GEOPHYSICAL INSTITUTE QUARTERLY

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Ash-Plume Displays Can Make Flying Safer

A dynamic computer program that can display colorful, three-dimensional images of ash plumes in motion was developed recently by Geophysical Institute researchers.

The program, which is designed for aviation control towers, runs on the Denali Supercomputer scheduled to move to campus this summer. Scientists now access the supercomputer at its temporary home in Minnesota.

The program can display a moving image of an ash plume from any one of Cook Inlet's active volcanoes immediately after eruption. The 3-D ash plume is displayed as if the viewer were seated in the cockpit of an airplane; the plume can be viewed from any point and at any altitude. Given wind and weather parameters, it depicts the direction the ash plume will travel, and effectively predicts where the highest densities of ash will move.

When the program is fully developed, aviation control tower personnel will be able to use it to make precise suggestions about where a pilot should fly to avoid encountering an ash plume immediately after an eruption. Clouds frequently hide ash plumes from ground and air observation so the moving 3-D images, which can be examined regardless of weather conditions, are particularly useful.

The need for such a program became dramatically evident after Redoubt Volcano erupted in December 1989. One day after the eruption, a Boeing 747 experienced complete engine failure while flying through an ash cloud. After gliding for eight minutes, the flight crew restarted two engines barely 7,000 feet above the ground, then made an emergency landing in Anchorage.

"This near tragedy taught us that an accurate prediction of the eruption of a volcano alone cannot prevent a disaster," said Geophysical Institute Director Syun-Ichi Akasofu. "We came to the conclusion that if we could simulate the movement of volcanic ash clouds by computer, we would be able to reduce the chance of any encounter of planes with ash."

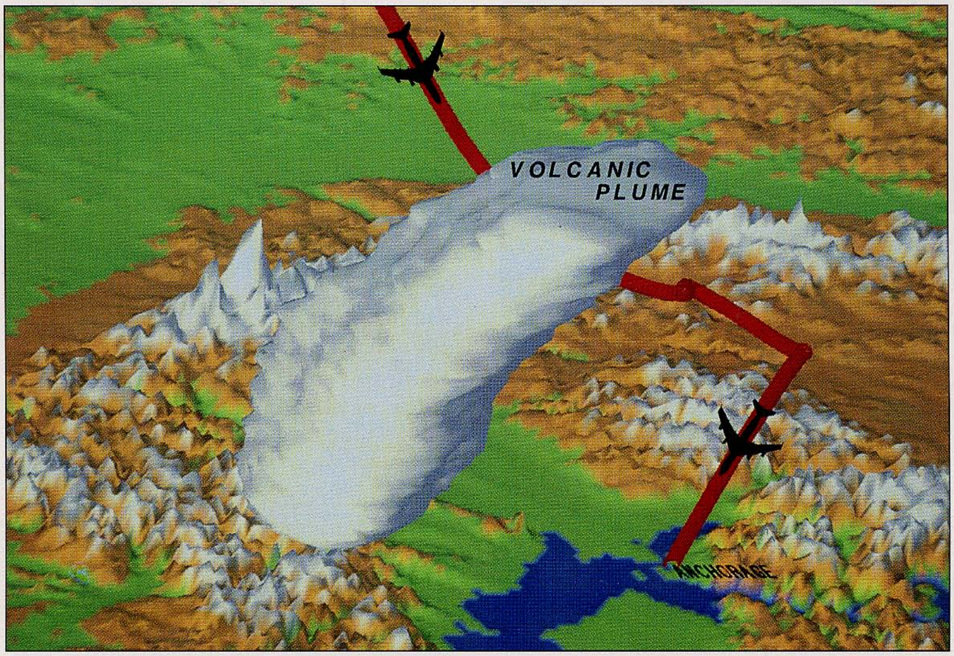
After the Redoubt Volcano eruption, funds for developing the program were made available from the Office of the Governor, the Alaska Science and Technology Foundation, the Municipality of Anchorage, the National Science Foundation, and several airline companies.

Geophysical information needed for the program will be supplied by the Alaska Volcano Observatory. AVO monitors Cook Inlet volcanoes year-round and, as eruptions seem imminent, sends warnings increasing in urgency to the Federal Aviation Administration, the Alaska Division of Emergency Services, concerned communities and businesses, and the National Weather Service.

The computer program was developed by Geophysical Institute Adjunct Professor Hiroshi Tanaka, of Tsukuba University in Japan. The 3-D images generated from Tanaka's work were designed by Geophysical Institute Senior Systems Analyst Rick Guritz along with UAF Associate Professor Mitch Roth and the staff at the UAF Arctic Region Supercomputing Center. To ensure accuracy, Research Assistant Professor Ken Dean, a specialist in remote sensing, compares the 3-D images to those of ash clouds taken by a NOAA satellite.

Akasofu hopes that concerned agencies and organizations will join an effort to develop the new program fully for practical use.

