

Project Title: Collaborative Research: Changes in Lake Dynamics on the Arctic Coastal Plain of North America Over the Past Half-Century

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Note: This is a collaborative project with John Lenters at University of Nebraska-Lincoln (ARC-0713822) and Yongwei Sheng at UCLA (ARC-0013903).

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Classification: Hydrology

Dataset Title: Water temperature and bathymetric depth soundings for lakes on the North Slope of Alaska

Abstract: A regional assessment of thermokarst lakes across the Arctic Coastal Plain of Alaska was conducted using satellite images to detect changes in lake coverage and morphometry during the satellite era. This effort was supplemented by the use of digital aerial photographs to extend our analysis back to ~1950, and to assess temporal patterns of change. The analyses were augmented by summer field studies focused on lake evaporation, seasonal and interannual changes in fundamental lake characteristics, and collection of lake water temperature and bathymetry in three study areas. The measurement program is designed to map patterns of shoreline changes, monitor interannual variations in lake levels, and estimate energy and moisture exchange between lakes and the atmosphere. In summer 2008, lakes near Barrow were studied and instrumented. In 2009, we focused on lakes further inland near Atqasuk. In 2010, lakes near the Arctic Coastal Plain-Arctic Foothills were studied.

Metadata files: This data set contains lake water temperature and lake bathymetric soundings from thermokarst lakes on the North Slope of Alaska, collected during summer over a 3-year time period. Along with this *ReadMe* file, in this directory is a master list of all lake locations called *Lake Locations.xls*. It contains only the Latitude and Longitude for all lakes for which there is temperature and/or bathymetric data.

Lake Water Temperature Directory:

There are three files with a similar name and format: e.g., *Hinkel_2008_LakeWaterTemperature.xls*. Water temperature measurements were collected from lakes in 2008, 2009 and 2010. In each file, the first page lists the lake name, location (LatDD, Long DD), and notes about instrument deployment. Each subsequent work page contains the temperature time series for the period of record for a particular lake. In 2008, lakes were monitored in June and July in five (5) lakes near Barrow, Alaska. By convention, these lakes names begin with 100. In 2009, lakes were monitored near Atqasuk and are numbered beginning with 200, while in 2010 lakes were monitored about 65 km SSE of Atqasuk near Reindeer Camp and are assigned a number beginning with 300. Each summer, hourly measurements were collected using Onset Water Temperature Pro v2 data loggers (U22-001, accuracy 0.2 C over range 0-50 C, resolution 0.02 C at 25 C). Loggers were attached to a cable/rope which had an anchor (sandbag) and float. A total of 2-4 loggers were attached to each cable, with the number of sensors increasing with water depth. One logger was always near the float and one near the sandbag to obtain the upper and lower measurements in the water column. In some lakes, replicate measurements were obtained with one thermistor string on the north (N) end of the lake, and one on the south (S) end. Rafting lake ice broke some of the cables after several weeks.

As mentioned, the Excel file contains several sheets. The first sheet provides Metadata on the lake name, the latitude and longitude (decimal degrees, WGS 1984 datum) of each thermistor string (north or south), the logger number, and notes on retrieval. Column headings include Met Data Page: Lake_Site, LatDD, LogDD, 2008_Name, LocalName, Logger#, Retrieval in August. Subsequent pages contain the hourly temperature measurements for each lake. Time is along the rows. Columns have the date, time (Alaska Daylight Time, GMT-9:00), logger number and depth below surface (cm) with temperature measurements in (C). Temperature measurements for multiple loggers are listed. Some loggers were lost or destroyed.

Lake Bathymetric Soundings Directory:

These files contain bathymetric depth readings from many of the lakes described above. Each lake has its own subdirectory. Within will be an Excel file that contains the processed depth soundings and is named, for example, *L305.xls*. The data have also been converted to a shapefile with the same name. For those lakes with adequate coverage, these data have been interpolated to a raster that representing a continuous surface of lake water depth. The name of this DEM is typically *nn5m_E*. This means that a natural neighbor algorithm was employed, and the data were interpolated onto a 5 m grid. The “E” means that the output DEM, which usually extends beyond the lake shoreline, was subjected to a mask of the lake shoreline and a new DEM was Extracted; it shows only water depth within the lake basin.

Deployed on a Zodiac inflatable boat with an outboard motor, a Lowrance/Eagle SeaCharter502cDF iGPS Sonar Unit obtained high frequency water depth soundings in June or August. The output was processed through vendor provided software called SonarViewer version 1.2.2. The three file columns are longitude, latitude and water depth (and in some cases surface temperature in C). Latitude and longitude are reported in decimal degrees using the WGS 1984 datum. Depth is in meters. Individual trip segments were integrated into one large file, and data points along the shoreline were digitized to allow for extrapolation into shallow water. The resulting data were converted to a point shapefile for mapping in ArcMap 9.3.

References:

Hinkel, K.M., Lenters, J.D., Sheng, Y., Lyons, E.A., Beck, R.A., Eisner, W.R., Maurer, E.F. and Potter, B.L. (in review). *Bathymetry and summer water temperature of thermokarst lakes on the arctic coastal plain of Alaska*. **Journal of Geophysical Research-Earth Surface**.