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Decoding bedrock channel morphology using high-resolution topographic data

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The 3D morphology of a river channel is a key control on the resistance experienced by the flow, affecting the channel hydraulics, sediment transport and in-stream habitats. In bedrock channels, the morphology is a combination of multiple components including exposed bedrock, overlying sediment cover, and boulders. Furthermore, the morphology of exposed bedrock is expected to depend on the lithology, rock structure and the dominant erosion processes. In order to improve predictions of flow resistance in bedrock channels, we first need to understand how these different components contribute to the overall bed morphology. Here, we present high-resolution (cm-scale) topographic data collected using terrestrial laser scanning from multiple bedrock channel sections on different lithologies. We compare how roughness varies between these channels, and at different spatial scales. We identify the dominant wavelengths at which roughness occurs, and consider how they correspond to the different channel components. We also consider the extent to which lithology and sediment grain size appears to affect channel morphology and roughness.