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The influence of supraglacial debris on proglacial runoff fluctuations and water chemistry

Catriona Fyffe (1), Ben Brock (2), Martin Kirkbride (3), Andrew Black (3), Claudio Smiraglia (4), and Guglielmina Diolaiuti (4)

(1) Institute of Science and the Environment, University of Worcester, Worcester, United Kingdom (c.fyffe@worc.ac.uk), (2) Department of Geography, Northumbria University, Newcastle, United Kingdom (benjamin.brock@northumbria.ac.uk), (3) School of the Environment, University of Dundee, Dundee, United Kingdom (m.p.kirkbride@dundee.ac.uk), (4) Department of Earth Sciences 'Ardito Desio', University of Milan, Milan, Italy (claudio.smiraglia@unimi.it)

This paper seeks to explore how the debris' influence on glacial ablation, topography and drainage structure impacts on the water chemistry and runoff signal of the proglacial stream. This was achieved through analysis of the supraglacial and proglacial water chemistry and the proglacial hydrograph of Miage Glacier, Western Italian Alps. Although the supraglacial water chemistry was influenced by the debris, there was also evidence that the less efficient hydrological system beneath the debris-covered lower tongue also increased the ion concentration of the proglacial stream. Compared to published data for clean glaciers, fewer diurnally classified daily hydrographs were found in the proglacial discharge record, with the amplitude of the diurnal signal peaking later and being relatively low in amplitude. These hydrograph characteristics were thought due to the debris' attenuation of the melt signal, and the smaller input streams and less efficient subglacial drainage system beneath the debris-covered lower tongue. Warmer than average weather conditions were required for strongly diurnal hydrographs to be shown, with a 'saw-toothed' hydrograph shown under average conditions. The diurnal relationship between conductivity and discharge often demonstrated anti-clockwise hysteresis, indicating that the more rapidly routed dilute melt component from the mid-glacier peaked before the peak in discharge. Components from higher up glacier and the lower debris-covered tongue likely had longer transit times and reached the proglacial stream later.