

Glacier decline in the Central Andes (33 degrees S) : Context and magnitude from satellite and historical data

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Abstract

Central Andes (33°S) represent a water-scarce region. During arid years, glacier runoff may constitute the main hydrological input at warm season and hence a steadfast deglaciation may represent a decrease in the regional water-budget. Ice-retreat enables landscape transitions from proglacial towards a paraglacial environment, allowing the formation of newly formed cryogenic deposits. Ice-surface changes in the Central Andes (33°S), including the high-mountain areas from Aconcagua, Mendoza and Maipo basins (Argentina and Chile), were studied using digitalized maps, aerial photographs, Landsat (1-8) and Sentinel-2A data for the period between 1956 and 2015. Band ratio and Normalized Difference Snow Index (NDSI) methods were tested using Landsat 8 and Sentinel-2A data for comparison. Geomorphological changes were assessed at Monos de Agua catchment (2750-4000 m a.s.l.) in the Aconcagua basin (Chile) as a regionally representative landscape transition case. Regional glacier shrinkage of $46 \pm 5\%$ between 1956 and 2016 was observed for the Central Andean sub-basins in both Argentina and Chile at 33°S. Overall, $107.1 \pm 5 \text{ km}^2$ of newly exposed surfaces are subject to permafrost conditions. Such insights raise concern in terms of current and future environmental assessments for newly formed cryospheric elements in water scarce regions..