P-042

METHODS OF COMPLEX ANALYSIS FOR STUDING SEISMICITY REGULARITIES AND ANOMALIES

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INTRODUCTION

In this paper, there is considered a high-tech system EEDB (Expert Earthquake Database) for solving a wide range of geophysical research tasks of the seismic-geodynamic regime. The logical structure of the EEDB represents a set of program blocks: a seismological database, a geographical subsystem and a subsystem of data analysis, which interact with one another.

SEISMOLOGICAL DB

underlying the basis of the system, contains 63 catalogs of historical and modern earthquakes. The preprocessing of initial catalogs consisting in selection of an earthquakes subset according to inquiry parameters is as follows: the choice of a current catalog, the range of time, magnitudes, a spatial range, etc. Further, the dynamic separation of the earthquakes from aftershocks is possible.

GEOGRAPHICAL SUBSYTEM

uses the "shaded-relief raster images" for creating the digital geographic maps. The 3D-effect is provided by the consecutive triangulation method and calculation of each triangle brightness according to the orientation of its plane with respect to the pitch angle of a light beam. To make the construction of maps of various scales, there are available some global databases (GTOPO-30 and SRTM-90) [1], representing a surface relief with various resolutions. Then the vector and the dot layers and, also, explanatory texts are imposed onto a raster image.

DATA ANALYSIS SUBSYSTEM

includes methods and algorithms of solving geoinformation analysis tasks. The first layer consists of procedures of checking the completeness and the quality of the earthquakes catalogs. The next layer of the program block is associated with the visual analysis of the seismic characteristics and consists of the two sublayers: graphical and cartographical.

Graphical methods of research include the construction of various graphs and diagrams. For example, the temporal behavior of a slope of the Gutenberg-Richter magnitude-frequency relationship *b(t)* [2,3] and of the environment damageability parameter (concentration criterion $K_{avg}(t)$) [4].

The parameter K_{avg} is relation of average distance between seismic dislocations R_{avr} which have occurred in some seismoactive volume V_o for period DT, to their average length [4]: $K_{avg} = R_{avr} / L_{avr} = m^{-1/3}/L_{avr}$, where $m=N/V_0$ - volumetric concentration of dislocations; L_{avr} is the average length of dislocation on ensemble of fractures; N - the common number of earthquakes in a range of energy classes [K_{min}, K_{max}] which occurred in seismoactive volume V_0 for period DT. Average length of break: $L_{avr} = S_{j=1,\dots,N} L_j / N$, where L_j is the length of the seismic dislocation of each of considered earthquakes which is estimated under the formula $\lg L_j = aK_j + c$ (the default values of constants: a = 0.244; c =-2.266).

As known [4], the sharp fall of K_{avg}- values is one of forecast attributes of preparing destruction of environment. The graphs (Figure 1) show, that the periods of its flat course are replaced by the periods of sharp fall of values, either multistage or as one large jump. The latter may be regarded (alongside with other attributes) as one of precursors of the future shocks.

The cartographical research methods also presented here are the following: the calculation of cartograms of the spatial distribution of values *b* and K_{avg} (Figure 1,a). For exapmple, an increase in the value *b* (Figure 3) from 0.9 up to 1.2 observed on the 1974-1983 temporal interval (except for area 4) of the BRZ (Baikal Rift Zone), specifies changes in geodynamics of the given site as unloading. We observe the same growth in the local area of BRZ surrounding the Olkhon peninsula (Figure 3,c).

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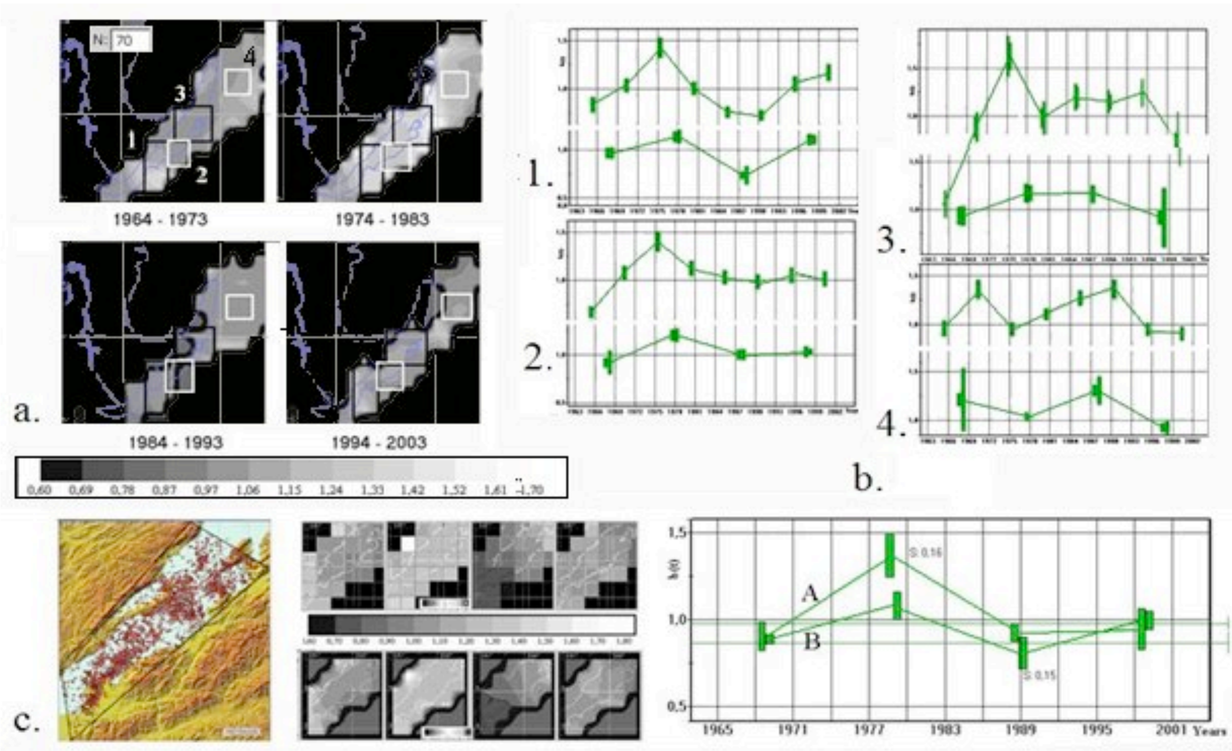

Figure 3 A change in the parameter of the slope of the Gutenberg-Richter magnitude-frequency relationship b-value: as a zonal maps (a) and temporal b-changes (on 5- and 10-years intervals) for areas 1-4 shown in the frames (b). Black frames (1-2 zones) correspond to 5-8.7% errors; white frames (3-4 zones) – 3.6-4.4%. A change in the parameter b(s) of the local part of BRZ (c).

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