Pipeline Bounty
Includes Long-term
Permafrost Research


photo courtesy Tom Osterkamp

Geophysical Institute Professor Emeritus Tom Osterkamp recently summarized a quarter century of permafrost research in Alaska and changes that occurred during that time.

In 1976, seeing opportunity in the construction of the trans-Alaska pipeline, Osterkamp began establishing a network of holes 100-200 feet deep in the soil along the trans-Alaska pipeline corridor from Prudhoe Bay southward. He realized that a road traversing Alaska from north to south (to enable building and maintaining the pipeline) allowed easy access to the different types of frozen ground in Alaska—the rock-hard soil hundreds of feet thick on the North Slope, the thinner but still plentiful frozen ground north of the Yukon River, the hit-and-miss permafrost south of the Yukon, and the southernmost reaches of frozen ground near Gulkana.

Osterkamp drilled most of the 16 boreholes along that route in 1983. To that network of permafrost observatories, he added others over the years, the farthest south in Bethel. The boreholes, and his dutiful years of driving across Alaska to see what they told him, have created a good snapshot of Alaska's permafrost over the last quarter century.

Top: Tom Osterkamp with his Labrador retriever, Happy, at a permafrost-monitoring site near Bonanza Creek west of Fairbanks in 1999. Bottom: Osterkamp's kids Jon (left) and Eric (right) help work on a permafrost bore-hole in 1980.

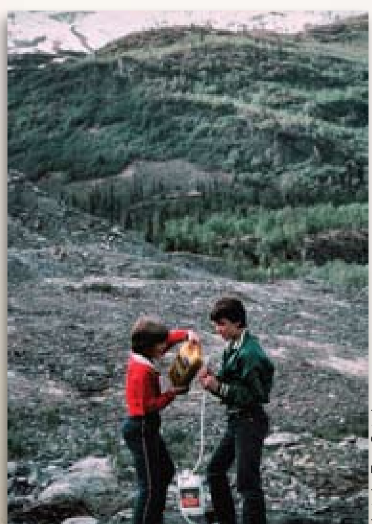


photo by Tom Osterkamp

Permafrost, ground frozen for at least two years, is a relic of a colder time that has endured in northern places such as Alaska because summer's warmth has yet to overtake winter's cold. As Alaska's air temperatures have warmed in the recent past, Osterkamp and his colleagues have noticed that the permafrost in Alaska has responded.

Alaska climatologists noticed a "regime shift" in 1976-77, after which the state warmed in most places. Since Osterkamp installed the observatories, permafrost temperatures warmed 3-4 degrees Celsius on the coastal plain of the North Slope, 1-2 degrees Celsius in the Brooks Range, and 0.3-1 degree Celsius south of the Yukon River in Interior Alaska, bringing much Interior permafrost to within one degree of thawing.

Though most permafrost in Alaska has warmed during the past quarter century, some areas of permafrost have bucked the trend, and Osterkamp is unsure why. Since he drilled boreholes at the Yukon River Bridge and Livengood in the 1980s, permafrost there has cooled. Until 1994, permafrost at an Eagle, Alaska, borehole remained stable.

Warm air is not the only thing that can thaw permafrost, Osterkamp said. In Healy, off the Stampede Trail, permafrost thawed even though air temperatures cooled.

"Warming of the permafrost at Healy in the late 1980s and 1990s was almost entirely due to snow cover effects there," Osterkamp said. "Snow influences also play a significant role in warming permafrost along the pipeline."

Osterkamp's results were published in both EOS and the Journal of Geophysical Research. Today, the boreholes are monitored by Geophysical Institute Professor Vladimir Romanovsky, who has expanded the program worldwide.

photo by Matt Druckenmiller

UAF UNIVERSITY OF ALASKA FAIRBANKS

Researcher Ponders if the Loss of Sea Ice Affects Tundra

photo by Ned Rozell

Eighty percent of arctic tundra plants grow within 60 kilometers of northern oceans. Several studies of satellite data in Alaska suggest that tundra is getting warmer and more biologically active because sea ice is lingering off northern coasts for shorter periods of time. Reduced sea ice cover during the spring and summer may lead to a longer growing season and greener tundra plants in arctic and subarctic climates.

As part of the interdisciplinary Greening of the Arctic project, Geophysical Institute Associate Professor Uma Bhatt is researching whether a greening Arctic is related to changes in sea-ice cover. She is applying climate analysis techniques to both satellite microwave images of sea-ice concentration and Advanced Very High Resolution Radiometer (AVHRR) satellite land-surface temperatures to search for relationships between coastal ice and arctic land along the coast.

Bhatt is finding that trends and variability of sea ice, land temperatures, and vegetation greenness are consistent. As sea ice decreases, land surface temperatures and vegetation greenness have increased. The signal is stronger in the Chukchi-Bering-Beaufort region than in the Kara-Laptev region.

