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When this approach is applied for modeling transfer processes, the following questions arise:

1. What is the optimal partition of the object under study and the subsequent numbering of the resulting vertices?

2. The resulting vertices of the graph are individually considered equilibrium subsystems, while the entire process under study is thermodynamically nonequilibrium. The local-equilibrium process cannot be understood as a process in the full sense of the word; rather, it should be considered as a series of successive equilibrium states of elementary volume. Each of these states is determined by a finite set of equilibrium thermodynamic variables and their values. Moreover, it is only for these states that the concepts of temperature and entropy can be introduced. Is it possible to consider that if a quasi-equilibrium process is realized in local volumes, the system as a whole can be nonequilibrium? Is the approach of locally equilibrium thermodynamics appropriate here? The cause of popularity, no matter how strange it may seem, may be the controversy of some provisions of this theory. It is they that make one think about the nature of heat and look for answers to seemingly obvious questions such as: what are temperature and entropy.

3. Must the resulting graph be a planar graph? Since a graph can be planar not only on a plane, but also in another space, what is the physical meaning of the planarity of this graph?

4. What is the physical meaning of the operation of combining graph vertices in the modeling of transfer processes? Is it possible with this operation to minimize the number of calculations?

Figure shows an example of the application of this approach for a homogeneous rod.

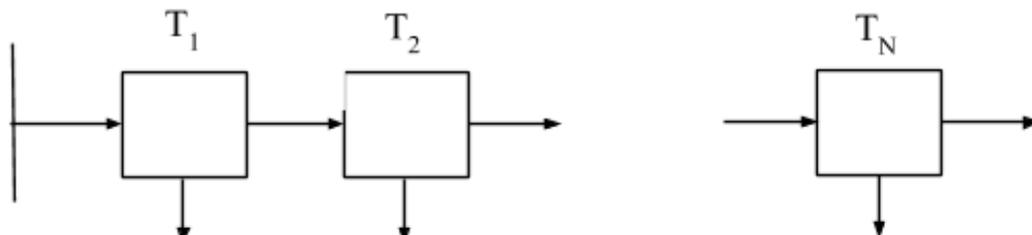


Fig. 1. Vertices for a homogeneous rod

A thorough analysis of the fundamental principles of thermodynamics and a geometric interpretation of these principles are necessary to find answers to these questions. The results of the work can be used in practical application at the stages of studies of heat power plants, design and operation.

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SOME ASPECTS OF MODELLING MONGOLIA'S GAS SUPPLY SYSTEM

Abstract. The paper describes the possible ways of supplying gas to Mongolia. The opportunities of Mongolia's participation in the creation of the regional gas market in Northeast Asia (NEA) are analyzed. The role of transport and distribution costs when making quantitative assessment is highlighted.

Key words: Mongolia, gas transportation infrastructure, cost estimations.

Ключевые слова: Монголия, газотранспортная инфраструктура, стоимостные оценки.

Introduction. The issue of supplying gas to Mongolia has been discussed since the end of the last century. Now the problem has arisen again, the reasons are the rapid growth of the gas market of China, which borders Mongolia, the ecological consequences of burning coal for energy needs, which can be observed especially in Ulaanbaatar, the country's capital, and the need for enhancing reliability and flexibility of Mongolia's power system with the prospective growth of renewables share as well as energy consumption growth.

Currently, the opportunities to supply Mongolia with gas by a gas pipeline from Russia to China passing through Mongolia's territory are being examined. One of the effects of participation in such trilateral international cooperation for Mongolia is the opportunity to attract investment, technology, and labour resources from abroad on mutually advantageous terms. Besides, there is an opportunity to import liquefied natural gas (LNG) by railway and road transport.

Resources. To date, conventional natural gas resources have not been discovered in Mongolia. Total Mongolian methane gas resources are estimated at 3.2 trillion cubic meters. The resources of coal-bed methane in the 22 main coal deposits are estimated at 68 billion cubic meters, with the resources of the country's largest coal deposit Tavantolgoi accounting for 79% of them [1]. Technically recoverable shale gas resources in Tamtsag and East Gobi basins are estimated at 59 billion cubic meters and 65 billion cubic meters, respectively [2]. However, despite the technical feasibility of the development of unconventional gas resources, high costs, the issue of water supply in South Gobi [3], and the need for huge investments

are still the problems, which are supplemented with the lack of gas transportation infrastructure, regasification and liquefaction facilities.

The ways of supplying gas to Mongolia and the approaches to modelling.

The following ways of supplying gas to prospective consumers in Mongolia exist:

- development of Mongolia's own unconventional gas resources;
- import of LNG from China;
- import of pipeline gas from China;
- import of LNG from Russia;
- import through transit pipelines from Russia to China.

