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MAPS CONNECTED WITH AGRICULTURAL PRODUCTION

MAPY ZWIĄZANE Z PRODUKCJĄ ROLNICZĄ

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IV. PRECIPITATION MODELLING ON MAPS USED IN THE OPTIMALIZATION AGRICULTURAL PRODUCTION

IV.1. SUBSTANTIAL ANALYSIS OF PRECIPITATION MAPS UNDER MAPROL SYSTEM

Precipitation belongs to the group of those natural elements which influence, to a high degree, the optimal location of agricultural production. Under MAPROL system (tab.1), the precipitation maps form a separate class, "41".

The isoline method is the most frequent method used to represent the differentiation of precipitation amount. An analysis of a representative set of European and American climatic atlases allows to pronounce such a statement. Only in some of them the precipitation maps are designed in another way.

The isoline method is used in its simple and complex forms. In the simple form, isolines, called in this case isohyets, connect points of the same value, and their course appears by way of interpolations of different types between the values at data points. In the other case, two solution variants can be distinguished. Either a drawing of isohyets and the marking of values at selected, specific points (description of values or diagram) are used the drawing of isohyets is supplemented with a colourful or pattern filling of the area between them (isochromatic lines).

Isolines, being a continuous pattern of a phenomenon, are in all these cases real isarhythms and not isomorphic lines.

Thematic scale interval limits (isohyet value spacing) on precipitation maps are generally assumed in a standard way. On World's maps (for particular months and years, all data in millimeters: 250, 1000, 2000 (3000 added after World War II)), on the continents: 100, 250, 500, 1000, 2000; the so-called Romer's scale under the Polish conditions : 400, 500, 600, 700, 800, 1000 and more. In specialistic atlases scales have been extended by supplementing them with isohyets with a spacing every 50 and even every 10.

The selection of isohyets using the value analysis method is a method of designing the thematic scale which is better adapted to real values distributions (precipitation amounts), taking into account the surveying network density. Isohyet values as received within this method are not constant.

Less transformed precipitation characteristics are used to work out their cartography models as **cartodiagrams** in a version with point located charts.

Maps worked out using the method of simple cartodiagrams transform the source information the least. Features' values are described in a continuous scale, beside measuring stations represented with points. This is the most objective way of representation; *with three-dimensional analysis, it is,* however, inconvenient.

IV.2. PROPOSAL OF A NEW METHOD

The representativeness of results obtained from measurements at surveying points depends on a proper location of points within the observation network and its density, adapted to the spatial distribution of a given characteristic. Observation sequences are analysed in different ways; intuitively or statistically but they hinder, in general, obtaining information on a phenomenon between measurement points. Concluding about the spatial distribution of continuous phenomena, even discrete ones, on the basis of information within the network with a limited number of measurement points makes the essence of modelling.

The representation of a cartographic model bases, in principal, on a distribution of a phenomenon under study, that is on a set of features which characterize it the best.

Information obtained from precipitation maps, which are helpful when working out agricultural problems, seldom apply to singular sequences. In general, a total of information on precipitations in different hydrological periods, which are very important for agricultural production, is required as the discrimination of similar classes and regions.

In practice there are two ways of designing the pattern of precipitation distribution :

- assuming values for determined areas (e.g. average values from selected observation stations), thus obtaining a continuous pattern of a phenomenon;
- continuing the phenomenon on the basis of characteristics determined at points.

The latter method constructs a cartographic model by means of interpolation functions which correspond to the nature of the phenomenon distribution between data points.

A frequently encountered way, up to the present, of providing continuity to the pattern of a set of features has been to assume values of one of the closest measurement points to be reliable. This requires an individual evaluation of the data for each point.

When assuming values for determined areas, it is not complicated to delimit areas classified into one class. The outside contour of a group of fields reckoned among the same class makes a limit.

