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THE PROBLEM OF DETERMINATION OF THE BOUNDARY LINE FOR CLIMATOLOGICAL REGIONS IN LOWER SILESIA

Abstract: The article presents the analysis of the course of the boundaries between climatological regions of Lower-Silesian Region described by some authors. Factors influencing the spatial regional diversification and possibilities of determining climatological similarities between minor units of reference are also discussed.

Key words: regionalisation, climate conditions, interpretation of many years' data.

1. Introduction

Determination of regions and subregions with homogeneous, similar climatic conditions is important from scientific and economic point of view. Depending on used methods the division of regions might be different both in number and the range of boundaries between them.

The aim of the author was to try to analyse the causes of these differences on the basis of fragments of Lower Silesia climatic maps. The authors of regional climatic elaborations: Romer (1949a), Okołowicz (1978), Wiszniewski and Chełchowski (1975), Woś (1995) and others determined the boundaries between the regions on the basis of differences in the elements of climate e.g. temperature and precipitation. They had the data obtained in different climatological periods and within recognised concepts defined general boundaries and boundaries of secondary significance. Romer distinguished two main regions in the referred area: the region of sub-mountain lowlands and mountainous basins climate and the elevated region of mountain climate. Okołowicz defined the region of significant domination of oceanic influence, the region of moderate oceanic influence and the third region influenced mainly by mountains and highlands. The last region was divided into three subregions: submountain areas, medium-high mountains and high mountains with minimum oceanic influence. Woś distinguished zones of different variation of particular types of weather frequency. He named the regions: Lower-Silesian Western, Central and Southern. On the basis of vegetation communities Szafer (1972) distinguished: 1) the zone of submountain basins with the Oder River Region and the Sudety Foothill Region, 2) Hercynian Sudety Subprovince with the Izerskie and Karkonosze Mts. Subregion and 3) the Sudety Mts. with regions: the Central Sudety Mts. and the Eastern Sudety Mts.

2. Materials and Methods

2.1. Analysis of influence of many years' average air temperature in various periods on diversification of climatic regions' boundaries ranges

It may be assumed that air temperature may have limited influence on modification of the boundary ranges (Tab.1), especially when the station surrounding or localisation has changed. Those data were first collected by Gorczyński and Romer who used them to define different types of regions determined on the basis of climatic data. The similarity of temperatures between 1850 and 1900 and in other periods should be emphasised.

2.2. Analysis of influence of physical-geographical and geobotanical borders on diversification of climatic regions' boundaries ranges

The first step in this comparable analysis consisted of transforming the borders of climatic regions from the maps designed by Romer (1949a), Okołowicz (1978) and Woś (1995) to conical, secant and area-efficient Albers' mapping scaled 1:500,000. The map "Physiographic Units" designed by J. Pawlak (AŚDiO 1997) on the basis of data by Kondracki and Walczak and the geobotanical regions distinguished by Szafer (1972) were also transformed and analysed in the aspect of similarity of the boundaries' range (Fig. 1).

Depending on an author, determination of the boundaries between climatic regions (and the differences between them reach often more than 100 km) differs in the localisation from the borders between general physical-geographical units. However, frequently the shape and range of the boundaries is similar or identical with the boundaries between provinces, subprovinces, macroregions and mesoregions discriminated on the map.

Many similarities may be also seen in the determination of borders of geobotanical regions described by Szafer (the zone of submountain basins, the Oder River Region, the Sudety Foothill Region etc.).

It is clear that physical-geographical mesoregions by Kondracki (1994) are a valuable tool in interpretation of climatic data obtained by interpolation. It is the basis of determining the character of the relief and its influence on topoclimates. They can also be used for correction of magnitude of extrapolated climate elements.