It is worth noting that in 2018 Mongolia has already started to import some volumes of LNG from China and then from Russia in order to switch to gas in the transport sector.

Currently Gas Infrastructure Development in the East Asian Region (GEAR) model is being developed [4]. In the model, Mongolia is represented as a node Ulaanbaatar, where the country's total natural gas demand is aggregated. The results of modelling the Northeast Asian gas market by employing GEAR indicate that the optimal solution in terms of supply and import costs is to build a gas pipeline from East Siberia to China that passes Mongolia's territory [5].

In Mongolia, the distribution of LNG by road and railway transport is the only economically feasible way to deliver gas to consumers located at large distances from each other and consuming relatively small volumes. At the same time, the total cost of transporting gas within the country between its regions and the distribution cost within the regions are strongly affected by the type of gas imported. If pipeline gas is supplied to a region, it is necessary to bear the cost of liquefying it before distribution. Besides, it is necessary to determine the optimal way to transport gas between regions. Thus, modeling of Mongolia's gas transportation infrastructure at the national level should reflect the routes and the means of gas transportation between regions, as well as the difference in distribution costs.

Conclusions. Today import is the only feasible way to supply gas to Mongolia due to the lack of the country's own conventional natural gas resources. At the same time, the structure of the total costs of supplying gas to end-users varies depending on the way of import and transport. Therefore, it is necessary to consider them when making quantitative assessments of supplying gas to Mongolia.

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A SWARM ALGORITHM MODIFICATION FOR THE NON-STATIONARY PHYSICAL FIELD INVESTIGATION

Abstract. Currently, the physical field survey problem is of particular interest in the field of underwater research. This article proposes an approach to solving this problem in a non-stationary formulation using a modified swarm algorithm that controls a group of autonomous underwater vehicles.

Keywords: physical field survey, non-stationary physical field, swarm algorithm, optimization.

Ключевые слова: обследование физического поля, нестационарное физическое поле, роевой алгоритм, оптимизация.

Introduction

Although humanity has now studied the Earth quite well, our knowledge of the underwater world is minimal. Several negative factors cause this problem: firstly,

the inability of a man to be in the underwater environment without special equipment; secondly, the high labor and resource intensity of the research process; thirdly, other physical limitations, in particular, on the distance of communication, vision, and other. Only relatively recently, with the invention of submersibles, the active phase of oceans research began.

There are many both practical and fundamental problems in this field. One of them is the task of trajectory survey of physical fields and anomalies searching, which includes many particular cases: mapping, search for given objects, direct examination of the physical field and search for areas with extreme values, and many others.

Undoubtedly, this task can be accomplished with human resources, but it is much more efficient to use autonomous underwater vehicles (AUVs) or their coordinated group. There are many works by both domestic and foreign scientists [1, 2]. However, most of them consider only stationary physical fields, the values of which do not depend on time.

This article suggests an approach to the solution of the above problem under the condition of non-stationary physical fields using a group of AUVs controlled by swarm intelligence.

Physical field survey problem

In this article, a two-dimensional case of the physical field survey problem is considered. In this case, the physical field is a kind of scalar mathematical field described by a function $f(x, y, t)$. The nature of the function is unknown in advance for search agents (AUVs). The function can be defined analytically or using a table (as a height map, as shown in Figure 1). In order to simplify the visualization and to unify interfaces, the function is sampled to a discrete set of values F^2 ($F \subset \mathbb{Z}$). These values are normalized (formula 1) at each search iteration. Real AUVs have an error of sensors, so a small enough change in the function parameters does not lead to a significant change in its value. Meanwhile, the neighboring points of the sampled set represent statistically important data.

$$\hat{f}(x, y, t) = \frac{f(*) - f_{min}(*)}{f_{max}(*) - f_{min}(*)} \times 255 \quad (1)$$

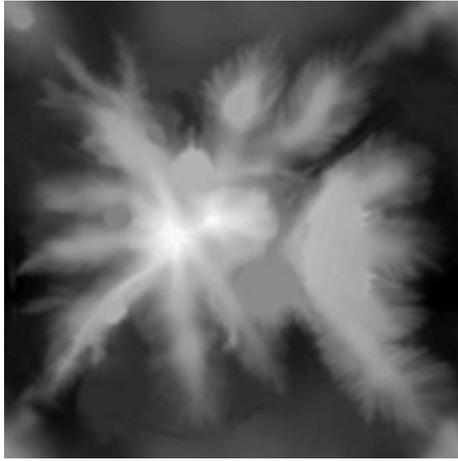


Figure 1 – An example of the examined physical field representation

Let us consider the problem of determining an area with an extreme value of the physical field. In this case, the task is reduced to search for such $(x^*, y^*) \in F^2$ at which the target function takes the maximum value, i.e., to the optimization problem of the following type (formula 2).

$$f(x^*, y^*, T) = \max f(x, y, T) \quad (2)$$

Where T is the time of the survey mission end.

