Documentation of the creep process
of Weissenkar rock glacier (Central Alps, Austria)

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Abstract

Weissenkar (46°57.5' N, 12°45' E) is a glacially shaped cirque in the Schober mountains of the Central Alps which are built of crystalline rocks. These rocks tend to be weathered to coarse debris favouring the formation of permafrost ice under climatic conditions with a mean annual air temperature of approximately –2°C in 2500 m a.s.l. Due to the vertical extent of the cirque ranging from some 2600 m to 3100 m a.s.l. and the steep slope in its upper part continuous deformation of the permafrost by force of gravity has created an active rock glacier as it is also the case in a great number of sites with comparable topography in this mountain group. The creeping permafrost body has actually reached a plateau where its motion is retarded due to low inclination resulting in a very pronounced surface topography.

This poster is focused on the documentation of the kinematic state of Weissenkar rock glacier. Geodetic and photogrammetric measurements have been carried out in order to obtain quantitative information on surface deformation, in general, and creep velocity and surface height change, in particular.

In 1997 a geodetic network consisting of two stable reference points located in the vicinity of the rock glacier and 18 observation points on the rock glacier was installed and measured with substantial support of the Institute of Navigation and Satellite Geodesy of the Graz University of Technology. These measurements have been repeated every year until now, with one interruption in 2002. Annual horizontal creep velocities obtained are rather small and range between 5 to 11 cm year^{-1}. In this poster selected results of the measurements (1997-2004) will be presented numerically and graphically. Furthermore, a comparative analysis of the data will be given.

Large-scale aerial photographs of three different epochs, i.e., 1974, 1998 and 2003, covering Weissenkar rock glacier were acquired in order to obtain area-wide information on the surface movement. Dense fields of three-dimensional surface displacement vectors were computed applying modern digital-photogrammetric methods. Results obtained for the time period 1998-2003 were compared with the respective values of the geodetic survey. The poster also comprises various thematic maps showing the mean annual creep velocity and surface height change for the time periods 1974-1998 and 1998-2003. As a basis of cartographic work a orthophoto map of the area of interest was compiled.

Finally, the kinetics of Weissenkar rock glacier will be discussed in respect to its morphology and its specific topographic situation.

Key words: Rock glacier monitoring, mapping, geodetic survey, digital photogrammetry, creep velocity, surface deformation, Weissenkar, Schober mountains, Central Alps, Austria