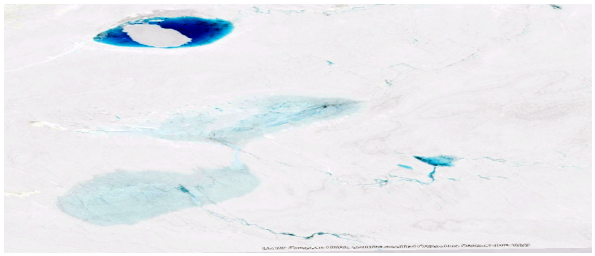
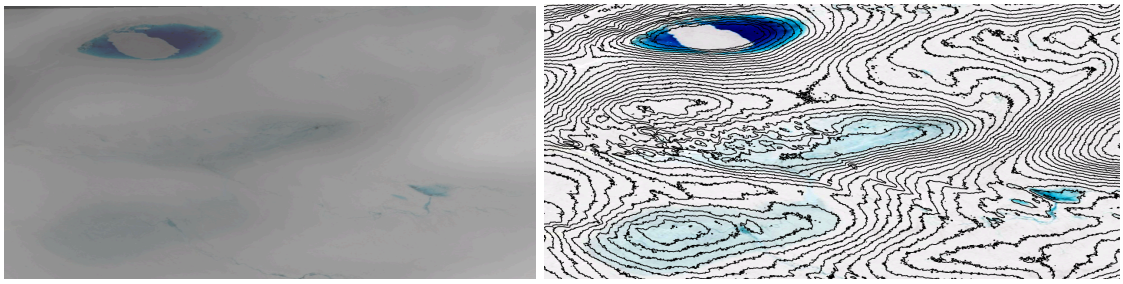
I investigated the behavior of two lakes and their respective volumes by analyzing two DEMs: one from May 1, 2022 and August 28, 2022. For simplicity, I will refer to them as North and South Lake.



Sentinel imagery from July 2022 georeferenced in ArcGIS interface

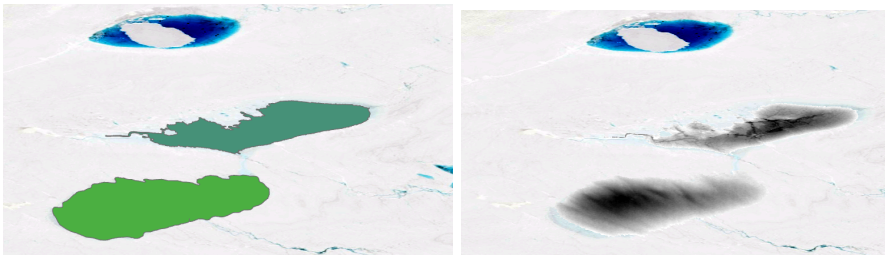
ArcticDEM provides DEM strips timestamped with dates starting from 2011 within the specific region under consideration. I utilized ArcGIS's Contour tool in order to transform the elevation models into contour lines to see if the outlines of the lake were visible.



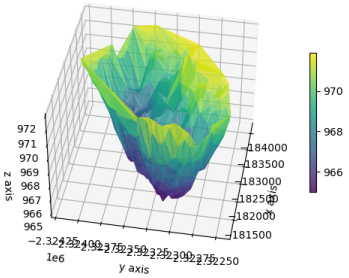
May 1, 2022 DEM + Contour

The contours in conjunction with the satellite imagery helped to determine approximately which contour best outlined the lakes. Relying on the imagery itself was susceptible to human errors as it was manually georeferenced onto the coordinate plane; in other words, the imagery may be a few pixels off or the resolution may not match with the actual positioning of ArcGIS's coordinate plane. My method involved extracting the specific contour line that I thought would best outline the position of the lakes, and then manually made a few touches so that it would best match the imagery.

Using ArcGIS's Clip Raster tool, I masked the DEM over the polygons to restrict the coverage to solely focus on the North and South lake. I included a Python representation of the geometric space of the lake to give a 3-dimensional perspective.



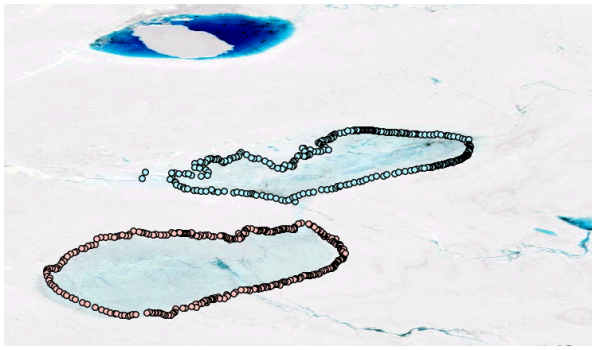
Clipping the polygon to mask a DEM



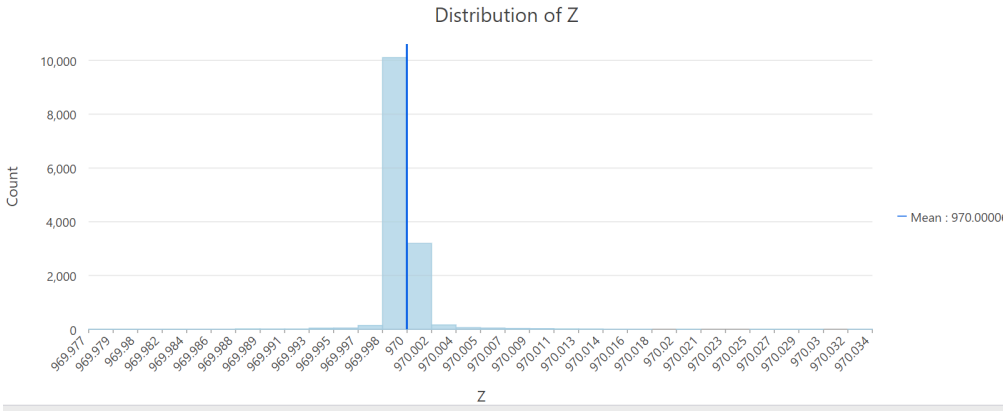
3-d Visualization of South Lake (May 2022)

In order to find the specific volume of a lake, I wanted to find what level (z-plane) to cut off the region so that it would calculate the empty area below the z-plane and restricted by the lake elevation model.

I manually placed approximately 300 points along the perimeter of each lake and computed the elevation values at these specific locations. Through meticulously and carefully clicking points along the border, I figured this would give me the best estimate as to where to cut off the region while minimizing variability. Overall, I repeated this procedure many times with slightly different contours to determine which results would match best with the imagery. As previously mentioned, the imagery itself would be unreliable; manually tracing the edges on the imagery to make a contour led to high variability and a significantly higher standard deviation.



~ 300 points around each lake



Histogram derived from elevation of specific points

For the **North Lake,** I computed the mean of the perimeter to be **970.03 meters** with a standard deviation of **0.1492 meters.** I utilized the Surface Volume tool in order to compute the volume of the North Lake. Using one standard deviation, my results are as follows:

May 1, 2022	**0.005769 ± 0.0003174 km^3**
August 28, 2022	**0.007824 ± 0.0003429 km^3**

For the **South Lake**, I used the same method as above and calculated the mean of the perimeter to be **978.00 meter**s with a standard deviation of **0.06466 meters**. Using the same method as above for the South Lake:

May 1, 2022	**0.009310 ± 0.0002050 km^3**
August 28, 2022	**0.01320 ± 0.0002473 km^3**