

Hoher Sonnblick: A super site for monitoring the cryosphere

Claudia Riedl¹, Stefan Reisenhofer¹, Daniel Binder², Annett Bartsch³, Adrian Flores-Orozco², Georg Heinrich³, Wolfgang Schöner³, Stefan Pfeiler⁴, Robert Supper⁴, & Ingo Hartmeyer⁵

¹ZAMG, Austria

²University of Vienna, Austria

³University of Graz, Austria

⁴Geological Survey, Austria

⁵University of Salzburg, Austria

The Sonnblick Observatory at the summit of Hoher Sonnblick (3106 m a.s.l.), Austria, is an outstanding research station established in 1886. Since then ongoing research covers studies and monitoring of the atmosphere, the hydrosphere, the cryosphere, the lithosphere and the biosphere. The permafrost monitoring of the summit of Hoher Sonnblick was initially motivated because of the instability due to permafrost degradation that threatened local buildings and the associated stabilization work. The distribution of and changes in permafrost are under constant monitoring at the Sonnblick and on the adjacent hill slope Wintergasse since 2006. These measurements contribute to Cryonet - Sonnblick in one of the 'integrated sites' within the Global Cryosphere Watch Program of the WMO.

In the Sonnblick area permafrost is probable above 2500 m in north faces and above 2750 m in south faces. An extensive observation network for ground surface, shallow and deep borehole temperatures, snow monitoring and geophysical measurements is established.

On the southern slope of Hoher Sonnblick continuous temperature measurements from three 20 m deep boreholes are available and can be viewed on the Web at www.sonnblick.net. Additionally, two Extensometer in 3 m and 5 m depth are installed in borehole 2 to survey permafrost-related crack movements. Close to this site in the investigation area Wintergasse measurements of 'Ground-Surface Tem-

perature' (GST) and 'Bottom Temperatures of the Snow cover' (BTS) have been carried out since 2006. Additionally, since 2010 every year few shallow boreholes with depths between 40 and 140 cm have installed to determine near-surface temperature. Each of these boreholes is equipped with four temperature sensors with a spacing between 10 and 20 cm to reach a probable geothermal gradient.

In summer 2015 three-component geophones were installed in the topmost 20 m deep borehole and at the foot of the Sonnblick north face for the quantitative observation and understanding of high alpine seismicity and rockfall events. Terrestrial based LiDAR completes the rock fall activity monitoring and the seismic network. Surface status monitoring is currently implemented in addition based on the satellite data from Sentinel-1.

In cooperation with the Geological Survey of Austria a permanently installed ERT array was established in July 2015 in the upper summit area of Hoher Sonnblick, which supply continuous information on near-surface ground thermal conditions to a depth of approximately 10 m in a high spatial resolution. ERT results from the first year of prospection are shown.

According to active seismic measurements in the years 2008 and 2009 repetitive measurements were performed in the summer 2015. The evaluation of these results are presented. Furthermore, the results of the first electromagnetic survey are shown.