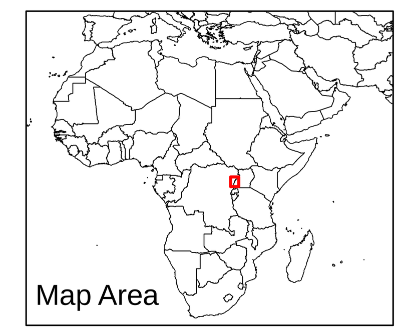
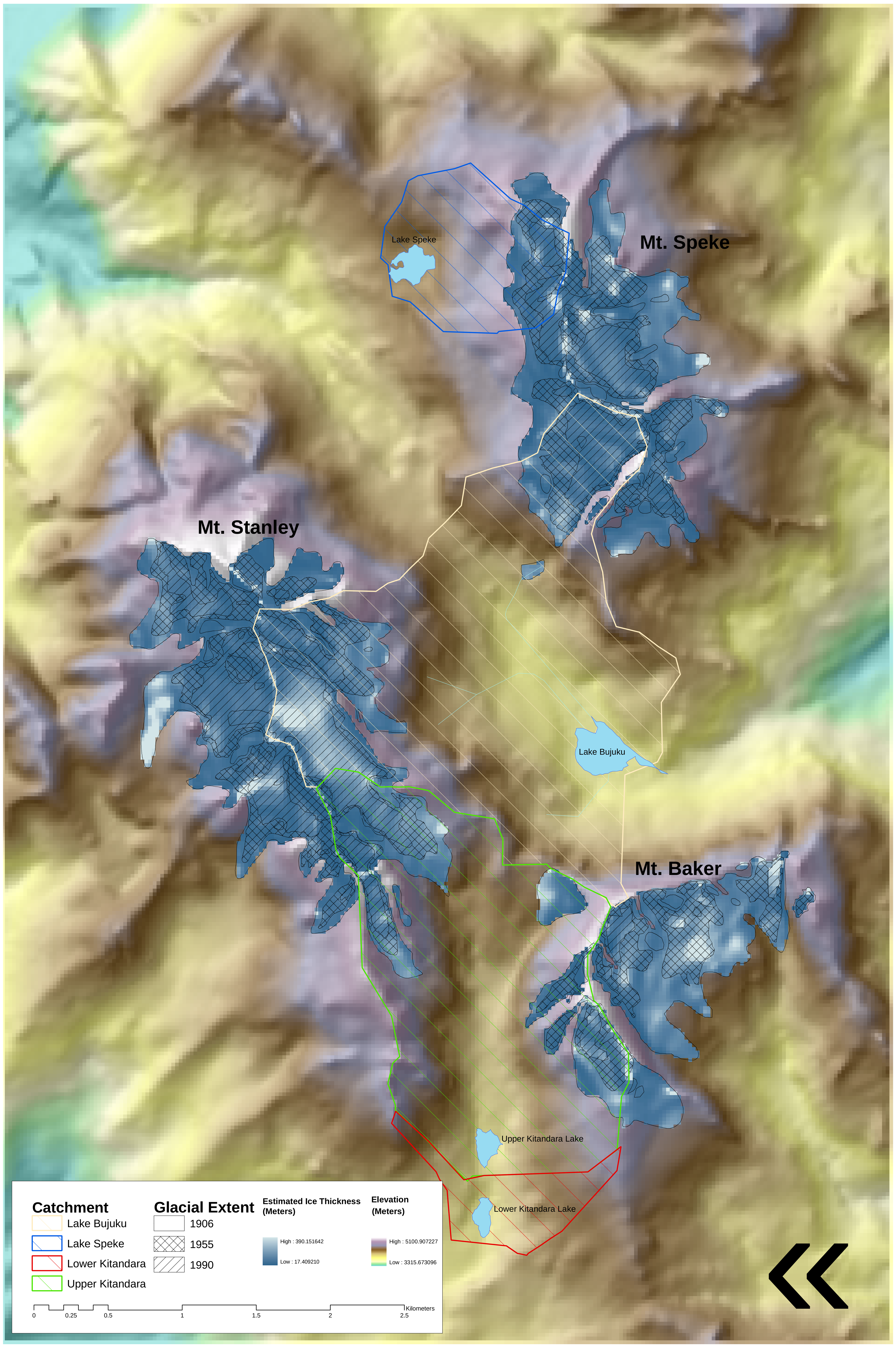


