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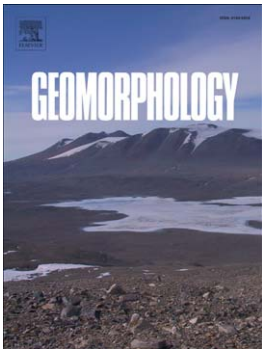

Mapping gullies, dunes, lava fields, and landslides via surface roughness

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Mapping gullies, dunes, lava fields, and landslides via surface roughness

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Abstract

Gully erosion is a widespread and significant process involved in soil and land degradation. Mapping gullies helps to quantify past, and anticipate future, soil losses. Digital terrain models offer promising data for automatically detecting and mapping gullies especially in vegetated areas, although methods vary widely measures of local terrain roughness are the most varied and debated among these methods. Rarely do studies test the performance of roughness metrics for mapping gullies, limiting their applicability to small training areas. To this end, we systematically explored how local terrain roughness derived from high-resolution Light Detection And Ranging (LiDAR) data can aid in the unsupervised detection of gullies over a large area. We also tested expanding this method for other landforms diagnostic of similarly abrupt land-surface changes, including lava fields, dunes, and landslides, as well as investigating the influence of different roughness thresholds, resolutions of kernels, and input data resolution, and comparing our method with previously published roughness algorithms. Our results show that total curvature is a suitable metric for recognising analysed gullies and lava fields from LiDAR data, with comparable success to that of more sophisticated roughness metrics. Tested dunes or landslides remain difficult to distinguish from the surrounding landscape, partly because they are not easily defined in terms of their topographic signature.

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