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MINING ACTIVITY IN GEORGIA AND NON-STATIONARY MODEL OF INTENSIVE CHANGE OF SOIL POLLUTION

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Abstract

In the era of developed industry, the contamination of the environment with radioactive elements and heavy metals turned out to be particularly dangerous, which became the cause of significant social problems in densely urbanized areas. This is evidenced, for example, by the special scale of oncological diseases and frequent genetic mutations.

Keywords: soil contamination, diffusion model, soli pollution, mining activity

I. Introduction

In the recent past, radiation pollution often occurred in particularly densely urbanized areas of industrial zones in Georgia. At present, the level of radiation contamination of the inspected part of Rustavi territory with Cs-137, Sr-90 and K-40 radioactive elements is not alarming. However, a reliable representation of the retrospective picture of the radiation situation requires an assessment of the change in the level of soil contamination in time and space. For this, we need to know the power of the pollution source and its duration. It is natural that environmental pollution develops both in space and time. Creating an adequate mathematical analogue of the process of spreading pollution in the soil is a task of particular difficulty. Its exact analytical solution is impossible, although there are approximate solutions, on the basis of which it is possible to correctly model the dynamic picture of pollution. In contrast to atmospheric pollution, the process of diffusion in the soil is significantly influenced by the orography of the earth's surface, the agrochemical nature of the soil and its magnetic properties. When modeling the spread of soil surface pollution in time and space, it is permissible to ignore the effect of the convection flow of surface waters.

II. Methods

In general, it is fair that the migration process of chemical pollution in the soil is significantly determined by the slow movement of groundwater, the so-called. Filtration, which is affected by atmospheric precipitation. In addition, in contrast to atmospheric pollution, the process of diffusion in the soil is significantly influenced by the orography of the earth's surface, the agrochemical nature of the soil and its magnetic properties. Despite such diversity, in some cases it is acceptable that some of these factors are not equally effective. When modeling the spread of soil surface pollution in time and space, it is permissible to ignore the effect of the convection flow of surface waters. Depending on the terrain, it is also possible to use the non-stationary diffusion equation.

III. Results

This general feature of the solution of the diffusion equation represented by Fourier components can be useful for the approximate retrospective reconstruction of the dynamic picture of pollution in the central park of Rustavi. It is obvious that for an approximate reconstruction it is enough to interpolate the measurement results separated by a certain time interval by means of the given graphic representations as palettes. In such a case, it becomes possible to specify the approximate date of the initial moment of pollution, as well as the prediction of the moment of leveling to the characteristic background value of surface soil pollution in the future.[1] For example, in the case of an orographically simple surface, the approximation of azimuthal symmetry is physically permissible

$$\frac{\partial K}{\partial t}=D\left(\frac{\partial^2 K}{\partial r^2}+\frac{2}{r}\frac{\partial K}{\partial r}\right),\ t>0 \qquad [1]$$

Where, k is the concentration, D is the diffusion coefficient, t is the time, r is the radial coordinate. We can consider two models.

$$T=\left(\frac{n\pi}{R}\right)^2 Dt \geq 0.4\ [2].$$

In the first case, the circle of initial concentration of chemical pollution. The distribution will be constant. In the second case, at the initial moment we will have point pollution. If we assume that there is no chemical pollution at the boundary, for both models of initial pollution we will have a suitable boundary condition of normalized background value: K(R,t)=0. In general, both variants of are suitable for modeling the dynamic change of chemical pollution on the Earth's surface and in the soil. represent the qualitative-quantitative visualization of the solution for both variants of the condition [2]. It is obvious that for an approximate reconstruction it is enough to interpolate the measurement results separated by a certain time interval by means of the given graphic representations as palettes [3]. In such a case, it becomes possible to specify the approximate date of the initial moment of pollution, As well as the prediction of the leveling moment of soil surface pollution to the characteristic background value in the future.