MITCH ROTH AND RICK GURITZ/DEBORAH COCCIA



***Ash**—Shown is the near tragic flight of a jet that flew through ash from Redoubt Volcano in 1989.*

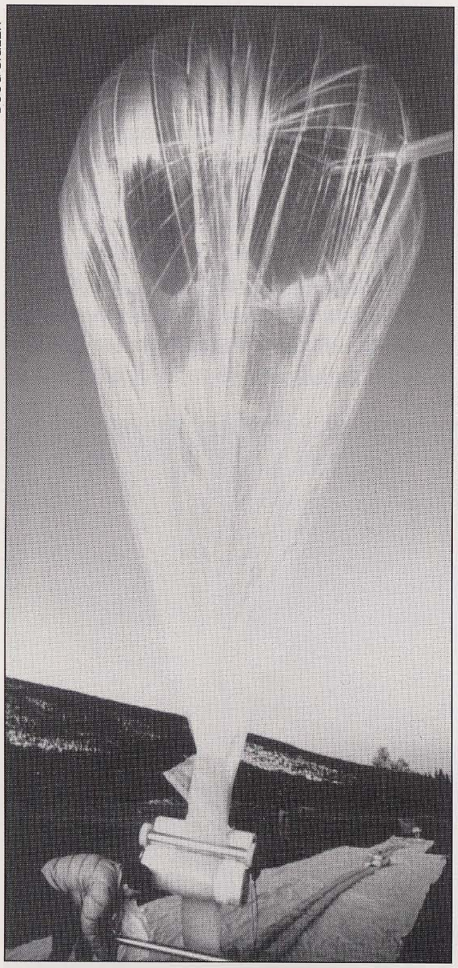
University of Alaska Fairbanks

Balloons and Rocket Find Auroras in Daylight

A rocket studying auroras that occur in the daytime was launched at 7:38 a.m. on May 6 from Poker Flat Research Range, which is owned and operated by the Geophysical Institute under contract to NASA.

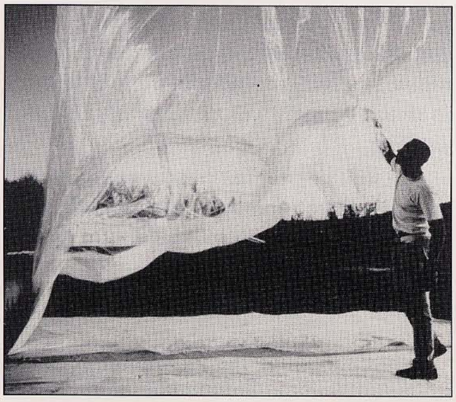
Since dayside auroras cannot be seen with the naked eye, scientists used real-time data from satellites and ground-based instruments to determine when conditions were right for launch.

DOUG SIGLER



Skyward—*National Scientific Balloon Facility employees Stephen Peterzen (above) and Victor Davison (below) prepare a 200-foot-wide balloon for takeoff from a field site near Poker Flat.*

DOUG SIGLER



Shortly after scientists observed the geomagnetic activity they had hoped for, they released a 200-foot-wide balloon that carried special aurora-detecting instruments up to 120,000 feet.

"As soon as the balloon reached altitude, right away it sent information to the range that indicated a dayside aurora was occurring," said University of Washington Professor of Geophysics George Parks, the principal investigator for the mission.

The data also indicated the presence of microbursts, which are short, impulsive bursts of electrons that usually last less than one second, but recur every few seconds.

"After we saw the microburst activity we made an immediate decision to launch the rocket," Parks said.

The payload portion of the two-stage rocket flew 168 miles high and stayed in the air for about 12 minutes. The scientific instrumentation inside the payload cruised through the dayside aurora, then descended to the ground under a large, orange and white parachute.

It landed about 180 miles north of the launch site on Poker Flat's downrange recovery area in the large triangular section bordered by Chandalar, Venetie, and Arctic Village. The payload was recovered by helicopter.

The preliminary data received from telemetry indicates that all instruments within the payload were functioning properly. Analysis of the data will take at least a year to complete, Parks said.

The payload contained five solid-state telescopes that measured high-energy electrons and other atmospheric phenomena. It was the first to fly through a microburst dayside aurora since a rocket was launched from a Canadian range in 1964.

Microburst dayside auroras emit low-level X-rays similar to the kind used by medical doctors, but in much lower dosages. The X-rays are left behind after electrons in the dayside aurora are absorbed by the atmosphere at low altitudes. These X-ray tracers can be detected by the special equipment carried under balloons. However, rockets are needed to study the electrons themselves, which exist only at higher altitudes.

The study aimed in part to clarify the source of electrons that create dayside auroras.

"There are basically two views on the subject," Parks said. "One camp believes that the microburst activity comes from way out in space and the other believes it comes from some place close to earth." Parks hopes the information received from the flight will help solve the controversy.

Rocket Payload Flies Higher Than Ever

A rocket payload launched at 1:09 a.m. on April 2 flew higher than any other flown from Poker Flat in the 23-year history of the range.

A powerful four-stage Black Brant 12 shot the rocket's payload more than 884 miles high. The six instruments contained within the payload were designed to take measurements scientists will use to figure out how moving particles in the aurora get their energy.

