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przy Centrum Studiów Polarnych
w Uniwersytecie Śląskim w Katowicach

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Title of PhD project: The impact of climate change on underwater light availability in Arctic waters.

The leading unit: Institute of Oceanology, Polish Academy of Sciences, Sopot.

Requirements:

1. Master's degree in the field of Oceanography, Physics, or similar.
2. Knowledge of research topics related to Marine Physic and Bio-physics
3. Good computing skills, experience with Linux, and programming skills in Java or Python additionally appreciated
4. Ability to work effectively in English, both verbally and written.
5. Ability to work at sea

Tasks description:

1. Getting to know and preparing scientific equipment for field research;
2. Preparation, organization, and conducting of field measurements in the fiords and shelf waters of the Western Spitsbergen;
3. Collecting and processing satellite data necessary for the analysis;
4. Development of site-specific remote sensing algorithms;
5. Data analysis;
6. Preparation of scientific publications and conference presentations;
7. Regular reporting of work progress;
8. Assistance in everyday scientific activity of the Marine Physic Department at IOPAN.

Abstract:

The Arctic Region has been recognized as one of the most remarkable regions of global climate change. The Arctic Ocean is warming must faster compare to the other parts of the world, causing not only the rapid ice sheet reduction. Melting ice sheet and glaciers not only increases the exposed ocean surfaces, increasing the amount of light reaching the ocean's surface and then distributed within the water column, but are also an additional source of suspended and dissolved matter, significantly changing the optical properties of the water and affecting the underwater light field (i.e. its intensity and spectral composition).

Light and nutrients are key drivers of Arctic ecosystem dynamics. Primary producers in the upper ocean (phytoplankton) require light for growth. Therefore, changes in light availability can have a significant impact on Arctic primary production. Phytoplankton Arctic primary production forms the basis of the Arctic marine food web, thus changes in primary production will have cascading effects on higher trophic level species such as fish, birds, and mammals. Due to climate change and the increase in water

temperature, the extent of particular phytoplankton groups also changes, which may be characterized by a different composition of light-absorbing pigments, which additionally modifies the light fields in the ocean. On the other hand, the variable, both in quantitative and spectral terms, light conditions prevailing in an intensely modified environment, impose increasingly stronger adaptation requirements for the existing phytoplankton groups. Furthermore, much higher trophic level predator-prey interactions are themselves also regulated by light, as the ability of visual predators (e.g. fish, birds) to detect prey is a function of available light (as well as visual acuity and prey size).

All of the above factors have significant contributions to the state of the marine Arctic ecosystem. Assessment of these contributions, related to the changes in light regime in the Arctic waters, to the observed trends in the variability of the Arctic ecosystem, and as well a better understanding of the relationships between them, will be the main goal of this project.

The analysis will be based on already existing and collected during the project environmental data, including spectral measurements of downward and upward light in the water column, together with quantitative characteristics of optically significant marine water constituents.

Obtaining observations in extreme conditions, which are characteristic of the polar environment, remains a challenge. Therefore, the project relies significantly on processing the project satellite data, to quantify large-scale changes in the light field and to predict the associated ecological consequences . Collected in situ, data will be also used for the development and validation of site-specific remote sensing algorithms, necessary for mapping the key optically significant water constituents as well as mapping of the parameters related to the light distribution within the water column, e.g. the euphotic zone depth and diffuse attenuation coefficient of downwelling irradiance. The combined use of satellite remote sensing and in situ observations could be also used to improve parameterization schemes in atmosphere-ocean circulation models to assess the role of the changes in the in-water light regime in the effect of Arctic amplification.

Other information:

The work will be carried out under supervision of: prof. Mirosław Darecki, darecki@iopan.pl, Institute of Oceanology, Polish Academy of Sciences.

The Secretary of the IEDS Recruitment Committee: +48 32 3689 380, e-mail: polarknow@us.edu.pl

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