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Response of Montasio Occidentale glacier (Eastern Italian Alps) to the warm summer 2012, investigated by terrestrial laser scanner

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The Montasio Occidentale glacier is a low-altitude, avalanche-fed glacier located at the base of the north wall of Mt. Jôf di Montasio (2754 m a.s.l.), in the Julian Alps. Its mean altitude is 1910 m and its current area is 6.8 ha. Recent geomorphological, geophysical e glaciological investigations on this glacier highlighted its peculiar behaviour, compared to the most part of the glaciers in the European Alps. In particular, the field data suggest a higher sensitivity to winter precipitation and a lower sensitivity to summer temperatures, with the important (negative) feedback of the debris cover in regulating its response to climatic changes.
The hydrological year 2011-'12 was characterized by scarce winter precipitation and high summer temperatures in the Julian Alps. Thus, we had the opportunity to study the reaction of the glacier when subject to much different climatic conditions compared to the previous years. The glacier was entirely surveyed on 17 May and 5 October 2012, by means of a Terrestrial Laser Scanner (TLS), which enabled the calculation of two high-resolution (10x10 cm) Digital Terrain Models (DTM) of the glacier and of the surrounding slopes.
The mass balance of the glacier, calculated by DTM differencing using the so-called geodetic method, was much more negative than in previous years and the snow- and firn-covered area shrunk significantly. The important role of the debris cover in reducing ablation in the lower part of the glacier was confirmed by the new observations, corroborating the previous field evidences. Collapse structures due to the breakdown of subglacial cavities were also detected, as well as local reworking of the debris cover by meltwater and/or rainwater. The high-resolution DTMs also enabled the quantification of the very low surface velocities (few decimeters per year) which characterize this ice body, and of changes in the surface displacement compared to previous observations.