Project acronym: GGMBIS

Project title: Geodetic and Glaciological Mass Balance Intercomparison at Storglaciären, Sweden

Project leader: Jeff La Frenierre, Gustavus Adolphus College, United States

Discipline: Earth Sciences & Environment: Global change & Climate observation

Station(s): Tarfala Research Station (Sweden)

This research aims to produce the first direct comparative analysis of glacier mass balance measurements made using both glaciological and geodetic approaches at Storglaciären, Sweden, home to one of the longest continuous (glaciological) mass balance time series in the world. From our base at the adjacent Tarfala Research Station, we will employ a geodetic approach that uses UAV imagery and Structure-from-Motion photogrammetric processing to create high resolution (~20 cm) surface models of Storglaciaren representing April and September 2023 ice conditions. By differencing each model against a third surface model previously generated in September 2022, we will be able to calculate the approximate amount of ice mass lost or gained over each time interval. These geodetic estimates will be made coincident with the ablation stake measurements Tarfala scientists make to estimate seasonal and annual mass balance using the glaciological approach, thus providing two independent estimates of glacier behavior over each time interval. Because the geodetic approach directly resolves key sources of uncertainty inherent to the glaciological approach, this comparison will thus provide a means to calibrate the existing 75+ year mass balance record Storglaciären. Additionally, because the glaciological approach partially resolves a key source of geodetic uncertainty, this comparison will also help improve future geodetic surveys of other non-coastal Scandinavian glaciers. Our research group is composed of an experienced field researcher and a current PhD student, and will include a (to-be-determined) undergraduate likely on their first field research experience. As such, this project also represents a high-value educational opportunity for two potential future scientists.