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Methods of the Visualisation of Precipitation Based on Various Observation Measurement Periods in GIS

JOANNA BAC-BRONOWICZ

Agricultural University of Wrocław, Department of Geodesy and Photogrammetry, Wrocław, Poland
e-mail: bac-bronowicz@kgf.ar.wroc.pl

Abstract. The paper is one of the first attempts to make use of the GIS to analyse the existing climatological data in the Lower Silesia region. The present study proposes a choice of the collection of basic climatic information obtained from survey stations and its further analysis dependent on the distribution. Signs on the maps connected with the reliability of the parameters depend on taking into account suitably long periods of observation.

Key words: data series, precipitation, punctual data, point symbols, Geographic Information System.

1. Introduction

The main foundation for the project of the Polish Spatial Information System (PSIS) was presented in the year 2000 as a result of different studies lasting a period of ten years (Bielecka and Linsenbarth, 2000). Besides topographic data and landuse characteristic, the next stage in the development of PSIS has to be the formation of a system with thematic data. Such elements as soil structure, geological and morphological forms and parameters of climate are very important for the right management of Earth's goods (Lee *et al.*, 1993). As a source of all the

above-mentioned data, except the climatological ones, specially processed and up-to-date materials, both cartographic and remote-sensing, can be used: maps, photos, pictures, thermal registrations. Climatological data are of a different nature and are gathered in a listed form. The accessible sources of the data represent different levels of reliability as far as their spatio-temporal representation is concerned.

In the present paper an attempt to present a cartographical design of data reliability has been made. Some of the observed climatological parameters from the Lower Silesia region have been chosen as the source data and analysed by means of the GIS (data from the Institute of Meteorology and Water Management yearbook; Wiszniewski, 1953).

2. Scope of Investigation

The method has been presented using as an example the collection of characteristics connected with precipitation. Accessible data are the result of measurements. Each of the meteorological stations provides information about the term of every registered feature; also the localisation of each station is known. For the purposes of the present study the following factors, important for agriculture and connected with the protection of natural environment, have been taken into consideration: monthly and annual precipitation sums, daily precipitation sums, the number of precipitation days, the maximum snow depth, downpours and rainfall of high density, hail, snow and thunderstorm data, snow cover water equivalent, the "totalizator" type of a rain-gauge. The information concerning a given station consists of a list of data related to different climatological periods.

3. Description

For fixed practical purposes different configurations of characteristics have to be considered. Still, even if characteristics of precipitation were treated separately, they may not always be compared with a proper reliability. It results from the lack of homogeneous data obtained from the whole territory under investigation (Bac-Bronowicz, 2001). For a certain number of stations in the Lower Silesia, the results from 110-year-long precipitation time series concerning the years from 1891 to 2001 have been published. Average values of precipitation from 30-year-long periods (for example: 1931–60, 1951–80) have been placed in particular series 110-year long. But even a 30-year-long period can be not representative because of an uneven distribution of precipitation in longer perspective (for all 110-year period). Reliable maps which show the distribution of climate factors can be created only on the basis of the results from the same periods (Bac, 1997). To make a complete inference, merely the data from the stations with similar geographical

location (relatively close distance, morphological and roughness conditions) can be taken into account. Besides, precipitation mean values can be used for detailed comparisons providing they were obtained from the same period and from continuous observation lasting at least thirty, or still better, forty years (Dubicka and Pyka, 1988). The observed annual precipitation sums show the lowest variability in comparison with other precipitation parameters. In case of a shorter period of observations, the analyses of the data should be more detailed. In extreme cases, maximum daily precipitation values can be used.

4. Proposed Method

Figure 1 presents the compound system of designations of temporal variety of the data being at disposal for map-makers. Each sign denotes a certain period of

