Snow Cover Extent in the Western Carpathians in Winter 2019/2020 Based on Sentinel-2 Satellite Images

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Abstract

The aim of this study is to compare the maximum and minimum extent of snow cover in a selected area of the Western Carpathians during the winter of 2019/2020. The analysis is based on Sentinel-2 satellite imagery, complemented with daily snow depth data.

According to the report of the Polish Institute of Meteorology and Water Management – National Research Institute (IMGW-PIB, 2025), 2024 saw the highest annual air temperature on record, reaching 10.9°C. However, when divided by seasons, the warmest winter occurred in 2020 (December 2019 – February 2020), with mean seasonal temperature of 3.1°C. This type of winter warming is very evident in mountainous areas, where the depth and extent of snow cover is directly dependent on prevailing air temperatures. Hence, the study area location in the Polish, Slovak and Czech Western Carpathians. According to the physico-geographical regionalization by Solon et al. (2018), the study area includes the following macroregions: the Western Beskidy Mts, belonging to the Outer Western Carpathians, as well as the Orawa-Podhale Basin and the Tatra Range which are part of the Central Western Carpathians. The climate of the study area exhibits features typical of mountainous and foothill areas, such as temperature decrease with altitude and precipitation increase up to a certain elevation.