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An integrative observation of kinematics and geophysical parameters of Gianda Grischa rockglacier, Upper Engadine, Swiss Alps

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Rockglaciers are complex morphological structures and can exhibit a large variability concerning kinematics, subsurface properties like ice content and porosity and genesis. They are usually divided into three classes concerning their kinematics: (1) active (supersaturated with ice and creeping), (2) inactive (degrading ice and/or almost no creeping) and (3) relict (free of ice, no creeping). In addition, they may be divided into two main classes concerning their origin (talus-derived and moraine-derived) and concerning their surface characteristics (blocky and pebbly rockglacier).

In this contribution an integrative analysis of rockglacier kinematics and geophysical surveying is presented using photogrammetric analyses and different geophysical techniques. Hereby, the attempt was made to link the kinematic behaviour to the subsurface properties. First results from a case study of the complex rockglacier system Gianda Grischa in the Eastern Swiss Alps are shown. This rockglacier is over 1 km long and consists of two individual parts: a W-exposed active one (overlaying an older relict part), and a W- to SW-oriented inactive part. The area was covered by a small mountain glacier during the Egesen stage of the Younger Dryas cold phase. In the subsequent warming periods, this glacier decayed. During the ‘Little Ice Age’ the catchment area of the currently active part was already free of surface ice, while the root zone of the presently inactive part was still covered by a small cirque glacier. Today, both cirques are free of surface ice except for some small ice patches. Horizontal av-

erage annual surface velocities were determined photogrammetrically between 1971 and 1998. During the 27 years under observation, the active part of the rockglacier crept downslope with an average velocity of approximately 0.4 to 0.5 ma-1, reaching maximum velocities of up to 0.8 ma-1. The inactive rockglacier part showed no statistically significant movement although a geoelectric survey indicates the presence of permafrost. Streamlines interpolated from the surface velocity field of the active part of the rockglacier indicate a minimum surface age of 4 to 5 ka. The geophysical surveys included 2D electrical resistivity imaging and 2D sledge hammer refraction seismics. The geoelectrical surveys were performed on the active and inactive as well as the relict part of the rockglacier. The derived resistivity values are very variable. The highest values representing ice rich permafrost or even massive ice cores were obtained on the active part of the rockglacier. Based on the results of the seismic surveys air-filled voids or cavities, which could cause equally high resistivities as massive ground ice, can be excluded.

In the context of a possible acceleration of rockglacier creep due to changing climate, the quantification and monitoring of subsurface properties, especially the ice and water content are relevant parameters. However, for a comprehensive interpretation of such a complex rockglacier, more detailed geophysical surveys are necessary.