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Differences in the energy and mass balance between a low- and a high-altitude glacial site in the Ortles-Cevedale (Italy), during the warm summer 2012

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Like in most of the European Alps, the glaciers of the Ortles-Cevedale (Eastern Italian Alps) are rapidly shrinking under the current warm climatic conditions. Different glaciers of this mountain group were found to react in different ways. The main control of their individual response appears to be the hypsometric distribution of area vs. altitude. In fact, the elevation affects the spatial distribution of the energy and mass balance through the atmospheric temperature and precipitation lapse rates, that determine the amount and frequency of ablation and accumulation. However, other processes and feedbacks take place during periods of rapid climatic change, which still need to be investigated and fully understood, in particular at high elevation.

Two Automatic Weather Stations (AWS), operating on glacial sites at different altitudes in the Ortles-Cevedale, enabled a first comparative analysis for the warm summer of 2012. The lower AWS was placed in the ablation area of La Mare glacier, at 2970 m a.s.l., on temperate ice. The upper AWS worked on the high-altitude accumulation area of Alto dell'Ortles glacier, at 3840 m a.s.l., over temperate firn overlying cold ice. The two AWSs, located 10 km away from each other, monitor air temperature and relative humidity, wind speed and direction, incoming and outgoing shortwave and longwave radiation, surface temperature and snow height, and record mean values at time intervals of 15 minutes. The upper AWS also measures the temperature profile below the surface to a depth of 15 m. Direct mass balance measurements were carried out in the proximity of the two AWSs at the end of the accumulation and ablation seasons, by means of snow depth soundings, density measurements into snow pits and ablation measurements through ablation stakes.

A strongly negative mass balance was measured in 2012 at the lowest AWS, which lost early in the summer the 110 cm thick snowpack accumulated during winter and underwent a net ablation of 350 cm of ice during the rest of the summer. In contrast, net accumulation occurred at the upper site, which only lost 45 out of 200 cm of snow accumulated during the winter season. We calculated the energy and mass balance of the two AWS sites and compared them, in order to highlight the controls and feedbacks governing the different responses observed in terms of mass balance.