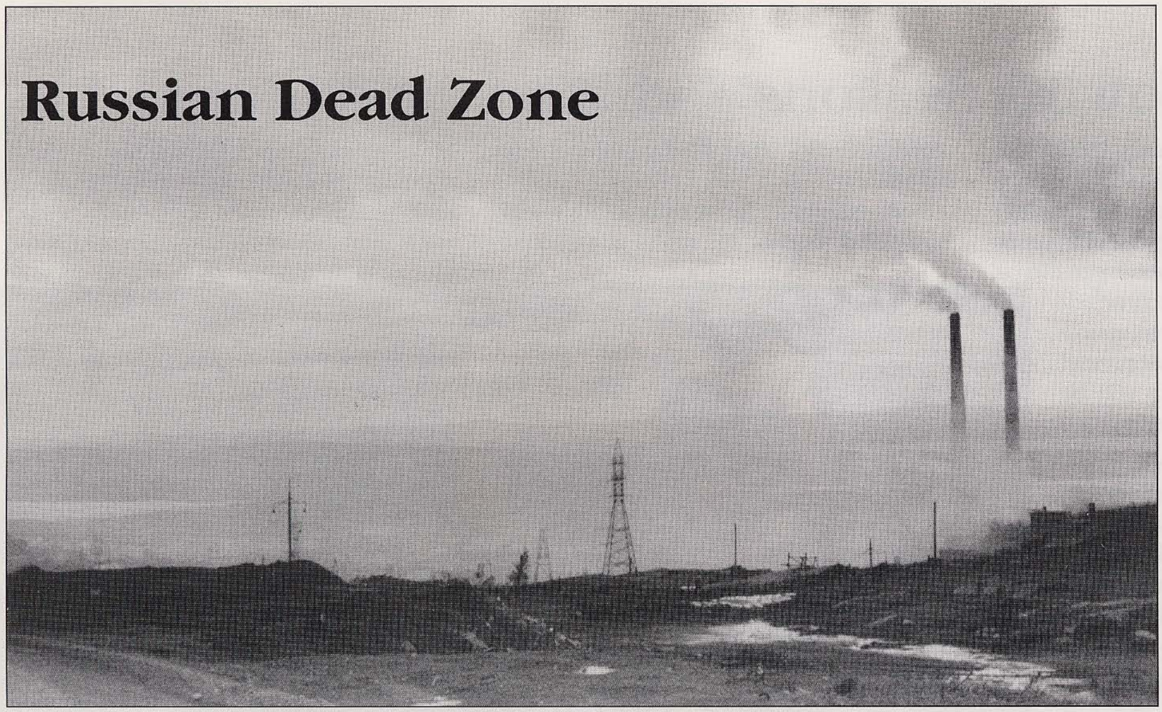
"We know electron beams that hit the upper atmosphere create the visible light in the aurora, but we don't know where those beams are formed or how they are energized," said University of California Research Physicist Charles Carlson, the principal investigator for the launch.

After the launch, instruments in the rocket payload flew through space for about 22 minutes, during which data about charged particles, plasma waves, and electric fields powering the aurora were beamed down to receiving stations at Poker Flat. The payload flew in an arc about 725 miles downrange over Kaktovik before it landed as planned in the Arctic Ocean.

The measurements will be analyzed by Carlson at the University of California's Space Sciences Laboratory in Berkeley. Carlson has been the principal scientist involved in the launch of six rockets from Poker Flat during the past 10 years.

Data from those launches helped scientists come up with two main theories concerning how the moving particles in the aurora are energized. Those who adhere to the voltage-drop theory say a particle gains energy the way a skier does when traveling down a steep hill. Those who hold to the electromagnetic-wave theory say a particle gains energy the way a surfer does when riding a board along wave crests to the shore.

Russian Dead Zone



Smelting Complex— *Researchers from the Geophysical Institute will spend several weeks this summer studying areas affected by industrial emissions from nickel and copper smelting complexes on Russia's Kola Peninsula. The industrial plants spew out heavy metals which remain in Russian soil and water and airborne sulfur dioxide which may contribute to acid rain and arctic haze in Alaska (photo by Jennifer Kelley).*

Trees standing ashen without leaves in desolate landscapes have captured the imagination and the creative energy of Associate Professor of Chemistry Dan Jaffe. A large poster of one such depressing scene hangs prominently on the wall of his office in the Geophysical Institute, reminding him of work that needs to be done.

This summer, he and a crew of volunteers will spend their third summer in Russia near a "dead zone" created by industrial emissions spewed out of a nearby nickel and copper smelting plant. Dead zones are areas in which trees, plants, moss, and all other life have been killed off by toxins.

The smelting complex Jaffe's team will study is one of two major polluters on Russia's Kola Peninsula, an area about one-eighth the size of Alaska that lies above the Arctic Circle and is home for about 1 million people.

The industrial plant is one of the largest sources of sulfur dioxide emissions in the world. Its chimneys and stacks pump out about 0.3 million tons of SO_2 each year. SO_2 is the major precursor to acid rain, which gained notoriety in the U.S. after it killed trees and other vegetation in scenic areas on the east coast.

The stacks from the Russian smelting complex also pump out heavy metals, such as lead, arsenic, copper, and nickel, all of which are hazardous to human health. During his first trip to the Kola Peninsula, Jaffe and his research volunteers discovered that about half of the heavy metals emitted from those stacks were seeping into the local soil and water. Considering the toxicity of these metals, it's not surprising that Jaffe heard two gruesome rumors about the quality of life in the neighboring city of Monchegorsh.

"We've heard that the average life expectancy is age 47 and that there hasn't been a normal birth in years," Jaffe said.

By taking snow samples, Jaffe's team also learned that very little SO_2 stays in the vicinity of the industrial plant. Snow is a passive receptor that collects heavy metals and other forms of pollutants. Finding little SO_2 in the snow is good news for local residents, but it may not bode well for people in Alaska.

"It means that the SO_2 coming out of the stacks is not removed locally and so it is going somewhere else," Jaffe said. "The finding seems to confirm observations made about arctic haze."

Arctic haze is the layer of dusky air pollution that floats over the Arctic in the spring and creates brilliant orange sunsets. Years ago, Professor of Physics Glenn Shaw discovered that arctic haze is composed of SO_2 and other pollutants spewed out of factories and other sources in North America, Europe, Asia and Russia. The tainted air gets to Alaska by way of an airflow associated with the Siberian High Pressure System.

Jaffe is working with Alexander Baklanov, a Russian scientist who specializes in creating theoretical computer models that can predict the quantity of pollutants emitting from the plant in the future given certain conditions. The models also can predict where pollutants like SO_2 will end up after programming in parameters such as wind velocity and direction.

The samples Jaffe and his crew collect will help Baklanov verify predictions and make future theoretical computer models more accurate. In the past, the group collected snow, water, and air samples from around the Kola Peninsula. This summer, the group will measure the size of the particles ejecting from the chimneys of the industrial smelter. Jaffe theorizes that a large fraction of the heavy metals spew out in particulate form and deposit locally, while the gaseous SO_2 is transported in the air across the Arctic.