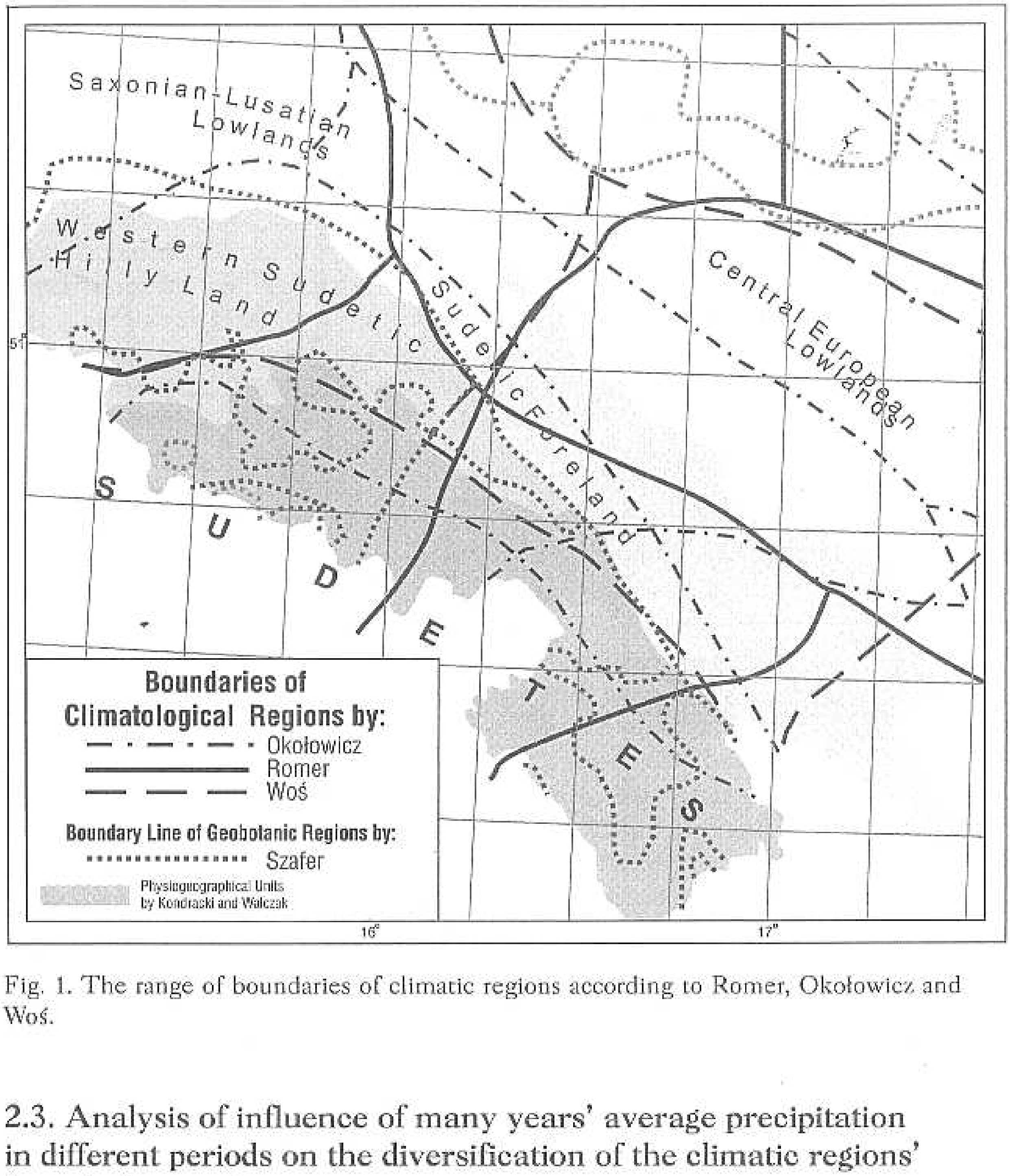


Fig. 1. The range of boundaries of climatic regions according to Romer, Okołowicz and Woś.

2.3. Analysis of influence of many years' average precipitation in different periods on the diversification of the climatic regions' boundaries ranges

In previously mentioned synthetic elaborations precipitation values were obtained in different periods and were interpreted in different ways. However they were always presented as many years' averages and their spatial distribution.