Estimating how glacial melt impacts lakes in the Rwenzori Mountains of Uganda

Ben Hudson- GE 132

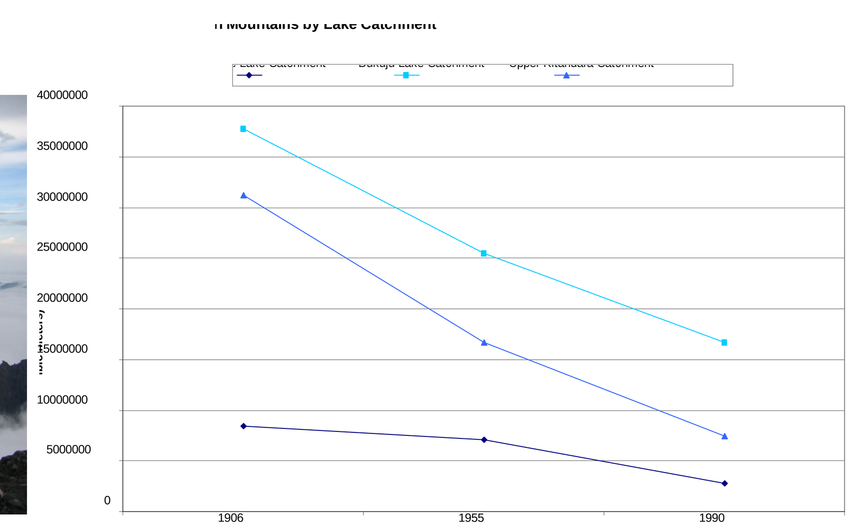


ABSTRACT

Glaciers in the Rwenzori Mountains of Uganda have received relatively little study and are predicted to disappear within 20 years. Inconsistent monitoring of glaciers provides difficulties in estimating glacial volume and runoff, however within these constraints this map estimates glacial volume and runoff's impact on the water budget of the lakes. It was found that glacial melt does not play a major role in monthly and yearly runoff.

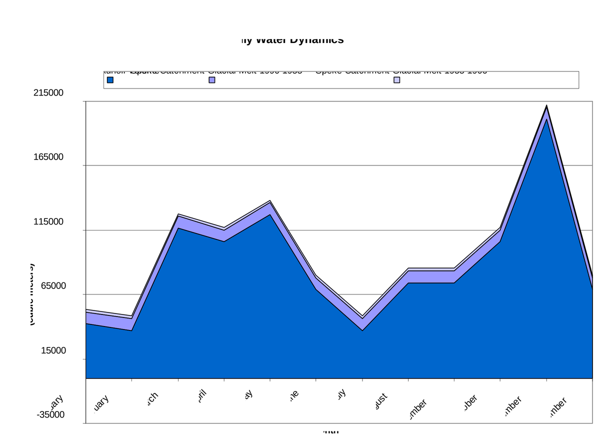
-Glaciers in Africa are disappearing at an alarming rate
-These glaciers are not well understood- especially their contribution to the overall hydrology of the watersheds they inhabit
-Understanding glacial dynamics is important to help prepare

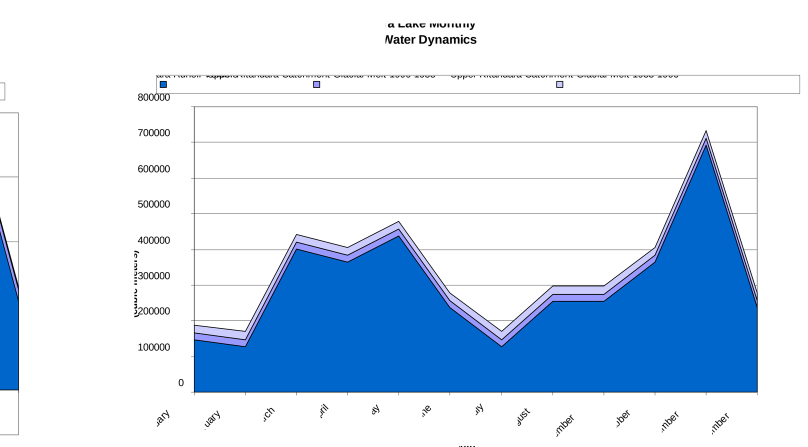
Mt. Speke from Mt. Stanley (Rwenzori.com)

