

## 50 years of mass balance observations at Vernagtferner, Eastern Alps

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The determination and monitoring of the seasonal and annual glacier mass balances of Vernagtferner, Austria, started in 1964 by the Commission of Glaciology, Bavarian Academy of Sciences. Detailed and continuous climate- and runoff measurements complement this mass balance series since 1974. Vernagtferner attracted the attention of scientists since the beginning of the 17th century due to its rapid advances and the resulting glacier lake outburst floods in the Ötztal valley. This is one reason for the first photogrammetric survey in 1889, which was followed by frequent topographic surveys, adding up to more than ten digital elevation models of the glacier until today. By including the known maximum glacier extent at the end of the Little Ice Age in 1845, the geodetic glacier volume balances cover a time span of almost 170 years. The 50 years of glacier mass balance and 40 years of water balance in the drainage basin are therefore embedded in a considerably longer period of glacier evolution, allowing an interpretation within an extended frame of climatology and ice dynamics. The direct mass balance observations cover not only the period of alpine-wide strong glacier mass loss since the beginning of the 1990s. The data also contain the last period of glacier advances between 1970 and 1990. The combination of the observed surface mass exchange and the determined periodic volumetric changes allows a detailed analysis of the dynamic reaction of the glacier over the period of half a century. The accompanying meteorological observations are the basis for relating these reactions to the climatic changes during this period. Vernagtferner is therefore one of the few glaciers in the world, where a very detailed glacier-climate reaction was observed for many decades and can be realistically reconstructed back to the end of the Little Ice Age.