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Szczepan Mrugała, Krzysztof Siwek

Department of Meteorology and Climatology, Institute of Earth Sciences
Maria Curie-Skłodowska University
Al. Kraśnicka 2cd, 20–718 Lublin, Poland
szczepan.mrugala@umcs.lublin.pl; krzysztof.siwek@.umcs.lublin.pl

CHANGES IN FREQUENCY OF OCCURRENCE OF YEARLY PRECIPITATION ANOMALIES IN THE LUBLIN REGION IN THE SECOND HALF OF THE 20TH CENTURY

Abstract: The aim of this paper is to characterise changes in frequency of occurrence of anomalous yearly sums of atmospheric precipitation in the Lublin region in the period 1951–2000. In the second half of the 20th century negative precipitation anomaly occurred in a larger number of stations than the positive anomaly. Particularly strong anomalies were observed in two decades (1951–1960 and 1981–1990). However, during two following decades (1961–1970 and 1971–1980) the positive anomaly occurred in more stations.

Keywords: climate change, precipitation anomalies, Lublin region

Introduction

Atmospheric precipitation is an discontinuous meteorological component, characterised by significant changeability in space and time. This makes it possible for both normal and anomalous precipitation to occur in any given period of time (month, season, year). In the context of increasing frequency of numerous extreme meteorological phenomena (Kaszewski, Siwek 2005), a deeper insight into weather anomalies is highly relevant. The sources covering this subject define precipitation anomaly as any precipitation diverging *in plus* or *in minus* from a predefined norm. However, the definition of the norm and the precipitation anomaly, as well as the ways of their measure-

ment is not agreed upon among the researchers of the subject (Mrugała 2001).

Methodology

The aim of this paper is to characterise changes in frequency of occurrence of anomalous yearly sums of atmospheric precipitation in the Lublin region in certain years and decades of the second half of the 20th century. The source materials included yearly sums of atmospheric precipitation for period 1951–2000 gathered in 62 stations (synoptic, climatological and measuring precipitation) located in the Lublin region and its vicinity (Siwek 2006) – Fig. 1. To calculate the precipitation anomaly, the method proposed by Mrugała (1997, 2001, 2007) was applied, which includes the asymmetry of the series of precipitation sums and their natural changeability in the year.

The formula describing the norm and anomalies of the atmospheric precipitation is defined by the following inequality. Sides of the inequality represent minimum and maximum range of the norm respectively.

$$\frac{\sum(p < \bar{p})}{n_{p<\bar{p}}} < p_N < \frac{\sum(p > \bar{p})}{n_{p>\bar{p}}}$$

where:

p_N – Normal precipitation for e.g. a month

$\sum(p < \bar{p})$ – Precipitation sum e.g. in months with values lower than the average in the series

$\sum(p > \bar{p})$ – Precipitation sum e.g. in months with values higher than the average in the series

$n_{p<\bar{p}}$ – Number of (e.g.) months with precipitation sums lower than the average in the series

$n_{p>\bar{p}}$ – Number of (e.g.) months with precipitation sums higher than the average in the series

Results

Between 1951 and 2000 there are years when precipitation anomalies were observed in most of the stations, as well as years, when they occurred only in separated cases or were not observed at all (Fig. 2). Years characterised by the most frequent negative anomalies are: 1982 (60 stations), 1951 (58 stations), 1961 (53 stations) and 1969 (51 stations). Eleven years of the analysed half-century are characterised by the occurrence of negative pre-

