

Contrasted glacier mass balance of debris-free glaciers between the southern and the inner part of the Everest region revealed by in-situ measurements since 2007

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Three debris-free glaciers are currently monitored in the Everest region (Central Himalaya, Nepal) and their annual glaciological glacier-wide mass balances (Ba) strongly differ. Mera Glacier (5.1 km² in 2012) is located in the southern part and has been in steady state over the last 8 years, whereas Pokalde (0.1 km² in 2011) and Changri Nup glaciers (0.9 km² in 2013), ~30 km farther north in the drier inner part of the range, have been losing mass rapidly with a Ba of -0.69 ± 0.28 m w.e. a⁻¹ (2009-2015) and -1.24 ± 0.27 m w.e. a⁻¹ (2010-2015), respectively. A qualitative comparison between Ba and annual or seasonal meteorological variables acquired at the elevation of glaciers suggests that these glaciers are sensitive to precipitation, to the incoming radiative energy fluxes and, occasionally, to very severe cyclonic storms originating in the Bay of Bengal. This contrasted mass balance pattern over rather short distances is related (i) to the low elevation of Pokalde and Changri Nup glaciers sometimes restricting them to a single ablation zone and (ii) to a steeper vertical gradient of mass balance for glaciers located in the inner arid part. This difference in gradient is potentially related to the across-range contrast in annual precipitation (south-to-north horizontal gradient of precipitation ≥ -21 mm km⁻¹ i.e. -2% km⁻¹) and a decreasing trend of precipitation at high elevation inside the range