Think objects, not pixels! Semi-automated object-based analysis for geomorphic identification and mapping from digital elevation data: the case of planation surfaces

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Many geomorphological maps have been produced thanks to advances in GIS software (e.g. processing performance) and digital elevation, satellite imagery or airborne datasets breakthrough (resolution, accuracy, coverage, availability). They are mainly built either by manual digitalization or through semi-automated pixel classification which are highly time-consuming and subjective for the former whereas the latter lacks relationship between neighbor pixels and introduce scale-bias. However, GEOgraphic Object Based Image Analysis (GEOBIA) that avoid these bias thinking objects rather than pixels emerged since two decades. This semi-automated method relies on i) a segmentation step that divide automatically the image into features through pixels grouping algorithms followed by ii) features classification (e.g. landforms of land-cover types) from their characteristics (e.g. shape, size) and statistics (e.g. elevation, slope, curvature, aspect).
Here, we performed GEOBIA to identify and map planation surfaces, which are widespread and useful to understand earth-surface dynamics and denudation chronology in source-to-sink studies. We developed two different protocols using SRTM 30arcsecond data and its derivatives (slope, curvature, ruggedness, etc.) on a study area where planation surfaces were recently mapped (Orange river, Namibia-South Africa). Both protocols differs in their classification way of thinking. The first use an unsupervised classification based on a clustering algorithm together with a fuzzy logic chart to define feature classes. The second use a supervised classification based on a machine-learning algorithm from user-defined landform samples. Our first results and benchmarking analysis of both protocols show i) that slope and curvature parameters should be preferred to elevation and other derivatives and ii) that they identify planation surfaces with accuracy around 80 to 90% despite their different philosophy. We will test the reproducibility and universality of both protocols from different control areas such as Argentina, Armorican Massif or even the French Massif Central before discussing the further steps required to discriminate the different generation of planation surfaces.