Submitted Abstract

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Abstract

Despite the effects of global warming on the cryosphere are well-know and documented, less attention has been devoted to the geomorphological implications of glacial retreat and to the effects of de-glaciation on surface processes in periglacial areas. The water cycle is altered by the changing duration and rate of snow melting and ice ablation, higher frequencies of high-altitude rainfalls which enhance snow melting, increase in average and peak runoff production. These alterations also impact the rate of sediment production, both from glacier areas, where sediments are released by ice melting and bed erosion, and from periglacial areas, where newly exposed sediments are displaced by precipitation and interactions with water flowing enhance sediments mobilization. These modifications impact on and interact with the biological dimension of the high-altitude ecosystem, including vegetation, lichens, microorganisms that adapt to a changing environment.

The goal of our research is the analysis and quantification of the hydrological and morphological dynamics of peri-glacial areas. The presented activity is focused on the Rutor glacier, in the Graie sector of the north-west italian Alps. The Rutor glacier is among the largest glaciers in Italy and its terminus, in the La Thuille valley, reaches an elevation of about 2600 m a.s.l. The area is relatively pristine due to the absence of mechanical lift facilities in the surroundings, although intense fluxes of hikers reach the nearby mountain hut or haunt the climbing and alpine-ski routes in the area. The periglacial area of this fast-retreating glacier (the terminus moved by more than 2 km since the mid-19th century) is characterized by a number of proglacial lakes, the major one being the Seracchi lake, which collects all melt water from the northward slope of the Rutor glacier as well as all the sediments. The research we present results from a multidisciplinary collaboration that involves glaciologists, hydrologists, geophysicists, geomatics and water engineers. The site has been explored and equipped to measure the high-resolution morphology of the area (using drones and airborne surveys), the streamflow and water temperature continuously in time, the lake water balance, the accumulated sediments characterization though radar and the sediment transport at the terminus through the use of geophones. Merging the contributions of different disciplines allows us to gain an advanced quantitative knowledge of the water and sediment budget in the area as well as to investigate the evolution of process defining the landscape at different time scales.