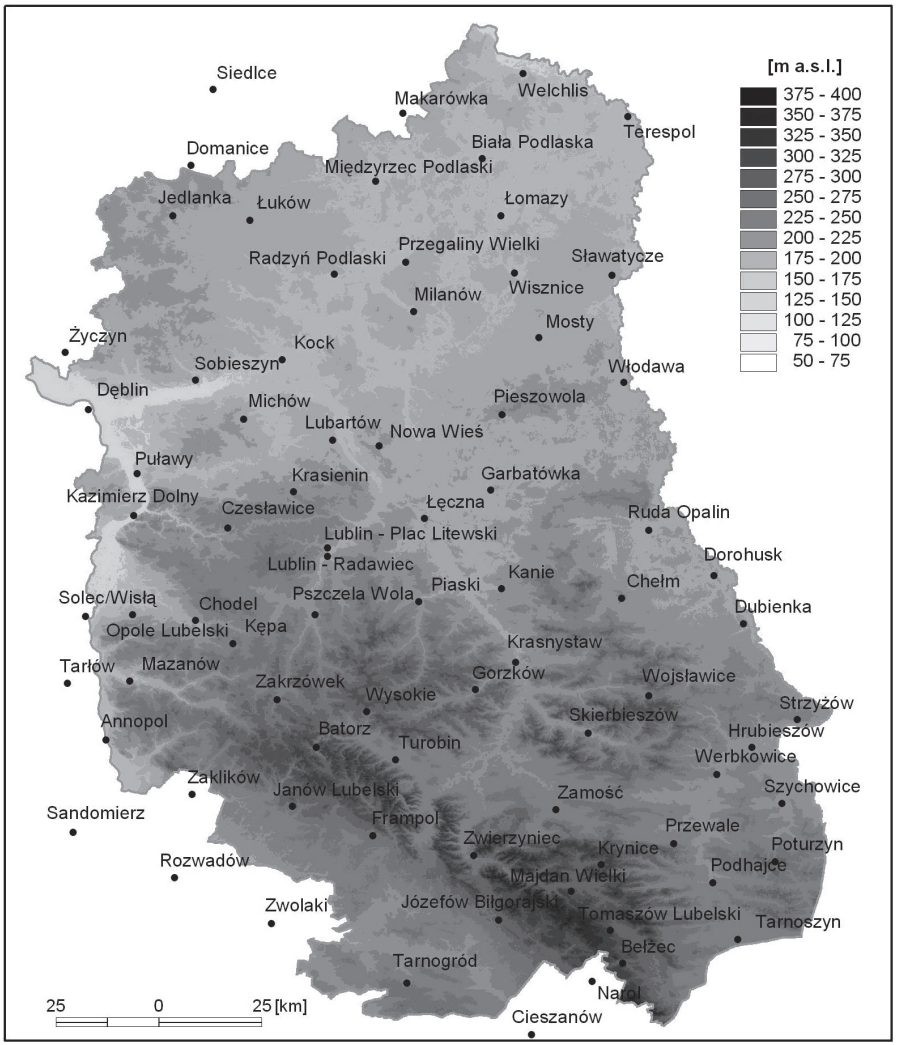

Fig. 1. The stations included in the study

cipitation anomaly in more than 31 (more than a half) stations. In 8 of the years the negative anomaly was not observed in any of the stations. A year in which the negative anomaly occurred in all of the stations was not observed in the series (Fig. 2). Years characterised by the most frequent positive anomalies are: 1974 (62 stations), 1970 (55 stations) and 1980 (51 stations). Six years of the analysed half-century are characterised by the occur-

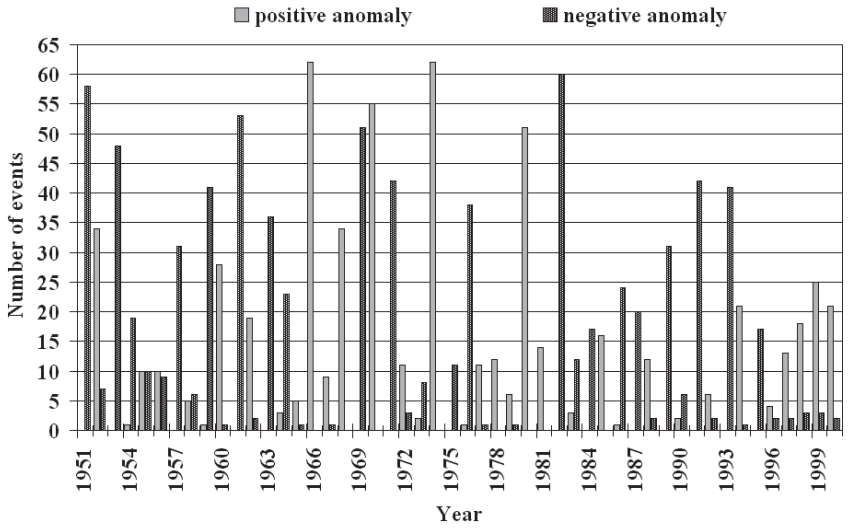

Fig. 2. Number of stations included anomalies of precipitation in selected years (1951–2000)

