than those involved in construction over non-frozen ground. Builders in Yakutsk have devised some clever and efficient ways in order to expedite tying reinforcing steel together for heavily reinforced foundations. Our firm is working with American builders in these practices in order to reduce the high cost of construction that is associated with these foundation systems. For further information contact Ed at cec@ak.net .

U.S. Department of the Interior GTN-P Activities in Northern Alaska

Gary D. Clow
U.S. Geological Survey

The U.S. Department of the Interior (DOI) is participating in two aspects of the Global Terrestrial Network for Permafrost (GTN-P). 1) DOI began installing automated climate-monitoring stations in the National Petroleum Reserve - Alaska (NPRA) and Arctic National Wildlife Refuge (ANWR) during 1998. These stations continuously monitor active-layer temperatures in addition to air temperature, snow depth, and up/downwelling shortwave radiation. The array presently consists of 9 stations and is continuing to expand. 2) The DOI also maintains an array of 21 deep boreholes in the NPRA to monitor the thermal state of deep permafrost in this region. During August 2002, temperatures were remeasured through the base of permafrost in 12 of the holes in the DOI/GTN-P borehole array; the remainder of the holes will be logged during 2003. Comparison of the 2002 logs with those obtained the last time the entire array was logged shows that mean-annual ground temperatures have warmed about 3 K in this region since 1989. More information is available by contacting Gary Clow at clow@usgs.gov .

Continuation of the 1998 Mallik Gas Hydrate Research-Drilling Efforts in the Canadian Mackenzie River Delta

Timothy S Collett
U.S. Geological Survey

Throughout most of last winter, three 1200 m deep research wells were drilled in the Mackenzie Delta region of the Northwest Territories to explore the presence of sub-permafrost gas hydrate. The holes, spaced 40 m apart, were located next to the Beaufort Sea on the northern part of Richards Island near the Mallik 2L-38 gas hydrate research well, which was drilled in 1998.

Gas hydrates have been of global interest for much of the last decade because of their potential impact on energy reserves, global climate change, continental margin slope stability, and petroleum drilling hazards. This project, involving more than 60 scientists/engineers and 250 support staff from six countries, overcame huge logistical problems compounded by its extremely remote location and harsh winter conditions. All major equipment was delivered by way of a project ice road constructed on the Mackenzie River. Overall project scientific leadership and responsibility was provided by Scott Dallimore (Geological Survey of Canada) and Principal Investigators were Tim Collett (US Geological Survey), Takashi Uchida (Japan National Oil Corporation), and Michael Weber (GeoForschungsZentrum). The Japan Petroleum Exploration Co. coordinated drilling activities. Other organizations involved in the project included: India Oil and Natural Gas Corporation, University of Ottawa, University of Alberta, US Department of Energy, Idaho National Environmental and Engineering Laboratory, Pacific Northwest National Laboratory, Lawrence-Berkley National Laboratory, and the University of Tokyo.

The recently completed Mallik 2002 project consisted of a number of different phases, which began, with the spudding of the first well on Christmas Day, followed by drilling the two additional wells and instrumenting them with fiber optic temperature sensors. The 640 m deep permafrost section in the main well was drilled and cased before continuous coring was begun which completely penetrated the gas hydrate section between about 890 m and 1150 m. Because recovery of gas hydrate containing sediment cores was extremely good, over 50 pressure vessels and four liquid nitrogen dewars were filled to capacity. Other aspects of the project consisted of well logging, obtaining down-hole temperature profiles, microbiologic studies, seismic cross-hole tomography, and the first modern production tests of a gas hydrate reservoir involving both pressure draw down and thermal stimulation.

A number of scientific and technical accomplishments were completed by the current Mallik 2002 and previous Mallik 2L-38 projects and are discussed in more detail at:
(1) http://sts.gsc.nrcan.gc.ca/gashydrate/mallik2002/home.asp,
(2) http://icdp.gfz-potsdam.de/html/sites/mallik/index/index. <http://icdp.gfz-potsdam.de/html/sites/mallik/index/index.html> html <http://icdp.gfz-potsdam.de/html/sites/mallik/index/index.html> ,
(3) http://sts.gsc.nrcan.gc.ca/page1/hydrat/hydrates. <http://sts.gsc.nrcan.gc.ca/page1/hydrat/hydrates.html> html http://sts.gsc.nrcan.gc.ca/page1/hydrat/hydrates.html