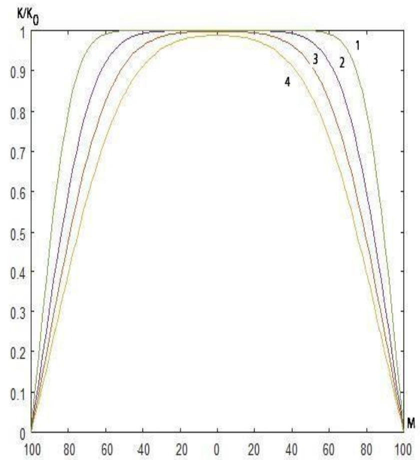

Figure 1: *Figure caption*

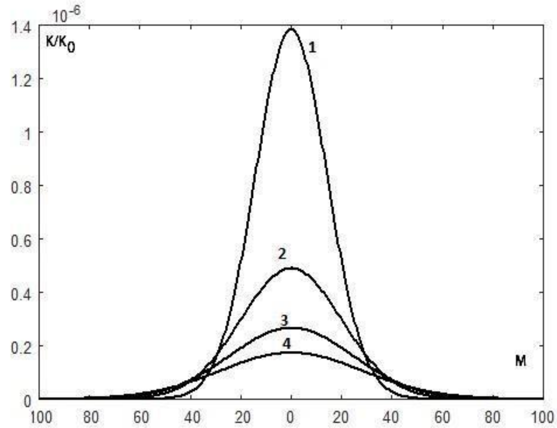

Figure 2: *Figure caption*

IV. Discussion

For the completeness of the analysis, Fig. 3 shows the history of the first graph of Fig. 2. togram (n=20), and in Fig. 4 - the corresponding percentage spread. It should be noted that qualitative information regarding the physical purpose of the immeasurable parameter T is revealed, as the effect of the diffusion coefficient in combination with time becomes evident.[4] Approximation of the ratio of pollution levels by means of the given graphic visualization roughly, However, quite correctly, it allows to determine the quantitative characteristic of the decrease of pollution intensity in time and space.

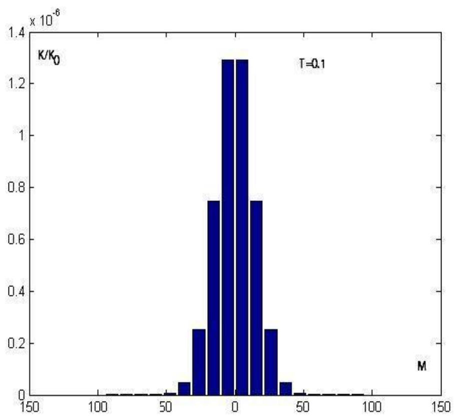

Figure 3.

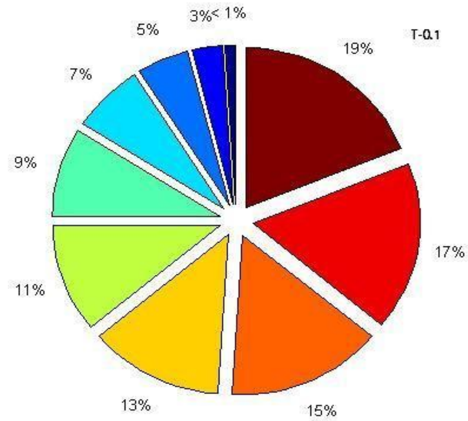

Figure 4.

References

[1] Tikhonov A.N., Samarsky A.A. Equations of Mathematical Physics. 1999 799s

[2] Carslow G., Eger D. Thermal conductivity of solids, M. Science. 1964.- 488 p.

[3] Nadareishvili , Gugushvili . "Radiation ecology" - bibliography. Ecological Scientific Society of Georgia, Bio-medical equipment. Society - Tbilisi, 1991, Vol. I, p. 608

[4] Mirianashvili K., "Atmospheric pollution factors and Mathematical modeling of changes in meteorological elements and Study of their influence on human health Publishing House of the State University, Tbilisi, 2005, 195p.