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Debris cover and surface melt at a temperate maritime alpine glacier: Franz Josef Glacier, Southern Alps, New Zealand

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During the last few years, after three decades of generally positive mass balance, Franz Josef Glacier (Southern Alps, New Zealand) has entered into a phase of strong frontal retreat. This development is combined with significant downwasting of the lower glacier tongue and a concurrent increasing emergence of debris on the surface in the ablation zone. Previously, melt rates at Franz Josef Glacier have only been measured on bare ice, so a short-term study in February 2012 saw a network of 11 ablation stakes drilled into locations of varying supraglacial debris thickness on the lower glacier. Direct ablation measurements were accompanied by observations of air temperatures and mapping of debris thickness and its distribution on the lower glacier tongue in order to calculate the potential effect of reduced overall ablation.

Mean ablation rates over 9 days varied over the range 1.2-10.1 cm d^{-1} and were closely related to debris thickness. Air temperatures provided a strong indicator of daily melt rates and by applying a degree-day approach, a range of degree-day factors between 1.1 and 8.1 mm d^{-1} $^{\circ}C^{-1}$ with a mean of 4.4 mm d^{-1} $^{\circ}C^{-1}$ was obtained. These values are comparable with rates reported in other studies. Mapping of the entire ablation zone revealed an area of 0.7 km^2 (or 14.3 %) covered by debris of 1-50 cm thickness. Based on measured debris thicknesses and calculated degree-day factors, ablation on those debris-covered areas of the glacier is reduced by a total of 41%. For the entire ablation zone this equates to a 6% overall reduction in melt. This study highlights the usefulness of short-term surveys to gather representative ablation data.