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The Hydrologic Cycle and its Role in Arctic and Global Environmental Change: A Rationale and Strategy for Synthesis Study (CHAMP)

Larry Hinzman
University of Alaska Fairbanks

The primary aim of Arctic-CHAMP is to catalyze and coordinate interdisciplinary research with the goal of constructing a holistic understanding of Arctic hydrology through integration of routine observations, process-based field studies, and modeling. Four goals should guide this effort: 1) Assess and Better Understand the Stocks and Fluxes that Constitute the Arctic Hydrologic Cycle. 2) Document Changes to the Arctic Water Cycle, Contributing a Hydrological Component to the Multi-Agency SEARCH initiative. 3) Understand the Causes of Arctic Water Cycle Change and Assess Their Direct Impacts on Natural Systems. 4) Develop Predictive Simulations of the Response of the Earth System and Human Society to Feedbacks Arising from Progressive Changes to Arctic Hydrological Systems. The entire arctic hydrology strategy is available via: http://www.arcus.org/ARCSS/hydro/index.html. Some of these goals are currently being supported under the recently NSF funded Arctic Fresh water initiative.

Studies in the Eastern Portion of the NPR-A

Torre Jorgenson[1], Erik Pullman[1] and Yuri Shur[2]
[1] ABR, Inc
[2] University of Alaska

Permafrost-related studies in the eastern portion of the NPR-A are being supported by Conoco Phillips Alaska to provide information for evaluating facilities design and potential environmental impacts of proposed oil development in the region. The research being conducted by Torre Jorgenson and Erik Pullman of ABR, Inc. and Yuri Shur, University of Alaska is designed to (1) determine the nature, magnitude, and distribution of ground ice in relation to terrain units, (2) evaluate potential thaw settlement from surface disturbance, and (3) to develop a conceptual model of how ground ice develops in relation to lake basin development. The study also is collecting information on soil carbon stores within the top 2.5 m of the permafrost.

Alaskan Telemetry Network Provides Near Real-Time Meteorology, Hydrology and Permafrost Data

Douglas Kane, B. Crane Johnson and Larry Hinzman
University of Alaska Fairbanks

Recent upgrades to our remote meteorological and hydrological stations now provide continuous monitoring of field conditions via the internet. Stations operated by the University of Alaska Water and Environmental Research Center on the North Slope and Seward Peninsula can now be monitored continuously via the internet. This enables investigators to conduct more efficient event-based research projects or to plan field visits based upon current weather conditions. These data may be accessed at http://www.uaf.edu/water/projects/ NorthSlope/northslope.html or http://www.uaf.edu/water/projects/atlas/atlas.html

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Numerical Simulation of Permafrost Thermal Regime and Talik Formation Under Shallow Thaw Lakes in the Alaskan Arctic

Feng Ling and Tingjun Zhang
University of Colorado at Boulder

Thaw lakes are one of the most obvious manifestations of the hydrological system at work in the tundra regions of the Alaskan Arctic, but the true extent of the role of thaw lakes in the Arctic land-atmosphere interactions and feedback has yet to be fully quantified and appreciated. A two-dimensional, physically based heat transfer model with phase change under cylindrical coordinate system was developed and used to simulate the long-term influence of shallow thaw lakes over permafrost on thermal regime of ground and talik formation in the Alaskan Arctic. A series of simulation cases were conducted using different combinations of long-term mean lake bottom temperature and lake water depth. The simulated results indicate that the existence of shallow thaw lake is a significant heat source to ground. It is concluded that variation of long-term mean lake bottom temperature, which is a product of changes in air temperature, snow thickness and properties, lake ice thickness, and lake water depth, has a significant influence on permafrost thermal regime, talik thickness, and talik formation rate under thaw lakes. For additional information contact Dr. Feng Ling at lingf@nsidc.org or phone 303-492-5562.

Subsurface Free-Phase Petroleum Hydrocarbons Near Barrow, Alaska

Kathleen A. McCarthy
U.S. Geological Survey

We are investigating the movement of free-phase petroleum hydrocarbons in the subsurface at a site near Barrow, Alaska. Data collected over several years' show that hydrocarbons from surface spills have migrated well below the permafrost table, most likely through fractures in the frozen sandy gravel. [This study is a cooperative effort between the U.S. Navy and the U.S. Geological Survey.] For additional information contact Kathy McCarthy at mccarthy@usgs.gov or phone 503- 251-3257.

