



IPY Study: The Shift to Seasonal Sea Ice

Sea ice on the Arctic Ocean has decreased in extent to a record minimum in recent years, a change that scientists are investigating during the International Polar Year research campaign of 2007-2009.

Part of the overall change in sea ice cover on top of the world is a large decrease in perennial sea ice—ice that survives the summer melt season. A larger proportion of existing sea ice is seasonal ice that forms and thaws each year. Geophysical Institute scientists are teaming with scientists worldwide on an IPY project to see how a greater percentage of seasonal sea ice might affect the North.

“We’re trying to get a handle on how pack ice as a whole is changing to seasonal ice,” said Hajo Eicken, a sea ice specialist and Geophysical Institute professor.

Perennial sea ice swirls around the Arctic Ocean for about three to eight years. Seasonal sea ice is thinner and



photo by Hajo Eicken

photo by Jim Barker

SEA ICE—At left, Geophysical Institute Postdoctoral Fellow Chris Petrich measures sea ice thickness. Above, Geophysical Institute Research Technician Christina Williams and University of Utah Professor Ken Golden measure melt pond and snow depth along sea ice near Barrow, Alaska.

behaves differently than perennial ice. Researchers from Alaska, Germany, Japan, Russia, Canada and Norway are teaming to find out if this shift from perennial to seasonal ice cover will have lasting implications.

“The ultimate goal is to see if we are moving into a new state in the Arctic,” Eicken said. “We need to understand this as a system, so putting in an observing network is a very important and challenging aspect of this IPY.”

Eicken and his colleagues were in Barrow during the spring of 2007 to conduct an extensive survey of the ice thickness distribution across the shelf

seas north of Alaska, where scientists have seen the biggest change in ice extent over the past decade.

Researchers involved in the project also are examining the interactions between ice and the people who use it or consider it a nuisance. Eicken and his colleagues will collaborate with scientists from different disciplinary backgrounds, such as University of Alaska Fairbanks Political Scientist Amy L. Lovcraft, to look at how whalers, fishermen, and other ice-users in northern communities can make the most of the sea ice research.

“We’re looking at how different groups of people use the sea ice and how the data might be of use to people in Alaska,” Eicken said.

photo by Jim Barker



ALBEDO—Chris Petrich, Postdoctoral Fellow at the Geophysical Institute, measures the albedo of sea ice during spring melt in Barrow, Alaska.





IGY 50 Years Ago

GI scientists that are active today participated in the IPY 50 years ago

For the fourth time in 125 years, scientists from around the world are collaborating on a polar research effort called the International Polar Year (IPY). Fifty years ago, several Geophysical Institute scientists participated in the third IPY (1957-58), also known to researchers as the “IGY” or International Geophysical Year. Some of those scientists went on to lead the Geophysical Institute, and some still are active in research at the institute today.



photo by Jeff Pederson

***IGY SCIENTISTS TODAY**—Research during the last IPY, also known as the IGY, provided opportunities for scientists who would shape the Geophysical Institute into what it is today. From left are T. Neil Davis, GI Director from 1976 to 1977, emeritus professors Charles Deebr and Gene Wescott, former GI Directors Syun-Ichi Akasofu (1986-1999) and Juan Roederer (1977-1986), and professor emeritus Carl Benson. Professor emeritus Buck Wilson was unable to appear in the July 2007 photo. Wilson is shown on the background of this page, surveying in Antarctica in 1958.*



Carl Benson

Professor Emeritus of Geophysics and Geology Carl Benson came to the Geophysical Institute in 1960. During the 1957-58 IGY, he studied Blue Glacier in the Olympic Mountains of northwest Washington. He participated in four traverses of the Greenland ice sheet in 1952-56. This led to a course for IGY glaciologists in 1956 to prepare them for research in Antarctica.

During his years at the institute, Benson studied ice fog in the Fairbanks area, seasonal snow processes in interior and arctic Alaska, performed research on McCall Glacier, Alaska, and studied ice-volcano interactions since 1961, primarily on Mount Wrangell, Alaska.

Describing IPY then and now, Benson pointed out some changes in science and in life on Earth since the IGY: the world population has increased from under 3 billion to more than 6 billion people, and we have investigated all the solar system planets except (now dwarf planet) Pluto.

Charles Deeher

Charles Deeher came to Alaska from Portland because of the opportunity created by the IGY. "The rate of pay for the Alaska graduate assistantship impressed my advisor at Reed College, but I was fascinated with the idea of research in the then-territory of Alaska," Deeher said.

