Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

STT03-06 Room:102A Time:May 23 11:10-11:35

Airborne Gamma-Ray Spectrometry Surveys in Austria - An Overview

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The Geological Survey of Austria (GBA), Department of Geophysics, has been conducting airborne geophysical surveys since the beginning of the Nineteen-Eighties. The current aerogeophysical system includes an airborne gamma-ray spectrometer (AGRS) used for measuring the natural and anthropogenic radioactivity. The AGRS is equipped with eight downward and one upward looking NaI(Tl)-detectors. The AGRS system of the GBA is designed to cover a broad range of applications like geological mapping, geotechnical applications and radiation protection.

The processing of the AGRS-data mainly follows the IAEA guidelines. The data processing includes aircraft and cosmic background correction; radon background correction; Compton correction using stripping ratios calculated from measurements over four transportable calibration-pads and height correction. The parameters to calculate elemental concentrations are determined from repeated flights at different heights over a calibration profile. In order to consider the topography effect, measured concentrations are calculated in respect to the point on the earths surface closest to the detector.

Furthermore, we recently developed a vegetation correction for coniferous forests. The vegetation correction uses the first and the last reflection of the laser altimeter to characterize the vegetation. This vegetation correction has been successfully applied to several survey areas since its introduction.

Besides measuring the abundances of potassium (K), uranium (U) and thorium (Th), the AGRS-system is able to detect Caesium-137 (^{137}Cs). In contrast to K, U and Th, ^{137}Cs is entirely of anthropogenic origin. After the Chernobyl atomic accident in April 1986, radioactive elements were transported through the atmosphere for long distances and distributed over vast areas. Depending on rainfall during this period, which caused a washout from the radioactive cloud to the ground, the soil in the affected regions was contaminated by ^{137}Cs to varying degrees. Although much of the ^{137}Cs content has already decayed (30.17 years half-life), notable amounts can still be detected in Austria.

In 1990 the GBA conducted an airborne survey in an area called Hausruck, located at the northern edge of the Alps. This survey is not only interesting because it achieved our goals in mapping gravel, but because it is also a good example of the benefit of AGRS over non-energy discriminating instrumentation (like Geiger counters). The northern part of the survey area shows a relatively high level of natural radiation. Due to rainfalls on the northern hillsides of the Alps in the time after the Chernobyl accident, there remains an increased concentration of anthropogenic ^{137}Cs in the southern part of the survey area. In this situation the total amount of radiation caused by natural and anthropogenic radiogenic elements is nearly the same in the entire area and only energy discriminating instruments like NaI(Tl)- or Ge(Li)-detectors are able to identify and map the distribution of man-made radiogenic contamination.

In 2009 a multi-sensor airborne geophysical campaign was conducted, which consisted of surveys in Austria and Slovenia. These surveys were designed as test studies for the application of airborne geophysics for landslide investigations. In all of the test sites, minima in the concentrations of ^{137}Cs correlated well with bare surfaces of active landslides, earthflows and zones of higher superficial water flow. One of these survey areas is the test site of Sibratsgfall, a complex of shallow and deep-seated landslides and earthflows. In 2000 the GBA conducted a first survey on this test-site. In 2009 the survey was repeated to monitor changes in geophysical properties of the landslide area. The comparison of the two surveys not only shows minima of ^{137}Cs over the landslide, but also a faster decrease of the ^{137}Cs concentration at the landslide than in the surrounding areas.

Keywords: airborne geophysics, gamma-ray spectrometry