Proposed approach

For the moment, the task of physical field survey is often solved by using a tack search algorithm in which a network of measurements covers the entire area with a given step or algorithms based on the gradient descent. For the above problem, both these methods are not applicable. A tack search will give an incorrect result when surveying a non-stationary physical field since measurements lose relevance over time. The gradient descent, on the other hand, has no protection against hitting the local minimum. Thus, it was suggested to use population algorithms, in particular, the WOA-GWO hybrid algorithm, to solve this problem. This algorithm has been developed as a part of the presented study and is based on the Whale Optimization Algorithm (WOA) [3] and the Grey Wolf Optimizer (GWO) [4]. All modifications described in the article were developed for WOA-GWO, but can be transferred to any swarm algorithm without significant changes.

The proposed modifications are based on a three-dimensional Voronoi diagram, where the third dimension is time. Voronoi diagram is a division of space into subareas (cells), in which the distance from any point of the cell to a given point (site) is less than to any other site. In this case, the sites are the measurements made by agents during the problem solution.

For the proposed approach, there is no need to build and store a three-dimensional diagram; it is enough to have its two-dimensional cut at particular

moments of the time. If the area of any Voronoi cell on the given cut is equal to zero, the measurement that gave birth to it is thrown out of the list. Thus the "forgetting" of old measurements, which in conditions of non-stationary physical field lose their relevance, is simulated. It was suggested to introduce a time factor allowing to adjust the speed of "forgetting." If its value is equal to 0, this process is disabled. Thus, all performed measurements are considered. If this parameter is increased, a smaller number of measurements is considered at the same time, up to the measurements obtained only at the current iteration. This process also indirectly allows one to regulate the labor intensity of the diagram cut calculation by reducing the number of measurements known to agents.

The first detected barrier in solving the physical field survey problem, which is typical for both stationary and non-stationary formulations, is agent initialization. Usually, robots move to the examination area as a single group, so at the first iteration, all agents should be situated on a small (in comparison with the whole examination space) area. Such restriction leads to hitting the local extremum in the vicinity of the starting point.

It was proposed to change the mechanism of selecting "leaders" in order to solve the above problem. A "leader" is a measurement that affects the calculation of the target position for agents at each iteration. In the basic WOA-GWO algorithm, as in its parent algorithms, the leaders are three measurements with the maximum value of the function (formula 3).

$$F = f(x, y, t) \quad (3)$$

A new function was proposed to replace it (formula 4).

$$F = k_1 \times f(x, y, t) \times k_2 \times s(x, y, t) \quad (4)$$

Where $f(x, y, t)$ is the value of the target function, $s(x, y, t)$ is the value of the Voronoi cell area with the site at (x, y) , k_1 and k_2 are weight coefficients (temporarily taken equal to 1).

Function $s(x, y, t)$ returns a value in the range $[0,1]$ and represents the normalized area value of the corresponding cell. Thus, an increased interest in the inspection of cells with a large area is achieved. It provides a more uniform inspection of a given area without skipping zones that have received a bad initial approximation but potentially contain an extremum.

However, this approach negatively affects the final iterations of the algorithm. Therefore, the choice of the leader determination function has been synchronized with the basic patterns of WOA-GWO behavior: exploitation (survey) and operation ("attack"/refinement of the solution). In the "exploration" behavior template, the

leaders are selected according to formula 4, otherwise – according to formula 3. Such an approach allows solving both described problems.

Another direction of work was to change the time function (formula 5), according to which the choice of agent behavior pattern is made. It has been noticed that during the final iteration, the agents examine a small area around a presumptive extremum (which size also depends on the time function) for a sufficiently large number of iterations. In the original algorithms, this allows specifying the value of the extremum with high precision, but within this task (with the limitations and assumptions adopted), it makes no sense. It was proposed to change the time function (formula 6) in such a way as to increase the percentage of exploration iterations without changing the range of accepted values to eliminate this disadvantage.

$$a = 2 \times \left(1 - \frac{time}{N}\right) \quad (5)$$

$$a = 2 \times \left(1 - \left(\frac{time}{N}\right)^k\right) \quad (6)$$

Where time is the number of the current iteration, N is the maximum number of iterations, k is the degree coefficient accepted equal to 5.