Values of features characterizing the concentration on a map may be represented by means of a diagram (cartodiagram method). In such a case a multi-parameter diagram is the best fitted; it may present the distribution of a set of features under study for discriminated concentrations.

Reckoning areas among the same class on the basis of various interpolation functions generates a necessity to delimit regions on the basis of a known or assumed structure of a field of a set of features. An interpolation model which takes into account the non-linear nature of the distribution of phenomena may be constructed on the basis of the correlation of random fields. Such a method applies to geological, soil knowledge, meteorogical, strength, agricultural-natural, filtration models and to econometry, economy, ect. as well.

Continuous characteristics, interpolated on the basis of data points located irregularly, may be modelled when using the division of an area into irregular sub-areas, [1], which are constructed similarly as in network of variable density.

In the cartographic model, the process of transitions from discrete characteristics to continuous characteristics is often accompanied by a visualisation in form of real or theoretical isarhythms. Isarhythms constructed in different ways (parametrical lines are seldom encountered here) constitute a certain probabilistic, a linea model of distribution of phenomena.

When constructing such models, it is generally assumed that after the verification, the probability of assigning determined values of features to data points is equal to 1. Thus, the probability should be determined with which corresponding values might be assigned to the neighbouring areas of points. For all the measurement points **the conditional entropy** is calculated and curves of relative quantity of information contained at the i-th point of a value of a given element at the j-th point in function of the distance between a given point and the remaining points are constructed.

The constructed curves represent an average information reduction in a given (area of influence) of a points, which is used to **evaluate the reliability**. The reliability criterion is the amount of information given by the data of a data point at a determined point

The classification of multi-feature objects in the cartography may most often be useful in the regionalization processes. It is essential then to position the selected concentrations of objects in the geographical space and to assign the classification results to the whole area of the territory under study. Even with a very complex nature of the phenomenon under study, the information on the probability of reckoning the sub-area among the same class may be reliable. Variously classified sub-areas may be divided into zones of a determined degree of assignment probability.

The form of the probability distribution in the environment of data points may be set theoretically or empirically. The form set theoretically most often is a concave, continuous and limited function. Such an assumption brings about the separation of concentric zones round data points. Their weights decrease as they move away from a data point. In this way the area form of the probability distribution is generated as an approximation of the real distribution. The final form of the probability distribution results from the reciprocal position of data points - relative extrema of the area.

By dividing the probability scale into intervals corresponding zones of identification reliability [2] are obtained. In order to settle the pertinence of zones of lesser pertinence probability, it is advisable to use additional information (e.g. orographic data up to the limits of precipitation regions). As a result of such a proceeding, two sub-areas: **environments of data points and satellite delimiting bands** may be distinguished within the pattern of separated classes.

Reckoning the neighbouring sub-areas among the same class and interval of pertinence degree brings about their connection. The shape of those sub-areas depends upon the location of data points, the nature of a phenomenon and the assumed reliability intervals. The cartographic modelling creates thus a perceptively simple capacity of the graphic presentation of the reliability of reckoning areas among this or another class.

On allocating areas on a map to corresponding classes, regions are obtained whose qualitive and quantitive characteristics are dependent on the measurement scale of original features. Those regions may be distinguished by using appropriate visual variables (colour, pattern). If the features are

