

Glacier monitoring in the eastern mountain ranges of Bolivia from 1975 to 2016 using Landsat and Sentinel-2 data

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Abstract

Tropical glaciers are sensitive to climate variations and more than 95% of them are located in the South American Andes. The present study estimated current glacial surface extent in the eastern mountain ranges of Bolivia. Glacial surface changes were estimated using satellite images and available literature between 1975 and 2016. Sentinel-2 images were used, for the first time, for glacier mapping in the tropical Andes and Landsat imagery for glacial surface area change. Estimated glacial area reduction between 1975 and 2016 in Cordilleras; Apolobamba, Real, and Tres Cruces–Nevado Santa Vera Cruz was 48.8, 50.7, and 59.4%, respectively. Overall glacier shrinkage between 1975 and 2016 was 51% (from 543.9 to 266.5 km²). For the same period, total glacier area reduction in the Bolivian Cordillera Oriental below 5000 m a.s.l. was 91%. A prevalent southward glacial orientation was accounted for glaciers along the Cordillera Oriental of Bolivia. Furthermore, meteorological data analysis showed a positive trend in the air temperature and a negative trend in precipitation in the region. If current environmental conditions persist, no glacial surface at low elevations (5000 m a.s.l.) will remain in the future. This may seriously influence water resources in the region. Nevertheless, glaciers above 5500 m a.s.l. are considered relatively stable.

Keywords

Amazon basin, Water resources, Glacier shrinkage, Tropical Andes.