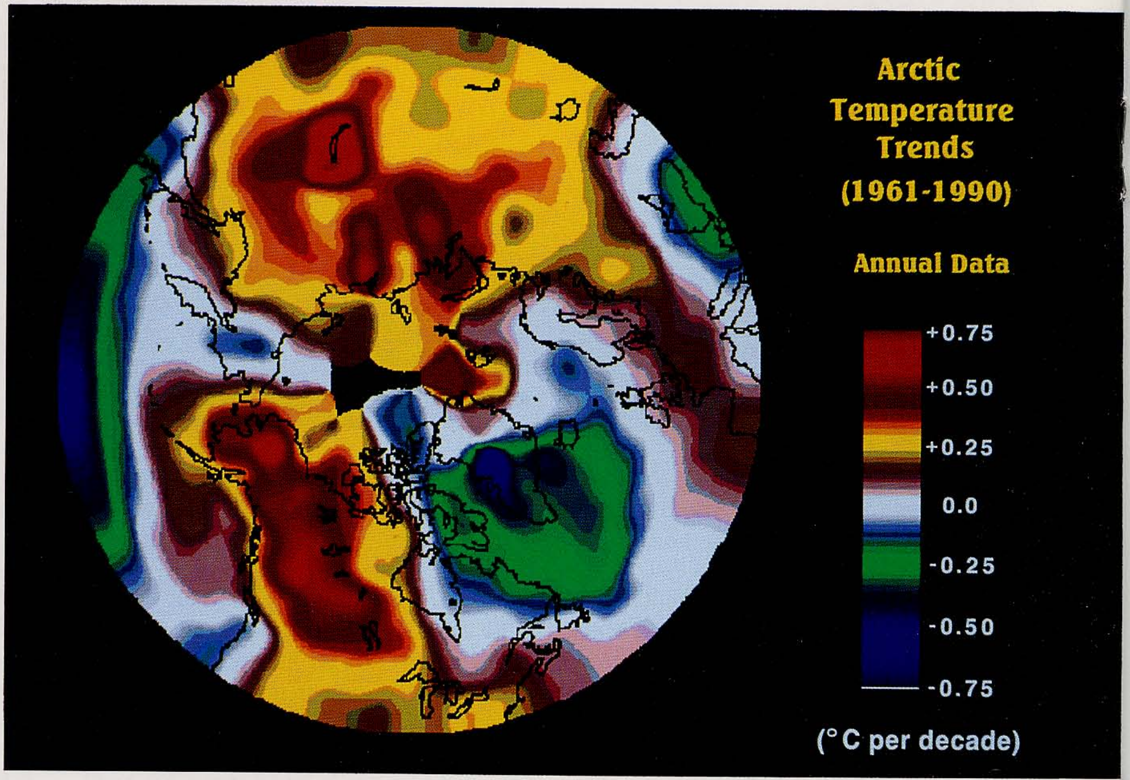
Jaffe's research trip to the Kola Peninsula is scheduled for July 15-25 with Earthwatch, a nonprofit organization that recruits volunteers to participate in scientific research and provides modest research grants to support the projects.

Jaffe plans to visit other areas in Russia from June 19 though July 10 as part of the "Young Investigator Program on Arctic Ecology," sponsored by the National Academy of Sciences. He was selected as one of 10 U.S. scientists to join 10 Russian scientists who will as a group develop long-term collaborative research concerning pollution impacts in Russia and the U.S.

Jaffe also is involved in the Arctic Monitoring and Assessment Program, an international program coordinated at the federal level. The AMAP was organized two years ago by the eight arctic nations to develop a plan for monitoring radiation, heavy metals, persistent organics (pesticides), acids and other pollutants in arctic air, land, water, animals, and humans.

The AMAP headquarters is in Oslo, Norway, where Jaffe plans to spend next year on sabbatical. His research has become so important that the U.S. Department of State has agreed to finance two months of Jaffe's work with AMAP on Russian and arctic pollution problems.

Longer Growing Seasons and Warmer Winters



Hot Spots—*The red areas on the computer-generated image above are "hot spots," locations in which arctic temperatures have warmed considerably during the past 30 years. Alaska is one such hot spot and so has been singled out for more detailed examination (analysis and data collection by John Walsh; model image by Amanda Lynch).*

Scientists say woolly mammoths and steppe bison roamed around Alaska thousands of years ago, and that sourdoughs experienced colder, darker winters 100 years ago. Now, thanks to computer-generated models that take into consideration the advent of global warming, scientists are able to predict what the climate in Alaska will be like 100 years in the future.

According to the most current predictions, the next generation of Alaskans living in the Interior will experience winters that are about 8°C warmer, shorter, and snowier, and they'll look forward to longer growing seasons. They'll also be less troubled by permafrost, be able to fish in deeper oceans, and see less sea ice in marginal coastal areas.

But let's back up a minute.

These predictions are based on the results of numerical models run on supercomputers. The models forecast a global warming of about 0.3°C each decade in mean temperatures during the next century, with high northern latitudes warming more in the winter than the global mean. The predicted rate of increase is greater than observed during decades spanning the past 10,000 years.

Global warming is expected to be particularly noticeable in the polar regions, which is why the Arctic has become a crucial area of research for climate change. Sea ice, snow cover, glaciers, tundra, permafrost, boreal forests and peatlands all are susceptible to subtle variations in sunlight, surface temperature, ocean-heat transport, air and ocean chemistry, and atmospheric pollution.

Observational evidence in the Arctic during the last few decades seems to verify the trend toward global warming. Arctic and subarctic land masses of Alaska, Canada, and Siberia all show temperature increases of up to 1°C per decade in winter.

