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On pointcloud analysis for geomorphologic and morphostructural mapping

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The usage of Digital Elevation Maps, either from Satellite Altimetric Radar Missions (such as SRTM, Jaxa and others), large scale or high-resolution Lidar surveys and Multibeam bathymetric surveys, small to medium scale photogrammetric surveys, or any other tridimensional surface restitution technique, have been widely used to assess terrain features such as morphostructural, watershed and hydrogeologic features, sometimes involving geomorphologic classification. Commonly, fast DEM analysis highlights abrupt slope change, producing mainly ridge lines and crevices/valleys like features. On applying a first order derivate to the elevation data, easily it is mapped those sudden changes on the terrain morphology.

The following work suggests the conversion of the DEM data to pointcloud, where, with specialized software (like freely distributed open-source CloudCompare), further analysis can be done, allowing fast analysis of big data, and with possible segmentation of the data into families. Depending on the user's objectives and applied analysis, segmented families can be geomorphologic features, morphostructural features, or any other.

CloudCompare allows the fast calculation of geometric features of pointcloud data, such as roughness, curvature, density (surface or volume), 1st order derivate, linearity, planarity, sphericity and others. The desired geometric attribute is then stored to scalar data, that can be split by value (split the original pointcloud to segmented pointclouds), representing families by feature. When existent, other features from pointcloud can also be converted to scalar values, and can also be split by value. Example, from colored pointcloud (commonly Lidar or Photogrammetry), RGB data can be split, revealing to be an extreme valuable tool, for example to extract low height vegetation data from bare ground (green tones from brownish tones), where ground points automatic classification (example, CSF addon on CloudCompare) wasn’t as precise as desired. CloudCompare allows to re-interpolate data by scalar field or by elevation, reproducing a 2.5D elevation raster, that can be reimported to Remote Sense and GIS specialized software, such as QGIS, for further integration or data interpretation, where Remote Sensing common techniques may allow, as example, data integration, weighted-sum composite analysis, automatic or semi-automatic classification, or other.

It is presented the proposed pipeline for this analysis, using large scale Satellite data (Santo António, Benguela, Angola), high-resolution medium scale bathymetric data (multibeam survey in Porto Amboím bay, Angola), and high-resolution Digital Terrain Model from SFM photogrammetric survey (Miradouro da Lua, Belas, Angola).