3.4. Open-Air-Lab Kitzsteinhorn: A decade of glacier and permafrost monitoring in the Hohe Tauern Range

Authors: Ingo Hartmeyer (1), Markus Keuschnig (1), Robert Delleske (1), Michael Krautblatter (2)

Affiliations: (1) GEORESEARCH Forschungsgesellschaft mbH, Salzburg, Austria; (2) School of Engineering and Design, TUM – Technical University of Munich, Munich, Germany

Abstract: Many high-mountain regions worldwide are warming at rates significantly higher than the global mean. This warming trend has severe impacts (e.g., glacier retreat, permafrost degradation, biodiversity reduction), which however often occur with considerable lag times and in non-linear fashion. Accurate identification and quantification of climate change consequences thus requires extended observation periods and long-term monitoring approaches. In this contribution we present results acquired at the Open-Air-Lab Kitzsteinhorn (OPAL) – a long-term geoscientific monitoring initiated in 2010. Since then the OPAL combines data on external forcing (climate), internal responses (rock temperatures) and surface changes (rockfall, glacier retreat) and thus provides valuable insights on the correlation between climate warming and rock mass destabilization in high-alpine rock faces. Borehole temperature measurements carried out at the Kitzsteinhorn north-face demonstrate permafrost conditions with maximum active layer depths around 4 m and a trend towards increased thaw depths. Temperature below the zero annual amplitude (at 15 m) is -1.8 °C and displays a warming trend that decreases with depth. Since 1953 the surface area of the Schmiedingerkees has decreased from 2.17 to 0.75 km² equalling a loss of 65 %. Ice volume is investigated by GPR (ground-penetrating radar) measurements and UAV

photogrammetry and has diminished from 30 to 17 million m³ since 2008 (-43 %) since 2008. The pronounced glacier recession has had a significant impact on rockfall activity, which is eight times higher in freshly exposed rockwall sections than in areas unaffected by recent glacier retreat.