Professor of Geophysics Gunter Weller, director of the Center for Global Change and Arctic System Research, warns that scientists still deal with many uncertainties concerning their predictions, particularly with regard to the timing, magnitude and regional patterns of climate change. So, while it may not be time to buy beachfront property in Nome for the grandchildren, it is a good time to consider seriously the implications of what the predictions may mean.

For example, the results of regional numerical models for the Arctic predict that warmer temperatures will bring even more rain to coastal Alaska and a rise in the average rate of global mean sea level by up to 6 cm each decade during the next century. The rise in sea level will affect coastal dwellers who will be faced with land erosion, shifts in fish populations, and the probability of intense storm surges.

For interior Alaska gardeners, one of the most encouraging predictions resulting from a gradual warming in climate during the next 100 years is a longer growing season—possibly up to three weeks longer.

As the climate warms, tree lines are expected to move slowly north and upslope in mountain areas and more traditionally southern species of plants are expected to take root around the state. Changes in vegetation also are expected to bring changes in the abundance and distribution of animals, including moose, caribou, and wolves.

Warmer temperatures also will affect snow and ice in Alaska. Currently, snow covers the ground in the Interior for six to seven months each year and nine to ten months farther north. Scientists predict even more snow on the ground in these areas in 100 years but for a shorter season, and they forecast more abrupt and severe spring breakup and runoff.

Glaciers in Alaska are expected to grow initially as the climate warms because of higher precipitation, and then to shrink and melt as temperatures increase further. Permafrost, which underlies almost all of Alaska, is expected to melt at the top and bottom initially, and then to disappear altogether. Warmer temperatures also may promote the thinning or disappearance of sea ice and ice shelves. These ice features promote the formation of cold bottom water that drains equatorward and influences circulation patterns in oceans around the world.

Climate change will have both positive and negative effects on Alaska's industries as well. For example, Weller suspects climate warming will greatly impact Alaska's petroleum industry. The cost of maintaining pipelines, access roads, camps, pump stations and other infrastructure will probably soar initially as temperatures rise and permafrost melts. On the other hand, thinner sea ice could facilitate offshore exploration and the marine supply of Prudhoe Bay.

One thing seems clear. Changes in the earth's climate will occur and overwhelming scientific opinion and available evidence point to a much warmer period ahead.

Scientists See into the Future

To find out what Alaska will be like in the future, Professor of Geophysics Gunter Weller, Postdoctoral Fellow Amanda Lynch, and others are running numerical models on the new Denali Supercomputer, which is temporarily in Minnesota and scheduled to move to UAF this summer.

The models simulate interactions that occur among the air, ice, and ocean in the Arctic and can be used to study poorly understood climate-related phenomena, such as arctic haze and other forms of air pollution, or to investigate the polar climate of the distant past.

The models also can be used to forecast weather a few days in advance, or to predict climate change over the next few decades. As a result, scientists can get a glimpse of what the arctic climate will be like in 100 years, when carbon dioxide in the atmosphere is expected to have doubled.

Carbon dioxide is an emission produced naturally and by burning oil, coal and gas. CO_2 adds to and accelerates the atmosphere's natural greenhouse effect, a process in which solar energy is trapped close to the earth, making the surface warmer than it otherwise would be.

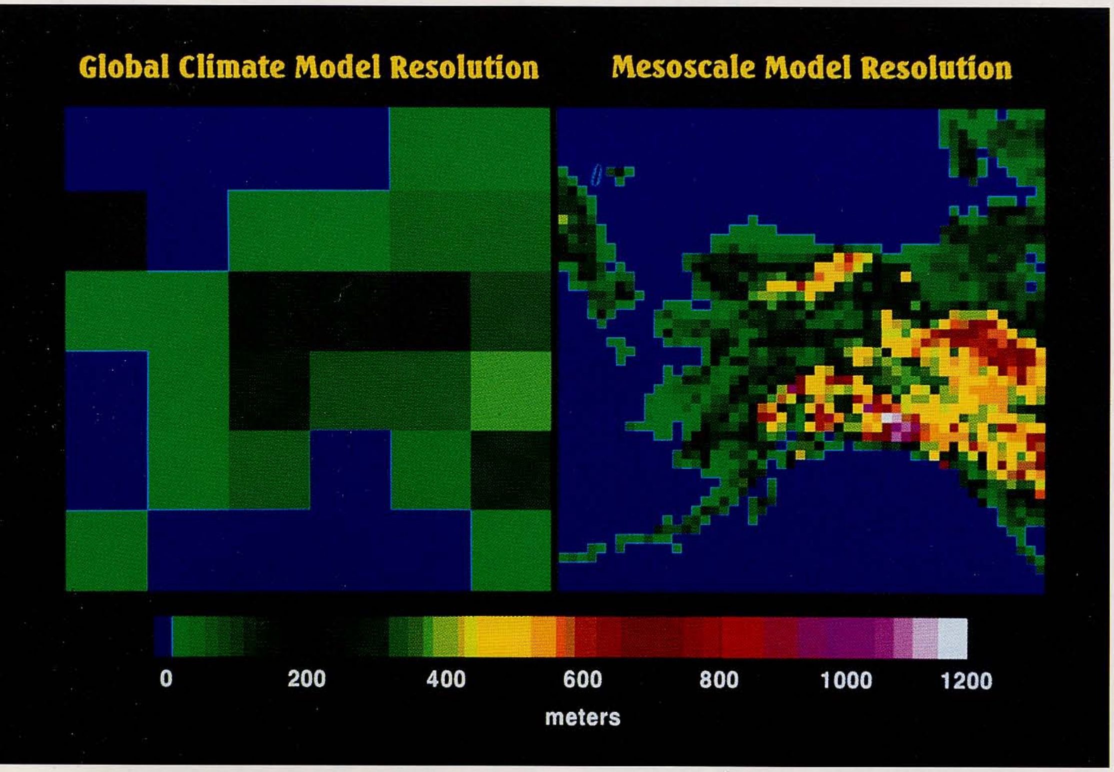
Most scientists agree with the general hypothesis of greenhouse warming and the great likelihood that the world's climate will be considerably warmer in the future. The fact that the global climate has been warming in recent decades already is borne out by numerous observations, Weller said.

