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Basin-wide erosion rates of a relict surface in the southeastern Tibetan Plateau from in-situ produced 10Be in fluvial sediments

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Over geological time Earth's surface undergoes radical changes. Few regions display these changes more than the Tibetan Plateau, a dynamic region undergoing changes brought about by tectonic and climatic forcing. Our goal is to quantify surface erosion rates on the Tibetan Plateau. Characterizing the surficial changes and the underlying causes are significant goals that require quantitative tools. With the development of AMS and improved understanding of nuclide production rates, in-situ produced cosmogenic nuclide dating has become increasingly effective for quantifying surface exposure age and erosion rates. Likewise, in-situ cosmogenic 10Be has been successfully to determine basin-wide erosion rates in many geological setting. However, quantifying fluvial erosion rates from glaciated basins using cosmogenic nuclide concentrations in fluvial sediments has limitations because burial by ice and glacial erosion can strongly reduce concentrations or entirely reset the cosmogenic nuclide clock in a landscape, which in turn leads to overestimation of fluvial erosion rates. In this study, we measured 10Be concentrations in river sand samples from both previously glaciated basins and non-glaciated basins, on a low-relief relict surface and the surrounding mountain area, respectively, in the southeastern Tibetan Plateau. The results show that fluvial sediments from glaciated basins have higher cosmogenic nuclide concentrations than expected given the deglaciation ages for these basins. Derived basin wide erosion rates are therefore significantly lower for glaciated basins than for non-glaciated basins. We interpret the high cosmogenic nuclide concentrations as a result of nuclide inheritance from before the last glaciation. In contrast to others studies indicating that overestimation of fluvial erosion rates can occur due to glacial erosion, our results suggest that in the case of a formerly glaciated relict surface in southeastern Tibet (largely preserved under non-erosive ice), glaciation does not result in an overestimation of fluvial erosion rates from river sediments. The basin wide erosion rates in this case help constrain a background value for fluvial erosion in the study area. This result is consistent with previous work suggesting that relict surfaces on the Tibetan Plateau undergo little erosion on late Quaternary timescale.