Because of the importance of the monthly sums precipitation values in July to compare the courses of isohyets presented by several authors were compared. After many analyses the isohyets presented by Gorczyński (1918), Wiszniewski (1953), Bac-Bronowicz (1996) and in Atlas Klimatyczny Polski (1973) were taken into consideration.

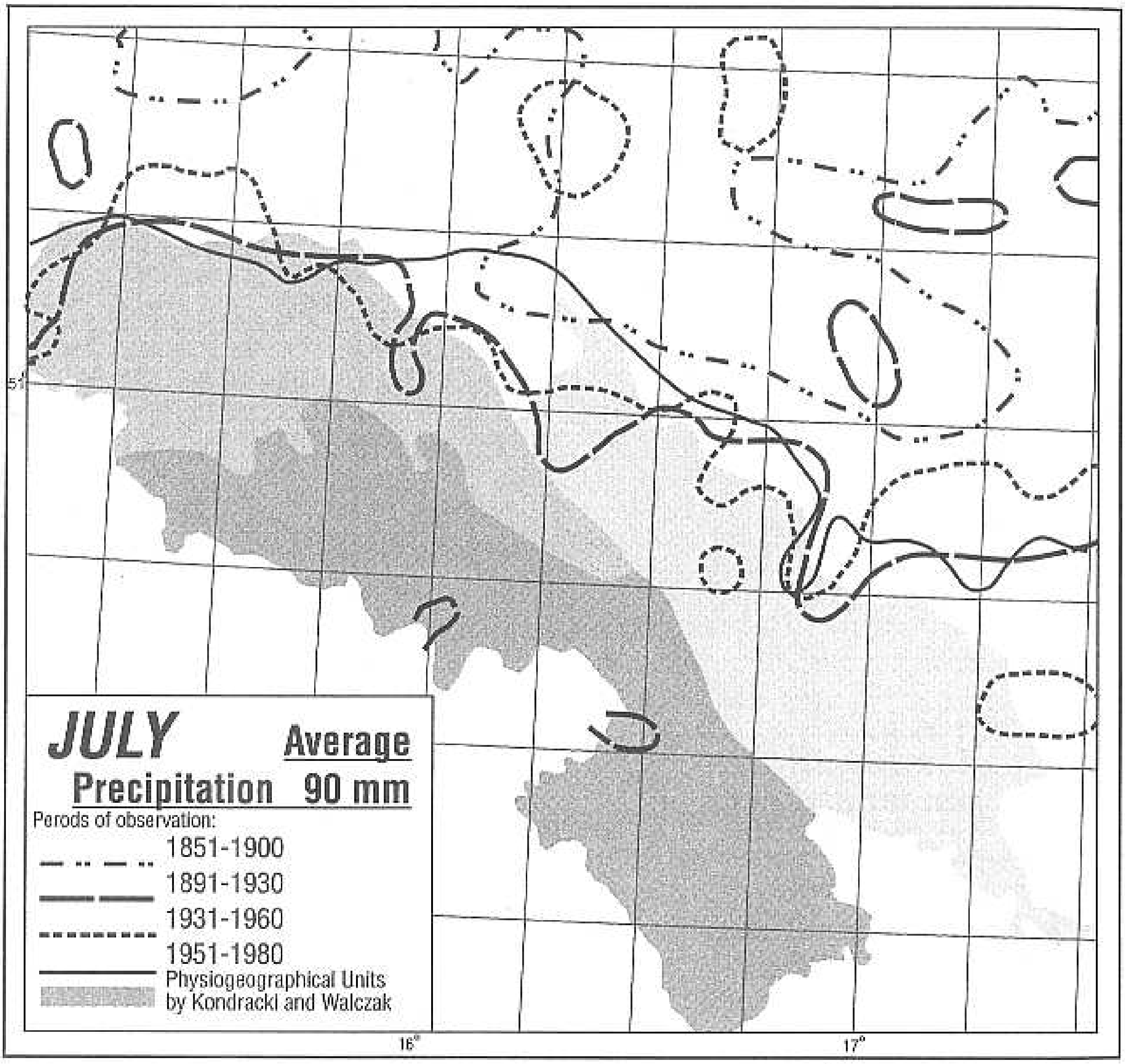


Fig. 2. The course of isohyet 90 mm in July in different periods of observation.

