Extended Abstract

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The Causes of Ice Thickness Fluctuation

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Extended Abstract

The research investigates the causes of ice thickness fluctuation on 39 artificial water bodies in the Silesian Upland (southern Poland). The research was carried out over three consecutive winter seasons. The measurements and observations were planned every two days throughout the freezing and ablation of the ice, and every four days while there was an ice cover. The thickness of the ice cover and the snow layer overlaying it were measured each time. The findings demonstrate that the 35 water bodies analyzed all have a similar (quasi-natural) ice regime in which ice thickness fluctuation is primarily determined by air temperature and the thickness of the snow layer covering the ice. The ice thickness on such bodies of water does not differ much from that recorded on lakes in northern Poland, with average thicknesses ranging from 4 cm to 21 cm and maximum thicknesses ranging from 14 cm to 40 cm depending on the season. Four bodies of water had varying ice conditions; in their case, the average and maximum ice thickness were much lower. This was created by the entrance of warmer potamic water (quasi-natural regime) in the Niezdara N water body, whereas it was caused by discharges of warm mine water in Pod Borem, Sonicka, and Somerek (anthropogenic regime).

One of the essential aspects of identifying the ice regimes of lakes and water bodies is data on the thickness of the ice covering them. The average and maximum thickness of ice on lakes are often juxtaposed with the dates of development and disappearance of ice phenomena and ice layers, as well as the length of time the ice-covered the water bodies.

The thickness of the ice covering lakes is determined by many environmental factors, the most important of which are: the lake's location, temperature patterns during the winter season, the amount of heat accumulated in the lake water and bottom sediment, and the amount of snowfall, which translates into the thickness of the snow cover covering the ice. Anthropogenic variables, such as the input of thermal pollution (heated water) and the influence of the so-called urban heat island, can also alter them.

The Silesian Upland is one of Europe's most man-made landscapes. Human activities connected to the extraction of natural resources, the growth of various fields of industry, and major urbanization processes have all been responsible for modifying practically all of the environmental components of this region over millennia. The presence of numerous manmade water bodies in the landscape of this area of Poland is one outcome of this activity, which is the result of both purposeful and inadvertent action. Even though artificial water bodies are not a natural component of the local ecosystem, they go through the same processes as natural lakes from the moment they emerge, and human alteration of limnic processes is mostly caused by pollution.

Many scholarly papers have been written about the events and processes that occur in the water bodies of the Silesian Upland. The subject of the progression of ice phenomena in local water bodies has been one of the most prominent study issues in recent years. The researchers sought to characterize the icing of the water bodies in this region of Poland, with a particular emphasis on the amount of alteration of ice phenomena caused by human activities. The majority of research on ice phenomena in water bodies in the Silesian Upland and its immediate surroundings tends to focus on individual water bodies or groups of water bodies distributed across limited regions.

According to research done on water bodies in the Silesian Upland, variance in ice thickness is mostly determined by air temperature patterns throughout a given winter season. Significant reductions in air temperature resulted in the production of thick lake ice in the great majority of the water bodies investigated. The amount of snow on the ground has a significant impact on the variation in ice thickness across various bodies of water. Differences in the thickness of snow covering the ice from the moment it forms might restrict the dynamics of crystal ice accumulation during the first freezing period and enhance the dynamics of snow ice accumulation during the second half of the winter season.

The ice formation mechanisms are similar to those seen in real lakes, and the changes in ice thickness are mostly determined by environmental factors such as topoclimatic conditions and the

morphometric properties of a specific water body (translating into the amount of heat accumulated in the water and sediment after the summer season, and consequently the pace of freezing). The RDA study demonstrates that the morphometric characteristics of water bodies (mostly their typical depths and amount of retained water) transfer into the thickness of the ice accumulated on them throughout the winter.