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UAV-based remote sensing of the Heumoes landslide, Austria Vorarlberg

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The Heumoes landslide, is located in the eastern Vorarlberg Alps, Austria, 10 km southeast of Dornbirn. The extension of the landslide is about 2000 m in west to east direction and about 500 m at its widest extent in north to south direction. It occurs between an elevation of 940 m in the east and 1360 m in the west, slope angles of more than 60 % can be observed as well as almost flat areas. Its total volume is estimated to be 9.400.000 cubic meters and its average velocities amount to some centimeter per year.

Surface signatures or 'photolineations' of creeping landslides, e.g. fractures and rupture lines in sediments and street pavings, and vegetation contrasts by changes of water table in shallow vegetation in principle can be resolved by remote sensing. The necessary ground cell resolution of few centimeters, however, generally can't be achieved by routine areal or satellite imagery. The fast technological progress of unmanned areal vehicles (UAV) and the reduced payload by miniaturized optical cameras now allow for UAV remote sensing applications that are below the high financial limits of military intelligence. Even with 'low-cost' equipment, the necessary centimeter-scale ground cell resolution can be achieved by adapting the flight altitude to some ten to one hundred meters. Operated by scientists experienced in remote-control flight models, UAV remote sensing can now be performed routinely, and campaign-wise after any significant event of, e.g., heavy rainfall, or partial mudflow.

We have investigated a concept of UAV-borne remote sensing based on motorized gliders, and four-propeller helicopters or 'quad-rotors'. Several missions were flown over the Heumoes landslide. Between 2006 and 2008 three series UAV-borne photographs of the Heumoes landslide were taken and could be combined to orto-mosaics of the slope area within few centimeters ground cell resolution. We will present the concept of our low cost quad-rotor UAV system and first results of the image-processing based evaluation of the acquired images to characterize spatial and temporal details of landslide behaviour. We will also sketch first schemes of joint interpretation or 'data fusion' of UAV-based remote sensing with the results from geophysical mapping of underground distribution of soil moisture and fracture processes (Walter & Joswig, EGU 2009).