Rock glaciers Gruben, Muragl and Murtel, Switzerland: Area-wide flow fields, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Kaeaeb, A 1998. *Rock glaciers Gruben, Muragl and Murtel, Switzerland: Area-wide flow fields, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center. https://doi.org/10.7265/6f9y-qe30. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

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TABLE OF CONTENTS

Notice:

This data set was first published on the 1998 CAPS CD.
The text for this document was taken unchanged from that CD.

1 DATA DESCRIPTION

Besides their thermal and mechanical properties, rock glaciers are essentially defined by their kinematics. Knowledge of the permafrost flow field provides important information about the origin, morphology, development, dynamics and internal structure of creeping mountain permafrost. Monitoring permafrost behavior helps detecting climate signals.

Aerial photogrammetry was used for determining digital terrain models (DTM) with high resolution. The differences of multitemporal DTMs of a rock glacier provide the vertical changes of the permafrost surface. Horizontal surface displacements were obtained by simultaneously comparing two aerial photographs taken at different times and from different positions (Kaeaeb 1996a,b; Kaeaeb et al.1998). Repeated overridings by the nearby glacier affected the upper part of the Gruben rock glacier, Wallis. Compared to the lower, periglacial part of the rock glacier the higher surface lowering rates of the debris-covered dead ice remains indicate the dead ice being out of equilibrium. Due to different internal structure and different slopes, horizontal surface velocities show different creep directions as well as different creep rates. The rock glacier advances by about 12 cm/a. A 25-year time series of photogrammetrical monitoring (1970-1995) documents the temporal variations of surface kinematics of the rock glacier (Kaeaeb et al. 1998a). Surface kinematics of Muragl rock glacier (Upper Engadin) over the period from 1981 to 1994 reveal this rock glacier to be a complex system of several individual streams. Changes in elevation show a pattern of zones of surface heave and subsidence in the range of +- 10 cm/a. The rock glacier advances by about 5 cm/a (Kaeaeb 1998). The velocity field 1987-1996 at the surface of Murtel rock glacier, Upper Engadin, points to two dynamically different parts of the creeping permafrost--(1) high activity and transverse ridges in the inner part and (2) lower activity at the left and right margins. The ridges are advected down stream with a velocity approximately equal to the surface velocity. Stream lines can be interpolated from the surface velocity field. The curvature of the isochrones on Murtel rock glacier is similar to the curvature of the transverse ridges, which suggests slow changes in the flow field (Kaeaeb 1998, Kaeaeb et al. 1998b).

1.1 Coverage of data set

1.1.1 Study location:

Gruben rock glacier, Valais Alps, Saas valley, Switzerland

Muragl rock glacier, Upper Engadine, Switzerland

Murtel rock glacier, Upper Engadine, Switzerland

1.1.2 Geographic extent:

Gruben rock glacier: 46 10'10" N - 7 57'50" E

Muragl rock glacier: 46 30'20" N - 9 56'00" E

Murtel rock glacier: 46 26'00" N - 9 49'20" E

1.1.3 Period of investigation:

Gruben: 1970-1995, Muragl: 1981-1994, Murtel: 1987-1994

1.2 Summary Description

Besides their thermal and mechanical properties, rock glaciers are essentially defined by their kinematics. Knowledge of the permafrost flow field provides important information about the origin, morphology, development, dynamics and internal structure of creeping mountain permafrost. Monitoring permafrost behavior helps detecting climate signals.

Aerial photogrammetry was used for determining digital terrain models (DTM) with high resolution. The differences of multitemporal DTMs of a rock glacier provide the vertical changes of the permafrost surface. Horizontal surface displacements were obtained by simultaneously comparing two aerial photographs taken at different times and from different positions (Kaeaeb 1996a,b, Kaeaeb et al.1998).

Repeated overridings by the nearby glacier affected the upper part of the Gruben rock glacier, Wallis. Compared to the lower, periglacial part of the rock glacier the higher surface lowering rates of the debris-covered dead ice remains indicate the dead ice being out of equilibrium. Due to different internal structure and different slopes, horizontal surface velocities show different creep directions as well as different creep rates. The rock glacier advances by about 12 cm/a. A 25-year time series of photogrammetrical monitoring (1970-1995) documents the temporal variations of surface kinematics of the rock glacier. (cf. Figure Gruben). (Kaeaeb et al. 1998a).

Surface kinematics of Muragl rock glacier (Upper Engadin) over the period from 1981 to 1994 reveal this rock glacier to be a complex system of several individual streams. Changes in elevation show a pattern of zones of surface heave and subsidence in the range of +- 10 cm/a. The rock glacier advances by about 5 cm/a.(cf. Figure Muragl). (Kaeaeb 1998).

The velocity field 1987-1996 at the surface of Murtel rock glacier, Upper Engadin, points to two dynamically different parts of the creeping permafrost: (1) high activity and transverse ridges in the inner part and (2) lower activity at the left and right margins. The ridges are advected down stream with a velocity approximately equal to the surface velocity. Stream lines can be interpolated from the surface velocity field. The curvature of the isochrones on Murtel rock glacier is similar to the curvature of the transverse ridges, which suggests slow changes in the flow field.(cf. Figure Murtel). (Kaeaeb 1998, Kaeaeb et al. 1998b).

1.3 Current storage of data

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Paper         X
Wordprocessor file(s) X
Database      X
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1.4 Datacenter

Department of Geography

Physical Geography Division

University of Zurich-Irchel

Are your data at risk of being lost? Yes or No *** No ***

1.5 Data samples

Figure GRU1DAT.GIF: Horizontal surface velocities and changes in elevation 1970-1995 on Gruben rock glacier.

ftp://sidads.colorado.edu/pub/DATASETS/fgdc/ggd293_rockglac_switzer/gru1dat.gif

Figure GRU2DAT.GIF: Temporal variations of average velocity and average change in elevation on the periglacial (i.e. lower) part of Gruben rock glacier.

ftp://sidads.colorado.edu/pub/DATASETS/fgdc/ggd293_rockglac_switzer/gru2dat.gif

Figure MURADAT.GIF: Horizontal surface velocities 1981-1994 on Muragl rock glacier.

ftp://sidads.colorado.edu/pub/DATASETS/fgdc/ggd293_rockglac_switzer/muradat.gif

Figure MURTDAT.GIF: Horizontal surface velocities 1987-1996 on Murtel rock glacier.

ftp://sidads.colorado.edu/pub/DATASETS/fgdc/ggd293_rockglac_switzer/murtdat.gif

2 CONTACTS AND ACKNOWLEDGMENTS

Andreas Kaeaeb

3 REFERENCES

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4 DOCUMENT INFORMATION

4.1 Please cite these data as follows:

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4.2 Publication Date

January 1998

4.3 Date Last Updated

January 2021