The courses of isohyets 90 mm in different periods (Fig. 2) reveal significant differences and difficult to explain relations with physical-geographical regions.

It was always controversial how to find proper period of observation, how to compare average precipitation in different periods and data obtained from the station of changing localization or from different determining points.

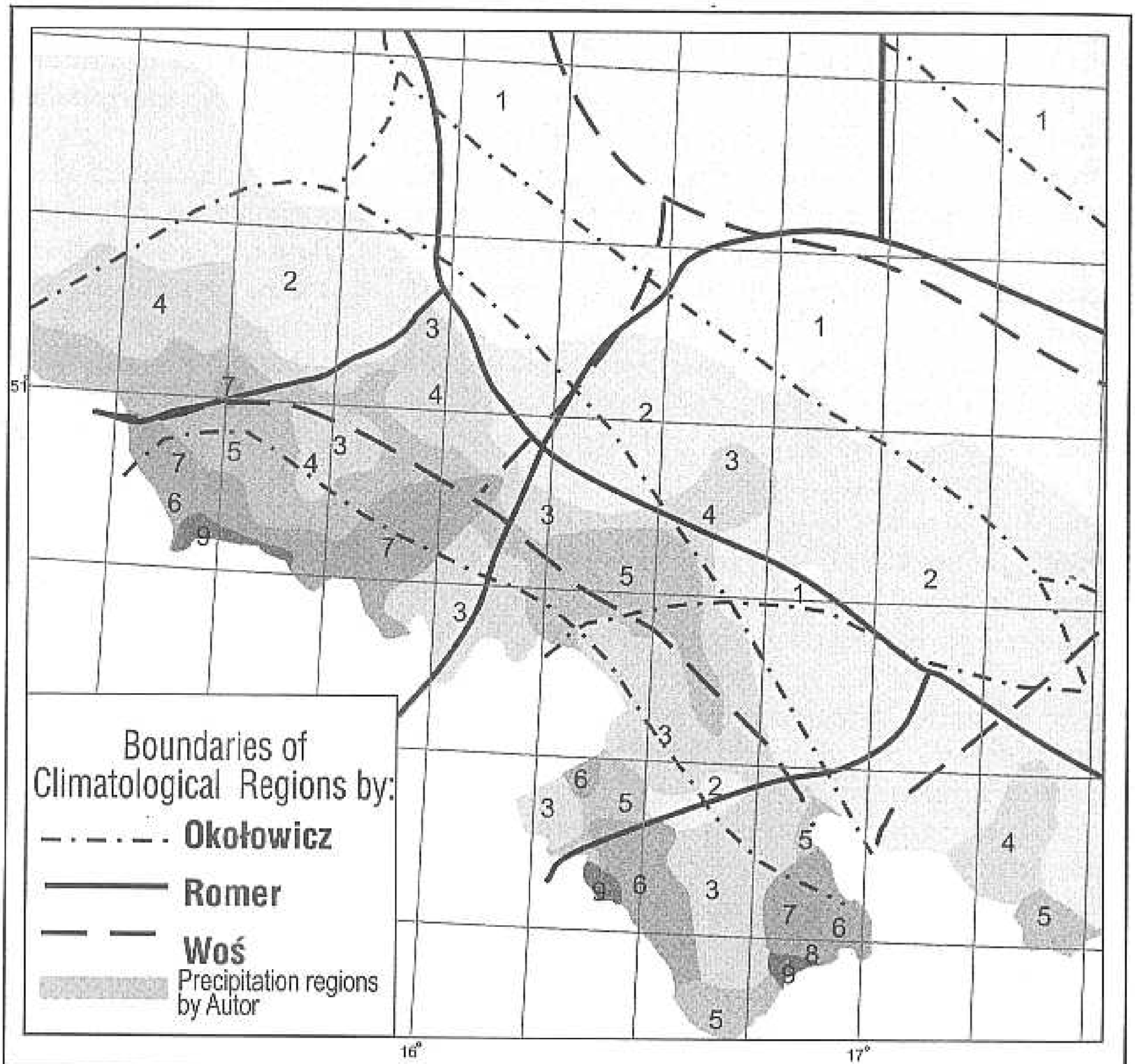
3. Results

Considerations presented above prove the great effort of the authors of climatic regionalization, who creatively showed similarities and differences in climatic conditions. The next step of analysis consisted in comparing given climatic regions' boundaries and distinguishing the precipitation regions. This was achieved by use of multi-variable construction and then regionalization of precipitation conditions, including an impact of altitude of the station on the probability of the precipitation conditions in Lower Silesia (Bac-Bronowicz 1996).

Using multi-variable classification nine types of regions were distinguished. Mean sum of precipitation in different seasons of the year and other parameters influencing the precipitation (e.g. altitude above the sea level) were taken into consideration. Regionalization was made with enclosing the areas around the stations to corresponding regions. For the period 1891–1930 the data from 390 stations in Lower Silesia were evaluated as valuable after verification but for the period 1951–1980 the amount of the stations equalled only 60. Therefore the assumption was made that decrease in the amount of observation points had no influence on the climate conditions (Fig. 3). The table with average parameters of the regions is shown beneath the map. The regions 3 and 4 as well as 6 and 7 are clutched on the map, because determinant of the division in these classes is altitude, not sum of precipitation. Distances between the values of average precipitation enabled to form one class. Such a division, based only on the atmospheric precipitation is convergent with the formerly distinguished regions but it also enables division into particular subregions with similar precipitation. This may be of special importance for agriculture.

