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Thermal detection of debris-covered-ice using ASTER imagery

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Debris covered ice may constitute a significant proportion of a glacier's mass yet the detection of the extent of debris covered ice is problematic when observing a glacier in the visible spectrum. Standard ice detection algorithms as used on satellite imagery (for example NDSI) poorly identify debris covered ice regions. Potential exists to utilise the thermal properties of debris covered ice to identify the same using the ASTER thermal bands. Such an application is trialled on a daytime and night time image of a glaciated region of New Zealand's Southern Alps. Through subjective expert analysis of daytime images, areas of debris covered ice are identified. Comparison of the thermal emissions from these regions, as identified by the ASTER thermal bands, to nearby plain debris is carried out. The differences in thermal emissions detected by ASTER on sunlit debris regions are more strongly influenced by aspect than by sub surface ice. In shadowed regions the influence of sub-surface ice on debris thermal emissions is inconclusive. Investigation of the night time image indicates differentiation between debris covered ice and plain debris may be possible. The difference in pixel size between thermal and SWIR bands prevents region delineation to the same scale as obtained when identifying snow and ice using NDSI. This technique may enable objective preliminary automatic detection of debris-covered-ice from satellite imagery without recourse to expert analysis.