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Glacier fluctuations and slope instabilities at Mount Meager Volcano: a historical approach.

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Mount Meager is a volcanic complex located in SW British Columbia, Canada. It covers an area of about 225 km^2 and it supports 32 alpine glaciers (as reported in the GLIMS Glacier Database); it is known for the high landslide frequency and magnitude.
In this study we document the present glacier morphology and activity at Mount Meager volcano, as well as landslide events. We digitized over 500 airphotos of the Mount Meager massif consisting of 8 time slices from 1947-2006 using SfM software to provide high-resolution orthophotos (0.42-1.13 m/pixel). The cartographic suitability of these datasets was tested by comparison with a Lidar DTM acquired in 2015-2016. By means of Lidar and orthophotos interpretation we mapped glacier outlines, moraines, landslide deposits, scars, and fractures. Glacier fluctuations were documented and related to geomorphic parameters: glacier length and basin area, headwall height and aspect, elevation of accumulation zone, glacier front position from 1951 to 2016, and relative retreat of front position in 2016. The glaciers at Mount Meager show different parameters and activity, but they are generally retreating. Total cumulated retreat is about 8 km^2 and retreat is about 20% with respect to the 1951 glacier extension.

We recognized mutual conditions posed by present and past glaciations and hydrothermal activity to present-day volcanic massif stability and glacier morphology. We developed a conceptual model to explain the high landslide frequency and the glacial activity at Mount Meager: rocks are fractured and altered by interaction with past ice sheets and today's glaciers are mostly debris-covered and sit in collapse scars from large landslides. Climate-related deglaciation of volcanic mountains not only cause changes in ice cover, but affects regional and local hydrology, slope stability, sediment supply, hydrothermal circulations, leading to short-term and long-term consequences on the overall relief geomorphology.