For physical fields that are known to be stationary, there is another indirect application of the Voronoi diagram. With a time coefficient equal to 0, the result is a reasonably good approximation of the diagram to a given prototype (Figure 2). Thus, the mapping problem is solved in parallel. This additional information may be useful for further researches in this area.

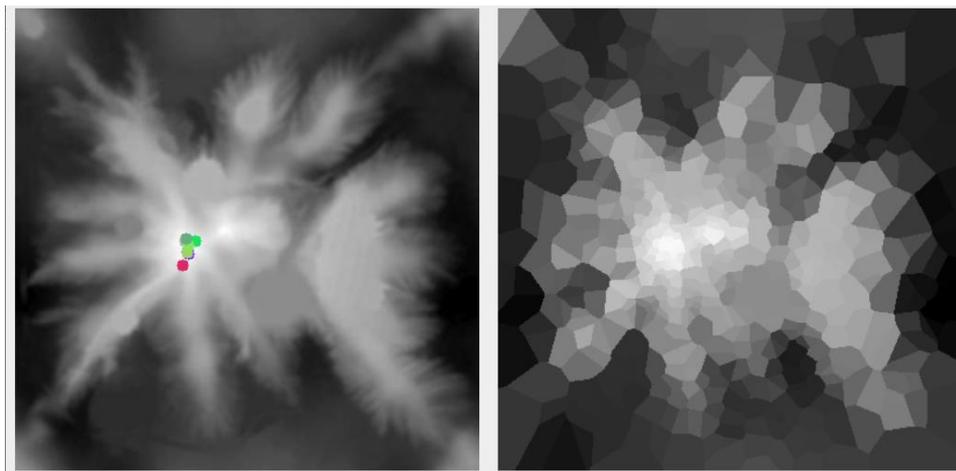


Figure 2 – Comparison of the initial physical field represented by a height map and a Voronoi diagram

Conclusion

Initial tests have shown that non-modified algorithms are unable to find a sufficiently good approximation to the extremum for non-stationary physical fields with any predicted probability. At the same time, proposed modifications allow finding a value close to the extremum with an average error of 5-7% and not exceeding 15% (at worst) in the overwhelming number of runs.

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WHY DO DIATOMS DIE AND WHAT DOES METACASPASE DO?

Abstract. It is known that programmed cell death (PCD) is characteristic not only of multicellular organisms, but also of unicellular organisms, including diatoms. They have analogues of caspases, metacaspases of the III class, which are involved in cell death. However, the molecular processes of PCD are not clear.

Keywords: programmed cell death, phytoplankton, diatoms, metacaspases, bacteria, *Fragilaria radians*.

Ключевые слова: Программируемая клеточная гибель, фитопланктон, диатомовые водоросли, метакаспазы, бактерии, *Fragilaria radians*

Diatoms are unicellular algae covered with a unique silica cell wall that live in various ecosystems – in reservoirs, including Lake Baikal, and even in the soil. They are responsible for approximately 20% of the Earth primary production [1]. For a long time, it was believed that the life cycle of diatoms either ends in the next division, or the cells are eaten by zooplankton. But due to numerous studies, it has become clear that they are capable of programmed cell death (PCD) when they encounter severe stress factors [2].

Among such factors, firstly, the lack of nutrients, for example: silicon (without which the cells are not able to divide), iron (which is required for the work of many enzymes) and nitrogen (as a key element for proteins and nucleic acids). The lack of these elements leads to the failure of many biochemical processes in the cell and to the inactivation of photosystems. As a result of this, large quantities of reactive oxygen species are formed, which begin to oxidize various components of the cell [3,4]. Secondly, when the diatom is infected with viruses in the cell, PCD is launched, possibly in order to prevent the spread of the virus in the population [5]. Thirdly, the interaction of diatoms with bacteria can be damaging, since the bacteria, for example, use chitin as part of the shell of diatoms as a carbon source [6]. And finally, in some other cases, diatoms are able to give each other signals, including signals to PCD [7].

When a stress factor occurs, cells try to deal with it. Many processes are activated that can help better capture nutrients from the environment, and deal with

oxidative stress [8,9]. However, if the protective systems of the cell are insufficient, then metacaspases to be activated. Metacaspases are enzymes, analogues of animal caspases in plants, fungi, and even bacteria. These are specific proteases that cut targets after amino acids of arginine or lysine. Diatoms metacaspases belong to class III, characterized by a rearrangement of structural domains [10].

