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The knowledge of the exact position and extent of various topographic features has increasing importance in geosciences. This is especially true if the features are or can be related to possible natural hazards like landslides, snow or rock avalanches, torrential precipitation discharge, etc. The dynamic character of some surface processes demands high accuracy DTMs (digital terrain models) for the detection and possibly for forecasting events of the aforementioned phenomena.

A very effective and straightforward way of topographic data acquisition is Airborne Laser Scanning (ALS, also known as LiDAR). High precision DTMs , derived from LiDAR data via sophisticated processing, has typically 1 m horizontal resolution or higher, while the vertical accuracy is on the order of ±10 cm depending on the LiDAR point density and the terrain slope. The determination of ground surface is possible even for forested or densely vegetated areas. This is an important benefit of LiDAR compared to other DTM generation techniques. The resulting vast amount of high-resolution digital elevation data makes it possible to outline microtopographic features that are often related to active tectonics, to recognize precursors of future mass movements or areas with increased erosion.

Our contribution deals with case studies from areas of the Austrian federal states of Burgenland and Vorarlberg. Neotectonic features are detected in the Seewinkel, an extremely flat area that also host playa lakes, and in the Leitha Mts., that has a unique tectonic position at the boundary of the Eastern Alps and the Pannonian basin. The latter tectonic boundary is neotectonically active and the movements can also be traced in microtopographic features. Further examples are shown from Vorarlberg, both from a high-relief area of Montafon, near to the Silvretta block and a medium relief area where active fluvial incision is combined with tectonic activity, causing major landslides (locality Doren). In both cases the microtopography provides evidence for active geomorphic processes. In the case of Doren multitemporal LiDAR data are available that show the post-event evolution of the landslide mass and the reaction of the fluvial system on the creeping material.

The analysis of LiDAR DTMs together with the necessary field observations and on-the-spot verification of the results provide comprehensive knowledge on microtopography and often lead to conclusions that may contribute to deeper understanding concerning natural hazard issues, like slope stability and tectonic activity.

Tectonic geomorphic microstructures in an Airborne Laser Scanning DTM in the Seewinkel Area, Little Hungarian Plain

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Our study area, the NW corner of the Little Hungarian Plain, at the junction of the Eastern Alps, the Pannonian Basin and the Western Carpathians, is a neotectonically active region forming the transition zone between the Eastern Alps and the partly subsiding Little Hungarian Plain. The on-going deformation is verified by the earthquake activity in the region. A part of the area, east of Lake Neusiedl, the so-called Seewinkel, has been measured by ALS technique, resulting in a DTM with 1 m horizontal resolution and vertical accuracy better than 10 cm. This area is an extremely flat vineyard region dominated by alluvial gravel deposits of uncertain age (Riss/Würmian?). The lack of significant outcrops renders structural geologic mapping of the area difficult.

Potential neotectonic structures of the DTM have been evaluated together with geological maps, regional tectono-geomorphic studies, geophysical data, earthquake foci, as well as geomorphic features and Quaternary sediment thickness values of the juxtaposed Parndorf plateau. The combined evaluation of these data supports the recognition of several tectonic features in the DTM that have a relief less than 2 m and therefore would not be visible in other datasets. The length of these linear geomorphic structures ranges from several hundred meters up to several kilometers. The most prominent of them forms a linear, elongated, 15 km long, 2 m high NE-SW trending ridge with gravel occurrences of average grain size of up to 5 cm on its top. We conclude that this feature is linked on a regional scale to the Mönchhof fault, which previously has been recognized in seismic sections only.This multi-disciplinary case study shows that ALS DTMs are extremely important for tectono-geomorphic investigations, they are even essential for the accurate location of neotectonic structures, especially in low-relief areas.

Influence of the Bohemian Spur on the evolution of the Eastern Alps

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The Bohemian Massif projects below the Eastern Alps and the Vienna Basin as a basement promontory often referred to as the Bohemian Spur. This salient defines a large concave to the SE segment of the European margin which is interpreted as a lower-plate margin of the Magura Basin. Based on academic and industry reflection seismic data in the NW Pannonian Basin, the Bohemian Spur can be traced much further to the SE than previously thought. In the easternmost Eastern Alps, in the area of the South Burgenland Swell, the European crystalline basement has not been penetrated by exploration wells. However, the Penninic outcrops of the Rechnitz Window group, interpreted as a metamorphic core complex, clearly indicate the presence of the Bohemian Spur underneath. The top Penninic surface was mapped in the subsurface on a sub-regional scale by seismic data and it can be used as a proxy for the extent of the underlying Bohemian Spur.

As the southwestern edge of the Bohemian Spur was controlled by a transform fault, this suggests that the Spur itself developed as a marginal ridge, very similarly to well-known examples of the equatorial Atlantic region. Thus, the extension of the Bohemian Spur to the SE as a pelagic swell with a conceptually predictable Jurassic facies succession, is interpreted to be the Czorsztyn