

5th EUROPEAN CONFERENCE ON PERMAFROST

EUCOP5₂₀₀₉

CHAMONIX MONT-BLANC
22 June - 1 July /// FRANCE



Book of Abstracts

Are there any intact rock glaciers in the Balkan Peninsula?

Alexandru Onaca¹

Brigitte Magori¹

Florina Ardelean¹

Emil Gachev²

Petru Urdea¹

Mircea Voiculescu¹

Flavius Sîrbu¹

¹West University of Timișoara, alexandru.onaca@e-uvt.ro

²South-West University „Neofit Rilski”, Blagoegrad

Abstract

A combined approach consisting in thermal monitoring and geophysical investigations was used to examine for the first time the presence/absence of permafrost in several rock glaciers in the Rila and Pirin Mountains (Bulgaria). The preliminary results indicate that patches of relict permafrost may occur at altitudes above 2400-2500 m in both mountain ranges.

Keywords: permafrost, rock glaciers, thermal monitoring, geophysical measurements, Rila and Pirin Mountains.

Introduction

Within the mountainous regions, rock glaciers are generally considered as the most visible expression of mountain permafrost occurrence (Barsch, 1996). These spectacular landforms were previously described in several massifs in the Balkan Peninsula but, so far, no research has been done on the possible occurrence of permafrost. The investigations were conducted in the Rila and Pirin Mountains, where the climatic conditions appear to favor the preservation of permafrost.

Study area

The Rila Mountains are the highest range in the entire Balkan Peninsula, reaching 2925 m, whereas the Pirin Mountains are the third highest in the south-eastern Europe, thanks to their 2915 m maximum elevation. Both ranges lie in the southwestern part of Bulgaria and experience a transition climate between the temperate continental and the Mediterranean. Above 2900 m, the mean annual air temperature (MAAT) drops to less than -2°C, whereas the precipitations are on average around 1000 mm/year. Similar climatic conditions can be found on the highest ridges of the Southern Carpathians where permafrost occurrence has been recently documented above 2000 m by several studies (Onaca et al., 2017). Unlike the Southern Carpathians, which are currently free of ice, the Pirin Mountains host the southernmost glaciers in Europe (Snezhnika and Banski Suhodol)

along with several long-lasting snow/firn patches (Gachev et al., 2016).

Methodology

Due to restricted drilling possibilities, alternative methods (e.g., geophysical and ground surface temperature measurements) were used to get subsurface information regarding permafrost occurrence in Rila and Pirin Mountains. Since the bottom temperature of the winter snow cover (BTS) has proved to be an excellent indicator of the presence or absence of permafrost we have already conducted classical BTS measurements. A total number of 20 iButtons DS1922L were scattered on the surface of the selected rock glaciers in the Rila and Pirin Mountains to examine the near-surface thermal regime and to determine whether the microclimatic factors at the ground surface are suitable for hosting permafrost. Based on the recorded data from the ground-surface thermistors, the mean annual ground surface temperature (MAGST), ground freezing index, insulating snow cover duration and zero-curtain interval were calculated. In several cases, the summer temperatures of the springs seeping from the base of the rock glacier front were measured. In addition, geophysical measurements (electrical resistivity tomography and ground penetrating radar) were performed in few sites.

Results and discussion

Rock glaciers are widespread in the alpine area of both Rila and Pirin Mountains, above 2200 m.

The results of geophysical and thermal measurements revealed that patches of relict permafrost may occur at altitudes above 2400-2500 m in Pirin and Rila Mountains. Based on our observations and measurements the sites where permafrost is probable to occur are characterized by openwork block layers of the rock glaciers, reduced income of solar radiation and a very efficient cooling effect of the blocky surface. BTS values lower than -3⁰ C were measured, at sites where the mean annual ground surface temperature is around 0⁰ C. Despite the thermal measurements were performed in similar conditions (e.g. coarse debris) a relatively high range in the BTS and MAGST values was measured, confirming that air circulation (e.g. convection, advection) within the coarse blocks could be responsible for these differences.

The geophysical and thermal measurements will continue for at least 3-5 consecutive years. However, forthcoming research on this topic is needed, since the possible permafrost patches could be the last frozen ground remnants in the Balkan Peninsula

Acknowledgements

This work was supported by a grant of Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P1-1.1-PD-2016-0172, within PNCDI III.

References

- Barsch, D., 1996. Rockglacier. Indicators for the Present and Former Geocology in High Mountain Environments. Springer, Berlin, 331 p.
- Gachev, E., Stoyanov, K., Gikov, A., 2016. Small glaciers on the Balkan Peninsula: State and changes in the last several years, 415: 33-54.
- Onaca, A., Ardelean, F., Urdea, P., Magori, B., 2017. Southern Carpathian rock glaciers: Inventory, distribution and environmental controlling factors. Geomorphology, 293: 391-404.