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Investigation of the epikarst zone in water catchment areas using Ground Penetrating Radar (GPR) – a feasibility study

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Ground penetrating radar is an important geophysical method to investigate the subsurface using very short electromagnetic pulses that are radiate into the ground and reflect back to the surface from inhomogenities cause by structures and boundaries.

The uppermost zone of the karst system – the epikarst - is defined as the interface zone between soil and rock in karst landscapes. Water movement and storage in small voids, which characterize the epikarst zone, appear to play an important role in the hydrologic regime and vulnerability of karst aquifers.

The area of investigation is situated 80 km south of Vienna (Austria) on the Schneeberg karst plateau which is the catchment area for major springs of the 1^{st} Viennese water supply pipeline (e.g. the Kaiserbrunn spring). At the plateau it is possible to observe several karst landscapes with different karst features within a narrow bound, e.g. zones with high doline density and karren fields, areas with glacial overprinting versus palaeo-landscaps as well as compact and fractured karst rocks.

The focus is the epikarst, where a significant amount of water is stored and most of the carbonate dissolution takes place. The aim of this feasibility study is to investigate if it is possible to derive information of the thickness and storage capability using the Ground penetrating Radar (GPR). For that matter profiles were measured with a GSSI SIR 2 device in combination with antennas with different main frequencies (Range 40 MHz – 500 MHz) and processed with REFLEX Software. Using different

main frequencies gives the possibility to explore different depths, from a range of some meters down to about 40 meters with different resolutions. Field studies and data acquisition were realized at different weather conditions and so different degrees of humidity saturation are to be expected in the investigated area. Furthermore one area was profiled along serial sections in order to model a 3D block.

First results show that structures like fractures and cavities can be clearly detected by GPR. Field data acquisition under different weather conditions reveal that humidity saturation is an important parameter when subsurface fractures on the karst plateau are imaged. Profiles measured at wet conditions show more significant reflections in the upper part of the record, whereas measurements at dry conditions show more reflections in the bottom part. Furthermore measurements on different days show the same results, which means the images are clearly reproducible.