



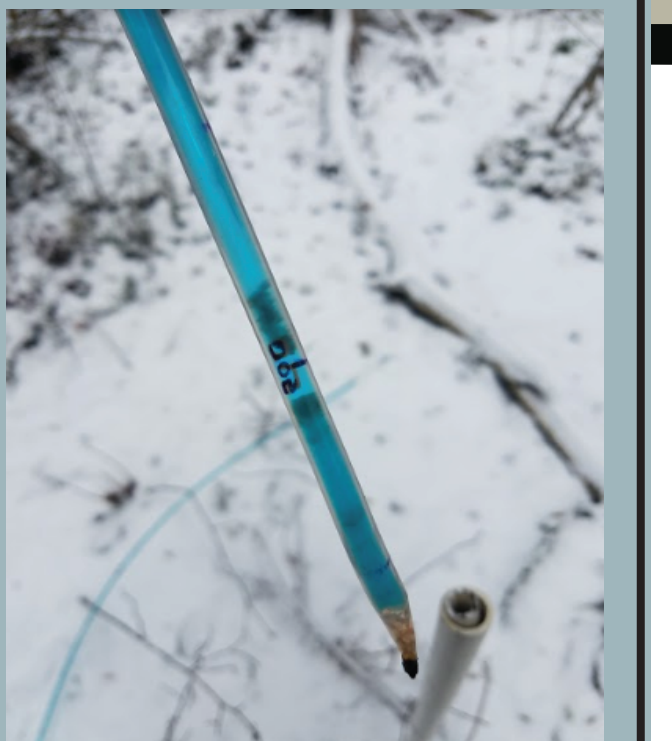
ALASKA FROST TUBE DATA ANALYSIS

Chelsea Huckbody



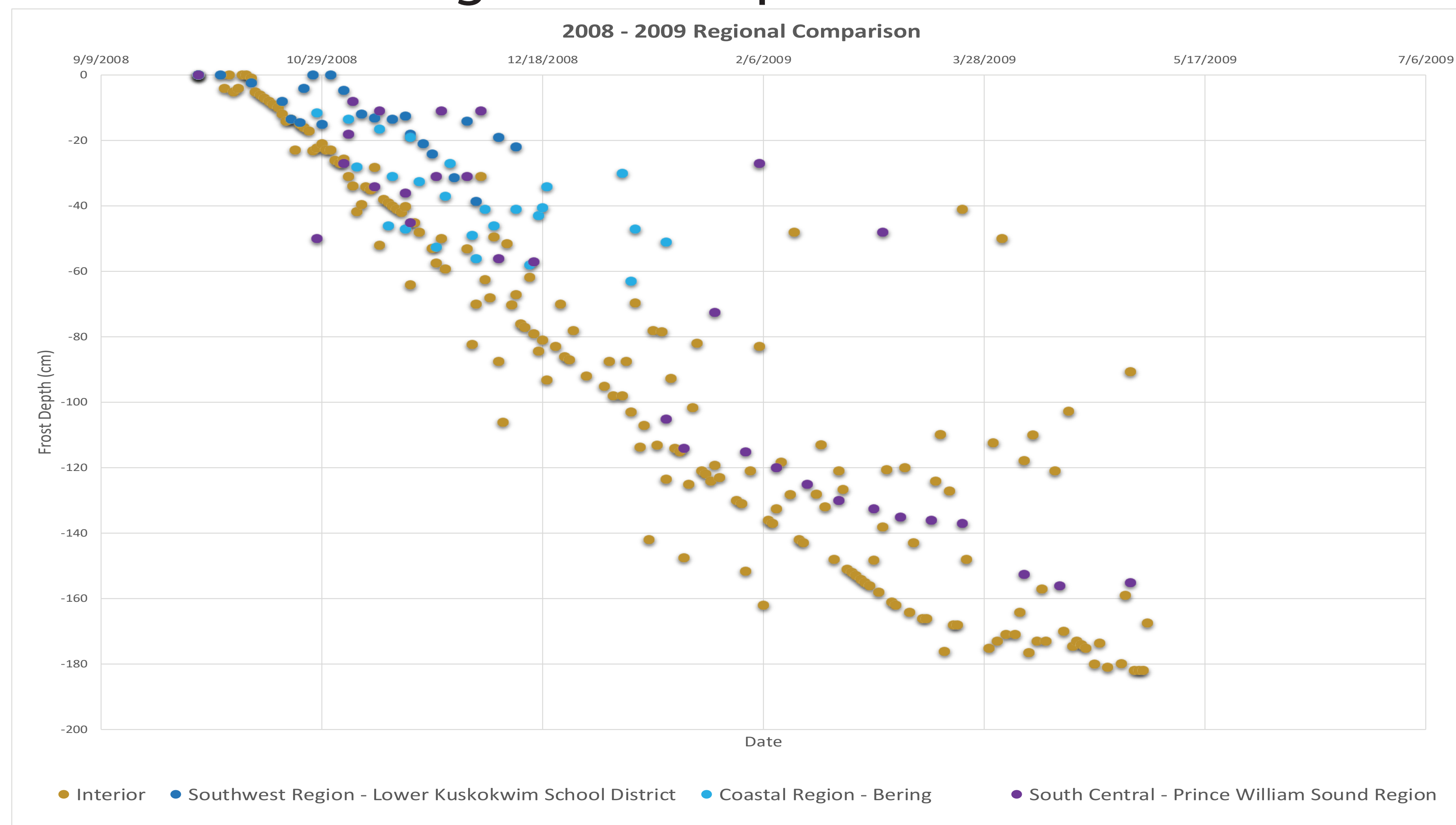
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Alaska is located in an arctic and sub-arctic climate with the presence of permafrost. Permafrost conditions range from isolated, sporadic, discontinuous, to continuous extent, depending on location (Yoshikawa, 2013). The Frost Tube Protocol monitors the depth and timing of the freezing of the ground, which is considered the active layer, in places with permafrost. Measurements are taken from ground depth, not the permafrost depth (Frost Tube Protocol). Frost depth can be influenced by air, surface, and soil temperature, as well as the snow depth and vegetation cover (Frost Tube Protocol). According to Iwata et al., soil frost depth influences the amount of snow-melt infiltration (2011), which could influence crop cultivation, plant growth, rate of decomposition of organic matter, and other biological, chemical, and physical properties that occur within soil (Frost Tube Protocol). Data gathered from this research will contribute to a greater understanding of climate change and its resonating effects on natural environments and local ecosystems, as well as how permafrost and active layer change over time (Yoshikawa, 2013). The following research was conducted to explore how frost depth varies between geographic location. Furthermore, the relationship between air and surface temperature is analyzed. Finally, the influence of elevation on frost depth is observed. Data collected from 2007 to 2011, by Yoshikawa, were entered into the GLOBE database and further visualized within the website to show the extent of frost tube locations throughout the state of Alaska. Averages taken from the data from September 2008 through May 2009 were organized and graphed to show the comparison of frost depth between interior, southern, and coastal regions throughout the state. Additionally, weekly measurements of air, surface, and frost depth were taken at the frost tube located in the woods in the northwest corner of the UAF campus.