Investigations on the Impact of Permafrost on Weather

Nicole Mölders[1] and John E. Walsh[2]
[1]University of Alaska Fairbanks, Geophysical Institute
[2]University of Alaska Fairbanks, International Arctic Research Center

High-latitude terrestrial variables and processes (e.g., permafrost, soil freezing and thawing, snow, interaction of soil moisture and soil temperature states, etc.) have received little systematic study in the context of numerical weather prediction (NWP) models. NWP models require information on the water and energy fluxes to the atmosphere at time steps of several minutes or so as lower boundary conditions. It is obvious that at such time scale highly resolved permafrost models are computationally prohibitive. The thermo-dynamic soil vegetation scheme (HTSVS) was developed for determining these fluxes at the biosphere/snow-atmosphere interface in atmospheric models. HTSVS considers one canopy layer, multiple snow and soil layers. HTSVS was implemented into the PennState/NCAR Mesoscale Meteorological Model MM5 in a two-way coupled mode within the framework of DEKLIM funded by BMBF (Germany). Simulations with and without consideration of soil frost processes are being performed to examine the influence of permafrost on the regional weather in Alaska. The inclusion of soil frost processes leads to altered fluxes of heat and water to the atmosphere, which modify the cloud and precipitation formation on the local scale. To examine the influence of permafrost on climate HTSVS will be integrated in the NCAR Community Climate System Model (CCSM) within the framework of the International Arctic Research Center (IARC) CAMP initiative funded by NSF (USA). For additional information contact Nicole Molders at nicole.molders@gi.alaska.edu or John Walsh at walsh@atmos.uiuc.edu .

Spatial and Temporal Variability of Ground Temperature and Thaw, Northern Alaska

F. E. Nelson[1], K.M. Hinkel[2], N. I. Shiklomanov[1]
[1] Department of Geography and Center for Climatic Research, University of Delaware
[2]Department of Geography, University of Cincinnati

This project is concerned with analyzing local and regional variability of thaw depth and the thermal regime of the active layer and near-surface permafrost. Thaw at the seven ARCSS/CALM grids on the North Slope was less than average in both 2001 and 2002. Values at the three foothills sites (Happy Valley, Imnavait, Toolik) are the lowest recorded since simultaneous observations at all sites began in 1995. The project includes a study of the thermal, hydrological, and biological effects of a large, artificially induced snowbank at Barrow. The

"Barrow Urban Heat Island Study" (BUHIS) also falls within the domain of this project; the initial year's data show a heat island effect of several degrees. Investigations by UD grad students Heath Sandall and Jon Little into the variability of frost heave and thaw subsidence at Sagwon and West Dock indicate that differential GPS technology has significant potential in studies of heave and subsidence, yielding accuracy comparable to that achieved with classical survey methods. Studies on heave and subsidence, performed by CRREL personnel in the early 1960s at sites in Barrow, were resumed in 2002. In conjunction with Ron Paetzold of the USDA Natural Resources Conservation Service, we are investigating the variability of the surface energy balance and shallow ground thermal regime in different landscape units near West Dock.

Shiklomanov completed a study of climate in the Kuparuk region that employed a suite of new spatial and temporal interpolation procedures, resulting in a 13 year (1987-1999) spatial time series of temperature and active-layer fields (Shiklomanov and Nelson, 2002a,b). UD doctoral student Anna Klene published papers outlining a method for parameterizing the n-factor in natural landscapes (Klene, 2001) and using it to map the depth of seasonal thaw over an extensive area (Klene et al., 2002b). Another recent publication (Klene et al., 2002a) outlines how permafrost studies can be incorporated into high school curricula, using NSF's *Teachers Experiencing the Arctic and Antarctic* program as an example of a successful program. UD grad student Mike Walegur submitted a paper (Walegur and Nelson, 2003) in which the potential distribution of permafrost in the northeastern U.S. was mapped. Temperature fields constructed for this work were derived from both the U.S. national weather station network and a series of 20 climate stations maintained on Appalachian summits by Walegur.

With Jerry Brown (IPA) we published a monograph-length paper (Brown, 2000) describing the organization of the Circumpolar Active Layer Monitoring (CALM) program, and summarized initial results from the its international activities. The National Science Foundation provided supplementary funding to the CALM program, headquartered at Cincinnati, to conduct a CALM workshop at the University of Delaware's Marine Studies campus in Lewes, DE in mid-November 2002. The focus of the workshop was on implementing standardized methods of data analysis, comparison of active-layer data collected in various arctic regions, and planning the future of CALM.