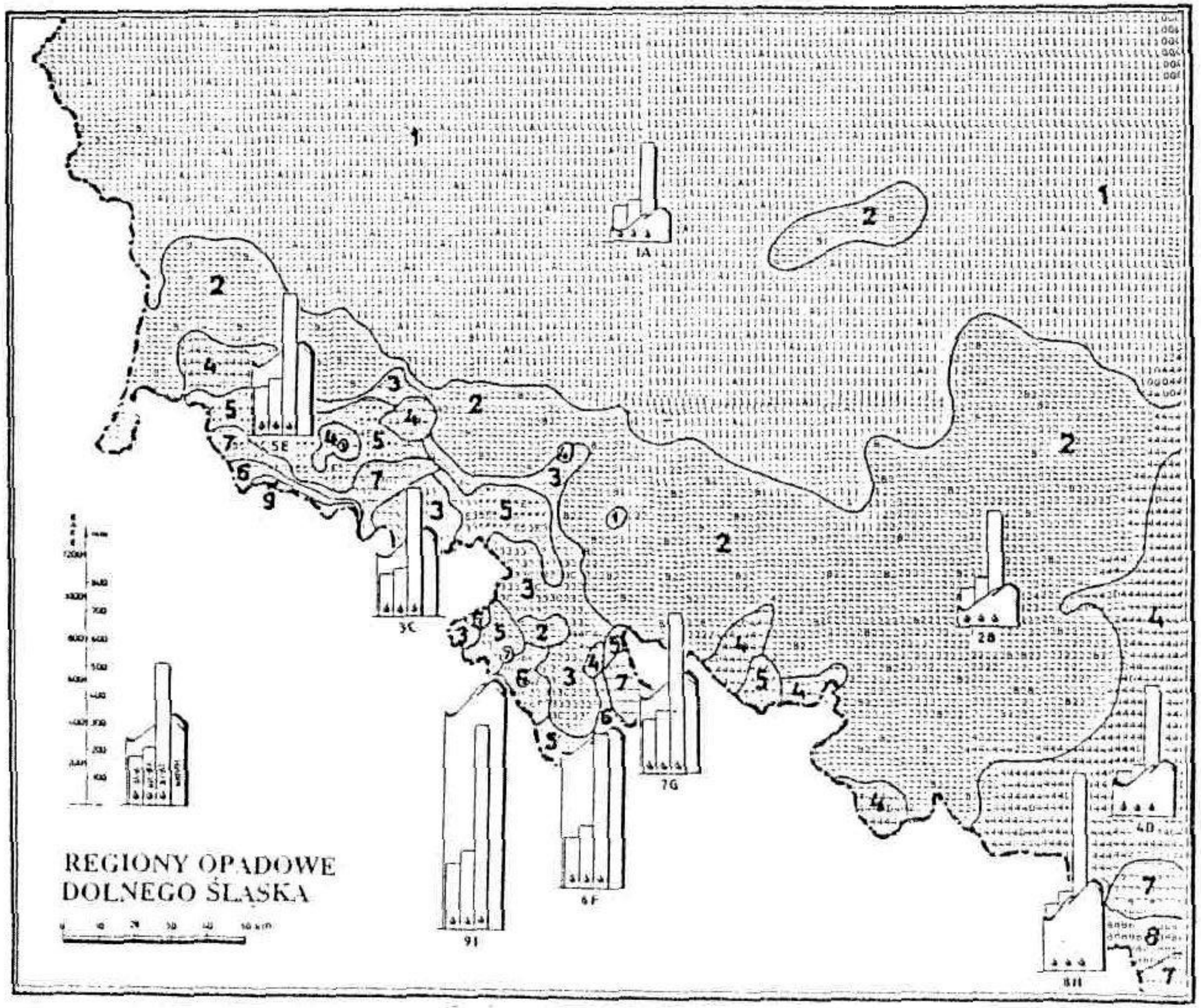

Fig. 13. Precipitation Regions of Low Silesia

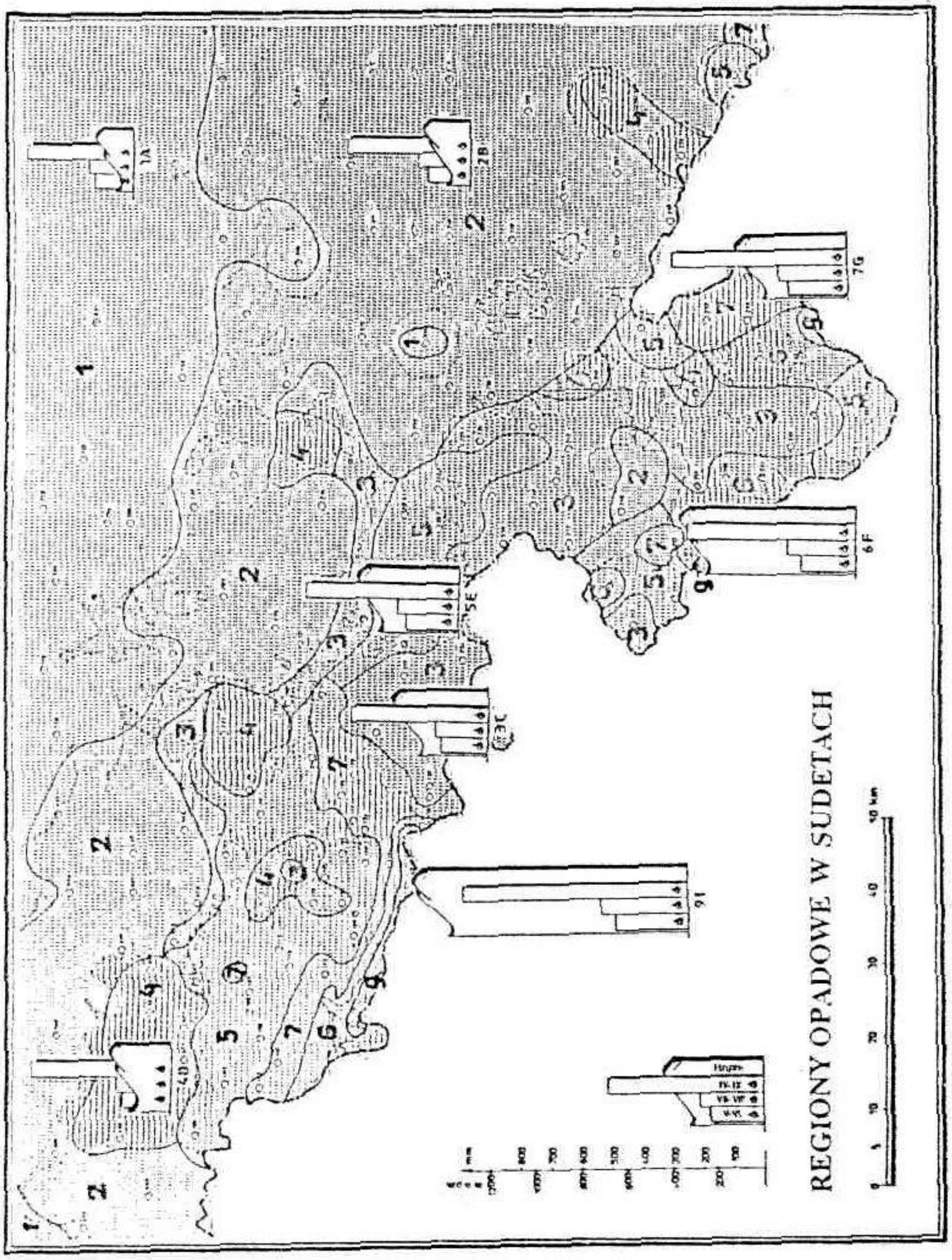

Fig. 14. Precipitation Regions of Sudety Mountains

expressed at a nominal scale, attention should be that the colour or pattern do not suggest the sequence of separated concentrations. In case the regions are ranked, vales (pattern or colour) may be iseful.

Two maps: (fig.13,14) "Precipitation Regions of Low Silesia" (Poland), "Precipitation Regions of Sudety Moutains" (Poland) are some examples of a cartographic modelling applying to the separation of precipitation regions. In the regionalisation process, hydrological periods decisive for agricultural production have been taken into account. Height above sea level is an additional information which increases the reliability of delimitation, which is expressed on a map by introducing diagrams. Maps of that kind under MAPROL system of agricultural maps will be reckoned among the class "14" - Natural Conditions.