Different types of diatoms have a different number of metacaspase genes, and therefore a different set of proteins. Perhaps some of them are needed to maintain the normal functioning of diatoms, while the other part is triggered by PCD [11]. What is the target of metacaspases? How exactly do they start PCD? At the moment, there are no answers to these important questions, therefore, studies of the structure of metacaspases and their role in the life and death of diatoms are of great importance.

Earlier in our laboratory, it was shown that during the interaction of the diatom *Fragilaria radians* with the bacteria *Bacillus mycoides*, the diatoms stop growing, collapse, and DNA fragmentation characteristic of PCD is observed (in press). Also, 8 genes of metacaspases were found in the *F. radians* genome using whole genome sequencing [12]. To find out whether they are active continuously or under certain conditions, we now confirm the nucleotide sequences of these genes using Sanger sequencing. After that, we will be able to evaluate the levels of metacaspase expression under normal conditions, after interacting with bacteria and in conditions of nutrient deficiency. Using substrates, which are sequences of target amino acids for metacaspases, we can evaluate the activity levels of these proteases.

Our study will help get closer to the answer about the role of metacaspases in the life and death of diatoms.

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УДК 547

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USE OF FUNCTIONAL ACETYLENE DERIVATIVES

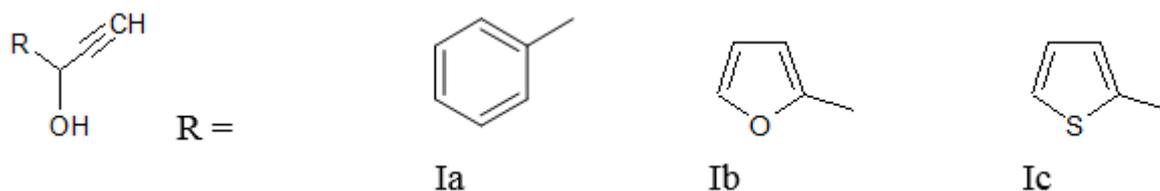
Abstract. Shiny nickel coatings are widely used in industry as a decorative and protective material. In this work, additives for improving the properties of a nickel coating are considered.

Keywords: brilliant nickel plating, organic additives, electrolytes, Hull cell.

Shiny nickel coatings are widely used in industry as a decorative and protective material. Obtaining coatings having protective and high decorative properties, directly as a result of electrolysis – without any further surface treatment – determines increased interest in methods for producing shiny coatings and questions of the mechanism of their formation.

In order to improve the structure of coatings, their technological and operational properties, organic additives or their mixtures are introduced into nickel electrolytes, in the presence of which fine-crystalline shiny coatings are formed. To obtain brilliant nickel coatings, organic compounds are used that contain both $=C-SO_2$ and $-SO_2=$ groups and unsaturated groups $C=O$, $C=C$, $C\equiv C$, $C=N$, $N=N$, $N=O$, $N-C=S$. The $C\equiv C$ group is included in functional derivatives of acetylene, for example, butynediol-1,4, propargyl alcohol and its derivatives, which are intensively studied and widely used as bright-forming additives in brilliant nickel electrolytes. So, in work, nickel sulfate electrolyte with the addition of tertiary acetylene alcohol, 2,5-dimethyl-3-hexyne-2,5-diol, was studied, which made it possible to obtain a brilliant nickel coating at an additive concentration of 2-3 g/l. However, this additive gives good results only in the presence of formalin and benzaldehyde.

Preliminary electrochemical studies in the Hull cell of secondary propargyl alcohols with aromatic and heteroaromatic substituents (Ia-c) were carried out:



Our studies have shown that the organic additives under investigation in a concentration of 0.05-0.1 g / l make it possible to obtain a brilliant nickel coating from a sulfate electrolyte.

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THE IRKUTSK FOCUS OF OPISTHORCHIASIS

Abstract. The work is related to the study of opisthorchiasis. Opisthorchiasis is a parasitic infectious disease in humans and animals caused by flatworms of the genus *Opisthorchis*. These worms are localized in the liver and cause serious damage to the host organism by waste products. Left untreated, the disease can result in death. Therefore, the study of opisthorchiasis is an important and urgent task.

Keywords: Sample collection and study of water flora and fauna in the Biryusa basin. Determination of the coordinates of reservoirs in which aquatic organisms infected with *Opisthorchis felinus* live. Identification of clear boundaries of the Irkutsk focus of opisthorchiasis. Health promotion strategies and raising awareness of the population living within the boundaries of the outbreak of opisthorchiasis.

In the Irkutsk region there is a natural focus of opisthorchiasis, which at the moment is practically unexplored. To rectify this situation, we have to investigate water bodies in the Biryusa river basin, collect samples of the flora and fauna and study them. After the parasite is detected in the samples, the coordinates of the reservoir in which these samples were collected must be mapped.

