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Extracting tectonic information using the integral method of river profile analysis: applications along the Wasatch fault, Utah

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Tectonic deformation at the Earth's surface is reflected in the morphology of river profiles, hill slopes, and drainage networks. Various topographic metrics derived from river profiles have been proposed to identify tectonic hotspots in neotectonic regions. Using a high resolution digital elevation model to extract topographic data from channel networks, the advantages of the 'integral method' are exploited to analyse river profiles and catchments across two segments of the Wasatch Fault Zone, Utah. The results demonstrate much lower data noise when compared to standard practices of taking derivatives of topographic data. Combined with statistical analysis, it is possible to identify segments of river profiles that have responded to spatially variable rates of rock-deformation along the fault zone. Using a channel steepness index derived from the integral method, we find that previously published ^{10}Be catchment-wide erosion rates exhibit conflicting scaling relationships with basin-averaged steepness indices. This is possibly explained due to occurrence of glacial erosion in certain basins during the last glacial maximum. A simple method for calibrating stream power model parameters using the integral method is used to estimate areas of fault displacement acceleration along the Wasatch Fault.