With Oleg Anisimov (Co-Chair of the IPA Working Group on Permafrost and Global Change), Nelson and Shiklomanov published two papers (Nelson et al., 2001, 2002) concerned with the role of permafrost in global change studies. The papers included mapping studies indicating the possible effects of thawing permafrost on human infrastructure. The group also published a study demonstrating the utility of stochastic modeling as an alternative method of mapping geocryological parameters (Anisimov et al., 2002).

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Regional-Scale Modeling of Soil Freeze/Thaw over the Arctic Drainage Basin

Christoph Oekle, Tingjun Zhang, Mark Serreze, and Richard Armstrong
University of Colorado at Boulder

The freezing and thawing of the active layer of soil in the Arctic terrestrial drainage basin is simulated using a one-dimensional heat conduction model. Main forcing data are surface air temperature and snow thickness. Emphasis is placed on producing a topography-improved temperature data set from NCEP reanalysis data, and a snow thickness data set from SSM/I satellite data together with climatological snow density. Soil bulk density, soil type and its relative composition are derived from the SoilData System of the IGBP-DIS. The model is run with 25 X 25 km resolution and daily time steps for the period September 1998 through December 2000. We compare modeled active layer depths with those measured at CALM field sites. This study shows for the first time the highly variable active layer depth over permafrost, seasonally frozen ground depth in non-permafrost areas, and freezing and thawing periods for the whole pan-Arctic land mass. For additional information contact Dr. Christoph Oelke at coelke@nsidc.org or phone 303-735-0213.

Permafrost Observatories: The Alaskan Transect

T.E. Osterkamp
University of Alaska Fairbanks

This year marks the twenty-fifth anniversary of the beginning of a series of permafrost observatories along a north south transect of Alaska stretching some 1200 km from Prudhoe Bay to Glenallen. The transect was completed in 1985 with twenty-five observatories in continuous and discontinuous permafrost. Additional sites have been established in outlying areas to help create a statewide picture of permafrost conditions. These observatories were created for the express purpose of investigating the effects of changes in climate on continuous and discontinuous permafrost. Data consists of precise temperature measurements made annually in drill holes typically 30 to 80 m in depth, daily air, ground surface, active layer and near surface permafrost temperatures recorded on automatic dataloggers since 1986, and supplementary data (soil types, active layer depths, thermal conductivity and diffusivity, recent daily measurements of moisture content in the active layer and near surface permafrost and other data). These data are available to interested investigators from NSIDC (http://nsidc.org). For additional information contact Professor Emeritus T.E. Osterkamp at fftteo@uaf.edu or phone 907-474-7548 (summer) or 636-629-0876 (fall, winter, spring).

Influence of Climate and Environmental Factors on the Thermal and Moisture Regimes of the Active Layer and Permafrost in the Alaskan Arctic

T. E. Osterkamp, Vladimir Romanovsky, Dmitrii Sergueev, Gennadii Tipenko, Tatiana Sazonova
University of Alaska Fairbanks

The primary objective was to develop a better understanding of the response of permafrost to changes in climate. The project addressed a field measurements program and a program for data analyses, interpretation, development of theory, and modeling.

During the period from 1986 to 2001, an intensive system of temperature (and lately soil moisture) measurements in the active layer and in near-surface permafrost was established by the University of Alaska Fairbanks in northern Alaska. At the northernmost three sites, annual mean air and ground temperatures vary significantly in a cyclic manner with relatively high temperatures in the late 1980s and late 1990s and a local maximum in 1989 and in 1998-1999. Temperatures were significantly colder earlier in mid-1980s and slightly colder in the early 1990s. At the same time, there was an obvious long-term increase in temperatures during the entire period of measurements, which could be associated with a warming trend or with an ascending part of a longer-term cycle. Annual mean temperatures at all three sites are very similar, while the ground and permafrost temperatures at West Dock are several degrees colder than at Deadhorse and Franklin Bluffs. A significantly shallower and slightly more conductive snow cover and a smaller range in seasonal air temperature variations at the West Dock site are responsible for these differences. The recent warming brought soil temperatures at the North Slope sites to a surprisingly high level. Annual mean temperatures of the ground and permafrost surfaces near Ivotuk are high, about –2 to –3°C, which is 2 to 3°C warmer than at the Deadhorse and Franklin Bluffs sites. This probably attributes to the differences in the snow cover thickness and its thermal properties. Comparison with USGS deep borehole data indicates that permafrost temperatures rose by 1 to 2°C since the mid-1980s in this area. Changes in air temperatures, snow cover, length of the sea ice season, solar effects, and other factors related to the Arctic Oscillation could, in principle, produce the observed temperature changes in the permafrost. Further investigations are necessary to understand the observed systematic changes in permafrost temperatures. For additional information contact Professor Emeritus T.E. Osterkamp at ffteo@uaf.edu or phone 907-474-7548 (summer) or 636-629-0876 (fall, winter, spring).