The complex life cycle of *Opisthorchis felinus* proceeds with the change of three hosts. The first intermediate host are mollusks from the Bithyniidae family. The second intermediate host is the fish of the Cyprinidae family. The ultimate host can be fish-eating animals or humans.

It is impossible to defeat opisthorchiasis. Though it is not necessary. It is enough to exclude a person from the list of final owners, that is it is much more important not to treat the disease, but to prevent it. This can be done by educating people who are at risk of getting infection. For this, it is necessary to know the boundaries of the focus of opisthorchiasis.

After establishing the boundaries of the outbreak, we will be able to begin educational work together with medical institutions in the Irkutsk region. Informing the population about the possible ways of getting infected with opisthorchiasis, we can save people from a deadly disease.

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MOSS AS INDICATORS OF ENVIRONMENTAL POLLUTION

Abstract. The development of basic research related to the stability and change in natural biocenoses under the influence of various anthropogenic factors does not lose its relevance. The need to predict environmental changes and the consequences caused by them increases in

proportion to the increasing impact on natural complexes. The search for ways to prevent negative consequences is just as relevant. However, it is possible to solve these issues only by determining the very fact of the presence of impact and its degree. This study is devoted to the research of the ability of mosses to saturate with heavy metals and the possibility of using them as bioindicators in assessing anthropogenic impact.

Keywords: bioindication, environmental monitoring, environmental monitoring, soil, atmosphere.

Ключевые слова: биоиндикация, мониторинг окружающей среды, бриофлора, почва, атмосфера

Pollution has not accidentally become one of the most important problems of our time. Due to the intensive development of industry and transport, an increasing amount of harmful substances is entering the atmosphere, hydrosphere and soil. Therefore, the development of effective biomonitoring systems to monitor the urban environment is important. There are a huge number of bioindication techniques developed for different species and groups of plants, taking into account their biological and ecological characteristics. The use of bryophyta, mainly leafy mosses for biomonitoring purposes is of great importance. In this regard, it has become necessary to study the bryo-diversity of different ecosystems and to select new indicator species suitable for the development of methodologies and the construction of bioindication scales. In connection with the above, the aim of the investigation is to study the floristic diversity of bryophyta surveyed phytocenoses and to identify indicator species suitable for biomonitoring of atmospheric and soil pollution. The work is based on more than bryo-diversity, collected in April-May 2018 in Talyan village of Usolye district of the Irkutsk region. Studies within the three trial sites identified 10 species of bryophyta, including nine species of leafy mosses and one species of liver mosses. Comparative analysis of the obtained data with similar materials on broadleaf forests of the same type located in environmentally friendly areas of the Irkutsk region showed that the bryophlora of the surveyed sites has a poorer floristic composition, which is expressed in the absence of a number of species (for example, members of the genus *Orthotrichum* (Hedw.), a rare occurrence of basophilic species sensitive to acid rain deposition (*Dicranum scoparium* Hedw., *Pottia bryoides* (Dicks.) Mitt., *Pohlia nutans* (Hedw.) Lindb., *Pleurozium schreberi* (Brid.) Mitt., *Funaria hygrometrica* Hedw.). The study identified a group of species resistant to atmospheric and soil (*Distichium capillaceum* (Hedw.) Bruch et al., *Orthotrichum fallax*, *Dicranum scoparium*, *Pottia bryoides*). These species can be recommended for biomonitoring. It has been found that the content of heavy metals in green ground mosses is closely related to the content of these 101 elements in the upper soil layer. Compared to epiphytes, ground species are less suitable for estimating heavy metals in the atmosphere. Mosses are

able to extract ions of different elements directly from the atmosphere if these elements are not present in the substrate. This is because the foot-shaped are devoid of covering tissues and moisture is absorbed by the entire body surface, which is very large in relation to the volume. Therefore, mosses serve as excellent indicators of the presence or absence of different elements in the atmosphere or substrate. Most promising is their use in the study of environmental contamination by heavy metals to indicate metals such as Pb, Zn, Cd, Cu, Fe, Ni. Different types of mosses absorb heavy metals at different intensities. There is extensive literature reflecting the accumulative capacities of different species. As indicators of heavy metals epiphytic bryophytes such as *Distichium capillaceum*, *Orthotrichum fallax* are used. *Epigee* species are also widely used: *Dicranum scoparium*, *Pottia bryoides*, *Tortula inermis* (Brid.) Mont., *Hylocomium splendens* (Hedw.) B. S. G., *Pohlia nutans*, *Pleurozium schreberi*, *Funaria hygrometrica* and many others. Based on the above, it can be concluded that the direct linear relationship between the species diversity of bryophyta and the distance from the motorway is the main source of pollution. A group of species resistant to atmospheric and soil pollution has been identified and recommended for biomonitoring.

