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Comparison of different landform classification methods for digital landform and soil mapping of the Iranian loess plateau

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The Iranian loess plateau is covered by loess deposits, up to 70 m thick. Tectonic uplift triggered deep erosion and valley incision into the loess and underlying marine deposits. Soil development strongly relates to the aspect of these incised slopes, because on northern slopes vegetation protects the soil surface against erosion and facilitates formation and preservation of a Cambisol, whereas on south-facing slopes soils were probably eroded and weakly developed Entisols formed. While the whole area is intensively stocked with sheep and goat, rain-fed cropping of winter wheat is practiced on the valley floors. Most time of the year, the soil surface is unprotected against rainfall, which is one of the factors promoting soil erosion and serious flooding. However, little information is available on soil distribution, plant cover and the geomorphological evolution of the plateau, as well as on potentials and problems in land use. Thus, digital landform and soil mapping is needed.
As a requirement of digital landform and soil mapping, four different landform classification methods were compared and evaluated. These geomorphometric classifications were run on two different scales. On the whole area an ASTER GDEM and SRTM dataset (30 m pixel resolution) was used. Likewise, two high-resolution digital elevation models were derived from Pléiades satellite stereo-imagery (< 1m pixel resolution, 10 by 10 km). The high-resolution information of this dataset was aggregated to datasets of 5 and 10 m scale. The applied classification methods are the Geomorphons approach, an object-based image approach, the topographical position index and a mainly slope based approach. The accuracy of the classification was checked with a location related image dataset obtained in a field survey (n $\sim$ 150) in September 2015. The accuracy of the DEMs was compared to measured DGPS trenches and map-based elevation data.
The overall derived accuracy of the landform classification based on the high-resolution DEM with a resolution of 5 m is approximately 70% and on a 10 m resolution >58%. For the 30 m resolution datasets is the achieved accuracy approximately 40%, as several small scale features are not recognizable in this resolution. Thus, for an accurate differentiation between different important landform types, high-resolution datasets are necessary for this strongly shaped area. One major problem of this approach are the different classes derived by each method and the various class annotations. The result of this evaluation will be regarded for the derivation of landform and soil maps.