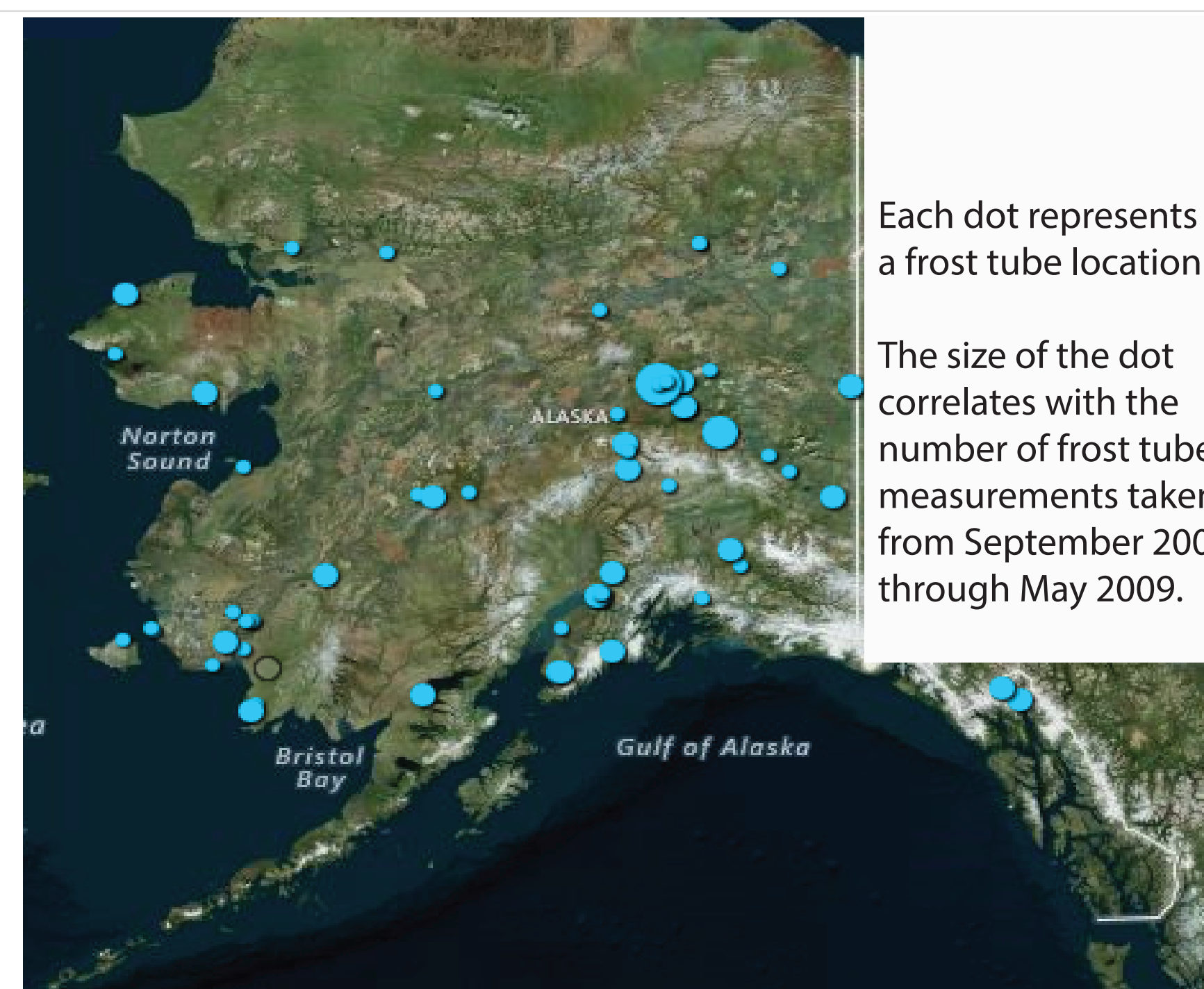
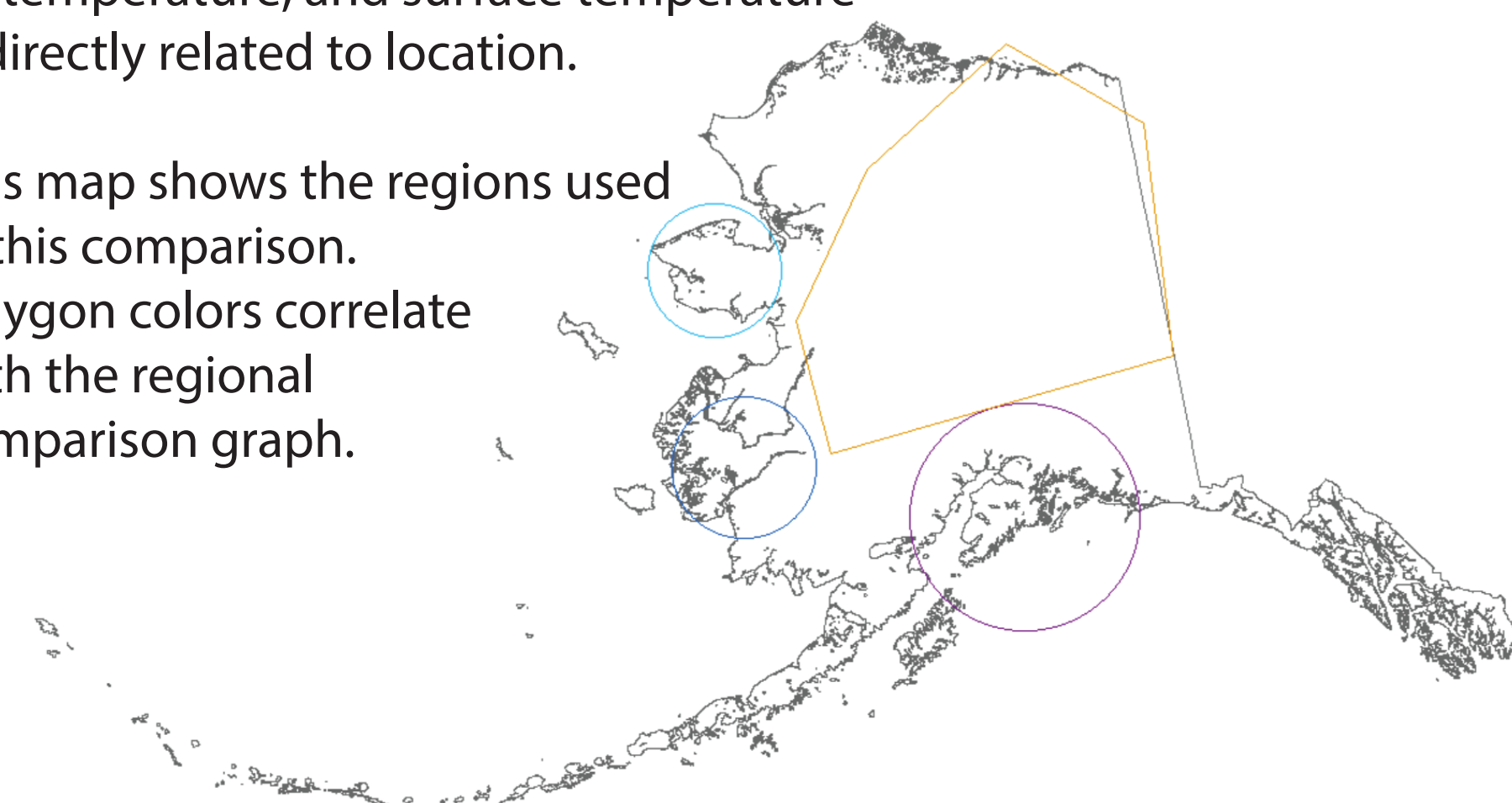
Presence of permafrost. Freezing liquid at the end of the tube.