The Frozen Ground Data Center: New Data for the International Permafrost Community

Mark Parsons and Tingjun Zhang
World Data Center for Glaciology and University of Colorado, Boulder

The International Permafrost Association (IPA) has long recognized the inherent and lasting value of data and information and has worked to prioritize and assess permafrost data requirements and to identify critical data sets for scientific and engineering purposes. The World Data Center (WDC) for Glaciology, Boulder at the University of Colorado in collaboration with the International Arctic Research Center (IARC) at the University of Alaska Fairbanks has initiated a new Frozen Ground Data Center (FGDC) as a key node in the IPAs Global Geocryological Data (GGD) system. The FGDC has expanded access to the 1998 CAPS data, is expanding data holdings, and is creating a new version of the CD to be distributed at the July 2003 IPA conference in Zurich.

The FGDC has improved access to existing data through an online search and order system and availability in the Global Change Master Directory. The FGDC has also expanded and updated current holdings with global and regional permafrost, soil temperature, and soil classification maps in a variety of grids and data formats especially geared to aid the permafrost modeling community. The FGDC is working closely with the IPAs Global Terrestrial Network for Permafrost (GTN-P) and its Circumpolar Active Layer Monitoring program to expand and update our data holdings as part of the GGD. We have also continued to update our online permafrost bibliography. We plan to continue acquiring data for the GGD and to produce value-added products such as gridded fields for model validation and analysis.

Identification of additional data and information from all participating countries, organizations, and individuals are requested. The IPA Standing Committee on Data, Information and Communication will continue to coordinate the GGD and CAPS activities. Suggestions on data acquisition, management and distribution are always welcome and encouraged. For additional information, please visit FGDC website at http://nsidc.org/frozenground/index.html, contact Mark Parsons at parsonsm@nsidc.org, phone 303-492-2359 or Tingjun Zhang at tzhang@nsidc.org or phone 303-492-5236.

The Shape of the Arctic Shoreface

Erik Reimnitz

The shape of the shoreface in the open ocean and bodies of fresh water at low- and mid-latitudes is controlled mainly by the wave regime and the composition of the materials making up the submerged land being inundated by water. At high latitudes in the northern hemisphere, the land being exposed to water may to a large extent be composed of ice. Also, it is shaped by processes that involve the action of floating ice ranging in size or extent from continuous sheets down to small floes and even individual ice crystals. Under these conditions the shape of the shoreface is expected to differ from that so well studied at low latitudes. The work being conducted here analyzes shorefaces from the Arctic Ocean, covering North America and Siberia, and involves researchers from Russia, Canada, and the United States. For additional information contact Erik Reimnitz at ereimnitz@earthlink.net

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Synthesis and Integration of Environmental Data Along the East Siberian Transect and Comparison of Active Layer and Permafrost Conditions with an Alaskan Transect

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In this study available environmental data (landscape characteristics, meteorology, active layer and permafrost characteristics) along the East Siberian transect through the Sakha republic, Russia were collected and incorporated in the “East Siberian Transect” GIS. All data collected were transferred to the database of the Joint Office of Science Support (JOSS) at the University Corporation for Atmospheric Research (UCAR) in Boulder and eventually will be stored in the ARCSS Data Coordination Center (ADCC) at the National Snow and Ice Data Center (NSIDC). Using these data, the warming trend within the East Siberian transect was established both for air and permafrost surface temperatures. During the period 1956-1990, the average trend in the permafrost surface temperatures for the entire region was 0.26°C per 10 years, and it was very similar to the average trend in the air temperatures (0.29°C per 10 years) for the same period. These data also show that, for this region, the more significant trends tend to occur in the lower latitudes (between 55° and 65° North), rather than in the Arctic and High Arctic.

