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THE APPLICATION OF MAPPING METHOD IN THE AGRO-CLIMATIC RESEARCH

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ABSTRACT

The questions of the application of the mapping method in agroclimatic researches are addressed. The scales of the maps of agroclimatic resources for the research of various level areas: a country, a region and separate states are grounded. An example of a large-scale mapping of agroclimatic resources is presented.

Keywords: ***researches, agroclimatic resources, maps, scales.***

1. INTRODUCTION

Agricultural production refers to the basic branches of the economy of any country, since its basic products are foods that make up the safety of vital functions. A dependence of agricultural industry from weather-climatic conditions is no doubt and it makes the importance of the research aimed at their detailed assessment at different territorial levels. Agroclimatic resources as a part of climatic resources that determine the conditions for agricultural production are of special importance.

2. LITERATURE REVIEV

The principles of an agricultural assessment of climate were laid in the early works of Selânìnova G. T., Koloskova P.I., etc. and remain unchanged, since they make a main task of agroclimatic researches: defining the degree of ease climate conditions for a cultivation of agricultural crops. The methods of researches of agroclimatic conditions are changing along with the development of science, new metrics that are able to adequately reflect the link of crop requirements with climate conditions and the methods of their determination are offered. The research methods by which it is possible to improve the analysis of a spatial distribution of agroclimatic resources for the territories of various sizes of averaging are of special importance. This is the first map-based method that allows to provide information about a spatial distribution of individual indicators or their complex by the data of point observations of individual meteorological and agrometeorological stations.

Principles of drafting agroclimatic and climate maps are the same and are mainly determined by the degree of scrutiny of the indicators, the nature of its variability in space, a density of meteorological stations network, the possibility of application of calculation methods and the availability of cartographic bases or maps that determine the spatial distribution of the indicators. The accuracy of such maps is determined by the specifics of their practical purpose, an area of observation and a scale. Of course, the minuteness and the accuracy of the maps are improving with the increase of a scale, or in accordance with modern terminology, a spatial resolution.

3. THEORETICAL CONTEXT

Two approaches for taking into account the peculiar patterns of a spatial distribution of the values of the indicators are important, in our view, when applying the Cartographic method. The principal difference between them lies in assessing the variability of value indicators under the influence of a latitude and a longitude of a position, an absolute height above a sea-level and local conditions and first of all the forms and elements of a relief, etc. The first traditional approach is effective in making small-scale maps of agroclimatic resources for indices, which variability in space is due only general geographic factors and the second is effective for the indicators which variability are also affected by local conditions.

Most small-scale maps of agroclimatic resources represented in national climatic atlases of different countries, as well as in the "Agroclimatic atlas of the World" [1, 2, 3, 31, 36], were made using the first approach. All factors that determine the changing of a climatic element in a geographical term are considered in

making the contours on these maps. Thus, according to the term "an accuracy of climatic maps," the intervals between the contours must include an oscillation of an index according to the data of individual stations, including systematic errors which depend on a location of individual stations.

Using the first approach is impractical for making small-scale maps of agroclimatic indices, which are significant variable in space under the influence of local conditions. The reason lies in the fact that due to a significant variability of the index, you need to choose so large intervals between the contours that making the maps loses its meaning. So you need to apply the approach by which it is possible at the same time to take into account a variability of the index for the whole complex of general geografic and local character factors .

The approach of making such maps, which were called “background maps”, was offered by Holtsberg I.A. and was implemented in making the maps of a slight frost danger on the territory of the former USSR and the world. Making the contours on them is carried out only for the values of agroclimatic indices, which on a negligible distance differ no more than an average quadratic deviation (σ). The data from the weather stations with the values more than ± σ is not taken into account when making the contours and a detailed analysis of their location was performed.

In the future, this approach has been improved and developed by Mishchenko Z.A. [18: 24] when making maps of daily amplitudes of air temperature, day and night air temperatures and their sums for the period with the temperatures above 10 0 C, and also an average of an absolute air temperature annual minimum. The essence of the method of making maps by this approach is as follows. A variability of indicators under the influence of general geografic factors are shown in the form of the contours on the map. Thus the background data of the stations which are representative for a specific area (i.e., the maps are made for the conditions of a open plain on the flat lands or for the middle parts of the slopes in the mountains) are taken into account. Later the data analyses of the stations, which are characterized by a different location, are performed. The deviation of the values of each station, which differ according to the location (a form of a relief, an exhibition and event of the slopes, a soil type, a proximity to the seas and large bodies of water, etc.) from the value of the contours on the map is determined by the interpolation method.

4. MATERIALS AND METHODS

The novelty of the methodological approach in making background small-scale maps lies in the fact that a table in the form of legends which contains the settings of its microclimatic variability under the influence of the degree of a continental climate, a type of a terrain and morfometrical characteristics is added to the map of a spatial distribution of the agroclimatic parameter.

Not reducing the theoretical and practical value of the proposed approaches to make small-scale maps it is necessary to specify their shortcomings, the main of them is subjectivity associated with a professionalism of a researcher. To overcome this shortage is possible with the use of an automation process of making the cards, which was first implemented in the 1970s by Karingom P.X. and Kaushila C.A. They developed the thematic cartographic models adapted to the existing software at that time and they made the first versions of the MAINFRAME-maps in a middle and large scale. Approaches, methods and ways of making such maps partially resolved the issues of an objectivity, but they have not received a wide distribution. Among the main reasons we should point out the followings.