Regional Comparison



Each point represents an average of frost depth from multiple location per region, for a specific date. These measurements are from the end of September 2008 through May 2009. This graph shows the relationship between geographic location, based on interior, southwest, south central, and coastal - Bering placement, where snow depth, air temperature, and surface temperature is directly related to location.

This map shows the regions used in this comparison. Polygon colors correlate with the regional comparison graph.

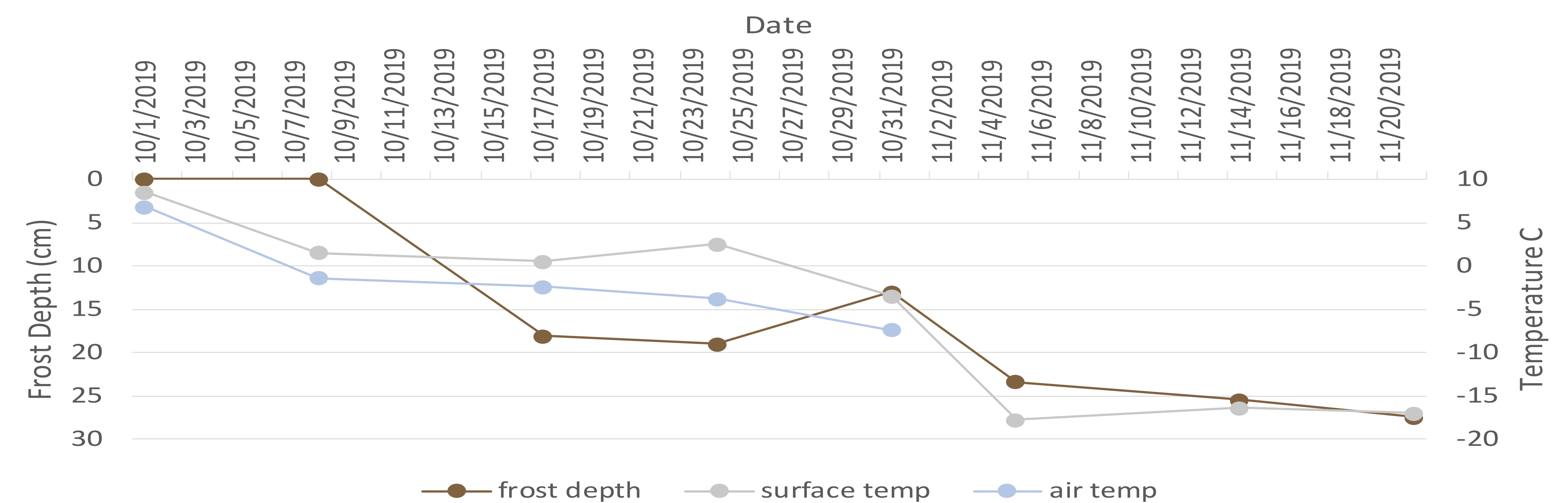


Map image from GLOBE.gov.

