MAPPING AND MATHEMATICAL MODELLING OF SPATIAL-TEMPORAL ORGANIZATION OF STRUCTURE LANDSCAPE OF AZERBAIJAN

Nabiyev Alipasha Alibek
Baku State University, Geographical Faculty
370145 Azerbaijan, Baku, Z. Khalilov street, 23

ABSTRACT

At present stage of physical geography development, mainly the paleogeography is required for quantitative analysis with applying of computer, so that this analysis allows to have access for application of complex modern mathematical models such as theory of combinations, non parametric and parametric mathematical-statistic methods, by which are succeed to discover more distinctive peculiarities in structure and development of paleolandscape. The results is invaluable on the regional geosystem forecasting.

INTRODUCTION

In this work for the first time in Azerbaijan is applying complex methods of modern mathematics so called matrix computation in the paleolandscape investigations for description of more practicable structure and their characteristic elements such as determination of structure's cause and interrelation of structural elements of geographical complexes within the alteration of leadership in time. The investigation of paleolandscape spatial-temporal structure by means of mathematic-geographic modelling on computer US-1035 and IBM PC AT of quantitative elements of the paleolandscape structure are taken from the Azerbaijan Republic paleolandscape maps, which compiled by prof. M.A. Myseibov (1981 y.) for nine section of geological time: I.Upper Miocene, II.Middle Pliocene, III.Upper Pliocene (Agchagil century), IV.Upper Pliocene (Absheron century), V.Under Pleistocene (Baku century), VI.Middle Pleistocene (Gurgans century), VII.Middle Pleistocene (Caspiian century), VIII.Middle Pleistocene (Khvalyn century (VIII)), IX.Late Pleistocene (the end of Khvalyn century), and X.Holocene (Modern century).

THE METHODS OF RESEARCH AND RESULTS

For solution of this problem with some modification which connected with character of investigation we have took the method, suggested by A.G. Topchiyev (1979 y.) and the methods mathematical-system analysis. The work have been carried out by following stages:

Matrix analysis of paleolandscape neighbourhood (meeting).
The goal of this analysis is to determine the leading paleolandskapcs which are the core of paleolandskapcs general structure and this period of the considering region. The second, to determine secondary elements in the paleolandskapcs structure of investigated region at this period so called core sattellite of paleolandskapcs structure. To define these elements of paleolandskapcs structure the A.G. Topchiyev’s criteria is interpreted as follows:

\[ t(i) = \frac{\sum i}{\sum j} \]

a) Natural Complexes (NC) is appeared as one of the landscape’s structure score if
\[ t(i) > 1 \]

b) Natural Complexes appears as a sattellite (non leading) of one or some different cores if
\[ t(i) < 1 \]

c) Natural Complexes has a boundary distribution which is closed to incident if
\[ t(i) \approx 1 \]

For solution of this question we have determined occurrence number of paleolandskapcs in space on the paleolandskapcs maps of Azerbaijan. On this bases have composed the matrix of occurrence, which have determined A.G. Topchiyev’s criteria values.

RESULT EXAMPLE

Table 1.

Matrix of paleolandskapcs neighbourhood in "Middle Fliocene" (II).

<table>
<thead>
<tr>
<th>N</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<th>10</th>
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<th>12</th>
<th>13</th>
<th>14</th>
<th>( \sum i )</th>
<th>( t(i) )</th>
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</thead>
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</table>
According to the results of the Topchiyev's criteria we have composed the landscapes organization maps which reflected the leading (core structure) and subordinate care satellites-landscape) elements at the paleolandscape structure(organization).

Figure 1. Map example of paleolandscape organization in "Middle Pliocene".

- Leaders of paleolandscapes organization: Plain Landscapes number 3 and Piedmount landscape 8.
-Non-leading (core satellites) of paleolands- 
capes organization: Plain landscapes numb.2.
-Accidental-distribution paleolandscape- the 
rest.

