



The Arctic Water Web

Research of Dan White and Colleagues

It's easy to take water for granted, especially if you live in an industrialized area where the water is piped right to your home. But for residents living in rural regions in the circumpolar North, such as on the Seward Peninsula of Alaska, freshwater is a precious commodity that must be diverted from streams, collected from pond thaws or shallow wells, and melted from snow and ice. Bound up in a dynamic ecological web, these water sources are affected by climate, used by a multitude of animals, and altered by human use. Intent on characterizing the many skeins in the water web and how they connect to one another, Dan White, a civil engineer at the University of Alaska, Fairbanks, is collaborating with Peter Schweitzer, a cultural anthropologist; Lilian Alessa, a biologist; and Larry Hinzman, a hydrologist.

Their collective effort will help define the relationship between climate changes in the Arctic, freshwater availability, and the impact on humans.



Above: a 5 million gallon drinking water storage tank being constructed in Nuiqsut, a village of 420 persons that must treat, store and heat 7 million gallons of drinking water for the 9 months that their water source is frozen. For comparison, the Fairbanks utility serves approximately 40,000 people and stores only 4 million gallons of treated water.

There is no doubt that the freshwater web in the Arctic is changing. For example, tundra ponds that sit atop permafrost near Council, Alaska, are slowly shrinking in size. The once-impermeable permafrost is slowly thawing, thereby allowing the water on the surface to trickle down into the underlying soil. Although nearby residents may not obtain their water from these ponds, they do subsist on the caribou and other animals that frequent the ponds. Away go the ponds, and the animal may go, too.

Very little data has been collected to date assessing the physical forces that drive such changes in water resources and how the changes will likely affect the communities that depend on them. But understanding the interplay between the various factors may help promote the long-term survival and sustainability of the communities and the water resources on which they depend. As White says, "You can't uncouple social science and physical science when talking about water."

For that reason, one of the primary research objectives of White's group is to identify the critical water use areas, or hotspots, across the Seward Peninsula based on "layers" of usage, which will then be integrated into a GIS framework. Schweitzer will identify water resources of cultural importance through interviews conducted with local residents, and the cultural needs for water will comprise one layer of water usage. White will determine water usage by animals and humans, for both domestic and industrial uses, which will comprise additional layers. By compiling these layers into a framework, the researchers can see just how valuable certain water sources are. The more layers a particular source has, the more it qualifies as a hotspot.

In addition to these data, Hinzman's group will collect hydrological data and model water resource changes in a changing climate. Data from meteorological towers already established across the peninsula will help track changes in the water balance by detailing factors such as snow accumulation, snow melt, and redistribution of the snow by wind.

Monitoring will also be carried out to determine the availability of freshwater now and in the future.

Combining the hotspot information and the hydrological data, Alessa will create a model that maps the biophysical and social water web on the Seward Peninsula. This model will be able to predict future water use by humans, changes in water availability, and the interplay between these two forces. The researchers will continuously communicate this information back to Seward residents so that everyone can benefit to the maximum extent possible. In addition to these outreach efforts, several high school students participating in the National Science Foundation's Technology Applications and Learning toward Professional Achievement Program will be taking part in data collection and analysis.

--Kara Nyberg, PhD



Above: aerial view of Shishmaref. The large tank is a 1 million gallon treated water storage tank. Shishmaref is on an island and must harvest all its freshwater from snow. Once the snow melts during summer months the water is treated and stored for consumption. Unfortunately not enough water can be treated and stored in the summer, and the community normally runs out by April or May and then must haul and melt ice for drinking water until the snow capture has melted.

Many thanks to Dan White and Larry Hinzman for providing information and photos. For more information about this research, check out the following: <http://www.uaf.edu/water/projects/ICWHA/ICWHA.htm>

UPCOMING
GREENLAND EVENTS

ANG Flight Period
13 - 19 June
CMI & Clauer teams in

ANG Flight Period
21 - 26 June

NGRIP Opens
22 June

Greenland

Who's in the field?

Kangerlussuaq & Remote Field

The Air Greenland Twin Otter began flying for Ken Jezek on Thursday for the PI's NASA grant. The team is using gravity and GPS measurements at 10 locations on the southcentral Greenland ice sheet to "weigh" the ice sheet and determine its mass change since 1995. Good weather allowed the team to finish ice cap work early and travel to Ilulissat for gravity measurements.



The Jezek team departs for the ice cap.

Summit

Liz Morris and Geoff Somers of the British Antarctic Survey (BAS), AKA the Cryosat 1 team, arrived at Summit on Wednesday (10 days early!) after a 6-week traverse. Their early arrival has turned into a unique opportunity for an international collaboration with Bob Hawley's Borehole Optical Stratigraphy (BOS) project. BOS is a method still in development and can benefit greatly from side-by-side measurements of density using the BAS Neutron Scattering technique. These side-by-side measurements will provide valuable "ground truthing" information to test the hypothesis that BOS is detecting subtle changes in density as well as grain size. Conversely, BOS data will help to validate the technique of identifying annual layers in the Neutron Scattering profile in the firn. For more info on Cryosat visit: <http://www.esa.int/export/esaLP/cryosat.html>.