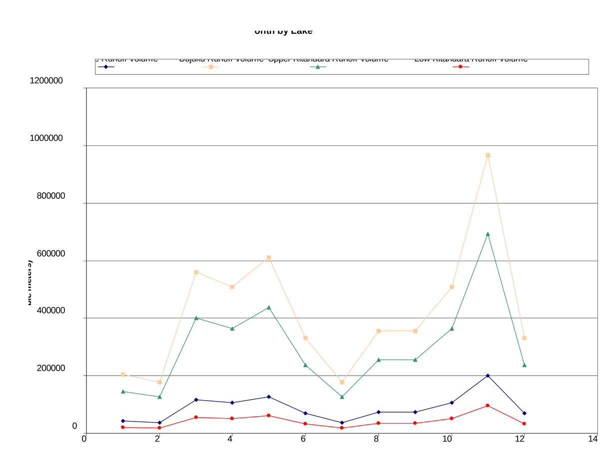


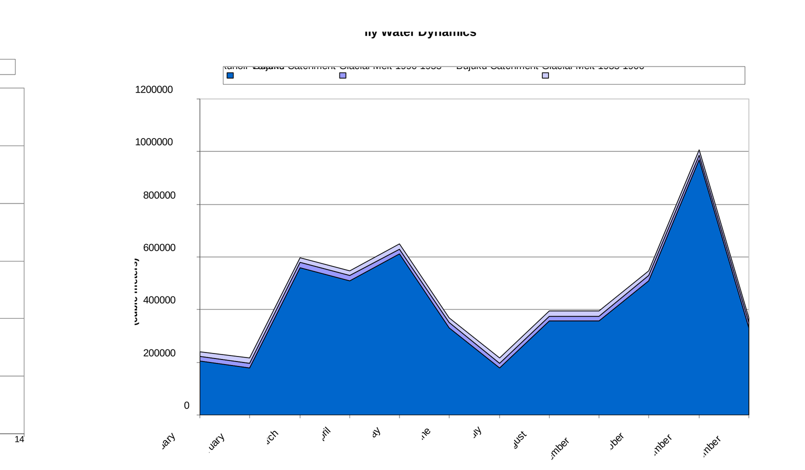
QUESTIONS

- Are glaciers an important source of water for the lakes?
- Where should paleo-climatologists take lake sediment cores to get a good glacial signal?









BACKGROUND

Despite being the third highest glacierized mountains in Africa (Kaser and Osmaston, 2002) and reaching over 5000 meters at their highest point the Rwenzori Mountains are one of the last refuges of glaciers on the continent. Located near the equator, (0º 10" to 0º 30" N, 29º 50" to 30º 00" E) the horizontal extent of glaciers in the Rwenzori Mountains has decreased from 2.01 ± 0.56 km2 in 1987 to 0.96 ± 0.34 km2 in 2003. (Taylor et al. 2006)

CONCLUSIONS

The lakes studied in the Rwenzori Mountains are largely dominated by precipitation, not glacial melt. For communities that depend on the waters that flow out of the Rwenzori Mountains this is largely good news- the glacial reservoirs that are predicted to disappear within 20 years (Taylor 2006) in fact are not large sources of runoff for the lakes. For paleoclimatologists looking for lakes with strong glacial signals the search continues.