Deeher remembers traveling with Neil Davis to Kotzebue in late 1958 and New Year's Day 1959 to dismantle an IGY station that included an all-sky camera, a riometer, and a reel-to-reel audio recording system, to which they added a vocal recording documenting the end of observations.

"God, it was cold and windy," Deeher remembered. "We stayed in the little (equipment) shack on the floor with sleeping bags and ate reindeer steak for breakfast, lunch, and dinner."

Today, Professor Emeritus Deeher is an aurora forecaster at the Geophysical Institute, posting daily predictions of aurora activity to the Web (www.gedds.alaska.edu/auroraforecast).

50 YEARS AGO – This page: top left, Charles Deeher and a scanning photometer at Ester Dome Observatory. Top right, scientists ignite a charge, producing seismic waves that traveled through glacier ice to reflect off the underlying rock in Victoria Land, Antarctica. Seismometers on the surface sensed the reflected waves, allowing scientists to calculate the thickness of the ice. Bottom left, Carl Benson. Middle, Weasel vehicle tracks from one of Benson's four Greenland traverses. Bottom right, Charles Deeher and Gene Wescott. **Right page:** top left, former Geophysical Institute Director Syun-Ichi Akasofu researched the aurora during the 1957-58 IGY. Akasofu recently retired as director of the International Arctic Research Center, University of Alaska Fairbanks. Top right, Charles Deeher looking into an all-sky camera. Middle, the Antarctic sky. Bottom left, Buck Wilson. Bottom right, Gene Wescott. Photos courtesy of Geophysical Institute researchers.



Charles “Buck” Wilson

Buck Wilson was part of a team that traversed Victoria Land in Antarctica during the 1957-1958 IGY. He and five other scientists used Snowcat tracked vehicles to travel from the American station at Little America to a point 800 miles out on the ice shelf on Victoria Land and back.

“It never got above minus 20 degrees Fahrenheit or so,” Wilson said. On the 109-day, 1,600-mile traverse, he and his partners measured ice thickness and snow accumulation, and took magnetic and gravity measurements.

In Antarctica that year, Wilson also saved the life of U.S. Station Manager Albert Crary by rappelling down to him with a rubber boat after part of an ice shelf collapsed from under Crary. Wilson was awarded a congressional gold medal for saving Crary, the first person to set foot on both the North and South poles.

Wilson started at the institute in 1951. “There were just seven people here then,” he said. “I worked with Elvey and Chapman measuring auroral heights with cameras here and at Healy.” After his IGY time in Antarctica, he came back to Alaska in 1959 and earned his Ph.D. at the University of Alaska in 1963 on geomagnetic storms.

Today, as an emeritus professor of geophysics, Wilson’s work involves studying infrasonic waves associated with the aurora, volcanic eruptions, and marine storms.

Gene Wescott

Professor Emeritus of Geophysics Gene Wescott hitchhiked to Alaska from Boulder, Colorado, in 1958. The trip took 10 days and cost him about \$35.

“I came up to climb mountains and I knew there was a geophysical institute there where I might get a summer job after climbing,” he said.

Wescott wrote a letter to Geophysical Institute Director Christian T. Elvey, requesting a job. Since he didn’t hear back, he traveled to Denali National Park, got a job at Camp Denali, and did some climbing. After that job ended, he traveled to Fairbanks and found that institute scientists had sent a professor to Denali to look for him.

“They hired me on the spot as a research assistant,” he said. As an “IGY hire,” Wescott worked on telluric current data and magnetometer data.

With the exception of a three-year leave of absence at NASA and a sabbatical or two, he’s been at the institute ever since. In early 2007, he traveled to Fort Yukon, Alaska, to help capture images of rocket launches from Poker Flat Research Range.

IGY Researchers: Leading the Way



Three Geophysical Institute scientists who participated in the IGY 50 years ago went on to lead the institute

T. Neil Davis

In May 1955, T. Neil Davis earned the first undergraduate degree in geophysics that the University of Alaska Fairbanks awarded. After receiving a master of science degree at the California Institute of Technology, Davis returned to Alaska and was in charge of running the International Geophysical Year (IGY) field stations in Alaska. He also was in charge of the Alaska all-sky camera operations. Davis designed and built some of the all-sky cameras, which today remain to be excellent tools for studying the aurora. He received his Ph.D. from UAF in 1961.