rence of positive precipitation anomaly in more than 31 (more than a half) stations. In two years (1966, 1974) the positive anomaly was observed in all of the stations. In 15 years the positive anomaly was not observed in any of the stations (Fig. 2).

The frequency of the occurrence of precipitation anomaly in the Lublin region in the analysed half-century was varied (Fig. 3). The driest decades were 1951–1960 and 1981–1990, in which the frequency of the occurrence of negative precipitation anomalies (average of 62 stations) was 37.1% and 27.7% respectively. The most humid decades were 1961–1970 and 1971–1980, in which the frequency of the occurrence of positive precipitation anomalies (average of 62 stations) was 30.3% and 25.2% respectively. The decade of 1991–2000 can be considered "normal", since most of the yearly precipitations sums (64.1%) fit in the normal range of precipitation values and the frequencies of positive or negative anomalies were low and of similar values (18.5% and 17.4% respectively). In the period of 1951–2000, the frequency of the occurrence of negative precipitation anomaly was 25.4%, and in the case of positive anomaly it was 18.9%. In the last three decades,

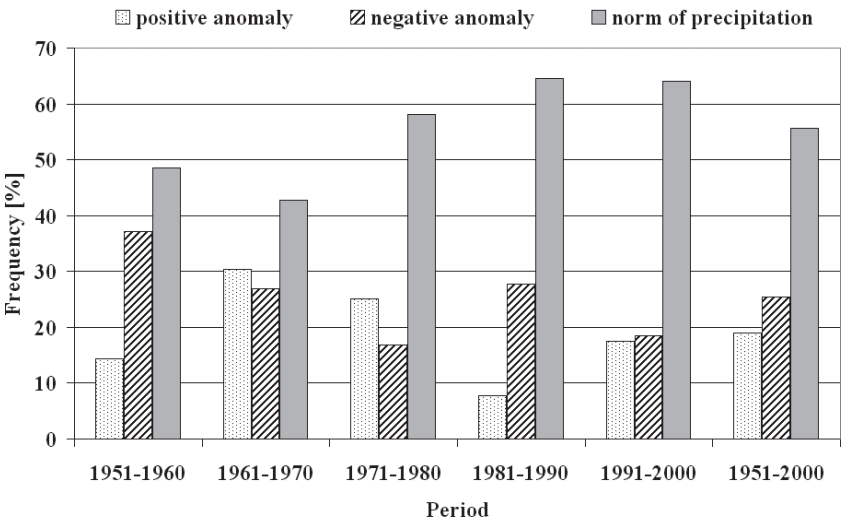

Fig. 3. Mean frequency (in %) of occurrence of anomaly and norm of precipitation in the period 1951–2000

the frequency of the occurrence of normal precipitation was higher than the average in the entire period of 50 years (Fig. 3).

Summary

In the Lublin region, the number of stations where particular precipitation anomaly was observed was changing year by year. In the second half of the 20th century negative precipitation anomaly occurred in a larger number of stations than the positive anomaly. Particularly strong anomalies were observed in two decades (1951–1960 and 1981–1990). However, during two following decades (1961–1970 and 1971–1980) the positive anomaly occurred in more stations than the negative anomaly, though it was not as clearly visible. During the last decade of the 20th century both positive and negative anomalies occurred in almost equal number of stations. In the 50-year period, as well as in the particular decades, normal precipitation occurred most frequently. This value changed from over 40% (e.g. the 1961–1970 decade) to over 60% (decades 1981–1990 and 1991–2000). In the 50-year period its frequency was 55.7%.

Acknowledgements

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