The Station was relatively quiet this week with no ANG flights. Brad Johnson continued excavating camp, pushing huge amounts of snow. New staff members are beginning to take over some of the camp operations. Saskia Bourgeois from ETHZ gave informational tours of the team's research site to both camp staff and researchers. ETHZ's fieldwork focuses on boundary layer, heat balance of the snow cover, and snow radiation/temperature studies. For more info, see <http://www.rereth.ethz.ch/umnw/atmosphphys/ohmura/pj.06.html>.

Summit had a medical call out response this week, a head injury and puncture wound scenario. All went well, good response time and thorough medical procedure was followed.



Summit medical scenario.



Robin Abbott, Greenland Logistics Manager, on HF radio comms with Summit.

Raven

It was a quiet week at Raven as well. Twice a flock of 60+Geese (Canadian or Snow) flew over camp about 30 feet off the snow surface! An Arctic Tern, a few Snow Buntings, a Wheat Ear, a handful of Red Poll, and a gull-type of bird were also spotted.

Weather

Mild & fair weather predominated in Kangerlussuaq. The temperature ranged around 15C, with some considerably windy days that kicked a lot of dust and glacial silt into the air.

Warm and pleasant weather at Summit with clear skies most of the week. Average morning temperatures were -15C, winds never exceeding 10 knots. Afternoon temperatures reached up to -10C. There was a light ice fog a few mornings, which burned off by mid-day. No mosquitoes.

A weather system settled in over Camp Raven holding pressure above 3000IN Hg for 6 days. It seems unusual for this site to have a stable weather pattern for such a long stretch of time. Skies remain clear with occasional mare's tails (cirrus) stretching north to south. It is no longer getting dark here, with just a few hours of twilight between midnight and 2 am.

UPCOMING
ALASKA EVENTS

Learn to Return Course
Toolik Field Station, AK
21 - 25 June

Alaska

Who's in the field?

Kenji Yoshikawa flew out of Barter Island to the Hula Hula and Kongakut River drainages this week to review aufeis (ice formed during the winter from groundwater springs).

Matt Nolan finished his work on the McCall and Okpilik Glaciers, as did a six-person team from the National Institute of Polar Research, Tokyo.

http://www.uaf.edu/water/faculty/nolan/glaciers/drmatt_mccall.htm



Jim McNamara & John Bradford
conduct boat-based sampling near
Toolik

Yoshikawa and Nolan are just two of the collaborators on the ARCSS – CHAMP Fresh Water Initiative project *Detection and attribution of changes in the hydrologic regimes of the MacKenzie, the Kuparuk, and the Len River Basins*. A 2.7MB power point presentation given at the Freshwater Initiative All Hands Meeting this May is available at:

http://arcticchamp.sr.unh.edu/FWI/AllHands_WoodsHole/ProjectPresentations/Hinzman_FWI_WoodsHole.ppt

Jim McNamara and collaborators finished their initial Toolik Field Station-based helicopter work on climate change impacts on geomorphology, hyporheic zone hydrology, and biogeochemical cycling. The group will continue their fieldwork throughout the summer. For more information go to: http://cc.usu.edu/~gooseff/arctic_proj.html.

Toolik Construction

- ✓ The Booney Barn was installed at Imnaviat Creek
- ✓ The Community Center is 98% complete, needing only touch up paint and countertops.
- ✓ The team began construction of new Tire Shack.
- ✓ Richard Perales finished insulating Lab 4 gray water pipe. All labs are now insulated.
- ✓ The team began construction of an outdoor wood storage rack.



Ken Hill & Jay Zarnestke from McNamara's group sample near Toolik while the helo stands by

Looking Ahead

- ✓ Darrell Kaufman, Feng Sheng Hu, and collaborators arrive in Anchorage Tuesday to begin work in the Dillingham area for their southern-Alaska study of Holocene climate variability.
- ✓ TREC – both Laurie Carr and Scott McComb travel to Toolik Field Station. For more information on the TREC project and to read about the teachers in Alaska go to: <http://www.arcus.org/TREC/index.html>
- ✓ Yo Chin and group will begin their Toolik work studying the effect of pollutants on Arctic freshwater systems.
- ✓ Larry Hinzman and a team of researchers travel to Nome, to conduct met tower maintenance as well as to continue fieldwork on the project featured on our cover page.

VPR welcomes Tracy Sheeley...

Tracy Sheeley began working in the Fairbanks office this week as the new Toolik Helicopter Coordinator. During the winter she works in Antarctica as the communications supervisor at the South Pole Station. Tracy has six years Polar Programs experience, and when she is not traveling or working at the South Pole, she makes her home in Talkeetna, Alaska.

