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Detecting geomorphic processes and change with high resolution topographic data

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The first global topographic dataset was released in 1996, with 1 km grid spacing. It is astonishing that in only 20 years we now have access to tens of thousands of square kilometres of LiDAR data at point densities greater than 5 points per square meter. This data represents a treasure trove of information that our geomorphic predecessors could only dream of. But what are we to do with this data? Here we explore the potential of high resolution topographic data to dig deeper into geomorphic processes across a wider range of landscapes and using much larger spatial coverage than previously possible. We show how this data can be used to constrain sediment flux relationships using relief and hillslope length, and how this data can be used to detect landscape transience. We show how the nonlinear sediment flux law, proposed for upland, soil mantled landscapes by Roering et al. (1999) is consistent with a number of topographic tests. This flux law allows us to predict how landscapes will respond to tectonic forcing, and we show how these predictions can be used to detect erosion rate perturbations across a range of tectonic settings.