



Detection of caves by geophysical methods to prevent natural hazards – Two case studies from Lower Austria

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The study area is located near Lunz am See in the Northern Calcareous pre-Alps at the contact of well bedded limestone (Opponitz Formation) and massive dolomite (Hauptdolomit), both from the Upper Triassic. Two case studies are presented: (1) In December 2016 a hole opened in a forest road and gave access to an underlying cave (length 147 m, depth 24 m) called Forststraßeneinbruch (cave registry no. 1823/64). From the survey, it was clear that also other parts of the cave are close to the surface (adjacent to infrastructure) as well. The aim of the geophysical surveys above this cave was to investigate whether these methods can provide information on the location of surface near caves that potentially collapse.

(2) 300 m down the valley, the entrance of a 1 km-long cave (Stiegengraben-Wasserhöhle 1823/25) was buried by gravel when a forest road was built in the 1970th. The cave acts as a spring during flood conditions but the water could escape through the coarse gravel. Not knowing the rare water activity of the cave, a lot of fine grained material was deposited on top of the coarse gravel recently. It is feared that due to this plugging of the spring the water pressure could rise and mobilize the unconsolidated material, which could result in a debris flow, endangering the houses in the valley below. Ground penetrating radar (GPR) and electrical resistivity tomography (ERT) were used to detect the exact position of the former entrance in order to allow the planned reopening. For the ERT measurements a system with 72 electrodes with 1 m spacing was used, which yielded a penetration depth of 15-20 m. Above Forststraßeneinbruch seven partly intersecting profiles were measured. Due to the dense forest, only five GPR measurements were possible along the same profiles. Therefore, both a 200 MHz and an 80 MHz antenna were used. With the 200 MHz antenna a penetration depth of about 10 m and with the 80 MHz antenna of about 30 m could be reached. To detect the buried entrance two more profiles using ERT and GPR were measured.

As there is access to Forststraßeneinbruch and thus a precise cave survey exists, it was possible to compare the results of the geophysical measurements with the real cave extent and thus to check the achievable accuracy. Besides the known cavities, also unknown ones could be identified.

A good agreement between the ERT and the GPR results could be found. A comparison with the cave survey showed also a good agreement with both methods and allowed calibrating the methods, which will make it easier to detect further cavities in this region.