At present interpretation of many years' average in order to assess thoroughly climatic conditions is needed, especially for small areas. Local authorities should also put emphasis on the use of precise data of environmental conditions when formulating characteristics of administrative units. Such approach may be helpful in the decisions about the ways to stimulate the economic progress. That's why the author pays attention to the need to correction of evaluation of climatic data obtained from climatological stations as their comparability is concerned in order to improve the utilisation of data. Nowadays information about climatic conditions serves only to load the database of environmental and natural conditions.

The community is frequently the elementary unit, for which one has to define single value of certain parameter characteristic for the whole area. Two parameters for the area of each community were defined according to the regionalization described above: the class dominating within the area and the homogeneity of precipitation conditions, formulated as the range of variations (the range of classes within the community area). To determine the type of natural conditions in the communities two additional features were introduced into the additive model: the relief and hydrologic conditions (Krzywicka-Blum, Bac-Bronowicz 1997). The grades of transition between the neighbouring communities were also calculated and the zones of agricultural production conditions delineated. Apparently, the index of transition is sometimes very high (it reached even maximal value of four – that means the change through four classes of production conditions). So high values of the index of transition prove that communities are too complex to be defined by single index incorporated into the geographical database.



Types	Number of Stations	1891 - 1930 Avarage Precipitation (mm) V+VI	VII+VIII	IV - IX	Average Elevation (m)
1	*120*	121	145	353	***122***
2	*94*	140	170	412	***211***
3	*31*	153	178	450	***451***
4	*40*	162	189	469	***276***
5	*29*	177	200	509	***448***
6	*5*	184	224	553	***763***
7	*17*	200	230	580	***493***
8	*2*	243	289	703	***446***
9	*4*	238	290	735	***1216***

Fig. 3. The borderlines of climatic regions based in regionalization of precipitation.

Tab. 1 Many years' average air temperature for extreme months and the year in different climatic periods.

