Permafrost Effect on Carbon Cycle

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ABSTRACT

Climate change is affecting our planet like never before; it is warming our temperatures, increasing the frequency of natural disasters, melting glaciers, and not to mention, thawing permafrost. In Alaska, and other high latitude regions, permafrost, which was originally conceived as permanently frozen ground, is now melting and is releasing immense amounts of stored carbon which are being released into our atmosphere. This permafrost did not pose a problem until recent years when temperatures became warmer and started melting it. As a result, NASA launched a program known as CARVE, Carbon in Arctic Reservoirs Vulnerability Experiment, in order to assess the emission rates of greenhouse gases, especially carbon, into our atmosphere. By using excel data and ArcMap, we were able to make maps that assess permafrost in Alaska. In the end, we were able to find overlapping time series, which led me to my area of interest, Fairbanks, Alaska.

BACKGROUND

Permafrost is frozen soil, rock, ice or organic matter that is at 0 degrees Celsius. It also covers 22% of the Artic and Northern hemisphere. Additionally, it consists of remains from dead plants and animals. Furthermore, due to the freezing temperatures of such regions, such as Alaska, these organisms do not decompose but rather freeze and store the organic carbon residing in them. As a result, permafrost is notorious for storage of organic carbon which is released as either methane or carbon dioxide, which are “lethal” greenhouse gases. However, as temperature only increases, as mentioned before, methane is known to be much more effective at trapping heat than carbon, thus permafrost is a major concern for scientists. Nonetheless, scientists are planning to alleviate the effects of permafrost, if not reverse the thawing of permafrost, by limiting their contribution of greenhouse gases.

OBJECTIVES

- Identify FLIR images that have overlapping time series.
- Identify images that clearly show landscape features.
- Identify temperature characteristics of landscape components for each season.

METHODS

The map of Alaska with SNOTEL stations was created by first, making an excel document with Alaska SNOTEL stations. We used the SNOTEL station’s longitude, latitude, elevation, and title name to make this document. Then, ArcCatalog was used to add the WMS server called BDL WMS from the Alaska Mapped website, a high resolution layer. Later, ArcMap was used to plot Alaska’s SNOTEL stations from the excel document.

•The map of Alaska with monthly FLIR plane paths was created by locating when the FLIR camera was being in used and what months it was being used. Afterwards, the paths from spring, summer, and fall were isolated to make into different layers using the Select by attributes option. Later, CARVE flight a line was added to the layers. The map of Alaska with buffers and intersections was created using seasonal months from spring, summer and fall. This was also added to layers of ArcMap, alongside with the SNOTEL stations, and CARVE flight path. Then an area of intersection was selected from where the buffers overlapped.

RESULTS

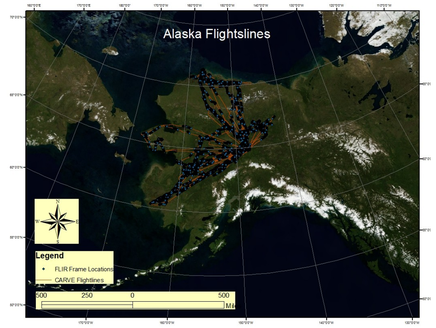

Figure 1 This map is depicts Alaska flight plane paths in the spring, summer, and winter of 2013. It shows the SNOTEL stations, and the flight path that covered it.

Figure 2 This is extraction of Figure 2 it depicts Alaska flight path in spring

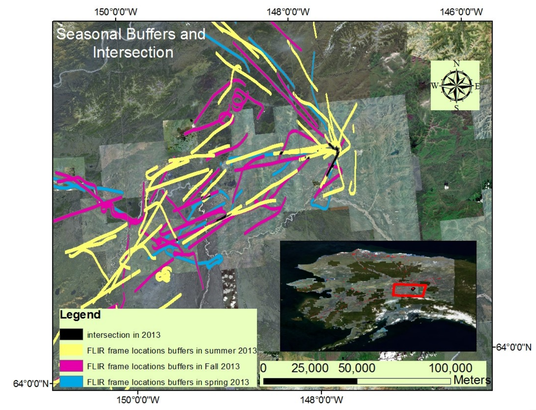

Figure 3 Projection of seasonal buffers and intersection in Alaska. This is the different paths in the spring , summer and winter, the darker Represents where the flight path overlapped, or in others intersected.

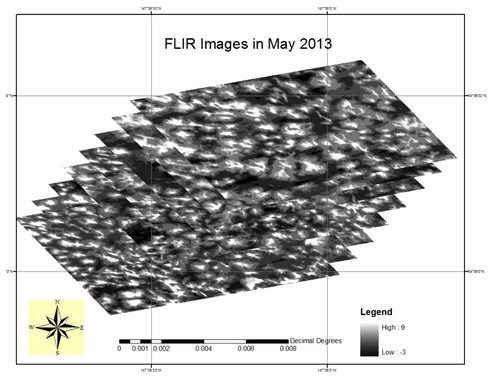

Figure 4 These FLIR Images in May 2013 are showing tree tops.

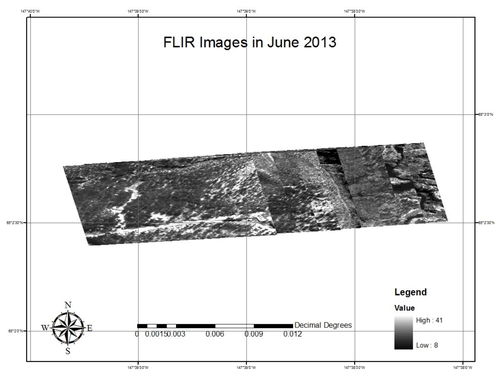

Figure 5 These FLIR Images in June 2013 are tree tops.

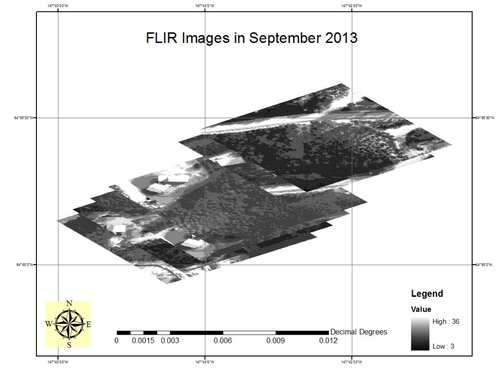

Figure 6 These FLIR Images in September 2013 are showing tree Tops.

CONCLUSIONS

After assessing our results we were able to locate the overlapping series, which eventually helped me discover my area of interest, which is Fairbanks, Alaska. We were also able identify FLIR images that were overlapping the time series. Likewise, we were able to identify images that showed landscape features, and then identified temperature characteristics of landscape components for spring, summer, and fall.

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