

Glacier Recession in the tropical Andes - Area and Mass Changes 2000-2016

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Tropical glaciers are very sensitive to climatic changes and therefore strongly affected by global warming. Nearly all glaciers in the tropics are located in the Peruvian and Bolivian Andes, where significant glacier recession was reported since in the last century. Previous studies regarding ice mass loss and glacier retreat focus on specific mountain ranges or individual glaciers and consider different observation periods. In this study, we carried out the first multi-temporal, region wide analysis of geodetic glacier mass balances and area changes throughout Peru and Bolivia, by means of multi-sensor remote sensing, for the study period 2000-2016. A total glacier area loss of -29% (-37 km² a-1) is derived by automatic glacier mapping using Landsat imagery. Geodetic mass balances are derived from interferometric SAR acquisitions. An average specific mass balance of -395 ± 55 kg m⁻² a⁻¹ is computed for the period 2000-2016. A strong regional and temporal variability in the mass balances ranging between 68 ± 102 kg m⁻² a⁻¹ to -990 ± 476 kg m⁻² a⁻¹ is found. For the period 2013-2016, increased glacier recession of -117 km² a⁻¹ and a more negative mass budget of -753 ± 178 kg m⁻² a⁻¹ is discovered. The observed glaciological changes can be correlated with changes in the climatic conditions and the strong El Niño event in 2015/16 is most likely the reason for the high ice loss rates in the period 2013-2016. Run off from the glaciated areas is a important water resource for large regions in Peru and Bolivia and our measurements provide crucial information for water resource management and glacier change projections.