"The trends are quite different across the Arctic," Bhatt said. "We think that this is related to the role of spatially varying seasonality in the marine environment (ice and ocean temperatures) impacting the land surface processes."

Bhatt is working on the project with University of Alaska Fairbanks Professor Skip Walker and Research Associate Martha Raynolds, and NASA Goddard Space Flight Center Senior Research Scientist Josefino Comiso.

photo by Ned Rozell

Tracking Whale Hunters to Learn about Sea Ice

Rather than sitting behind a computer crunching data, Geophysical Institute graduate student Matt Druckenmiller spends his spring days following the snowmachine tracks of whale hunters off the coast of Barrow, Alaska.

Druckenmiller, who is pursuing a PhD in geophysics, is analyzing landfast sea-ice cover in Barrow and Wales, Alaska. As part of his study, Druckenmiller is mapping whaling trails from the coast of Barrow to open leads in the ice. At the leads, hunting parties search for bowhead whales. Druckenmiller also is profiling the thickness of the ice beneath the trails using electromagnetic induction sounding. He wants to learn more about sea ice using high-tech tools, such as differential GPS for surface topography and satellite images, and the knowledge of locals who have used the ice all of their lives. His degree work is part geophysics and part anthropology. Some of his research funding comes from the Resilience and Adaptation Program at the University of Alaska Fairbanks.

Whalers in Barrow start packing down snowmachine trails over landfast sea ice in mid-March. A few dozen crews hunt for whales in April and May. Druckenmiller and Geophysical Institute Professor Hajo Eicken are looking for ways to make information on sea ice more useful for people like the whalers in Barrow, who use the ice as a pathway to the largest source of their subsistence food. Druckenmiller has found that producing maps of whaling-crew trails is opening doors to more shared knowledge about sea ice.

"We're attempting to bring knowledge of hunters to the analysis we do of ice conditions in any given year," he said. "If you hand a whaling captain a map of his trail location and the ice thickness beneath it, he's more liable to show interest and talk with you about ice than if you just showed up and gave him $50 for an interview.

photo by Hajo Eicken

Matt Druckenmiller hauls an electromagnetic induction ice-thickness sounder over a whaling trail near Barrow, followed by Blake Weissling and Michael Lewis of the University of Texas, who were testing similar instruments, and a bear guard.

"A captain might say, 'This is where, in January, ice came in and attached (to ice that was there earlier in the season).' Scientifically, it allows us to look at how ice thickness and stability vary from year to year."

Working with the Alaska Center for Climate Assessment & Policy (ACCAP), Druckenmiller is organizing a workshop in Barrow in November designed to train local leaders to interpret sea ice data resources and information derived from satellite, radar, and other observing platforms. He also hopes to get feedback on how to improve product relevance and add local knowledge to the data. Druckenmiller's ultimate goal is to provide sea-ice information in a format that people can use.

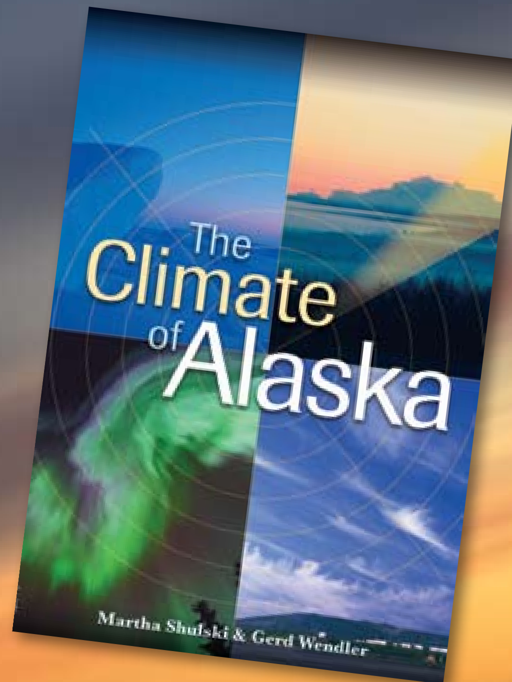
"We are trying to do science that is useful to both the communities (local people and planners), and those trying to understand the changes taking place," Druckenmiller said.

photo by Matt Druckenmiller

The Climate of Alaska Published

Ever wonder which Alaska town is the coldest (Barrow), the snowiest (Valdez), or the foggiest (Barrow, again)? Those facts and many more are in the pages of the recently published *The Climate of Alaska*, written by the Geophysical Institute's Martha Shulski and Gerd Wendler.

Shulski, a climatologist, is lead author of the book. She spent four years digging up historical records, gathering photos, and working with editors at the University of Alaska Press. She sifted through all the reliable weather records—most of which are younger than a century old in Alaska—and has written about trends and oddities, like the fact that the farthest north tornado swept through the village of Kiana in August 1976. Co-author Wendler is a professor emeritus of geophysics and directs the Alaska Climate Research Center. The book sells for $21.95 and is available locally in Fairbanks and at major booksellers online.



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