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УДК 547.46'054.6

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TRIFLAMIDATION OF UNSATURATED SUBSTRATES

Abstract. The reaction of triflamidation was carried out in the presence of oxidizing agents. As a result of our work a new method for the synthesis of organofluorine compounds was obtained.

Keywords: triflamides, triflormetganesulfonyl acid, sulfonyle amidines, triflamidation.

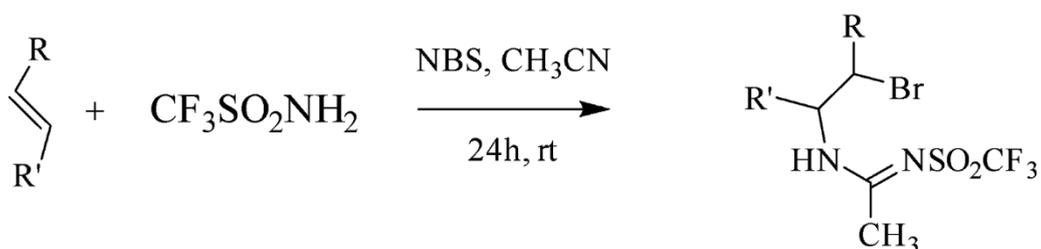
The goal of our experiments is to develop new methods for the synthesis of organofluorine compounds by studying the reactions of addition of trifluoromethanesulfonic acid amide ($\text{CF}_3\text{SO}_2\text{NH}_2$) to unsaturated compounds in the presence of oxidizing agents (N-halogenosuccinimides) with the involvement of a nitrile molecule as the third component, the study of patterns when varying the ratio of reagents and reaction conditions.

In our studies, one-reaction reactions of triflamide with a number of unsaturated compounds containing a double bond in the presence of N-bromosuccinimide in acetonitrile were carried out. All reactions were carried out at room temperature for 24 hours. Amidines (pre-anticipated products) were obtained in all reactions.

In this work the applicability of N-bromosuccinimide was considered as an alternative to other oxidative systems, in particular, the t-BuOCl + NaI system. The difference between this oxidative and t-BuOCl + NaI is that the solvent molecule is introduced into the reaction product. N-bromosuccinimide proved to be a highly specific oxidative system, however, it side-reacts with an unsaturated fragment of the substrate, which gives products of mono- and di-bromo substitution of alkene, which was necessary to get rid of by column chromatography on silica gel. Also in this study, the effect of electron-withdrawing substituents on the change in reactivity in substrates is examined.

The reactions studied proceeded according to a mechanism such as the Ritter reaction, that is, with the involvement of the nitrile group from the solvent into the product molecule.

The scheme of the reaction:



All reactions carried out should proceed according to the predicted mechanism; no deviations from the theoretically predicted products have been identified. In these reactions, skeletal rearrangements should not be observed; accordingly, bicyclic products will not form. The distinctive feature of sulfonamidation of unsaturated compounds with triflamide, in contrast to arenesulfonamides, is that the reaction proceeds according to the Ritter reaction, with the introduction of a solvent molecule into the products, since the nucleophilicity of acetonitrile is higher than for triflamide, but lower than for arenesulfonamides.

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MODELING THE INFLUENCE OF VARIOUS SCENARIOS OF GENETIC INTROGRESSION ON THE EVOLUTION OF NEUTRAL MARKERS

Abstract. In our work, using a computer simulation model, we studied the demonstration of introgression under various scenarios of molecular evolution in a population of diploid organisms.

Keywords: evolution, molecular phylogeny, modeling, introgression, mitochondrial genome, DNA, Baikal.

Microevolutionary processes involved in speciation include population expansions and extinctions, migration and some degree of reproductory subdivision between groups of individuals. Different combinations of these processes cause either phyletic evolution or species divergence. In natural ecosystems, especially in the ecosystems as complex as Lake Baikal these elementary processes may be interwoven into the most ways. These combinations in turn may result in an unusual patterns of genetic diversity.

Among the most interesting traces of complicated evolutionary history one may name incomplete sorting of ancestor lineages, mitochondrial and nuclear introgression. All these accomplishments may be diagnosed using phylogenies

inferred from markers of different location (plastid or nuclear). Sometimes clearly distinguishing sister species appear polyphyletic on one oath both kinds of trees.

