Abstract

The semi-automated mapping of landforms in Digital Elevation Models (DEMs) and derived products is a major research topic in geomorphometry. Mapping landforms over vast areas is essential to better understand landform formative processes and the morphogenesis of a landscape. Due to limitations of cell-based mapping systems, approaches that use irregular objects as mapping units have become important for deriving landform information from DEMs. However, most object-based landform mapping schemes that have been devised rely on user-specific knowledge and arbitrarily chosen spatial scales. In order to map landforms more objectively, this PhD research proposes a two-phased semi-automated workflow for application in Object-Based Image Analysis (OBIA) frameworks. The workflow integrates supervised and unsupervised methods for detecting 'characteristic scales' of segmentation-derived multi-scale morphometric object patterns (Phase 1), as well as explicit representations of common sense geomorphological landform knowledge (Phase 2). These knowledge models support the selection of representative operational features for semantics-based classification of landforms at detected scales. The workflow was successfully applied to derive two distinct types of glacial landforms from DEMs: cirques and drumlins. A third test on extracting gullies in aerial photographs showed that the workflow can potentially be transferred to non-glacial landforms, and to other data types with various spatial resolutions. The proposed workflow ensures that landform mapping is conducted at representative morphometric object scales and that objective geomorphological landform knowledge is integrated. Thus, it is expected that the workflow may become a standard in geomorphometry.

Keywords Object-Based Image Analysis (OBIA), DEM, geomorphometry, digital geomorphological mapping, semantic model, characteristic scale, drumlin, glacial cirque, segmentation