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## Palaeoglaciation in the low latitude, low elevation tropical Andes, northern Peru

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Palaeo-glaciological studies of former ice thickness and extent within the tropical Andes have tended to focus on locations where glaciers are currently present, or in high elevation locations where evidence exists of recently deglaciated cirques. Few studies have focussed on low elevation regions due to the presumption that glaciers could not have existed at such low altitudes within the tropics. A latitudinal 'data gap' exists between Ecuador and more central and southern Peru where evidence for former glaciation is abundant. To fill this gap we present rare evidence of past glaciation from the Las Huarungas region, northern Peru, located in a relatively low elevation massif (<3900 m).

Within Las Huarungas a large valley glacier existed, extending N-S ~12 km down valley to ~2900 m in elevation while glacial cirques existed exhibiting an E-W orientation on the western facing hillslope of the massif with pronounced moraine complexes and bedrock erosion. We used high-resolution remotely sensed imagery, a 30 m ALOS DEM, and preliminary field observations to identify and map an abundance of geomorphic evidence of glaciation. These include moraines at different stages of preservation and predominance, eroded bedrock surfaces, cirque landforms and overdeepened valleys to develop the first glacial geomorphological map of the region. We performed morphometric analysis (e.g. width, length, altitude, azimuth) of the mapped glacial landforms and cirques along with hypsometric analysis of the main valley of Laguna Shimbe, yielding a hypsometric maxima of 3250 m. Using the geomorphological map, we determine the former extent and thickness of palaeoglaciers in the area and use delineated glacial outlines of their furthest extent to reconstruct Equilibrium Line Altitudes (ELAs) of these ice masses using a combination of ELA estimation techniques.

Ongoing research aims to determine whether the palaeoglacial evidence is consistent with formation by valley glaciers or an icecap and whether the timing of the local Last Glacial Maximum (LGM) was synchronous with the global timing. A set of hypotheses for the timing and drivers of the reconstructed extent of former glaciers in the area will be presented. Our analysis confirms the presence of former glaciers in a low elevation and low latitude region of the tropical Andes. Our ongoing work aims to unveil the timing of the glacial events and the drivers of the glacial and climate history seen within this important region.