However, cause and effect relations have not been resolved and there is some disagreement about the magnitude of the expected climate change. Major uncertainties exist mainly because feedback effects among the various natural processes occurring on earth have not been adequately tested in the climate models and because the models themselves have not been able to simulate the interactions of a complex global environment.

The models run on Denali should help. The supercomputer has enough memory to run simultaneous forecasts of how CO_2 doubling will affect a variety of cycles influencing the earth's climate, making the model multi-dimensional and more true to life.

Better yet, the models run on the supercomputer are regional, rather than global. That means processes occurring in the Arctic will be observed in much greater detail, or studied at much higher resolution, than is possible in a model running at the global level.

Regional studies in the Arctic are crucial because the impacts of global warming are expected to be amplified at high latitudes. In turn, these impacts are expected to be large enough to drive global warming through feedback cycles. For example, the arctic tundra is a huge reservoir for carbon. If increased CO_2 in the atmosphere causes more heat to be trapped close to the earth and warms the tundra, more CO_2 from the tundra would be released, and thus would accelerate global warming.



Zeroing In—*Models depicting climate change on a global scale often cover such a large area that they miss the finer details researchers are able to analyze using high-resolution regional models. The computer image at left shows how Alaska appears in a global climate model; the right-hand image illustrates the greater detail portrayed on a high-resolution regional model of the Arctic (model image by Amanda Lynch).*

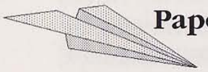
Lynch is studying the processes occurring in the atmosphere and on the land surface in polar regions and she's running computer programs that predict what the arctic atmosphere will be like in the future. Assistant Professor of Marine Sciences Dave Musgrave is modeling the dynamic processes at work in polar oceans and Professor of Physics John Walsh from the University of Illinois is concentrating on ice interactions. Walsh is a Wadati Visiting Professor at the Geophysical Institute.

Lynch and Walsh recently combined their atmospheric and ice research on the Supercomputer, and soon Musgrave will add to it his oceanic studies to produce a grand model that for the first time will show the interactions and feedback loops that occur among, as well as within, each dimension. The multi-dimensional model will come closer to simulating real-life scenarios in the future than any other model to date. The arctic model will then become a detailed piece of a more general global climate model, which should enrich scientific understanding of future climate changes worldwide.

GI NOTES

KUAC Festival '93

Volunteers who answered phones during the KUAC fund raiser from 6-9 p.m. on March 25 were **Mary Farrell, Martin Jeffries, Dan Osborne, Stan Schwafel, Ann Trent, Kathy Berry, Penelope Noecker, Steve Estes,** and **Dolores Baker**. A total of $6,364 was pledged to the station during that time.



Paper Planes and Pink Pigs

Postdoctoral Fellow **Dirk Lummerzheim** won the coveted golden egg, the overall first-place award in the Second Annual Royal Geophysical Air Farce (RGAF) Paper Airplane Flyoff this spring for designing a paper plane that flew long and far off the top of the Geophysical Institute and for being the only contestant to attempt to cushion the drop of a raw chicken egg from the eighth floor. Research Assistant **Ken Schwartz** won the flying pink pig, the second-place award in the contest for designing a plane that flew well beyond the Butrovich Building across the street from the institute.

Talk About Science

Famous former science editor at the New York Times, **Walter S. Sullivan**, gave a public lecture at the Geophysical Institute on April 23. Sullivan is one of America's most distinguished science writers. He covered the launching of Sputnik and the birth of plate tectonics and he is the author of eight books, including "Continents in Motion," "Black Holes, the Edge of Space, the End of Time," and "We Are Not Alone."

Sullivan's connection with Alaska began at age 17 when he went on an archaeological dig with the University of Alaska Fairbanks. His humorous and informative talk at the institute was entitled "Trying to Explain the Inexplicable—Communicating Science."

Professor of Physics **Glenn Shaw** was featured as a guest on "Earth and Sky," a radio program aired daily around the nation on public broadcast stations. In April, three consequtive daily programs were dedicated to arctic haze, air pollution from industrial sources in Russia and eastern Europe that is transported to Alaska by a river of air. Shaw identified the source of arctic haze in the early 1970s with fellow researcher Ken Rahn.

Shaw and Professor of Geophysics **Willy Weeks** also were featured speakers at a week-long Workshop on Arctic Contamination in Anchorage in May. Shaw spoke about arctic atmospheric circulation and Weeks spoke about sea ice. Both mediums can be used as a means of transporting Russian pollution to Alaska.

Geophysical Institute Quarterly

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The Alaska Space Academy

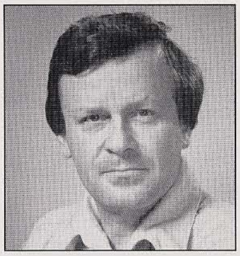
The space academy, a one-week residential camp for Alaska students who have graduated this year from grades 5, 6, 7, or 8, is scheduled for July 18 through July 24 at Lost Lake near Fairbanks. Students attending the camp will tour Poker Flat Research Range, design and launch rockets, and map the lake bottom using remote sensing technology and underwater-exploration devices equipped with a television probe. They also will investigate a life form surviving where man cannot.

