Interpolation and visualization of CTD data near a nival tributary at Lake Tuborg, Ellesmere Island

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INTRODUCTION: *Lake Tuborg is a large, primarily glacially fed meromictic lake on Ellesmere Island.*

This poster shows a newly developed technique of interpolating and analyzing CTD data using an open source program called OpenDX.

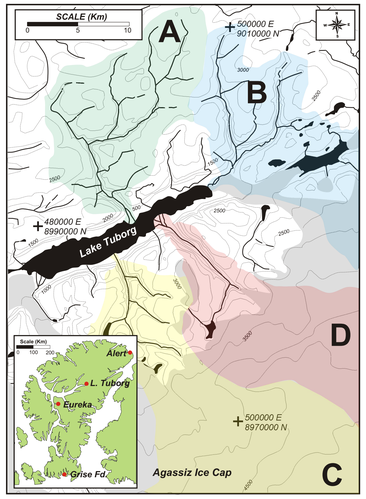


FIGURE 1: *The major watersheds of Lake Tuborg (~81°N 75°W). The southwest basin is meromictic (about 155 m deep); the northeast basin is entirely freshwater (about 80 m deep). Watershed A is nivally fed, B is mostly nivally fed, C and D are mostly glacially fed. Inset shows location of Lake Tuborg on Ellesmere Island.*

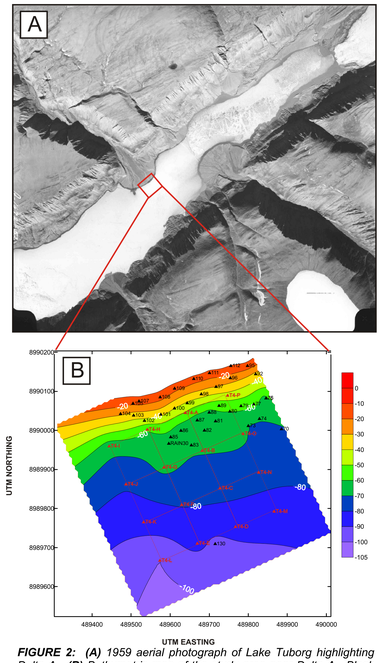


FIGURE 2: ***(A)*** *1959 aerial photograph of Lake Tuborg highlighting Delta A.* ***(B)*** *Bathymetric map of the study area near Delta A. Black symbols are points where bathymetry was measured. Red symbols are CTD cast sites. The red grid illustrates the sampling area. White labels are depth (m) below lake level.*

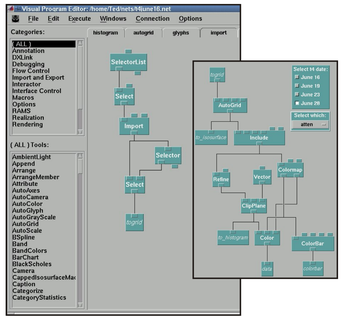


Figure 3: *Part of the OpenDX "net" used to produce the images in figures 5 and 6. Information passes into and out of* ***modules*** *designed for specific tasks such as gridding ("****autogrid****") and selecting variables ("****select****"). "****Invalid positions****" and a "****clip plane****" were inserted to force the interpolated CTD data to stop where it intersects bathymetry.*

Figure 4: *The CTD used for this project is a SeaCat SBE19. Data were collected at 0.5 s intervals in upcasts and downcasts, then binned at 0.5 m intervals. Binned data were thoroughly quality controlled by checking for bottom hits and evidence of thermal inertia. Depths shallower than 5 m were removed because of light contamination and supercooling by lake ice. Upcasts were most commonly used.*

Table 1: CTD AND TRANSMISSOMETER SPECIFICATIONS

	Temperature	Conductivity	Pressure	Transmissivity
Range	-5 to +35 °C	0-7 S/m	50 to 10,000 psia	0-5 V (~0.004-20 mg/L)
Accuracy	0.01 °C /6 months	0.001 S/m/month	0.5% of full scale	?
Resolution	0.001 °C	0.0001 S/m	0.03% of full scale	0.001 V

