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Planform and cross-sectional geometry of incising mountain rivers

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Meander theories predict that sinuosity along incising rivers should develop faster with greater width-depth ratios, flow speeds, and bank erodibilities. We have previously discovered that there is also a positive correlation between discharge variability and regionally averaged mountain river sinuosity. Here we address the prediction that sinuosity development depends on width-depth ratios by comparing our regionalized measure of sinuosity with channel cross sections. We estimate channel widths by digitizing rivers in high-resolution optical remote sensing imagery, and reach-averaged slopes by extracting elevation values from a digital elevation model. We use these measurements along with gauging station discharge data in an equation that we derive for flow width-depth ratio as a non-linear function of discharge, width, frictional resistance, and channel slope. We find that the width-depth ratios of incising channels correlate well with our measure of regionally averaged sinuosity.