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Caesium-137 as Indicator of Present Mass-Movement and Erosion Processes

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After the Chernobyl atomic accident in April 1986, notable parts of Eastern, Northern and Central Europe were contaminated by Caesium-137 (^{137}Cs). This radioactive isotope with 30.17 years half-life is completely of anthropogenic origin. After the accident it was transported through the atmosphere for long distances and contaminated the soil surface variably in the vast areas. Although much of the ^{137}Cs content has already decayed, notable amounts can still be detected.

The Department of Geophysics of the Geological Survey of Austria conducted in 2009 an airborne multi-sensor geophysical survey over three prominent landslides in Austria and Slovenia as a test study for the application of airborne geophysics for landslide investigations. Besides elelectromagnetic (subsurface resistivity) and passive microwave (soil moisture) measurements, a gamma ray survey was done; natural radioactive isotopes such as Potassium, Thorium, and Uranium were mapped. This paper deals only with the Caesium-137 distribution.

The Gschliefgraben test site (N Austria) is a complex of active and dormant earthflows, landslides and rockfalls in a 4 km long valley at the foot of Northern Calcareous Alps within Ultrahelvetic and Rhenodanubian flysch rocks. The last major reactivation occurred in 2007 and 2008. Also the Sibratsgfäll test site (W Austria) is a complex of shallow and deep-seated landslides and earthflows in sedimentary rocks of the Helvetic Zone, Liebenstein Nappe, Feuerstätte Zone and the Rhenodanubian Flysch. Here the major recent reactivation occurred in May 1999 affecting the villages of Sibratsgfäll and Rindberg. The Stoze landslide (NW Slovenia) occurred in November 2000 and is situated in dolomitic to clayey and marly Upper Triassic rocks, in Quaternary glacial moraine sediments and slope debris.

The Caesium-137 maps were compared to landslide inventory maps, airborne laser-scan DTMs and up-to-date orthophotos. In all of the test sites, the ^{137}Cs minima correlated well with bare surfaces of active landslides, earthflows, erosion gullies, spring areas and zones of estimated higher superficial water flow. On the other hand, the flat and stable areas have a relatively high content of this isotope. As conclusion we can say that the ^{137}Cs distribution could be used as a parameter for mapping of present active mass-movement, wash-out, and other superficial erosion processes that have occurred in Europe after the 1986 Chernobyl event. This study was done within the framework of the SafeLand project funded by the European Commission's FP7 Programme.