Parallel simulations of the past temperature regimes were made for several sites along Siberian and Alaskan transects. Siberian and Alaskan temperature time series show significant and somewhat surprising similarities. However, there is some seeming lag in the soil temperature variations at the Alaskan sites compared to the Siberian sites.

As part of this study, an analytical model, which was developed as a part of another project, was incorporated into the East Siberian Transect GIS. The model simulates spatially distributed active layer thicknesses and annual mean permafrost temperatures. Several different scenarios of future climatic conditions were used to run this model for the next 100 years. As these calculations show, we might expect the considerable warming of ground temperatures (up to 3-4°C) and increase in active layer thickness (up to 1-1.5 m) within East Siberian transect. The increase in air temperatures will have the most pronounced effect on permafrost in southern parts of the East Siberian transect and this increase can even cause the long-term permafrost degradation and taliks formation where only seasonal freezing will take place. However, the increase in permafrost temperatures and in active layer thickness will not be uniform in time and there will be some years during which decrease in temperatures may occur.
Additional information about this project can be obtained from our web page:
www.gi.alaska.edu/snowice/Permafrost-lab/proj_trans/pr_trans.html .

Permafrost and Erosion Observatories , Barrow, Alaska
Vladimir Romanovsky, Kenji Yoshikawa, Jerry Brown and Orson Smith

In April 2002 the team of Vladimir Romanovsky, Kenji Yoshikawa, and Jerry Brown added two, 45-meter boreholes to the Barrow Permafrost Observatory. The new holes are located within several kilometers of the four 1950s boreholes instrumented in 2001. Thermistor cables and recorders are installed in all six holes. In August, two 1-meter thermistor probes were installed adjacent to the new holes. Mean annual permafrost temperature is about – 10 C. Initial results are reported in Eos with more information on the following web site (to be inserted). The borehole program is supported by the International Arctic Research Center (IARC). The 14 coastal transects established along Elson Lagoon as part of the Arctic Coastal Dynamic program were remeasured (led by Jerry Brown and Orson Smith); only minor changes were noted since 2001. For more information contact Vladimir at ffver@uaf.edu .

Arctic and Antarctic Research at the University of Washington

Ron Sletten and Bernard Hallet
University of Washington

At the University of Washington, diverse current studies focus on physical and chemical processes that are fundamental to landscapes and ecosystems in cold regions. We are launching a project on "Biocomplexity of Carbon Cycling in the High Arctic" along with researchers at Colorado State University and University of California, Santa Barbara. We will establish study sites in the vicinity of Thule Air Base, Greenland where we will monitor physical, chemical, and biological interactions and feedback including the effect of soil disturbance on vegetation dynamics, carbon flux, and chemical weathering. We are completing another study of weathering at the watershed level based on field studies in Zackenberg, Greenland and sites on southwest Greenland. Another project monitors the diffusion of heavy metals contaminants at study sites in Alaska and measures molecular diffusion coefficients utilizing Nuclear Magnetic Resonance. A study has recently been completed on the influence of frost boil disturbance on plant succession and soil development parameters in the Arctic Wildlife Refuge; a publication presenting these results will be completed this winter. Our work in the Antarctic focuses on the dynamics and evolution of contraction crack polygons, the motion of rock glaciers, the formation of inflational soils, and other geomorphic processes that bear on the stability of landscape surfaces to help understand the ages of surfaces in the Dry Valleys. In this project, we are studying the oldest ice reported on Earth and this provides the best terrestrial analog for investigating the stability of subsurface ice and periglacial processes on Mars. For further information on our work, contact Ron Sletten (sletten@u.washington.edu) or Bernard Hallet (hallet@u.washington.edu).

The Effect of Snow on Permafrost in Alaska

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Cold Regions Research and Engineering Laboratory

At CRREL, we have developed a statistical model that can be used to predict the temperature of the snow-ground interface over a large region. The model is based on measurements made in the Kuparuk Basin, south of Prudhoe Bay, Alaska. Using the model, we have "mapped" the snow-ground interface temperature for the entire basin (which is over 200 km in length) for an entire winter and investigated the impact of these temperatures on soil microbes. A paper describing the work has just been published in the Journal of Hydrometeorology (Vol. 3, 377-394). The model is simple and probably suitable for ecological as well as geotechnical applications. Along a similar line, we have also published a winter climatology of the same basin (CRREL Report TR-02-01: available on-line at
http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TR02-10.pdf.
Both publications emphasize the importance of snow in controlling permafrost temperatures and active layer thickness. More information is available from Matthew Sturm at msturm@crrel.usace.army.mil.