The camp is sponsored by the Geophysical Institute and UAF's Alaska Space Grant Program in association with the Midnight Sun Council of the Boy Scouts of America. For more information contact Assistant Professor of Geophysics Neal Brown at (907) 474-7999 or Administrative Assistant Kim Fisher at (907) 474-6833.

Elvey Addition Model

A table-sized model of the new addition planned for the institute is expected to be complete and ready for display by the end of June. Kumin and Associates, Inc., and Kaplan/McLaughlin/Diaz will present the model to the institute along with a final report on the conceptual design.

CONGRATULATIONS

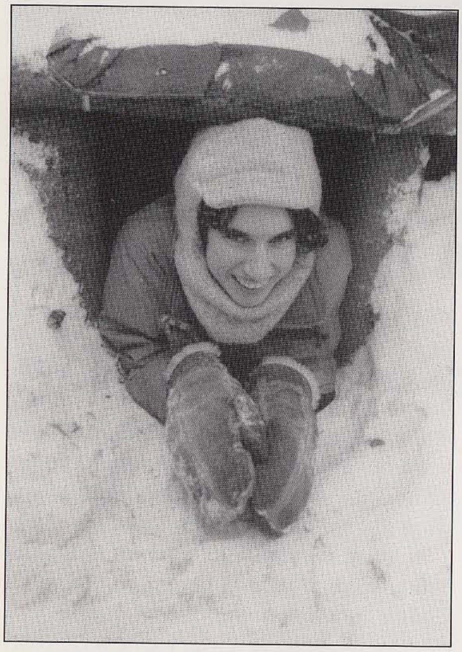


Professor of Geophysics **Gunter Weller** received one of two 1993 Edith R. Bullock Prizes for Excellence given out this year by the Trustees of the University of Alaska Foundation, a corporation within the university that manages private and corporate gifts received at UA campuses throughout the state. The award is given each year in recognition of outstanding work on behalf of the University of Alaska. Weller and Professor of Marine Science Thomas Royer will each receive $15,000 for the honor. Weller is internationally recognized for his leadership in earth-system studies and polar research and has been a professor of geophysics with UAF since 1968. He holds appointments as Geophysical Institute deputy director, director of the Alaska Synthetic Aperture Radar (SAR) Facility and director for the Center for Global Change. His academic degrees are from the University of Melbourne, Australia.

Professor of Physics **Juan Roederer** was appointed this spring to the five-member Consultative Committee of the International Center for Theoretical Physics based in Trieste, Italy. ICTP is a prestigious research institute operated under the joint sponsorship of the International Atomic Energy Agency of the United Nations, UNESCO, and the Italian government.

ICTP's main goal is to promote front-line research in a variety of subdisciplines of physics, including elementary particle studies, nuclear physics, solid-state physics and geophysics. The main function of the Consultative Committee is to assess the past performance of the Center and to make recommendations on the development and implementation of a three- to five-year plan for the institution.

Surviving the Arctic Wilds



Staying Warm*—Research Assistant Jennifer Kelley peeks out from a lean-to constructed with logs and tree limbs lashed together and covered with canvas. Snow packed around the structure acts as insulation to warm the inside.*

Getting lost in the Alaska wilderness immediately brings to mind the topic of survival. Every year, people who become stranded in remote northern locations are found emaciated from starvation and exposure. Many of them could have survived comfortably until rescued if they only would had known the answers to a few simple questions.

These crucial questions were answered for the Geophysical Institute researchers, graduate students, and staff members who attended a three-day arctic land and survival course sponsored by UAF Risk Management this spring.

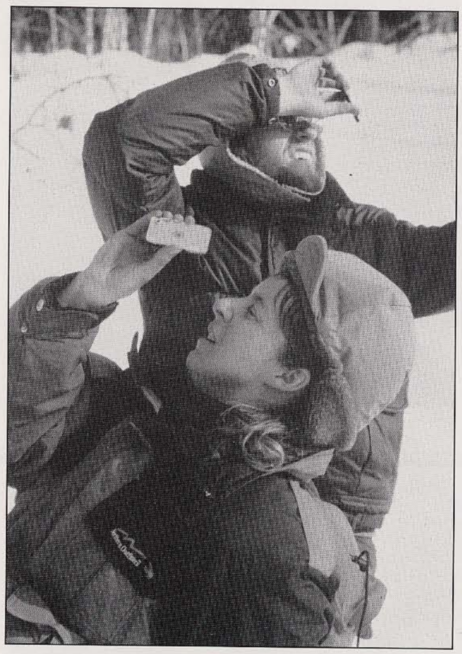
As a graduate of a U.S. Air Force arctic land survival training program, Risk Management Director Joe Adams was familiar with the types of survival problems that could become the sudden concern of institute researchers working in the field.

For example, what do you do if your plane goes down in the middle of the Brooks Range? How would you survive stranded on the ice some place directly north of Barrow? Once you find yourself stranded, how would you set bone fractures, construct shelter, and procure food and water? How would you start a fire without matches? How would you protect yourself from frostbite and hypothermia?

So many people from the institute were interested in learning about arctic survival that Operations Assistant Penelope Noecker spent months juggling people onto the class roster from a long waiting list. When the course began, Learn-to-Return (LTR) Training Systems instructors Bruce Birchell and Mike Seizys faced more than 30 students.

Both Birchell and Seizys are former air force survival trainers who know how to survive in situations ranging from the sands of Saudi Arabia to the icy waters of northern oceans.

