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A feature-preserving denoising algorithm to improve the quality of geomorphic analysis

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Noise in topographic data obscures features and increases error in geomorphic products calculated from Digital Elevation Models (DEMs). DEMs produced by radar remote sensing, such as SRTM, are frequently used for geomorphological studies, yet they often contain speckle noise that reduces the quality of geomorphometric analyses. We introduce an algorithm that denoises three-dimensional objects while preserving sharp features. It is free to download and simple to use.

In this study the algorithm is applied to topographic data (synthetic landscapes, SRTM, TOPSAR) and the results are compared against using a mean filter, using LiDAR data as ground truth for the natural datasets. Compared to those filtered to an equivalent level with a mean filter, data smoothed by the denoising algorithm are closer to the original data and to the ground truth. The feature-preserving nature of the algorithm allows significant smoothing to be applied to flat areas of topography, while limiting the alterations made in mountainous regions. This has clear benefits for creation of geomorphological maps in areas of mixed topography and has applications in fields such as hydrological modelling and landslide prediction.