The American Society of Civil Engineers (ASCE) Technical Council on Cold Regions Engineering (TCCRE)

Bucky Tart

TCCRE held the 11th International Conference on Cold Regions Engineering in Anchorage, Alaska, May 20-22, 2002. There were over 230 attendees participating in 32 technical sessions. Seventy papers were published in the conference proceedings. The theme of the conference was "Cold Regions Impacts on Transportation and Infrastructure". Eleven papers and 4 technical sessions focused on the performance of the Trans Alaska Pipeline System (TAPS) after 28 years of operation.

During the conference awards luncheon, Jim Rooney delivered the Ed Rice Memorial Lecture and Bucky Tart received Harold R. Peyton Award for Cold Regions Engineering and Norbert Morgenstern was awarded the CAN-AM Amity Award. The Peyton recipient was also recognized during the 250th Anniversary celebration of the ASCE that was held in Washington, DC November 3-7, 2002.

The 12th International Conference on Cold Regions Engineering will be held May 16-19, 2004 in Edmonton, Alberta, Canada and will be co-sponsored by TCCRE and the Cold Regions Engineering Division of the Canadian Society of Civil Engineering. The 13th International Conference on Cold Regions Engineering is being planned for Bangor, Maine in June or July 2006.

Use of Amino Acid Racemization and Radiocarbon Dating to Investigate the Metabolic Activity of "Dormant" Microorganisms in Siberian Permafrost

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Jet Propulsion Laboratory, NASA

The extent to which organisms can survive extended periods of metabolic inactivity in cold environments such as permafrost is one of the key questions in the study of life in extreme environments. Viable bacteria have been cultured from million-year-old Siberian permafrost samples, but the relationship between the age of the bacteria and the age of the sediments remains controversial. In this study we analyze the level of racemization of amino acids in permafrost samples collected from several sites in Northern Siberia in order to continue our ongoing collaborative investigation of microorganisms as well as eukaryotic organisms (seeds, tissues, etc.) preserved for geological time at low temperatures. We are verifying the age of the bulk organic carbon in these samples using ^{14}C measurements (at samples where this method is still applicable, i.e. ca. 50000 years) and geological stratigraphic information. Racemization measurements will be done both for bulk carbon extracted from the samples, and on intact cells separated from the permafrost matrix. This approach will allow us to distinguish the age of free amino acids in the permafrost matrix from that of intracellular amino acids in cells believed to have been dormant over the history of the permafrost. We have evidence from preliminary studies of permafrost samples using these techniques that even during long exposures to low temperatures (minus 10-15ºC), the bacterial cells in permafrost are not completely dormant, but continue to metabolize and at least partially control the extent of amino acid racemization. Also we propose laboratory studies to determine a limit for the level of amino acid racemization after which cells cannot sustain themselves. For further information contact Dr. Alexandre I. Tsapin at tsapin@jpl.nasa.gov .

Cryoturbation-Ecosystem Interactions: Field Observations and Experiments to Validate a New Model of Frost-Boil Formation and its Relevance to Climate Change

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Frost boils are patterned ground features unique to permafrost regions. They have a variety of forms, but the most common are small 1to 3-m diameter, often circular, patches of bare soil, that are spaced from 1 to 10 m apart (nonsorted circles of Washburn 1980). They occur in regular patterns of "spotted tundra" that cover large landscapes of the Arctic (Figure 1). Previous studies in northern Alaska suggested that frost boils are linked to a wide variety of important ecosystem properties including the flux of energy, water, and nutrients to the land surface, watersheds and the atmosphere (Bockheim et al., 1998; Nelson et al, 1998; Walker et al, 1998) and even the forage quality for wildlife (Walker et al, 2001). Prior to this study, the concept of frost-boils as unique ecosystems had not been considered.