ESTIMATING ICE THICKNESS

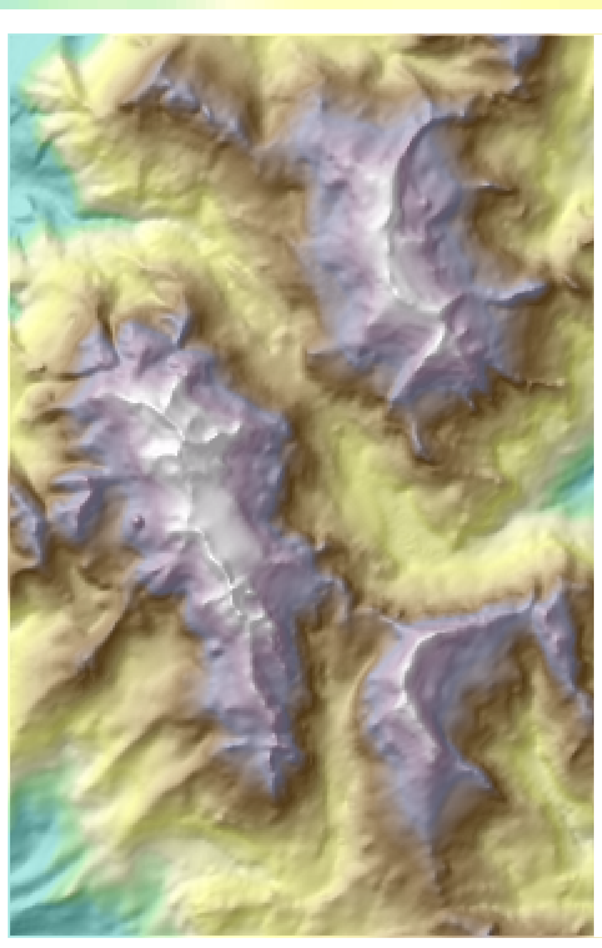
The 2-D extent of the glaciers in 1906, 1955, and 1990 was determined previously (Moelg 2003)

A formula that links ice thickness to the slope of the glacial surface was used (Kaser & Osmaston 2002).

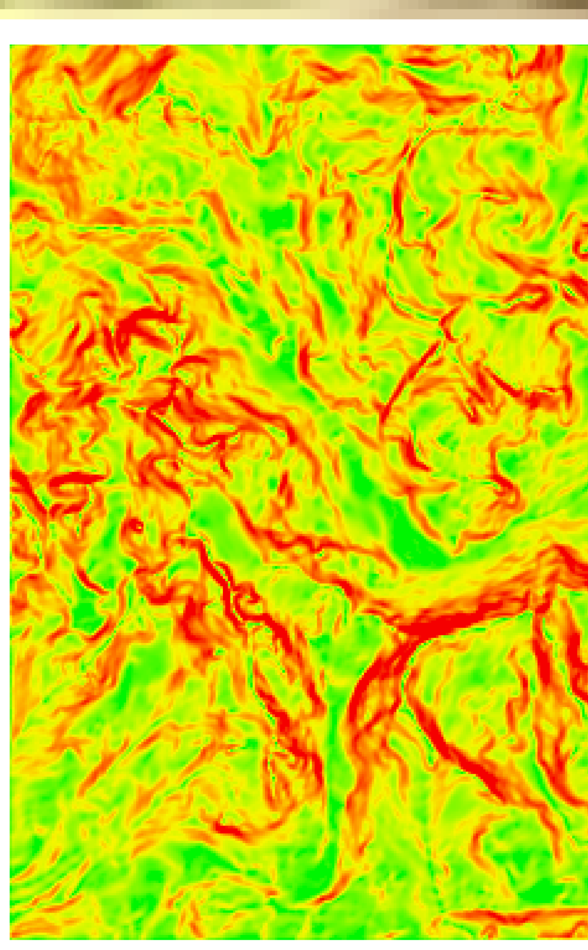
H = t / [? *g *f *sin (a/ 57.296)]

Where H is the thickness of ice, t is the basal shear stress on the glacier bed, ? is the density of ice, g is acceleration due to gravity, f is a form factor related to the hydraulic radius, and a is the angle of inclination of glacial surface in radians. Alpha is divided by a factor converting radians (default in ArcMap) to degrees. Below variables were held constant:

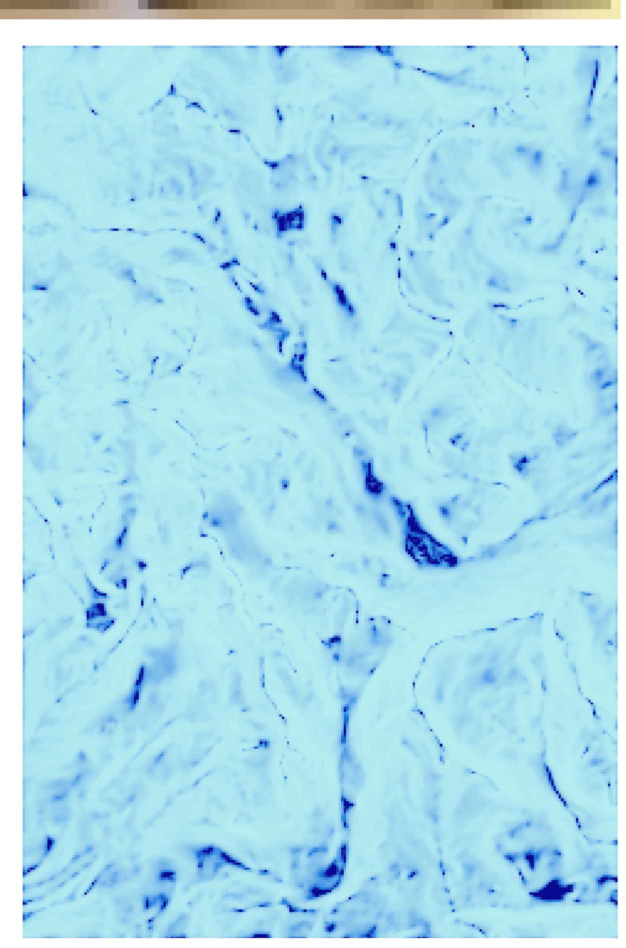
t = 97000 Pa   g = 9.8 m s-2
? = 910 kg m-3   f = .69



Step 1: The digital elevation model (with hillshade for emphasis)



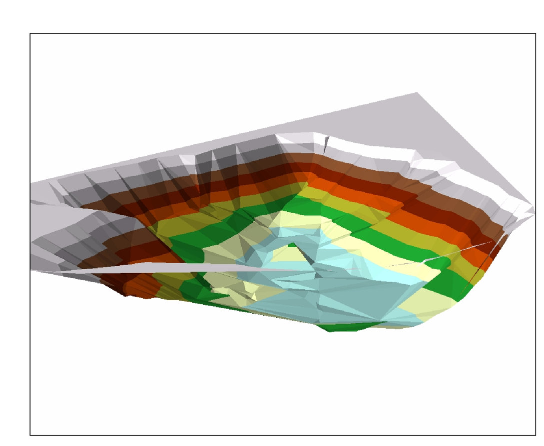
Step 2: Using raster calculator to create a raster of slope (above) from the DEM



Step Three: Use the slope raster as a in formula at left to calculate ice thickness

METHODS: LAKES

Using GPS points linked to depth measurements TINs were created to estimate the volume of each lake. A image of the TIN of Lake Bujuku is at right.



METHODS: HYDROLOGY

Catchment areas were calculated using the Hydrology Toolbox. Monthly runoff was calculated where Monthly runoff = monthly precipitation values * the area of the catchment * the empirically determined runoff coefficient

	Lake Volume (m3)	residence time (years)
Lake Speke	305684.51	0.261431126
Lake Bujuku	709013.83	0.133250045
Upper Kitandara	225363.53	0.058084162
Lower Kitandara	137526.49	0.031378661

Lake Bujuku in photo at right and image of TIN above right. Calculations of Lake volume and residence time of water are in the table at left. Residence time assumes lake is at steady state.

THANKS

-Lynn Carlson, Gillian Galford, and Wilfrid Rodriguez for all the GIS help
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