The analyses of the paleolandscape organization maps ha-
ve discovered that:
- The leading paleolandscape are not meeting at the Upp-
er Miocene it shows that the paleolandscape structure 
core are not formed at this period so all the paleolands-
capes have lead accidentally distributed character.
- Organization of paleolandscape structure show in 
figure 1.
- At the Akchagil century the paleolandscape's structu-
re cores composition become complicated.
- At the Absheron century the cores composition is con-
tinued to become complicated. Some of middle mountains and 
plain landscaes are charaterized by accidental distribu-
tion.
- At the Baku century the middle mountains and plains 
paleolandscape are gone out of the core satellites compo-
sition and become of paleolandscape structure core. On 
this case at this century have created contrast and the 
paleolandscape structure.
- At the Gurkhans century plain and middle mountains 
paleolandscape have returned to the composition of cores 
satellites. At this century have happened reorganization of 
paleolandscape structure.
- At the Caspian century high mountainous and mountai-
nous paleolandscape have gone out of the composition of 
core and become accidentally distributed elements of st-
structure. The structure core of paleolandscape at this 
century were plain and middle mountains paleolandscape.
- At Khvalyns century high mountainous and middle mo-
untains paleolandscape have returned to the composition 
of the core's satellites. The core of paleolandscape struc-
ture consisted of plain, foot mountainous and some where middle mountainous paleo-
landscape.
- At the end of Khvalinsk century the core of paleo-
landscape structure consisted from plain, foot mountainous, 
middle mountainous and high mountainous paleolandscape.

MATRIX ANALYSES OF POSITIONAL RESEMBLANCE

Matrix of positional resemblance was computed on the base 
of species and individual resemblance matrix with the help 
of Hemming measure, which look as follow:

\[ P(i,j) = \frac{n(i,j)}{n(i) + n(j) - n(i,j)}; \]
where $n(i), n(j) -$number of neighbours a "i" and "j" natural complexes, but $n(i,j)$ - the number of common neighbours, computing example (Table 2).

Table 2.

<table>
<thead>
<tr>
<th>Species NO</th>
<th>Number of individual place of landscapes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
</tr>
<tr>
<td>$S_1(2)$</td>
<td>1 0 1 1 0 0 0 1 0 0 1 0 0 0</td>
</tr>
<tr>
<td>$S_2(3)$</td>
<td>1 1 0 1 1 1 1 1 0 0 0 0</td>
</tr>
</tbody>
</table>

Common neighbours - - + - - - - - - - - - (here data taking of Table 1)

The value of positional resemblance is changed in the limits of 0-1 and can be interpreted as follows:

1. The high resemblance $6.60 \ p(i,j) = 1.00$
2. Average resemblance $0.30 \ p(i,j) = 0.60$
3. Weak resemblance $0.00 \ p(i,j) = 0.30$

COMPUTATION EXAMPLE

Table 3.

Matrix of positional resemblance for Middle Pliocene (II).

<table>
<thead>
<tr>
<th></th>
<th>1 2 3 4 5 6 7 8 9 10 11 12 13 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.14 0.22 0.33 0.20 0.00 0.25 0.50 0.50 0.14 0.16 0.00 0.00 0.00</td>
</tr>
<tr>
<td>2</td>
<td>0.30 0.16 0.16 0.00 0.16 0.16 0.14 0.14 0.12 0.16 0.16 0.00 0.00</td>
</tr>
<tr>
<td>3</td>
<td>0.11 0.11 0.12 0.11 0.10 0.11 0.09 0.10 0.00 0.11 0.00 0.00 0.00</td>
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<tr>
<td>4</td>
<td>0.25 0.00 0.33 0.666 0.25 0.15 0.20 0.00 0.00 0.00 0.00 0.00 0.00</td>
</tr>
<tr>
<td>5</td>
<td>0.00 0.25 0.20 0.20 0.15 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00</td>
</tr>
<tr>
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</tr>
<tr>
<td>7</td>
<td>0.25 0.33 0.16 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00</td>
</tr>
<tr>
<td>8</td>
<td>0.20 0.14 0.16 0.25 0.25 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00</td>
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<tr>
<td>9</td>
<td>0.14 0.00 0.25 0.25 0.25 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00</td>
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<tr>
<td>10</td>
<td>0.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00</td>
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<td>11</td>
<td>0.00 0.00 0.25 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00</td>
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<tr>
<td>13</td>
<td>0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00</td>
</tr>
</tbody>
</table>

On base this table and interpretation we have lined our gramped and weakly connected elements of paleolandscape structure of the investigated region. These structural interrelations are presented as color graph-model, which printed on computer IBM IC.

REFERENCE