17-5 - CHARACTERIZING MECHANISMS OF MASS WASTING AT THE COTTON BROOK LANDSLIDE IN WATERBURY, VERMONT USING REMOTE SENSING AND FIELD-BASED METHODS

Sunday, 17 March 2024

1:30 PM - 5:30 PM

Armory Ballroom (Doubletree by Hilton)

Booth No. 45

Abstract

The Cotton Brook landslide, located in Mt. Mansfield State Forest near Waterbury, Vermont is the state's largest documented landslide. The site's stratigraphy is characterized by glaciolacustrine sediment overlying glacial till and bedrock. When the hillslope initially failed in 2019, it mobilized up to 200,000 m^3 of surficial material downstream toward the Waterbury reservoir. This study spans from 2014 to 2023 and integrates field-based and UAS-derived data to 1) identify the mechanisms of continued mass wasting following the 2019 slip and 2) develop a workflow that allows us to estimate the magnitudes and rates of topographic change linked to diverse styles of earthflow. We utilized ArcGIS, Metashape Pro and CloudCompare softwares to conduct topographic differencing techniques with DEMs and 3-dimensional point clouds. We compared their outcomes to refine the workflow and quantify uncertainty. Vertical change measurements derived from DEMs over-estimated topographic change by up to ~10% when compared to values from 3-D point cloud results. We attribute this discrepancy to errors introduced by georeferencing and interpolation of elevation values. The latest volumetric estimates detail material redistributed from the hillside to the surrounding watershed. For instance, volumes extrapolated from ArcGIS and CloudCompare for material accumulated at the toe are approximately 135,000 m^3 and 126,000 m^3, respectively. Calculated uncertainties ranging from 1 cm – ~50 cm from CloudCompare were mapped spatially. To ground truth our geospatial analysis results, we mapped the main active earthflow processes driving sediment movement. The predominant mechanisms contributing to mass wasting include the collapse of thick piles of glacial lake sediment bordering the main slip and deepening gullies on the slip surface. Our quantitative analyses suggest the collapse of glacial material is accelerating, in part due to recent historic flooding. Gully features began as shallow rills and have evolved to reach depths of up to 1.5 m and are responsible for channelizing sediment into Cotton Brook. Our findings provide an opportunity to quantify material displaced and make predictions about how the sediment budget in the watershed and the Waterbury reservoir is impacted by the Cotton Brook landslide.

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