IGY data collected from the all-sky cameras led to three major new concepts in space physics, Davis said. Scientists used the information to discover magnetic reconnection, magnetospheric convection, and the auroral substorm theory. He noted that graduate students did much of the IGY work in Alaska.

Davis, who was instrumental in the creation and operation of Poker Flat Research Range, served as acting director of the Geophysical Institute from 1976 to 1977. He also initiated the Alaska Science Forum, a weekly newspaper column about science that has endured for more than 30 years, and has authored books about the aurora, permafrost, and the history of Poker Flat Research Range.

***SHAPING THE INSTITUTE**—T. Neil Davis was acting director of the Geophysical Institute from 1976-77. Here he is shown in the early stages of his career, helping to establish Poker Flat Research Range in the late 1960s (top), receiving the first-awarded undergraduate degree in physics from the University of Alaska Fairbanks in 1955 (middle), and taking time to educate the public on science, in this case illustrating a magnetic field with iron filings (bottom).*



Juan Roederer

Former Geophysical Institute Director Juan Roederer was head of the National Cosmic Ray Laboratory in Argentina and a professor of physics at the University of Buenos Aires during the IGY in 1957. Researchers with his laboratory installed and operated the southern portion of a north-south chain of IGY cosmic ray observatories. The northernmost observatory in the multi-station chain was at College, Alaska. Roederer also was the Argentine delegate to the International Conference on the IGY, held in Moscow in 1958. Today, he considers himself a “child of the IGY,” in part because his IGY work on the cosmic ray effects of solar plasma clouds (now called coronal mass ejections) launched his international recognition as a scientist.

Roederer moved to the U.S. in 1967, when he became a professor of physics at the University of Denver. He became director of the Geophysical Institute in 1977 and manned the post until Syun-Ichi Akasofu took over in 1986. He also served as vice chairman and chairman of the U.S. Arctic Research Commission from 1985 to 1991.

Today, Roederer is conducting research on Jupiter’s radiation belt and on the foundations of information theory. His newest book, *Information and its Role in Nature*, was published in May 2005.

Syun-Ichi Akasofu

Syun-Ichi Akasofu came to Fairbanks from Japan as a Geophysical Institute graduate student in 1958, when he was 28. He has lived in Alaska ever since.

A worldwide authority on the aurora borealis, Akasofu gained much of his early experience by spending many hours watching the aurora and films from the network of all-sky cameras deployed during the IGY.

While analyzing volumes of data gathered in the IGY campaign, Akasofu noticed unique auroral patterns that contradicted earlier theories. One new finding was that the aurora is distributed in a deformed oval belt rather than a perfect ring belt. Another was that the aurora over the entire polar region became extremely active up to three times a night; a discovery that led to Akasofu’s auroral substorm theory. His 1964 paper on the subject remains one of the most cited papers in space physics.

Akasofu became director of the Geophysical Institute in 1986, succeeding Juan Roederer. In 1999, he left to head up a new center for research that he had helped establish: the International Arctic Research Center. He retired from the center in January 2007.



LEADERS – Juan Roederer, former Geophysical Institute director (1977-1986), is shown illustrating Earth’s magnetosphere (top), pausing in front of the institute (second from top), and attending commencement ceremonies (middle) with former Geophysical Institute Director Syun-Ichi Akasofu (1986-1991). Akasofu is shown preparing magnetometers for fieldwork (second from bottom) and smiling for the camera as a graduate student at Japan’s Tohoku University in 1956.

IPY Permafrost Project

SUBSURFACE ICE—Polygons, honeycombs of ice walls that lie beneath the surface of the soil, are pictured. The aerial photo was taken 25 km east of Deadhorse, Alaska.

Geophysical Institute permafrost scientists will help determine the state of the world's permafrost during the International Polar Year. Permafrost, ground frozen for more than two years, lies beneath one-fifth of the world's land surface and 80 percent of Alaska. Much of Alaska's permafrost is within one degree of thawing.

The project, titled the Permafrost Observatory Project: A Contribution to the Thermal State of Permafrost, involves collaboration from America, Argentina, Australia, Canada, China, Denmark, Finland, Germany, Iceland, Italy, Japan, Kazakhstan, Korea, Mongolia, New Zealand, Poland, Portugal, Russia, Spain, Sweden, Switzerland, and England.

Professor and permafrost expert Vladimir Romanovsky will lead his Geophysical Institute colleagues to establish permafrost observatories during the IPY in Alaska, Russia, and Greenland. Most of the new stations, perhaps as many as 200, will be in Russia, which has a vast area of continuous permafrost. Much of this permafrost is at lower latitudes than discontinuous permafrost in Alaska.

