Geophysical Research Abstracts
Vol. 12, EGU2010-11995-1, 2010
EGU General Assembly 2010

Advanced AEM by Comprehensive Analysis and Modeling of System Drift

Arnulf Schiller, Klaus Klune, and Ingrid Schattauer
Geological Survey of Austria (arnulf.schiller@geologie.ac.at / Fax 0043 1 7125674 - 55)

The quality of the assessment of risks outgoing from environmental hazards strongly depends on the spatial and temporal distribution of the data collected in a survey area. Natural hazards generally emerge from wide areas as it is in the case of volcanoes or land slides. Conventional surface measurements are restricted to few lines or locations and often can't be conducted in difficult terrain. So they only give a spatial and temporary limited data set and therefore limit the reliability of risk analysis. Aero-geophysical measurements potentially provide a valuable tool for completing the data set as they can be performed over a wide area, even above difficult terrain within a short time. A most desirable opportunity in course of such measurements is the ascertainment of the dynamics of such potentially hazardous environmental processes. This necessitates repeated and reproducible measurements. Current HEM systems can't accomplish this adequately due to their system immanent drift and - in some cases - bad signal to noise ratio.

So, to develop comprising concepts for advancing state of the art HEM-systems to a valuable tool for data acquisition in risk assessment or hydrological problems, different studies have been undertaken which form the contents of the presented work conducted in course of the project HIRISK (Helicopter Based Electromagnetic System for Advanced Environmental Risk Assessment – FWF L-354 N10, supported by the Austrian Science Fund).

The methodology is based upon two paths: A - Comprehensive experimental testing on an existing HEM system serving as an experimental platform. B – The setup of a numerical model which is continuously refined according to the results of the experimental data. The model then serves to simulate the experimental as well as alternative configurations and to analyze them subject to their drift behavior. Finally, concepts for minimizing the drift are derived and tested. Different test series – stationary on ground as well as in flight – show a clear correlation between the drift in raw voltage data and temperatures of critical system components, especially in the transmitter and receiver sections. Further, the correlation with air pressure, humidity, structure geometry and static electricity has been investigated. It shows that in case of a tuned system the dependency of signal phase and amplitude on system component temperatures prevails by far and can explain most of the system drift in the voltage domain. Post-processing for compensating for the drift of HEM-data is done by two different approaches: In the first, temperature dependent transfer functions of the transmitter- and receiver section are modeled on the basis of system temperature data and a correction is derived. In an advanced approach the drift of the system is analyzed by multivariate analysis including a broader set of data (HEM-signal, transmitter-reference signal, system temperatures, humidity, air pressure, height, dynamic loads) and based on an extended model. It proves that such an analysis is able to identify residual drift sources. As a result an integrated modeling scheme is depicted which enables a better separation of signal variations caused by the system or by changes in the measurement geometry from signal variations caused by the source distribution in the ground if critical system parameters are incorporated.