Mapping offset channels from LiDAR derived terrain models along Hunter Mountain Fault Zone.

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Abstract

Searching for geomorphic features that reveal tectonic movement can often be like looking for a needle in a haystack. However, remote sensing technology, such as LIDAR, allows for the generation of digital terrain models that can be more time efficient and cost-effective when identifying a fault trace and analyzing associated landforms. The purpose of this project is to show how a point cloud LAZ file obtained from OpenTopography.com is processed in ArcGIS Pro to generate a 0.5-meter gridded raster with last return, ground points and visualize the DEM in a 3D scene for tectonic analysis. Derived terrain models, including a hillshade, slope-aspect, shaded relief, and 1-m contour map, are used to identify a ~1km long trace of the Hunter Mountain Fault zone in northern Panamint Valley, CA. To analyze lateral movement, five channels crossing perpendicular to the fault were selected and the displacement between piercing points were measured. Channel thalwegs, used as piercing points, were extracted from stream links and stream order rasters from the watershed analysis iterative workflow. The five offset channels result in an average right-lateral displacement of 69.17 meters along the N40°W striking fault trace. These results are combined with more extensive studies that estimate a slip rate of 2-3.2 mm/yr for the HMFZ to calculate a very rough estimate of 25-34 Ka for the fan age or age of channel incision. Although this is not a complete study including statistical accuracy, it presents how useful a digital terrain model can be for a virtual fault analysis and field work reconnaissance.