Our project was designed to help validate a differential frost-heave model (DFH) (Peterson and Krantz, 1998). DFH is a physically based model that provides considerable insight to the self-organization process in frost boils. Early results from the model suggested that soil-surface temperature is a primary controlling variable for frost heave. A variety of factors influence soil surface temperature including the local climate, exposure to winds, and insulation provided by snow and vegetation. The latter two factors were thought to be the key variables controlling frost heave, so our field efforts focused on examining the influence of variations in plant and snow cover. The goal of this project was to link the Peterson and Krantz model with empirical studies of vegetation, snow, and frost heave to help validate the DFH model and arrive at predictive relationships between frost-boil formation and ecosystem processes.

The preliminary results and descriptions of the sites are posted on our web site at http://www.geobotany.uaf.edu/cryoturbation/index.html or for full report contact Skip at ffdaw@uaf.edu

Arctic Research at the Louisiana State University

Jess Walker, Louisiana State University

The Spring 2002 issue of *Witness the Arctic* is a well written historical perspective on the reason that arctic research has a formal place at LSU. It should also be noted that the ice-wedge photo on page three was one that originally graced the 1963 cover of Arctic. An unabridged version of this overview is available on the ARCUS web site at:
www.arcus.org/Witness_the_Arctic/Spring_02/Contents.html

Also, just published is *Landscapes of Transition*, edited by K. Hewitt et al. and published by Kluwer in 2002. My paper deals with "Landform development in an arctic delta: the roles of snow, ice and permafrost" pp 159-183. The other papers in this volume deal with cold regions ranging from high mountains to high latitudes. For additional information contact H. Jesse Walker at hwalker@lsu.edu or phone 225 -578-6130.

Work in Northeastern Nebraska and Snowy Range, Wyoming

William J. Wayne
University of Nebraska-Lincoln

I have submitted a manuscript to the 2002 IPA Conference, titled "Provenance of sand in periglacial sand wedges and sheet sand, northeastern Nebraska, USA". It is currently being reviewed. I am continuing to make observations on relict patterned ground in the Snowy Range, Wyoming, and hope to have a manuscript eventually. For additional information contact William Wayne at wwayne@unl.edu .

Climate Change: Evidence from Historical Soil Temperature Measurements in the Russian Arctic and Subarctic

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Changes in the near-surface soil temperature have direct impacts on carbon exchange, ecosystems, the active layer and permafrost, and other hydrologic, physical, and biological processes. In this presentation, we document changes in the near-surface soil temperature from 250 stations in the Russian Arctic and subarctic over the past several decades. Mean annual soil temperatures at 40 cm depth have increased about 0.9 to 1.0^{o}C from 1930 to 1990. The increase is more pronounced from 1970-1990. Overall, this study indicates that changes in soil temperature in the Russian Arctic and subarctic are probably controlled by changes in air temperature, with some modification by precipitation. However, at individual stations, this may be not true; changes in snow cover in winter months and rainfall in summer months may have opposing effects. Further study is needed to improve our understanding of soil temperature fluctuation and its potential environmental impact, and to expand analysis to the entire Arctic and subarctic region. For additional information contact Tingjun Zhang at tzhang@nsidc.org or phone 303-492-5236.

Helical Piles in Permafrost

Hannele Zubeck and He Liu
University of Alaska-Anchorage

Helical piers and other piles utilizing helices for increasing pile capacity are used in permafrost more and more frequently. Design method that is based on adfreeze strength does not apply to these piles and alternative methods need to be developed. Zubeck and Liu are modeling the pile soil interaction with Finite Element Analysis and running field experiments. For additional information contact Hannele Zubeck at hannele.zubeck@uaa.alaska.edu or phone 907-786-1970.

Web links listed above:

www.permafrostalaska.com
http://www.laii.uaf.edu/ATLAS/atlas.cfm
http://sts.gsc.nrcan.gc.ca/gashydrate/mallik2002/home.asp,
http://icdp.gfz-potsdam.de/html/sites/mallik/index/index.html
http://sts.gsc.nrcan.gc.ca/page1/hydrat/hydrates.html
http://www.arcus.org/ARCSS/hydro/index.html
http://www.uaf.edu/water/projects/NorthSlope/northslope.html
http://www.uaf.edu/water/projects/atlas/atlas.html
http://nsidc.org
http://www.gi.alaska.edu/snowice/Permafrost-lab/proj_trans/pr_trans.html
http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TR02-10.pdf
http://www.geobotany.uaf.edu/cryoturbation/index.html
www.arcus.org/Witness_the_Arctic/Spring_02/Contents.html