Summer temperature profiles within supraglacial debris on Khumbu Glacier, Nepal

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ABSTRACT

Temperature measurements made during summer within supragalcial debris on Khumbu Glacier, Nepal show a strong diurnal signal that diffused downward into the debris with decreasing amplitude and increasing lag. Surface temperatures during the day were up to 35 ℃ higher than the air temperature; energy transfer into the debris was dominated by the solar radiative flux. Temperature profiles through the debris indicate that heat flow deeper than about 0.2 m was primarily by conduction. The thermal conductivity k of the debris, estimated from a calculated thermal diffusivity and a representative heat capacity, was 0.85 ± 0.20 W m^{-1} K^{-1} at one site and 1.28 ± 0.15 W m^{-1} K^{-1} at another. At the first site the debris was 0.40 m think and the average temperature gradient $\partial \bar{T}/\partial z = 19$ K m^{-1}; the average flux of energy through the debris was sufficient to melt 4-6 mm of ice per day. The debris was thicker (estimated to be 2.5 m) and the temperature gradient lower (4.5 K m^{-1}) at the second site, and the calculated ice melt was less than 2 mm day^{-1}.