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Permanent geoelectrical and temperature monitoring in the permafrost region Magnetköpfl, Salzburg

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Changes of climate parameters due to global warming generate increased permafrost warming and deglaciation in alpine regions. In the area of interest scientists observe increasing rock instability due to the disappearance of the permafrost inside the Magnetköpfl, a peak below the Kitzsteinhorn (3203 m a.m.s.l), as well as the decrease of glacier hight followed by a lack of counterpressure at the flanks of the slope. As a result, slabs of rock fall onto the year-round ski slope during the warmer season. Geoelectric measurements are an adequate method to measure permafrost, since the underground electric resistivity is highly dependent on temperature.
The GEOMON4D, an autonomous geoelectric monitoring system, developed by the Geological Survey of Austria, equipped with 80 electrodes and powered by a fuel cell, was installed for testing reasons in the year 2007 on Sonnblick and 2010 on Mölltaler Glacier. In 2011 the system was moved to the Magnetköpfl. The results of the active site show, that the resistivities are much higher than at the Mölltaler Glacier, which was about 200 m lower and contained no permafrost. Although the GEOMON4D is adapted for very high subsurface electrical resistivities with a constant current source we still approach the 10 V at the input channel with an injected current in the range of μA. Resistivity ranges at the Magnetköpfl from 104-108 Ohmm. By the end of December we covered the interesting period of the freezing process by measuring increased resistivity in the first 3 m below surface.
Since the soil temperature is highly dependent on various parameters (e.g. location, slope angle, lithology) it is necessary to have on site soil temperatures for a more reliable interpretation of the resistivity data. The geoelectric measurements are accompanied by various soil temperature sensors in several depths on and around the Magnetköpfl. The recording of the soil temperature is conducted in the framework of the MOREXPERT project by the University of Salzburg and alpS.
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