Gössnitzkees (Schober Group, Hohe Tauern) –
A heavily debris-covered glacier in the context of climate change

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Abstract

The Gössnitzkees glacier lies at the head of the Gössnitz Valley in the Carinthian part of the Schober Group in the Hohe Tauern mountain range. Due to its topography and climatic conditions on the southern slopes of the Alps, the Schober Group, with its 30 peaks exceeding 3,000 meters, has relatively little glaciation. The Gössnitzkees, the largest glacier in the Schober Group, is a cirque glacier fed by avalanches and is currently almost entirely covered in debris. Visual glacier demarcation is difficult or often impossible due to debris cover in remote sensing data, as well as in situ. Glacier retreat and permafrost degradation have led to increased rockfall in recent years. Consequently, an Alpine Club trail in the immediate vicinity of the Gössnitzkees glacier had to be closed or abandoned.

To support glacier research at the Gössnitzkees glacier, the Graz working group for permafrost and glacier research uses various measurement methods: geodetic measurements, terrestrial photogrammetry, TLS, aerial surveying (airplane, drone), ALS, satellite surveying (optical sensors, RADAR), geophysical measurements (ground-penetrating radar, geoelectrics, hammer-seismics) and climate measurements (meteorology, ground temperature at different depths).

This article deals with continuing the glacial history of the Gössnitzkees glacier with evaluations of current aerial photographs and geodetic measurements and the integration of data from climate monitoring, such as temperature.

The results include changes in area and volume. The most recent aerial photographs date from 2021. According to these, the Gössnitzkees glacier has broken up into four sections. The current area is only a quarter of its 1850 extent (the last maximum extent, recognizable in the terrain by the prominent lateral moraines). The average ice thickness loss is approximately 0.5 m/year. The debris cover also allows for highly accurate, area-wide movement measurements, i.e., the determination of 3D displacement vectors. Based on the determined changes in terrain elevation and the movement pattern, the glacier margin can be derived relatively accurately.

The annual geodetic measurements (1996-2025, 30 epochs) show a significant decrease in annual ice melt and flow velocity. Due to the volatility of the measured variables, the climate signal (temperature increase) is only discernible over longer periods. The change in ice thickness correlates with the degree of debris cover, and the flow velocity with the ice thickness.

Keywords: Hohe Tauern, Gössnitzkees, debris-covered, glacier monitoring, glacier retreat, climate change