Summary

The Geological Survey of Austria/Department of Geophysics conducted the research project TEMPEL in the years 2011 to 2014. The main objective of the project was the evaluation of the geoelectrical method in terms of a monitoring tool, for a better understanding of dynamic processes at active landslides. For this purpose, several appropriate locations were equipped with a geoelectrical monitoring system. Because of the importance of additional data (displacement, groundwater table, etc.) locations with already existing monitoring infrastructure were preferred. However, for a sufficient database at some sites the installation of additional monitoring systems, e.g. for displacement, soil humidity, soil temperature, ground water table, was necessary. The interpretation of the large amount of collected data (geoelectrical as well as additional data) should be the basis for an improved knowledge about the overall status of the particular landslide body and respectively its change during phases of reactivation. For the implementation of this objective, some technical improvements of the existing geoelectrical monitoring system (Geomon4D, power supply, etc.) as well as significant developments in the field of data processing (quality control, filtering, inversion) were necessary. Several international cooperation partners supported the project concerning infrastructure, logistics and data exchange. For the improvement of existing processing routines, which were required for long term monitoring data, a close collaboration with the Korea Institute of Geoscience and Mineral Resources (KIGAM) was intended. For this purpose, each project year included a 3 months working stay of Dr. Jung-Ho Kim, an expert in this field of research, who worked as a visiting researcher at the Geological Survey of Austria. He developed an innovative 4D inversion software enabling detailed analysis of resistivity changes of the subsurface for long periods, which is essential for the interpretation of geoelectrical monitoring data. In the course of the project, geoelectrical monitoring was performed in total at 10 different landslide locations. Depending on local conditions (evolution of the landslide, data quality, infrastructure, etc.) the monitoring periods vary between several months and four years. Based on our data we can state that in some cases, even in the period of four years, there is no certainty to record a sufficient number of reactivation phases of the landslide, to ensure high interpretation reliability. This fact shows the importance of long periods of data collection. At least five monitoring sites will be continued in follow up projects to increase the significance of the interpretation. However, based on the recorded monitoring data we can conclude, that geoelectrical monitoring data contribute significantly to an improved interpretation of ongoing processes in landslide areas. The data clearly showed, that almost in all cases water infiltration was the controlling factor for displacement, but the infiltration process itself was highly dependent on local subsurface properties, preconditions (water saturation), the intensity of precipitation (can be also snowmelt) and seasonal variations. Based on the development of the new inversion software, for the first time clear differences in the infiltration processes could be proven with geoelectrical monitoring data, even if

comparable water input to the subsurface appears. At the same time, the monitored displacement data showed an obvious dependence on the characteristic of water infiltration. Therefore, the results of the geoelectrical monitoring could give a rough estimation of the conditions which cause an increased probability of high displacement rates. In contrast to commonly used monitoring methods (inclinometer, tensiometer, GPS), which provide only point information, the geoelectrical method gives spatially distributed information on the subsurface. Therefore, geoelectrical monitoring in combination with conventional methods turned out to be a very useful tool to contribute to an improved interpretation of landslide triggering processes.