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Region-growing segmentation to automatically delimit synthetic drumlins in 'real' DEMs

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Mapping or 'delimiting' landforms is one of geomorphology's primary tools. Computer-based techniques, such as terrain segmentation, may potentially provide terrain units that are close to the size and shape of landforms. Whether terrain units represent landforms heavily depends on the segmentation algorithm, its settings and the type of underlying land-surface parameters (LSPs). We assess a widely used region-growing technique, i.e. the multiresolution segmentation (MRS) algorithm as implemented in object-based image analysis software, for delimiting drumlins. Supervised testing was based on five synthetic DEMs that included the same set of perfectly known drumlins at different locations. This, for the first time, removes subjectivity from the reference data. Five LSPs were tested, and four variants were computed for each using two pre- and post-processing options. The automated method (1) employs MRS to partition the input LSP into 200 ever coarser terrain unit patterns, (2) identifies the spatially best matching terrain unit for each reference drumlin, and (3) computes four accuracy metrics for quantifying the aerial match between delimited and reference drumlins. MRS performed best on LSPs that are regional, derived from a decluttered DEM and then normalized. Median scale parameters (SPs) for segments best delineating drumlins were relatively stable for the same LSP, but varied significantly between LSPs. Larger drumlins were generally delimited at higher SPs. MRS indicated high robustness against variations in the location and distribution of drumlins.