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Quantitative Estimates of Holocene Glacier Mass Fluctuations on the Western Tibetan Plateau

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Knowledge of the alpine glacier mass fluctuations is a fundamental prerequisite for understanding glacier dynamics, projecting future glacier change, and assessing the availability of freshwater resources. The glaciers on the Tibetan Plateau (TP) are sources of water for most of the major Asian rivers and their fate remains unclear due to accurate estimates of glacier mass fluctuations are lacking over long time scales. Here, we used $d^{18}O$ record at a proglacial open lake as proxy to estimate the Holocene glacier mass fluctuations in the Western Kunlun Mountain (WKM) quantitatively and continuously. Relative to past decades, maximum WKM glacier mass loss (-28.62 ± 25.76 Gt) occurred at 9.5-8.5 ka BP, and maximum glacier mass gain (24.53 ± 25.02 Gt) occurred at 1.3~0.5 ka BP, the difference in WKM glacier mass between the two periods account for ~20% of the total glaciers. Long-term changes in glacier mass suggests the TP glaciers likely face severe threats at the current rates of global warming.