

EGU2020-3168

<https://doi.org/10.5194/egusphere-egu2020-3168>

EGU General Assembly 2020

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Classification of glaciers during summer in Southern Rocky Mountain Trench using surface albedo and temperature anomalies

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Under most atmospheric conditions, the albedo and temperature of surface snow and ice are two of the main influences on the energy budget for glacier melting. Given that surface albedo and temperature are linked, knowing where and when negative albedo and positive surface temperature anomalies coincide is important for identifying locations and time periods in which anomalously high rates of surface melting are likely. We used measurements from the Moderate Resolution Imaging Spectroradiometer (MODIS) sensors on NASA's AQUA and TERRA satellites to map the albedo and surface temperature of snow and ice on glaciers in the of Southern Rocky Mountain Trench ecoregion in the summer months (June-August) from 2000 to 2018. We use these data to identify specific regions and time periods in which low albedo and high surface temperature coincide since these conditions are likely to support anomalously high rates of surface melting. We also use these data to identify regions/periods in which albedo is particularly low while surface temperature is average or low, since such conditions suggest localized and/or short-term decoupling between the two parameters. We found anomalously low albedo and average/low temperature consistently at multiple glaciers during time periods when there were major forest fire events. We suggest the low albedo results from deposition of pyrogenic carbon from forest fires. We found that, on average, ~25% of the glaciers in the region experienced increasingly negative albedo anomalies and increasingly positive temperature anomalies in summer months from 2000 to 2018. However, we also found that for ~45% of the glaciers that are small, there was a poor correlation between the timing of albedo and temperature anomalies. Our results indicate that the correlation between albedo and temperature was weaker for the small glaciers, and identify specific glaciers that are likely the most vulnerable to climate warming.