Lateral Channel Confinement, Tributaries, and their Impact on Channel Morphology
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Humans have had a ubiquitous influence on fluvial systems worldwide (Wohl, 2013). Landscape modifications such as lateral channel confinement and flow modifications frequently result in changes to channel morphology including width, depth, channel slope, unit stream power, and particle size distributions (PSD). Morphologic changes can be directly measured, but may also be reflected in the patterns of water surface roughness. This research builds on downstream hydraulic geometry (Leopold and Maddock, 1953) and the sediment links concept (Rice, 1998) to examine anthropogenic and natural controls on channel form across spatial scales. It also develops a method for mapping water surfaces with the same resolution we measure channel form. This research examines how anthropogenic and natural mechanisms control channel form along a 200-kilometer section of the Rogue River in Southern Oregon. I use a combination of remote sensing and field data to create a hyperscale data set containing width, slope and depth data. I use Structure-from-Motion to create particle size distributions for all exposed gravel bars in the study area. With these data I conducted a number of non-parametric statistical analysis to examine how natural and anthropogenic forces influence longitudinal trends in channel morphology. v I find that the Rogue River is a highly heterogenous river. At basin-wide scales it does not conform to our traditional views of downstream hydraulic geometry. At smaller spatial scales, the role of local geology triggers an alteration between the commonly observed trends in downstream hydraulic geometry and trends that do not match theory. At scales of 10s of kilometers anthropogenic controls on channel form trigger statistically significant modification of channel form as compared to natural channel reaches. Tributary and non-tributary sediment sources do not consistently result in a statically significant change to channel morphology. However, evidence of persistent delivery of sediment through alluvial and colluvial processes does appear to play an important role in channel morphology. This research supports the claim that intensive and extensive data collection of fluvial systems will further out understanding of how external and autogenic processes control channel morphology; allowing the combination and improvement of current theory which exist and distinct spatial scales.