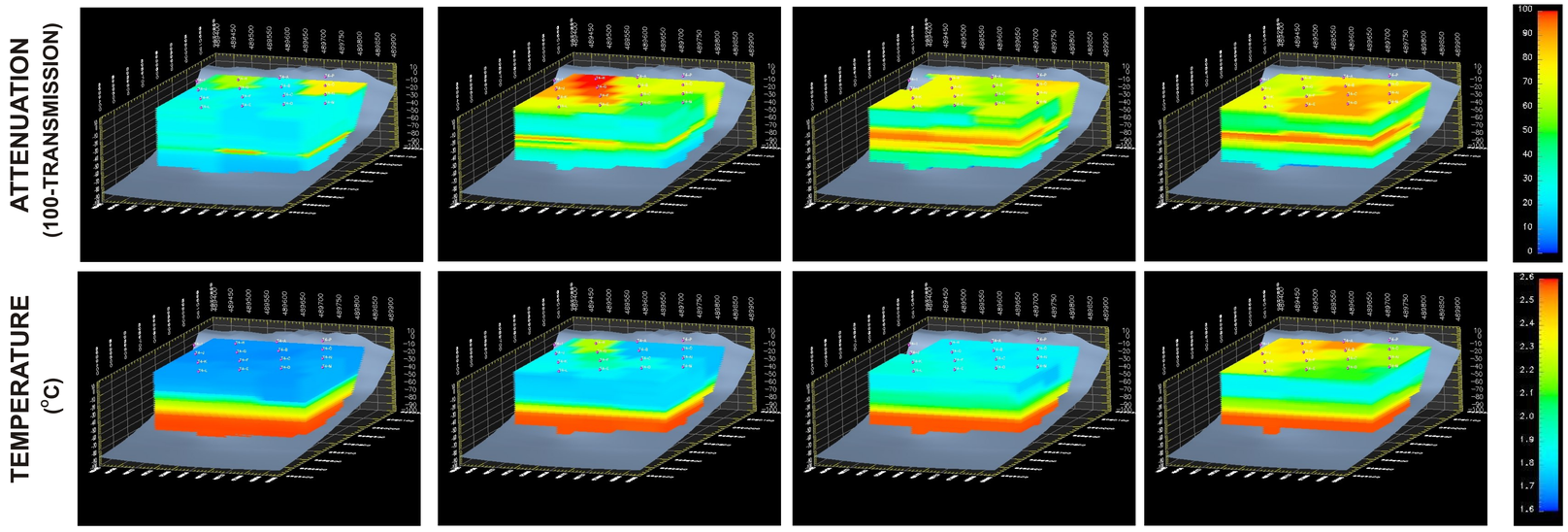


Figure 5: *OpenDX visualizations of water temperature and transmissivity near Delta A during peak nival melt in 2001. Two increases in attenuation on June 16 correspond to the position of two tributary arms. Note the attenuation increase near the chemocline (~55-65 m). The cause is uncertain, but could be algal mats, suspended sediment of insufficient density to pass into the monimolimnion, or precipitation from the dissolved load. By June 19, the tributary has avulsed, and only one major channel existed, producing a turbid overflow plume. The entire water column had become turbid by June 23-28, and the attenuation increase near the chemocline had become thicker. Below the chemocline, water temperature was near 2.5 °C throughout the study period. Note the warm water temperatures associated with the overflow plume on June 19 and 28.*

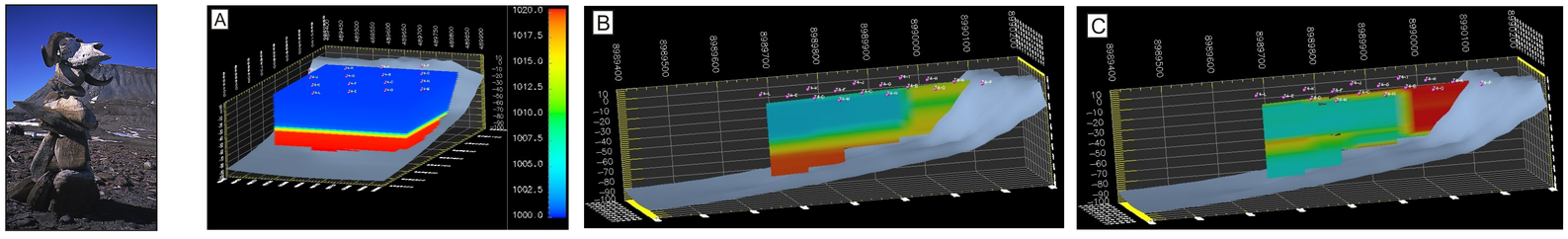


Figure 6: ***(A)*** *Conductivity (us/cm) on June 19. Note the strong salinity stratification and thin chemocline.* ***(B)*** *2-D slab of water temperature on June 16.* ***(C)*** *Attenuation on June 16. B and C use the same colorbars as Figure 5.*

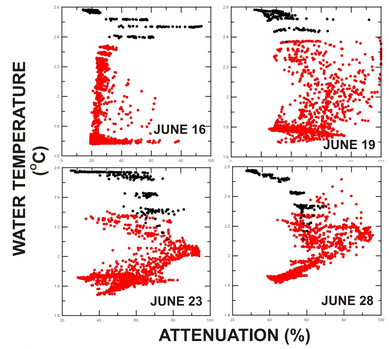


Figure 7: *Concurrently recorded variables plotted together. Black symbols are measurements below the chemocline. Red symbols are measurements above the chemocline*

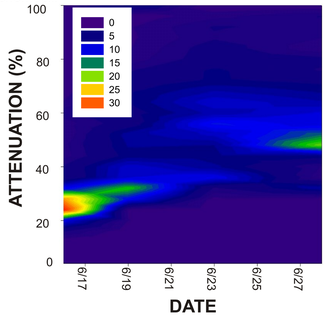
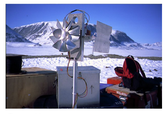


Figure 8: *Surface plot of attenuation histograms through time. Colors represent the number of measurements within each "bin".*



FUTURE WORK

Sediment traps and a flow meter were deployed during the same period that CTD grids were performed. Analyses of these data are currently underway, and will be presented shortly.

Fieldwork in 2002 will focus on obtaining more CTD grids near Deltas A and D. Water samples will be obtained concurrently with CTD casts in an attempt to calibrate the transmissometer to suspended sediment concentration. Determination of grain size will be carried out with a Coulter particle size analyzer and image analysis techniques.

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