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# Evaluation of recent glacier recession in the Cordillera Blanca, Peru (AD 1962–1999): spatial distribution of mass loss and climatic forcing

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### Abstract

We use a combination of aerial photogrammetry, satellite imagery, and differential GPS mapping to quantify the volume of ice lost between AD 1962 and 1999 from three glaciers on Nevado Queshque in the Cordillera Blanca, Peru ( $\approx 10^4$  S). The largest averaged surface lowering (thinning) occurred in the southwest aspect (22 m) and the least in the eastern aspect (5 m). A heuristic sensitivity analysis indicates that  $9.3 \text{ W m}^{-2}$  was required to melt the total observed ice loss and this can be explained by sensible heat transfer related to a temperature rise of  $1 \text{ }^\circ\text{C}$ , combined with a latent heat decrease related to a  $0.14 \text{ g kg}^{-1}$  increase in specific humidity. A first-difference analysis of temperature records from 29 stations in the Cordillera Blanca shows an average rising trend of  $0.26 \text{ }^\circ\text{C}$  per decade over the 37 year interval, more than adequate to supply the hypothesized sensible heat transfer. A simple transmissivity model within a digital elevation model indicates solar radiation related to altered cloudiness was not a predominant climatic forcing. The distribution of glacier area with altitude calculated with the digital terrain model explains the observed asymmetrical ice melt.