

## RESEARCH ARTICLE

# Sunshine duration in Poland from ground- and satellite-based data

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## Abstract

The aim of the study is to characterise the spatial variability of sunshine duration in Poland. The study used ground-based and satellite-based data from 1983 to 2018 multi-annual period, from the territory of Poland. The ground-based data include daily sums of sunshine duration from 29 Institute of Meteorology and Water Management—National Research Institute stations and two stations of the Jagiellonian University. Satellite-based data from the product “SDU - Sunshine Duration, v003” were used with a resolution of  $0.05^\circ \times 0.05^\circ$ , coming from the nearest pixel of a given meteorological station. These values were obtained from the SARA-2.1 database, published by The European Organization for the Exploitation of Meteorological Satellites (EUMETSAT). It was found that the mean annual sums of sunshine duration calculated on the basis of ground-based data in Poland range from about 1,460–1,500 hr in the south and south-west of the country (mountain areas) to 1,800–1,830 hr in the north—the region of the eastern Baltic coast. Satellite-based data are in line with ground-based data in relation to the dependence of sunshine duration on latitude, that is, the increase in sunshine duration from the south to the north in the summer and in the spring, and the decrease in the winter. In the autumn, the spatial variability based on satellite data is more latitudinal than in the case of ground-based data. Moreover, in the autumn and winter, the sums of sunshine duration based on satellite data are overestimated and, in the summer, especially since the turn of the 20th and 21st century, they have been underestimated. The performed analysis has shown that there is some conformity of the results, but the accuracy of matching satellite-based data and ground-based data depends on the location of the station and is subject to fluctuations in the annual and multi-annual cycle.

## KEYWORDS

correlation analysis, heliograph measurements, satellite-based sunshine data, sunshine duration

## 1 | INTRODUCTION

Sunshine duration is the longest measured characteristic of solar radiation. In Poland, measurements using the Campbell-Stokes heliograph began in Krakow in 1883, as

one of the first five measurement programmes in Europe (Matuszko, 2014). Although sunshine duration determines only the time of direct solar radiation, it also provides some data on the total solar energy reaching the Earth's surface during the daytime. Previous works on