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EXPLORING THE VALIDITY OF SURFACE ROUGHNESS ANALYSIS FOR RELATIVE AGE ASSIGNMENT OF QUATERNARY ALLUVIAL SURFACES IN THE INDIO HILLS, COACHELLA VALLEY, CA

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Surface roughness analysis is a commonly used method to quantitatively differentiate Quaternary surfaces in a range of studies (e.g. neotectonics, geologic mapping, planetary geology). Surface roughness is typically calculated as the standard deviation of the slope of the topography using a moving window, with window dimensions varying depending on data resolution and application. However, limitations and challenges with its use, such as entrenchment (reroughening) of alluvial surfaces via headward erosion or facies related controls on surface texture have not been properly explored. The goal of this study is to examine the relationship between the age, physical characteristics of alluvial surfaces, and LiDAR-based (0.5 m resolution) surface roughness analysis results. The study focuses on six Quaternary alluvial surfaces in the Indio Hills of the Coachella Valley, California, three of which have been dated in a prior study (Blisniuk et al., 2021), providing good age control. For each surface, we obtained data on the clasts, vegetation, and/or matrix observed at 1-m increments along a 50 m transect. We documented clast sizes (lengths, widths, and heights) and incorporated their longest axes in statistical analyses. Surface roughness maps and associated statistical data were obtained for each surface using eight different moving window sizes, ranging from 1.5 m^2 to 100 m^2. In general, it appears that surface roughness increases with increased window size. However, the results, when compared to the physical data from transects, were inconsistent. Although the clast sizes, clast size ranges, and proportion of matrix generally diminished with increasing age of the alluvial surfaces, the surface roughness does not track in a consistent fashion, with some younger surfaces appearing smoother than older ones. A possible explanation for the inconsistencies is rejuvenation of the surfaces by tectonic processes (Qf4) and entrenchment of the surfaces through headward erosion (Qf3), both of which were observed in the field. The full dataset will be used to explore what window size may best correlate to characteristics observed at the ground surface. A preliminary conclusion is that relative age assignment of surfaces using surface roughness analysis alone may not be accurate and should only be used in conjunction with other methods.

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