Międzynarodowa Środowiskowa Szkoła Doktorska
przy Centrum Studiów Polarnych
w Uniwersytecie Śląskim w Katowicach

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Title of PhD project: Modelling of subsurface melt in Blue Ice Areas

The leading unit: Institute of Geophysics PAS.

Requirements:
1. MSc in geophysics, physics, geology, geodesy, geography or similar subject.
2. Advanced knowledge of optics, glacjology, hydrology or geomorphology, glacjologią, hydrologią lub geomorfologią
3. Familiriaty with methods and advanced skills in remote sensing and GIS
4. Basic programming skills
5. Advanced skills in English

Tasks description:
1. Analysis of satellite data with focus on optical properties of glacial ice;
2. Compilation of archival field measurements in the vicinity of the;
3. Dobrowolski Station Mathematical modelling of solar radiation propagation in the glacial ice;
4. Modelling of the subsurface melt of glacial ice;
5. Preparation of science articles and doctoral thesis.;

Abstract:

The main objective of this research project is to determine the role of the internal greenhouse effect beneath the ice surface in the ice ablation process of glacier ice. This phenomenon, which has been previously studied to a limited extent, appears to have a significant impact on the mass balance of blue ice areas (BIAs), characteristic of the Antarctic Ice Sheet. One of the key issues to be addressed will be the influence of surface irregularities and the presence of rock material on the localized intensification of solar radiation absorption, a crucial factor in the ablation process and, consequently, the glacier mass balance.

To address these questions, a multidisciplinary approach will be employed, utilizing a combination of advanced techniques and research methodologies. Mathematical modeling will play a vital role in developing detailed simulations of the internal greenhouse effect beneath the ice surface. The results of these simulations will be validated through comparison with data from satellite lidar measurements (ICESat-2). Additionally, machine

learning algorithms will be used to analyze and interpret complex datasets, aiding in satellite image classification and model optimization.

The primary focus of this research will be the ablation zones of glaciers located near the Polish Antarctic Station, named after Dobrowolski, situated in the Bunger Oasis in East Antarctica. This area holds significant importance in the context of Poland's involvement in polar research, due to the revitalization of the station and the resumption of Polish research activities in this region.

In summary, this research project aims to determine the role of the internal greenhouse effect beneath the ice surface in the ice ablation process of glacier ice, particularly in the blue ice areas of the Antarctic Ice Sheet. It will employ a multidisciplinary approach, including mathematical modeling, satellite lidar measurements, and machine learning, with a primary focus on ablation zones near the Polish Antarctic Station, Dobrowolski, in the Bunger Oasis in East Antarctica.

Other information:
The work will be carried out under supervision of: Michał Pętlicki, petlicki@igf.edu.pl. Institute of Geophysics PAS

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Information on the IEDS admissions: https://www.mssd.us.edu.pl/en/admission-2024-2025/