The arctic land survival course consisted of two parts. Everyone attended an eight-hour classroom session and 19 students went on to complete two-day field instruction. During the field instruction at Ft. Wainwright, students were put in a simulated survival situation, assigned fake injuries (an odd collection of bone fractures and sprains), and were able to use only the equipment pulled to location on sleds. The sleds contained boxes of live rabbits (that would later be eaten) and miscellaneous tools, such as saws and shovels. Bags containing six nutrition bars, one tea bag, and one sugar packet were shared by each two-person team.

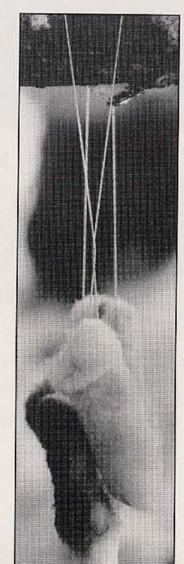


Signaling*—Research Assistant Carol Petersen and Glaciology Technician Chris Larsen practice sending emergency signals with mirrors to indicate their location to passing aircraft.*

Everyone attending the field instruction learned how to ration food while digging ice caves, collecting firewood, and removing snow for a central fire pit and meeting area. In the meeting area, students learned cord-lashing techniques for fashioning wood braces, frames, tripods, and snowshoes. Students also were shown a variety of ways to start fires with products ranging from cotton balls and petroleum jelly to steel wool and flashlight batteries. After a day of nibbling on nutrition bars, 19 starving people also learned how to make snares, and how to properly dispatch, skin, butcher and stew a rabbit.

Huddled Together*— Warming up are research assistants Ken Schwartz, Matt Nolan, Chris Larsen, and Carol Petersen (pictured from left to right). At right is a pillowcase tied off at three corners and stuffed with snow. Filtered water flows out of the fourth corner into a coffee can.*

A grubby crew returned from that field, but they were hardier and surer of their ability to survive in the Arctic. The UAF Risk Management team was so impressed with the institute response, they plan to repeat the program next year.



—A special feature and photos by Doug Sigler, one of the course survivors

A Different Point of View

The colorful world thriving under ice platforms in the Chukchi Sea was viewed live in technicolor by researchers this spring. The images were displayed on a television set tucked inside a tent covering a large hole drilled through sea ice near Barrow, Alaska. The camera taking the footage was perched on an RTV 100, a remotely operated submersible vehicle that looks rather like an orange mechanical bug intent on swimming up, down, and sideways under water.

The vehicle is attached to its above-ice counterparts by a 150-meter-long fiber optic umbilical cord. The unit with all its attachments weighs about 600 pounds and was dragged out onto the ice in several boxes stacked on a sled pulled behind a snowmobile.

Senior Research Consultant Lew Shapiro used the RTV 100 to view the underside of a pressure ridge formed after one ice sheet ran into another off the Barrow coast. When two ice sheets collide, they force blocks of ice to pile over and under each other at the juncture. Some of the ice blocks remain separate like ice cubes in a bag from a convenience store, but others in the ridge eventually freeze together making the newly formed ice sheet much thicker than it otherwise would be, especially on the underside. "The keel is always being bigger than the sail," Shapiro said.

Shapiro and Professor of Physics Will Harrison devise theoretical models to predict the depth to which blocks of ice in pressure ridges will freeze together. The information is interesting to designers of offshore structures that potentially could be damaged by wind-blown masses of ice.

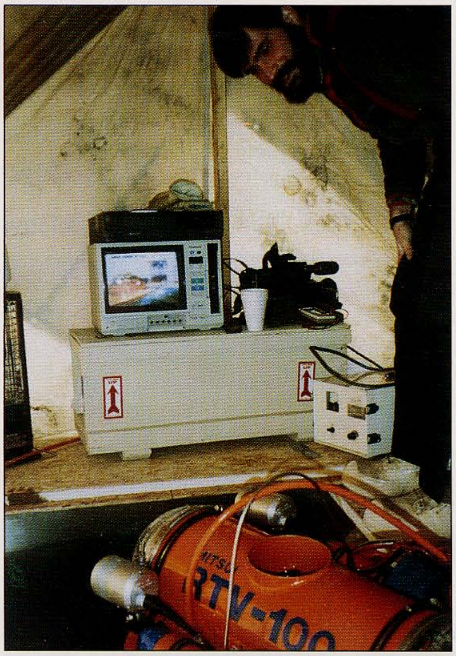
Electronic Technician Bill Zito spent a good deal of time on his knees inside that tent near Barrow looking into the hole drilled through the ice. Zito, the man at the controls, was responsible for maneuvering, spinning, and otherwise navigating the RTV 100 for researchers. In addition to the underside of pressure ridges, Zito saw algae, shrimp, ice worms, and lots of jellyfish under water. Before the sighting, few researchers believed so many jellyfish survived under ice in winter.

Zito was personally introduced to one white fish. When the RTV 100 was ascending, a fish got trapped in a pool near the top. "Lew told me he was a worm and to reach in a pull him out," Zito said. "Then, chomp. Would you believe it bit me?"

The RTV 100 was helpful in Shapiro's work, but it is expected to be a boon to biologists who need to make repeated, routine observations of creatures living under ice. And it can be used in remote communities to look for people who have drowned or whales that are struck but get away. "It's cheaper and safer than hiring divers to go down under," Shapiro said.

A grant awarded to Shapiro from the West Coast National Undersea Research Center provided the funds needed to operate the vehicle under ice near Barrow. The RTV 100, manufactured by Mitsui in Japan, was donated to the Geophysical Institute three years ago by the Japan Marine Machinery Development Association. Since that time, Zito has modified the $35,000 vehicle several times to make it operate more easily in icy water.

BILL ZITO



Going Under—*David Doudna, technical director of the West Coast National Undersea Research Center, watches the RTV 100 descend into the Chukchi Sea to take videos of life thriving under ice platforms.*

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