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Geomorphic expression of neotectonic activity in a low relief area in Airborne Laser Scanning DTM – a case study of the Little Hungarian Plain

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Neotectonic studies in low relief areas (e.g., alluvial plains) are typically based on seismic profiles because of the lack of outcrops and the very low relief. The active status of detected faults characterized by low, but present seismicity is an important issue for the safety of vulnerable industrial facilities, like hydroelectric or nuclear power plants. The activity of the majority of the faults in alluvial regions cannot be proven by seismic studies, because the topmost part of the seismic sections is typically muted. On the other hand, it is known that almost all active faulting have topographic expression, but normally it is difficult to observe this in the field, especially in densely populated alluvial plains, where the anthropogenic influence cannot be excluded. In topographic maps these features are sometimes present, but contour lines are only deflected, and it is hard to identify these features. Digital terrain models are suitable for this purpose, but their resolution is typically not enough to allow such extensive studies.

A new and promising technology, the Airborne Laser Scanning (ALS, also known as airborne LiDAR) is capable to provide very high accuracy digital terrain models (DTMs) up to the decimeter vertical resolution at which scale the active faulting can be detected. A further advantage of the ALS technology is that the soil surface can be mapped even in vegetated areas with moderate canopy cover, therefore tectonic faults

can be detected in these regions as well.

In our study area, the westernmost part of Pannonian basin, at the western rim of the Little Hungarian Plain (LHP), left lateral strike-slip faulting takes place along the Mur–Mürz–Leitha–Žilina fault zone since at least Miocene times, that is clearly indicated by the focal mechanisms of the instrumentally registered earthquakes. The course of the fault system is rather confined in the Eastern Alpine section more to the west, while in the area of the LHP the fault is branching into swarms of smaller displacements. However, the exact position of these fault sections is poorly known because of the low relief.

To localize the possible course of the faults we analysed an ALS DTM with a horizontal resolution of 1 m and vertical accuracy 10 cm of the area of the Seewinkel, a vineyard area east of the Lake Neusiedl (Fertő-tó). The data were integrated with previous observations, like earthquake foci, geological maps, geomorphic observations, etc.

In the following, we present the geodynamic setting of the area in large and small scale, then the ALS data acquisition and processing is briefly outlined followed by the data integration. We discuss the geomorphic features detected in the high-resolution DTM and compare their position to the observations and models of the previous authors. As a conclusion we imply that some of the geomorphic features are related to the faulting, and consequently, the ALS-derived DTM is especially useful for neotectonic evaluation in low relief areas, i.e., the Little Hungarian Plain.