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Handling of very large DEMs (ca. 1 TB) for efficient geomorphic and geologic interpretation: visualization of glacial/periglacial phenomena in the Bodensee-Oberschwaben area (southern Germany)

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The German land of Baden-Württemberg has created a LIDAR-based digital terrain model covering 36.000 km^2 with an accuracy of horizontally 1 m and vertically 0.15 m, and a volume of 1 TB. This model is ideally suited for systematic geomorphic analyses as it is extremely accurate and allows reliable large-distance correlation of geologic and geomorphic phenomena. Until recently no available software could handle this amount of data in real time. One of us (T.M.) has developed a software (TerrainView) allowing the visualization of and navigation within the entire data set in 9 levels of detail in orthoview and perspective view. The current version contains a limited number of functions which have proven to be effective tools for geomorphic and morphometric analyses. Height values can be colour-coded using ColourMaps defined upon specific individual requirements and are expressed both in shaded ortho and in perspective view. Light direction and vertical exaggeration can be adapted to produce optimal shading and relief effects. Gradients are visible in normal and inverse mode and can be exaggerated to enhance steepness. Contours can be spaced on individual criteria and draped as overlays on all types of view. The software also allows the construction of variably transparent cones intersecting the surface as a function of the parameters gradient, apex height, and base length. Morphometric data (longitudinal sections, cross-sections, gradients) can be derived placing polygons. Position within the area of Baden-Württemberg is optionally included as inset. All types of views can be exported as high to very high resolution png files. The background configuration of every picture obtained can be saved as a script allowing instant reproducibility. We present our first geomorphic studies based on this data set focussing on glacial and periglacial landforms in the Bodensee/Oberschwaben area. Branch basins, outwash plains, moraines, fragmentary recessional moraines, kettled and hummocky moraines, eskers, kames, kame terraces, subglacial valleys, drumlins, and recessional terraces can be effectively visualized and mapped with unprecedented accuracy, in places surpassing the resolution of existing geological maps by an order of magnitude.