

Rock glaciers and protalus ramparts in the south-eastern Alps

Renato R. Colucci (1), Chiara Boccali (2), Manja Žebre (3), and Mauro Guglielmin (4)

(1) Department of Earth System Sciences and Environmental Technology, CNR – ISMAR Trieste, Trieste, Italy, (2) Department of Mathematics and Geosciences, University of Trieste, Trieste, Italy, (3) Geological Survey of Slovenia, Ljubljana, Slovenia, (4) Department of Applied and Theoretical Sciences, University of Insubria, Varese, Italy

Rock glaciers and protalus ramparts are characteristic landforms of the periglacial domain often used as markers of the permafrost occurrence in mountain terrains. Therefore, relict rock glaciers can be used for paleoclimate reconstructions. We present here the first rock glacier inventory of south-eastern Alps (including the northeasternmost region of Italy and Slovenia) obtained through the use of high resolution orthophotos and high resolution digital terrain model interpolated from airborne laser scanning (LiDAR). We mapped 53 rock glaciers covering a total area of 3.45 km². The majority of rock glaciers are classified as relict and distributed between 1,708 and 1,846 m a.s.l. with slope range between 19° and 27°. Their altitudinal range is the lowest for the southern Alps and comparable with what has been found for relict rock glaciers in the Northern Alps of Austria (1,798 m) and in the Austrian Niedere Tauern Range (1,823-1,850 m). Besides rock glaciers we also observed 66 protalus (pronival) ramparts covering 0.48 km². They are predominantly located in the Carnic Alps, Julian Alps and Karavanke (80% of the total); the majority is distributed between 1,697 m and 2,007 m a.s.l. Protalus (pronival) ramparts situated in the Carnic Alps and Prealps (47% of the total) generally follow the same geographical distribution of rock glaciers, whereas more than half of the inventoried protalus (pronival) ramparts are located in the more maritime area of the Alps where there is the higher precipitation. The analysis also highlighted 9 pronival ramparts located in front of permanent snow/firn bodies and small glacierets. These ridges produce a damming effect for avalanches which enhance accumulation of winter snow, a significant impact to the local mass balance. Using paleoclimate reconstruction based on the existing 1981-2010 climatology of the area, we infer that the rock glaciers possibly formed during one of the dry and cold periods of the late Pleistocene (12.8±0.3-11.9 ka BP) and early Holocene (10.8±0.2-10.1±0.2 ka BP). Possible evolution of the active pronival forms observed in the most maritime area of this alpine sector is also discussed.