	January							July							Year						
period	1851	1881	1881	1931	1951	1951	1951	1851	1881	1881	1931	1951	1951	1951	1851	1881	1881	1931	1951	1951	1951
	1900	1930	1960	1960	1976	1980	1990	1900	1930	1960	1960	1976	1980	1990	1900	1930	1960	1960	1976	1980	1990
length of the periods (year)	50	50	80	30	20	30	40	50	50	80	30	20	30	40	50	50	80	30	20	30	40
Station																					
Koszalin	-1,9	-1,5	-1,5	-1,7	-1,6	-1,4	-1,2	17,1	16,7	16,8	17,1	16,4	16,4	16,5	7,2	7,2	7,3	7,6	7,4	7,5	7,6
Suwałki	-5,5	-4,9	-5,2	-5,6	-5,4	-5,4	-5,1	18,2	17,9	17,8	17,7	17,3	16,9	16,8	6,0	6,2	6,2	6,2	6,0	6,0	6,1
Szczecin	-1,0	-0,9	-1,1	-1,4	-0,9	-1,2	-1,0	18,3	18,3	18,2	18,1	17,6	17,6	17,7	8,3	8,3	8,3	8,3	8,1	8,3	8,4
Białystok	-4,6	-4,1	-4,4	-4,9	-4,1	-4,8	-4,5	18,6	18,4	18,4	18,3	18,1	18,7	18,6	6,8	7,0	6,9	6,9	6,7	6,8	6,8
Gorzów	-2,2	-1,5	-1,6	-1,8	-1,4	-1,8	-1,4	17,5	17,7	18,0	18,5	17,7	17,7	17,8	7,7	7,9	8,1	8,4,	8,1	8,1	8,1
Poznań	-1,9	-1,4	-1,7	-2,2	-2,1	-2,2	-2,0	18,8	19,0	18,9	18,8	17,7	18,0	18,0	8,2	8,5	8,5	8,3	7,9	8,1	8,1
Warszawa	-3,6	-2,9	-3,1	-3,5	-3,6	-3,4	-3,1	18,9	18,6	18,8	18,4	18,7	18,1	18,1	7,6	7,8	7,6	7,8	7,6	7,7	7,8
Katowice	-3,4	-2,1	-2,8	-3,3	-2,6	-2,8	-1,7	17,6	18,0	17,8	17,9	18,0	17,4	18,2	7,2	8,0	7,7	7,8	7,7	7,7	7,8
Kraków	-3,3	-2,5	-2,7	-2,9	-3,0	-3,0	-2,9	18,7	18,8	19,0	19,3	17,9	18,0	18,0	7,8	8,2	8,4	8,6	8,1	8,0	8,1
Zakopane	-5,6	-4,9	-5,2	-5,8	5,5	-6,0	-4,9	15,3	14,7	14,7	14,9	14,5	14,3	14,4	4,6	5,0	4,9	4,9	4,9	5,0	5,1

Sources: Gorczyński (1918) – data for the period 1851-1900; Romer (1949b) – data for the period 1851-1900; Wiszniewski (1971) – data for the period 1891-1930; Sadowski (1983) – data for the period 1951-1980; *Rocznik Statystyczny* (1951-80) - data for the period 1951-1980; Chomicz (1997) – data for the period 1951-1976

4. Conclusions

The author made the analysis of the range of boundary-lines between the climatic regions, which showed diversification caused by different concepts of synthesis of basic data – many years' averages. It may be supposed that many years' average precipitation (represented most frequently by precipitation of July) plays a greater role than many years' average air temperatures (Tab. 1). From hydrological point of view differences in the course of isohyets may cause significant differences in the calculation of mean precipitation for given areas.

These facts should be especially emphasised now, when National System of Spatial Information is created. Defining the climatic conditions on the basis of available data for such small units of reference as proposed (1 square kilometre and further divisions into the smaller units) may prove to be a risky task.

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