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Extracting an unbiased erosion history of glacial landscapes

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There is an ongoing debate on whether or not late Cenozoic cooling led to an increase of erosion rates. The main point of controversy comes from our ability to measure erosion rate back in time. Using a probabilistic approach, some recent studies have implied that erosional hiatuses can overshadow any potential increase in erosion rates, especially in glaciated mountain belts. The main assumption behind this proposition concerns the choice of a probability distribution that characterizes how erosion operates in time and space. Here we investigate how such a choice may influence the inferred erosion history. We show that, even when using a heavy tail distribution, the likelihood of bias of an inferred increase of erosion rates may be avoided when erosion rates are estimated over fixed time intervals and averaged spatially, in agreement with previous studies. More importantly, we find that it may be difficult to fully justify the choice of heavy tail, light tail or other probability distributions from erosion estimates alone. Using a model of glacial erosion, we find that it is difficult to justify a Pareto distribution of landscape scale erosion hiatuses. We conclude that the time scale bias on measured glacial erosion rates is not as universal as previously suggested, and does not influence erosion rates over the timescales of thermochronological data.