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Recent advances in geomorphological mapping in the Sudetes Mountains, SW Poland

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The Sudetes – a medium-altitude mountain range in Central Europe – have a long history of mapping geomorphic features. Past approaches relied heavily on ground registration of specific landforms and interpretation of topographic maps at the scale of 1:25,000 and 1:10,000, although both tended to underestimate roughness of local hillslope topography. Aerial photography, in turn, proved of limited usefulness in the densely forested terrain. An increasing availability of LiDAR-derived digital elevation models provides new opportunities for geomorphological mapping and allows to verify previous views, whereas portable tools help to map subtle geomorphic features if LiDAR is not available. Selected results of recent mapping exercises will be presented, based on three case study areas: Karkonosze Mountains, Stołowe ('Table') Mountains and Kamienne Mountains.
In the Karkonosze, the highest mountain range within the Sudetes, elevated above the timberline in its axial part, a complete multi-layered geomorphological map based on LiDAR data with 0.6 x 0.6 m resolution and ortophomap interpretation has been prepared in the GIS-Environment (Global Mapper, QGIS). DEM was used to establish geomorphometric parameters of relief, mainly slope, and to track boundaries between different landforms, whereas aerial photographs helped mainly to map the extent of specific cold-climate relief features above the timberline. The map consists of 46 thematic SHP layers, showing landforms of different origin. The value of the map is twofold. First, this is the first complete digital geomorphological map for a mountainous area in Poland. Second, since it is based on high-resolution altimetric data, it allowed to verify previous views on the extent and style of mountain glaciation, distribution of mid-slope benches, characteristics of channel pattern etc.
The Stołowe Mountains are an example of nearly completely forested tableland morphology, difficult to perform ground mapping, especially along steep sandstone-capped escarpments. Again, LiDAR data were used to map the extent of characteristic landforms such as plateau levels, escarpments, talus slopes, rock labyrinths, tors, as well as anthropogenic landforms (road gullies, agricultural terraces and levelled terrain, disused quarries, drainage ditches), now hidden under forest. Two maps have been prepared. One shows the extent of particular geomorphic units which can be distinguished at meso- and macroscale, so that the map is legible in A4 format (1:25,000 scale). Altogether, 26 geomorphic units are mapped. Another one attempts to present contemporary morphodynamics of the area and shows the extent of 8 geomorphic domains, each characterized by a specific set of surface processes and their relative intensity.
In the Kamienne Mountains no high-resolution LiDAR data are available and the area is steep and densely forested. Geomorphic mapping was limited to specific locations, where relict landslides have been recognized on the basis of characteristic hillslope morphology. It was based entirely on field mapping carried out using laser target marker and/or ArcPad 7.1 software, implemented into portable computer with GPS receiver. Selected detailed geomorphic sketches of landslide bodies will be presented.