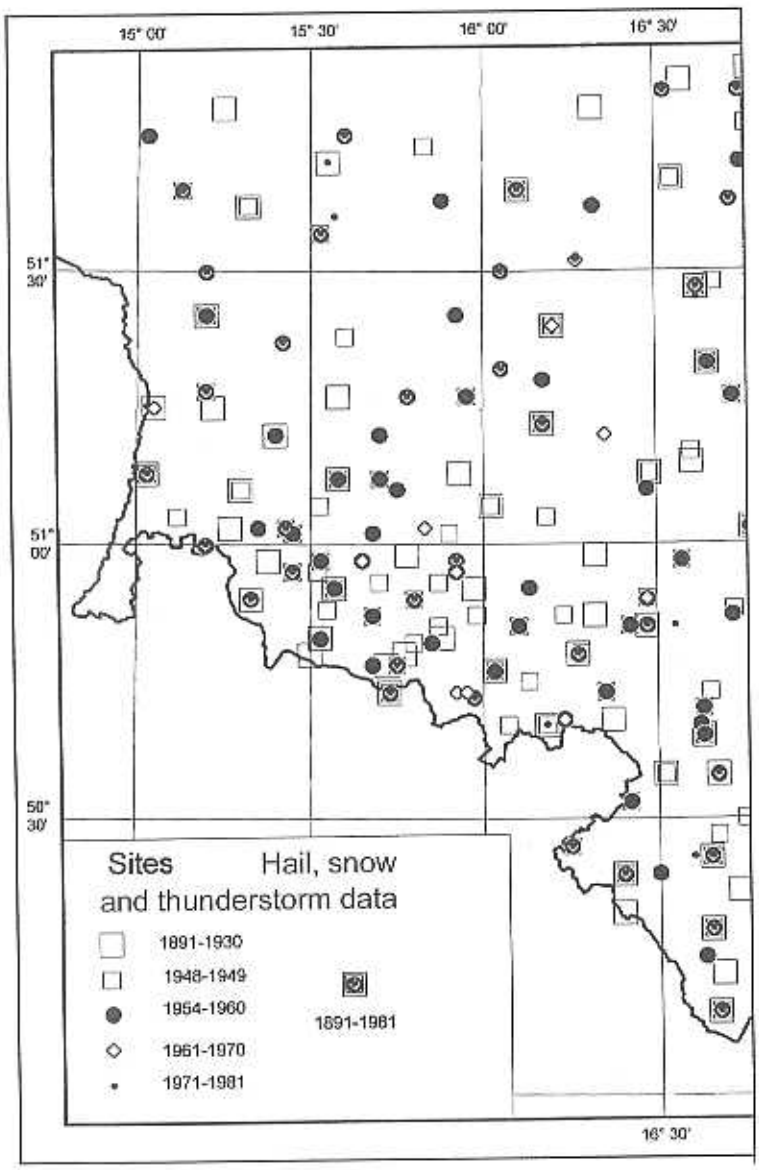

Fig. 1. Distribution of precipitation data (Lower Silesia region)

data gathering (Mościbroda, 1999). An appropriate comparison of designation creates a complex sign with the full information and representing the total period of measurement of a chosen characteristic.

Each of the characteristics has to be treated separately because a set of characteristics is not always constant during the whole period of the activity of a station. Applied graphical variables: value, shape, pattern – allow to recognise holistic spatial distribution of a chosen group of terminal data and assess the level of their reliability in the region of Lower Silesia under investigation.

The example presented in the paper is a simplified form of the more detailed proposal. All characteristics have been elaborated and many may be used in a practical way in different thematic studies, planning and valorisation. Maps are compared in GIS creating an easy platform to be used. Figure 2 presents a more elaborate proposal for the part of studied territory. It can be noticed that adding the variable "colour" might improve the reliability of the system.

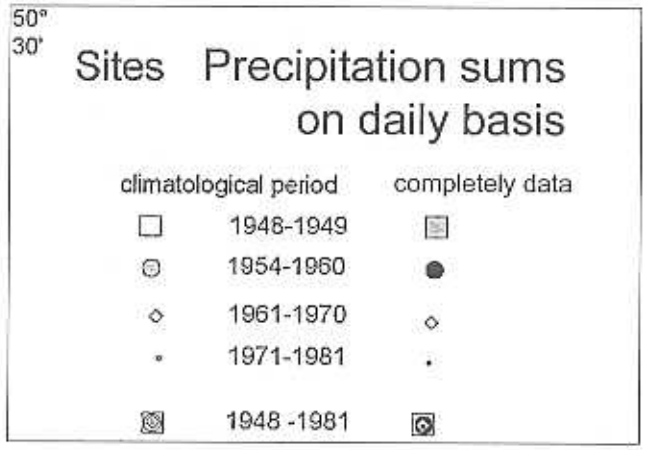

Fig. 2. Legend: precipitation data (Lower Silesia region)

5. Conclusion

Correctness and usefulness of a cartographical modelling process depend mostly on truthfulness, adequacy and on how far it is representative of the data.

This statement is especially important in the age of the fast development of spatial information systems, which accelerated and simplified gathering and transferring data. Thanks to these systems, existing separate data files can be easily and fast combined and integrated into the large data sets. Currently, GIS endusers require detailed precipitation maps not only with mean annual values, but also with the information on expected deviations with the probability of extreme events.

Such models enable unbiased assessments of climate conditions with a detailed spatial resolution. It seems to be the current issue because several research programmes on the construction of climatic databases in medium scales have just been started.

Methodology of creating climatic data is based on the regional spatial information systems which are still under development.

Creating adequate multivariate maps of climatological conditions using GIS systems requires the full information about both climatic data and their accuracy based on metadata, as well.

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Metody wizualizacji danych o opadzie atmosferycznym z różnych okresów pomiarowych w GIS

Streszczenie

W artykule przedstawiono możliwości analizy dostępności i ciągłości danych o opadach atmosferycznych. Informacje z bazy skonstruowanej w systemie informacji przestrzennej pozwalają na ocenę wiarygodności średnich wartości parametrów w zależności od kompletności danych w poszczególnych punktach pomiarowych. Do prezentacji wyników wykonano projekt złożonych sygnatur punktowych.

Słowa kluczowe: ciąg pomiarowy, opady atmosferyczne, znak punktowy, system informacji geograficznej.