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A glacial chronology for post Little Ice Age glacier changes based on proglacial geomorphology, tree rings, OSL- and ^{14}C-dating at Mt. Pulongu, southeastern Tibet

David Loibl (1), Philipp Hochreuther (2), Daniela Hülle (3), Haifeng Zhu (4), and Frank Lehmkuhl (1)

(1) Physical Geography and Geoecology, RWTH Aachen University, Aachen, Germany (d.loibl@geo.rwth-aachen.de), (2) Department of Geography, FAU Erlangen-Nürnberg, Erlangen, Germany (philipp.hochreuther@geographie.uni-erlangen.de), (3) Department of Geography, Cologne University, Cologne, Germany (huelled@uni-koeln.de), (4) Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing, China (zhuhf@itpcas.ac.cn)

The remote eastern Nyainqêntanglha Range contains numerous temperate monsoonal glaciers which are highly sensitive to climate change. However, there is still a great lack of information on late Holocene glacier fluctuations and the factors driving these changes. We conducted field work at two large debris covered glaciers on the northern and southern slopes of Mt. Pulongu (~6,300 m a.s.l.). Detailed geomorphological mapping of the proglacial settings revealed similar patterns of two major and three minor/recessional glacial advances. At the northern glacier, tree ring dating for the moraines of the two major advances resulted in minimum ages of ~1670 AD and ~1745 AD, respectively. These Little Ice Age (LIA) ages are supported by geochemical measurements on glacial and glacio-fluvial sediments from these settings showing almost no signs of chemical weathering. Further evidence, including ^{14}C-age and depositional characteristics of a buried tree, and moraine topography, suggest that the second advance was stronger but was hampered by a dead ice relict of the previous advance. At the northern glacier, this obstacle led to an ice tailback and subsequently to lateral moraine oversteepening and breaching, resulting in a large lateral glacier lobe. At the southern glacier, the valley is narrower and hence did not allow the formation of a lateral glacier lobe. However, the proglacial setting, i.e. pronounced push moraines, suggests a similar sequence of events. Furthermore, both settings contain two moraine-dammed lakes in similar positions. A combination of OSL-dating, tree ring based reconstruction of the local climate, and constraints from the proglacial geomorphological setting enabled the inclusion of the 3 minor moraine stages into the glacial chronology. This multiproxy-approach resulted in a well-established morphochronology with multiple direct and indirect dates that allow the reconstruction of the glacial fluctuations at Mt. Pulongu since the LIA. A regional remote sensing study revealed that these settings are no special cases, but that many large glaciers in the eastern Nyainqêntanglha range show similar proglacial sequences, including several examples of large lateral glacier lobes. We therefore assume that – despite great heterogeneity in this high-mountain environment – the emerging patterns were caused by climatic changes that affected the whole region.