

EGU2020-22512

<https://doi.org/10.5194/egusphere-egu2020-22512>

EGU General Assembly 2020

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Use of WWI photos for quantitative reconstructions of glaciers along the Italian-Austrian front

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The knowledge of past fluctuations of glaciers is the key for understanding their dynamics and their climate-related evolution. Glacier mass balance and length changes are the two metrics normally used for reconstructing past fluctuations series of glaciers. However, length change measurements series are often discontinuous and require validation, whereas mass balance measurements are available for only a few glaciers worldwide and only for the latest decades.

In the context of glacier reconstructions, other sources of information such as historical-archival, glacio-archaeological and geomorphological data are of critical importance, because they enable the completion and validation of direct measurement series and their extension into the past, providing spatial and temporal constraints.

A unique source of unexploited historical information dating back to the First World War (WWI, 1915-1918) exists for many glaciers in the Eastern Italian Alps. This information mainly consists of old photos, which however are spread over a multitude of sources, often difficult to access, and in many cases not yet digitized.

We propose a workflow that enables extracting quantitative information from terrestrial photographs taken during the WWI period, aimed at the reconstruction of glacier area, volume and firn lines by means of the monoplottting technique. This method relies on the availability of high-resolution digital elevation models, which became recently available over wide areas thanks to LiDAR and aerial photogrammetry. This work presents the methods applied, and the results obtained, on several case studies in the Adamello-Presanella, Ortles-Cevedale, Dolomites, and Julian Alps.