"The major idea is to establish this snapshot of permafrost temperatures for two or three years," Romanovsky said. "We hope to establish a network of boreholes and actively involved groups of permafrost researchers in

Russia that will continue to be active in the future."

Project researchers will use standardized instruments and methods of data gathering to measure permafrost temperatures worldwide. Historically, the permafrost temperature record has been unreliable due to varying instrumentation and methods used to take readings. For example, many Russian permafrost readings were made with mercury thermometers; new measurements will be taken using thermistors with temperature variable resistance.

Romanovsky traveled to four locations in Russia in the summer of 2007, as well as to the North Slope and Gakona, Alaska. In September, he

will travel to Greenland to establish additional permafrost observatories. Engineers from Denmark plan to produce permafrost risk maps from the Greenland research.

The researchers' overall goal with the collaborative permafrost project is to obtain standardized measurements of the world's permafrost during the IPY. Romanovsky also hopes the project will attract more scientists to his discipline.

"We want to develop a new generation of permafrost scientists," Romanovsky said.

PERMAFROST—At right, permafrost erosion can be seen on the Lena Delta in Russia.

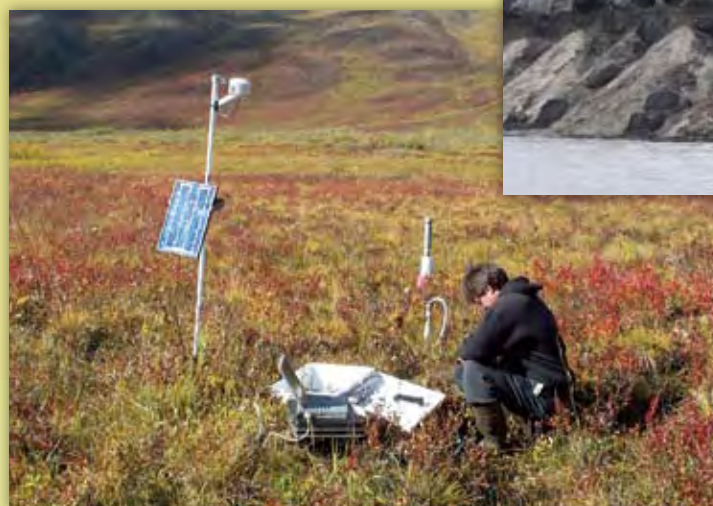


photo courtesy Vladimir Romanovsky



photo by Guido Grosse

FIELDWORK—At left, permafrost expert Vladimir Romanovsky takes field measurements. Data gathered through the Permafrost Observatory Project will help determine the state of the world's permafrost.

IPY Lidar Studies at Poker Flat Research Range

Poker Flat Research Range, located 30 miles north of Fairbanks, is the site of one of four Rayleigh lidar (laser radar) systems at high latitudes that scientists will use this winter to record the temperature of the arctic atmosphere as part of an International Polar Year research campaign.

Richard Collins, associate professor at the Geophysical Institute, will lead the Alaska team of researchers. David Atkinson from the International Arctic Research Center, University of Alaska Fairbanks, and Lynn Harvey from the University of Colorado are co-investigators on the project, and Atmospheric Science Ph.D. student Brentha Thurairajah from Sri Lanka will work on the project as part of her degree. Other contributing scientists will operate lidar systems across the Arctic in Andoya, Norway; Kangerlussuaq, Greenland; and Eureka, Nunavut, in Canada.

The researchers will use the lidar systems to measure temperatures from about 40 to 80 kilometers

above Earth's surface. This region is too high for weather balloons. The goal of the lidar project is to document the state of the arctic atmosphere during the IPY, and to better understand the connections between the upper and lower atmosphere. Measurements taken with the lidar systems will help researchers determine the character of large-scale weather features, such as the arctic stratospheric vortex and the Aleutian anticyclone.

"We're hoping to get a benchmark of the weather in the middle atmosphere and see how it connects to weather in the lower atmosphere," Collins said.

International collaboration is key to IPY projects. Ongoing collaboration with Kohei Mizutani, of the National Institute of Information and Communications Technology in Japan, helped establish this IPY project.

For more information about lidar studies at Poker Flat Research Range, visit the Lidar Research Laboratory Web site at www.gi.alaska.edu/splidar.



photo by T. Matsuo

The Poker Flat Research Range Lidar Laboratory



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