

# **Climate Change and its impact on the thermal state of Alpine glaciers and permafrost**

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Mountain glaciers and permafrost are key indicators and unique demonstration objects of global climate change (IPCC, 2007). As a consequence, they are “essential climate variables” in the terrestrial part of the Global Climate Observing System (GCOS/GTOS). The corresponding monitoring networks, the Global Terrestrial Network for Glaciers and Permafrost (GTN-G, GTN-P), use an integrated, multilevel strategy, which helps to bridge the gap between detailed local process-oriented studies and global coverage by combining in-situ measurements (mass balance, length change and temperatures for glaciers, active layer depth and borehole temperatures for permafrost) with remote sensing data and digital terrain information (areas, elevations, topographic parameters, inventories) and numerical modelling (thickness estimates, energy balance, temperature and flow modelling). The primary goals of such long-term climate-related monitoring programs are early detection, model validation, and assessing impacts of change.

Climate change in the European Alps in the 20<sup>th</sup> century has been characterized by a strong increase of air temperatures. These changes caused pronounced effects in the thermal regime of cold glaciers and in regions with permafrost. The primary aim of this presentation is to illustrate such effects based on existing data for the case of the Alps, where especially dense information has been available through historical times.

IPCC (2007): Climate Change 2007, Working Group I: The Science of Climate Change.