Firstly, the agroclimatic indices were not considered as an object – environment, but mapping the field of a single metric excluding the impact factors of the environment was made. Thus, a simple procedure such as interpolation of the values according to the components of a regular grid was performed. Secondly, a solution of mapping tasks requires the improvement of software that would support a simultaneous operation with spatial and atributic data, which would implement a spatial analysis of indicators. This feature is missing in the proposed models of these authors. Thirdly, the numerical analysis associated with mapping requires a powerful computer (a processor speed, and a memory which at that time were limited).

The last time at a presence of modern computers and a special software, including GIS technologies, ArcView packets, ArcGIS, it is able to return to the solution of the task of mapping in an agroclimatic research. The advantage of this software is in the ability to bind each object in the space (geocoding), a storage of information, organized in thematic layers, the work with those can be carried out both individually through the layers and simultaneously with all the layers.

Formation of a database in a shell of a specified software is carried out using the classical method of layered organization of the information, which involves a separation of the objects and the atribute information linked with them into logical layers. The last are a set of spatial (a geographic latitude and longitude, a height above a sea level) and atribute (specific agroclimatic data) information. In the case of a presence of a figure and refined cartographic base with the layers of geographical coordinates and an absolute height of a place, as well as a meteorological, agrometeorological and hydrographic network the task is to create the layers of atribute information.

An attempt to map fenological fases and a moisture of winter wheat [139, 153] and the maps of a distribution of radiation-thermal resources and the conditions of a slight frost danger was made on the example of Ukraine [139, 153]. Making MAINFRAME-maps was preceded by several methodological improvements, covering representation, processing, and analysis of the atribute information. But the first task, due to the lack of original maps was in preparation of a cartographic base: trolling and figuring (in the rastrov and motion models), selecting an appropriate projection of the maps, checking its adequacy. Next a layer of thermal resources was formed and his snap to the layers of meteorological stations and geographical factors was carried out .

In the process of making the agroclimatic maps of a particular importance, a specification of a stations representation, a determination of the range of values and establishing the rank of mapping were acquired . In the ArcView program shell the contours were drawn using the method of obernenozvazen distances, which determines an accuracy of their drawing. The definition of classes that in "a manual mode" are determined depending on a range of indices variability and comprise 100 or 200 ° C refers to the methodological issues when mapping of agroclimatic resources. In automatic mode a number of classes and, accordingly, a separation of variables into classes or ranks is performed using standard schemes of classification: linear interpolation, cvantils, equal intervals and standard deviations. Each of the schemes has their advantages and disadvantages, however, as shown by the obtained results for all schemes it is possible to lose of a sense of selecting the classes.

Thanks to the opportunities in this shell of editing, when making maps, based on a range of indices variability and for “manual making maps", a number of classes and a range of values on the classes were defined. It is especially difficult to define a range of values with a view to their variability in the first and last classes, because in an automatic mode the range «<» or «>» is excluded from the variants of graduation set. That is necessary to select a graduation so that the maximum and minimum values were in a range of the first and last classes or were close to them, but the difference must not exceed 100 ° C.

5. CONCLUSIONS

The results of theoretical and experimental research of meso-and microclimats in the areas with heterogeneous surface caused a development of the methods of agroclimatical zoning the areas referring to meso-and microclimate and various-scale mapping of agroclimatic indices. First of all, you need to select a direction of various-scale zoning, which was first justified in the works of Mishchenko Z.A. and executed on the territory of Moldova by the terms frost danger and daily and night thermal resources. Further, within the framework of this direction, Lyashenko G.V. advanced the technique and performed a complex agroclimatic zoning the territory of common individual farms with area of 2-5 thousand hertares and the administrative district covering 92 thousand hectares referring to meso- and microclimate. In a parallel a method of making medium-and large-scale maps of agroclimatic zoning was developed.

The further development of the research dedicated to agroclimatic zoning the areas of various sizes and various-scale mapping of agroclimatic resources on territory of Ukraine was continued by Lyashenko G.V.. The methodology of research in this area is based on the application of methods of macro-, meso-and microclimate data processing of meteorological and agrometeorological observations with different levels of their spatial and temporal average and methods of generalization of information of agroclimatic resources and limited agroclimatic conditions. The degree of generalization of agro-climatic information is determined by the size and nature (heterogeneity) of a surface area for which agroclimatic zoning is done. They define selecting map scales that are capable to reflect a possible range of values due to heterogeneity of a surface area with high precision.

In this direction the issues included not only a degree but also the stages of zoning and mapping refers to methodological issues. The author believes the method of agroclimatic zoning from the significant territories to smaller ones, from general to specialized ones to be more justified and advisable and drawing maps from small to large-scales. According to this order it is nesessary firstly to detaile agroclimatic conditions in a space-time context, and secondly, with regard to certain agricultural crops. The degree of generalization of the information decreases, however, the degree of their filtration in terms of identifying the impact of individual elements of the surface increases. An accuracy of dedicated agroclimatic taxons (macro-, meso-and microregios) on the maps of agroclimatic zoning.

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