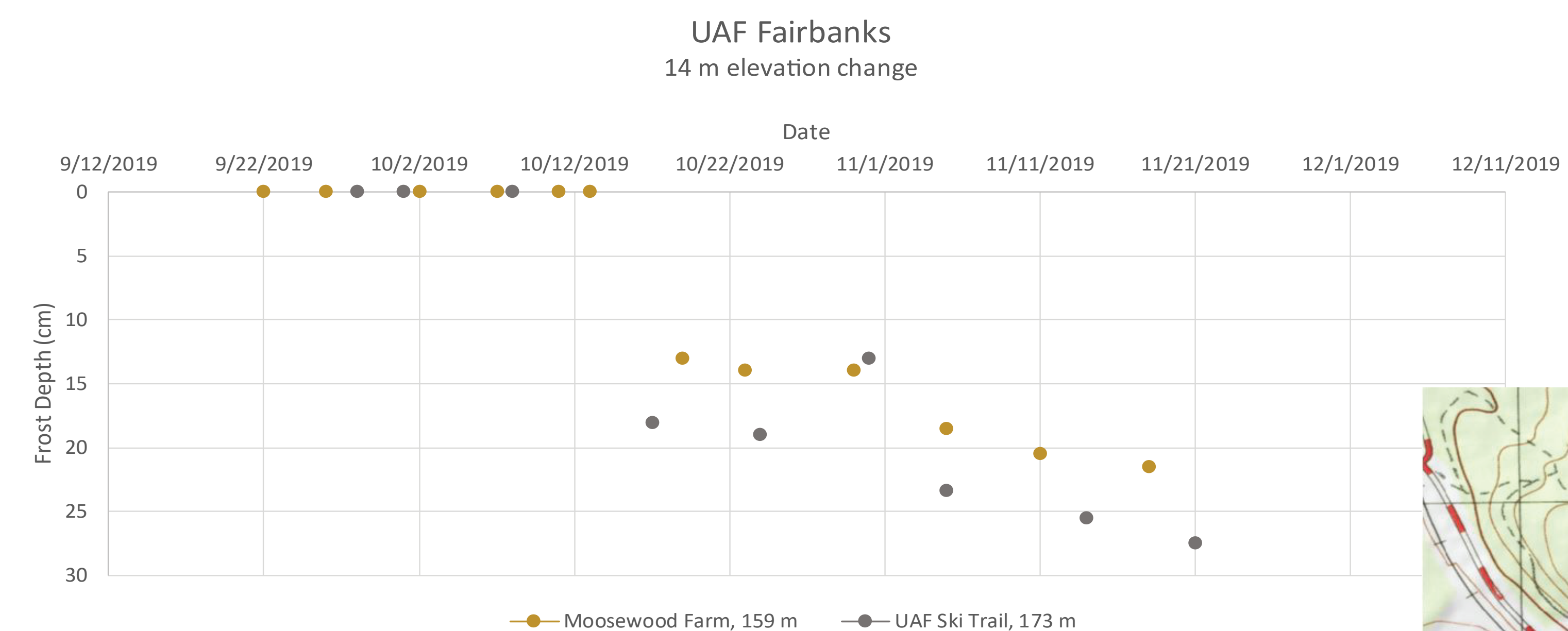


University of Alaska Fairbanks: Campus Case Study

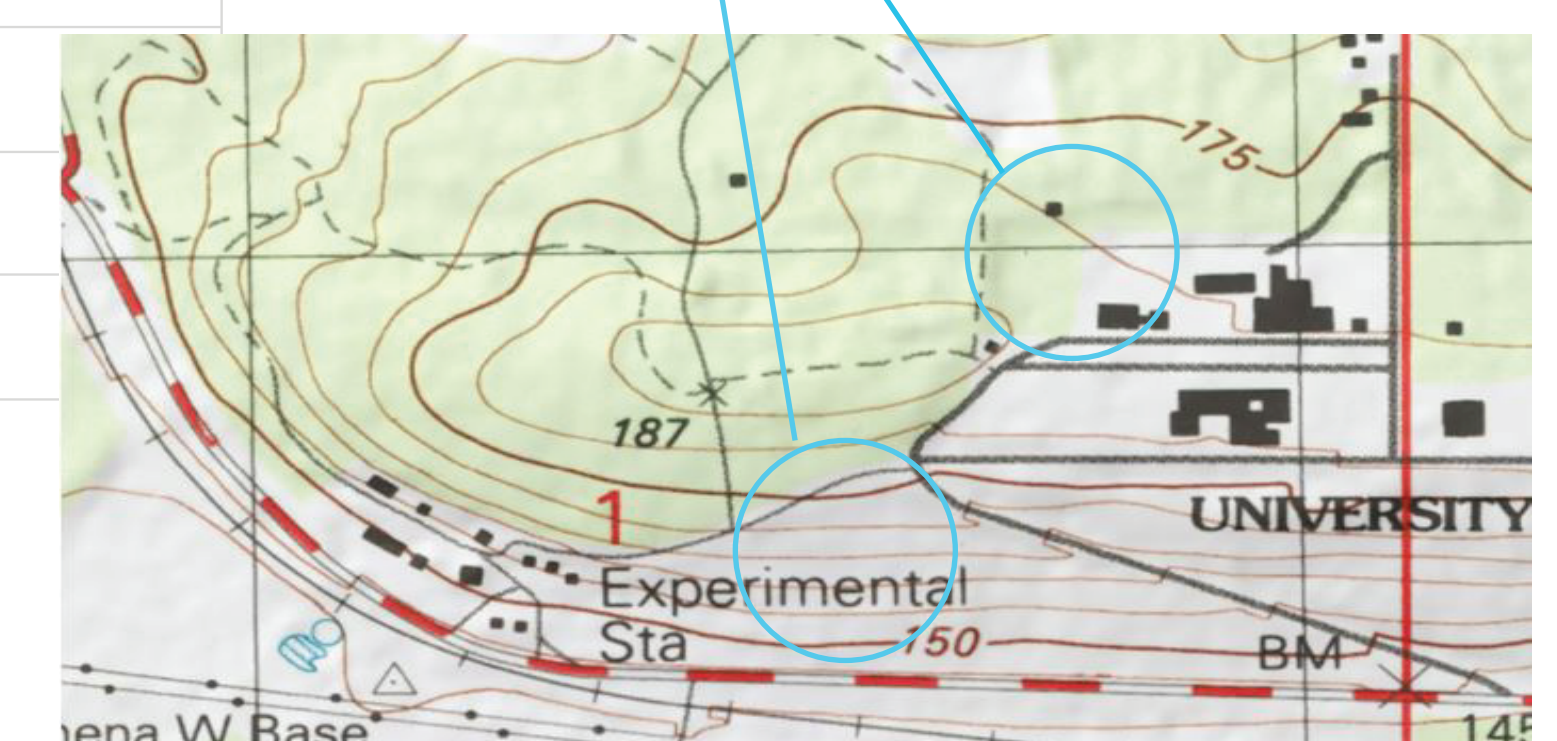
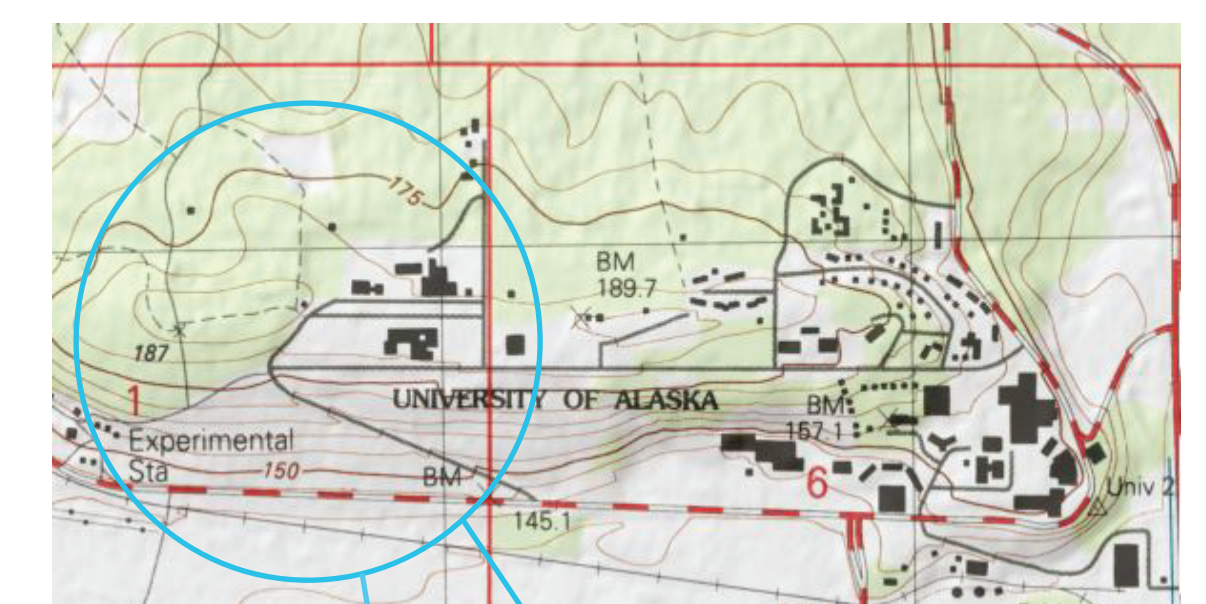
UAF Ski Trail Frost Tube frost depth compared to surface and air temperatures



Surface temperature and frost depth were measured on a weekly basis. Frost depth is closely related to air and soil temperatures, therefore, frost depth measurements indicate when air temperature remains below freezing, allowing soils to freeze from the ground surface down (Frost Tube Protocol). This graph shows frost depth beginning to decrease as air and surface temperature decrease.



Frost depth data collected from a frost tube location in an open farm field (Moosewood Farm), from the southwest corner of campus, were shared and compared with the northwest location (UAF Ski Trail) frost tube data to visualize the influence of elevation and canopy cover on frost depth.



Fairbanks, Alaska topomap

references

Frost Tube Protocol, GLOBE.gov, 2019.
Photographs: Chelsea Huckbody
Iwata, Yukiyo et al., Comparison of soil frost and thaw depths measured using frost tubes and other methods. Cold Regions Science and Technology, (71) 2012, 111-117.
Yoshikawa, Kenji. Permafrost in Our Time: Community-Based Permafrost Temperature Archive. University of Alaska Fairbanks Permafrost Outreach Program, 2013.

