Overview

About half of the Arctic Coastal Plain (ACP) of Alaska is thermokarst lakes and drained lakes over permafrost (Figure 1). In 2012, over 50 lakes in northern Alaska were instrumented for CALON, a project designed to monitor physical and biogeochemical processes in Arctic permafrost lakes.

Ten observation holes along two 200 km transects from the Arctic Ocean to the Brooks Range foothills. At each site, two representative lakes of differing area and depth were instrumented to collect field measurements on lake physiochemistry, lake surface and terrestrial-climatological, and lake bed and permafrost temperature.

Almost every day and temperature sensors are deployed through the ice, and water samples are collected.

Data are downloaded from lakes and met stations in August, according to a timeline of events including ice decay, summer energy and water balance, freeze-up and ice growth.

Discrete samples and measurements of geochemical and biogeochemical parameters in April and August.

Project includes an indigenous knowledge component, with interviews of elders, hunters, and fishermen from four Arctic villages.

Want to learn more about CALON at AGU?

835G-05, Townsend-Small et al., Sources and fluxes of atmospheric methane from lakes in the Alaskan Arctic.
Wednesday, 2:40 PM,Moscow West 2003

B23H.02, Lenters et al., Physical drivers of lake evaporation across a gradient of climate and lake types. Tuesday, 1:05 PM, Moscow West 2003

Figure 5. Maps of thermokarst lakes from satellite remote sensing data. In the past 3 decades, thermokarst lakes in Arctic Alaska increased in number and areal extent, in contrast to the shrinking and disappearing trend in discontinuous permafrost zones.

Figure 6. Energy balance in Emaissauk Lake during 2014. Unlike the previous two years, summer 2014 is much less episodic, showing consistent turbulent heat fluxes during the first 2/3 of the summer. Combined with cooler air temperatures (3°C to 4°C in the previous two years, this lead to much cooler mean water temperatures than the previous two years. The overall rate of cooling, however, is comparable to 2012, while the Bowen ratio is identical to 2013 (0.57).

There were 346 guesses logged during the 2014 Toolik Lake Ice Classic, a fun and educational pheno-biological competition sponsored by the Circum-Arctic Lakes Observation Network (CALON) project and Toolik Field Station.

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Figure 7. Above, photos from the Toolik webcam. Left, guesses logged for the 2014 Toolik Lake Ice Classic. The day with the highest number of guesses logged was June 15. The average ice-off date for Toolik since the year 2000 is June 19. In 2014, Toolik became 100% ice free on June 23. Eleven competitions selected this ice-off date.

One goal of the CALON project is to explore the interaction of native knowledge and landscape-process research in Arctic Alaska. We do this by interviewing the people of the villages on the North Slope, and so far on this project we’ve talked to Elders and hunters from Barrow and Anaktuvuk. This past May, Team E went much farther afield to a village we’ve never been to before: Anaktuvuk Pass (place of the caribou dropoffs).

This village holds a special significance: it is where the last of the Nunamuit people—the People of the Land—reside. The Inupiaq are basically driven into the inland people, who hunt the caribou, and the sea people, who mainly hunt whales and seals. Western during the late 1800s and early 1900s, many Nunamuit people had to leave their inland hunting grounds due to disease, famine, and the dwindling of the caribou herds. Today, most of them have intermarried and live in other areas, but in 1949 some families returned inland and founded Anaktuvuk Pass. Today, it is the only Nunamuit settlement remaining, with a population of 300 people.

We interviewed 10 Elders who gave us a very different perspective on landscape change from the coastal Inupiaq. Many of them are active hunters who travel by foot in the mountains and Arctic Slope region, and they have covered a wider, more varied terrain and studied it in detail. They identified new gorgos and pond contraction cracking north of AVP, and they noted changes in vegetation and animal migration that may be due to anthropogenic disturbance. One of their most interesting observations was that the upland lakes and ponds near AVP have been drying up.

Figure 8. Most of the CALON lakes are shallow and well-mixed, but too-006 is deep enough that stratification develops in summer. This lake has the highest summer CH4 concentrations observed in the CALON lakes.

Conclusions and Future Work

We have one more field season – spring/summer 2015

Assessing physical and biogeochemical feedbacks to climate warming requires long-term monitoring in the Arctic. We hope that future iterations of CALON will include the entire Pan-Arctic. Please contact us if you would like to be involved!