

Regional climate forcing and topographic influence on glacier shrinkage eastern cordilleras of Peru

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Abstract

This study assessed the influence of regional climate variability and topography on surface area changes at glacierized mountain peaks of four eastern tropical Andes cordilleras between 10.5° and 13.5°S, namely, Huaguruncho, Huaytapallana, Urubamba and Vilcabamba, during the period 1985–2015 using satellite data. Time series analysis of three key climate variables (temperature, precipitation and relative humidity) at 500 hPa level was also included. Decreasing trends in precipitation and increasing relative humidity trends were observed at the northern region. Further analysis on mean distribution of wind at 500 hPa level showed significant rising trend southwards during the austral winter. Glacierized surfaces at lower altitudes were shrinking faster than those at high altitudes as expected. However, spatial orientation of glacier retreat was not similar to nearby cordilleras such as Vilcanota and Carabaya excepting for Cordillera Urubamba. Despite the high rate of precipitation due to the humidity transport from the Amazon Basin on the eastern slopes, glaciers on the eastern and north-eastern slopes in the Cordillera Urubamba retreated at a higher rate compared with those glaciers on western and south-western sides. Whether higher retreat on the eastern sides towards the south is controlled by precipitation phase changes (rain or snow) or by increased humidity levels was discussed. Furthermore, there was a predominant snowline altitude (SLA) rising trend varying between 56 and 129 m for the studied glaciers. A sharp rise in SLAs for periods 1995–2000 and 2010–2015 was attested, coinciding with warming trends in the Pacific. The relative stability in observed SLAs between 2000 and 2010 also coincided with cooling trends in the Pacific..

Keywords

Cordillera Vilcabamba, Glacier retreat, Peruvian Andes, Tropical glaciers, Urubamba valley, Wet outer tropics.