We have used computer simulations to study the adaptive dynamics under different environmental scenarios in order to study the peculiarities of genetic diversity generated in molecular markers of different localization and inheritance modes. In order to achieve this goal neutral "DNA sequences" were included into the objects of the model. These sequences are passed from parents to they progeny and are allowed to mutate randomly at a constant rate. This mimics the process of neutral molecular evolution. After the completion of each simulation these "sequences" were sampled randomly from the survived objects and used for tree inferences. This approach allows one to find at least some of the scenarios which could generate patterns of molecular diversity found in the real world. We discuss different distorted patterns of molecular diversity and ecological scenarios which could generate them in fluctuating environment.

Introgression is the process of incorporation of alleles of genes of one species in the gene pool of a sister species in interspecific hybridization (introgressive hybridization). This process is important from the point of view of both population and evolutionary genetics, since its study helps in the study of the basic processes of speciation.

It is well known that an abnormally large species composition of the body. The mechanisms that led to the formation of biodiversity in ancient lakes are still poorly understood. One of the most interesting objects of modeling is an ancient lake, which approaches one of the closed habitats.

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УДК 579.841.11:862.1

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MICROBIOLOGICAL COMPOSITION OF AIR ON THE EDUCATIONAL FARM OF THE IRKUTSK AGRARIAN UNIVERSITY

Abstract. The article proposes the results of the investigation aimed at determining the microbiological air composition of the air at the Irkutsk GAU training farm. It was found that the microflora of the air is represented by cocci and rod-shaped flora and by mold fungi of the species *Aspergillus*, *Rhizopus*, *Alternaria*, *Penicillum*. The quantitative composition of the air on the farm of the Irkutsk State Agrarian University in general complies with the standards.

Key words: bacteria, fungi, air contamination, pollution, farm.

The availability of information on the microbiological composition of air is one of the most important components in the breeding and keeping of farm animals on farms. This knowledge is necessary in order to be able to control the bacterial contamination of the air, on which the health and productivity of farm animals often depends.

The species composition of the air microflora is determined by the existing sources of pollution: soil dust, animal feces, food, litter, products of sneezing and coughing, etc. The quantitative and qualitative composition of microorganisms depends on the season, the quality of lighting, temperature conditions, human and animal density, frequency of cleaning and the quality of ventilation, as well as on the type of products being processed and the nature of technological operations.

Materials and methods. The object of the study was the air from the animal stalls on the training farm of the Irkutsk State Agrarian University of the following species: cattle, including young animals, horses, rams and rabbits. The air sedimentation method (Koch's sedimentation method) was applied to various nutrient media: Nutrient agar, Czapek's agar and Sabouraud's agar with potassium tellurite. The colonies were cultivated in a thermostat at 29.9 °C. The species composition was determined using a mass spectrometer. Molds genera grown on Sabouraud and Czapek media were identified using a microscope.

The results of our own research. At the nutrient agar, the total microbial contamination of the air was calculated after 72 hours of cultivation in a thermostat according to Omeliansky formula. Thus, we obtained the following results:

- In the horses stable, the total microbial contamination amounted to about 60,000 bacterial cells in 1 m³ of air, which is the normal parameter for a dry shop with no more than 70,000 bacterial cells in the air.
- In the sheep stall, indicators are slightly lower, namely 55,000 bacterial cells per 1m³, which also corresponds to the normal parameters.
- The cow enclosure turned out to be the cleanest with a total microbial airborne contamination of 9500-10000 bacteria per 1m³.
- Calf barn by total microbial contamination approaches the boundary of the normal parameters when the content in the air is from 19500 to 21000 microbial cells in 1 m³.
- The only place in which the general microbial contamination differs from the normal parameters is the rabbitry. With a proper content of 70,000 microbial cells per 1 m³ of air, it contains from 79,000 to 83,000, which can be attributed to the overcrowding of animals and insufficient ventilation of the room. However, such a deviation from the normal parameters is not critical for animals keeping.

The microbiological composition in all Petri dishes has similar cultural properties so the samples were taken only from the environment that was seeded in the place of horses keeping. In order to examine the bacteriological diversity of the air microflora at the training farm in more detail, we studied colonies with various cultural properties: circular mucus-like membrane, opaque with erose margins, chromogenic colony, glistening colony with lobate margins, as well as glistening

colony with erose margins. Reinoculation was carried out on Nutrient agar of each colony, cultivated for 24 hours in a thermostat at 30° C, the taxonomic division was done on a mass-spectrometer.

A bacterioscopic specimen was prepared from the grown colonies, their Gram staining was completed.

In general, the microflora of the air is represented by gram-positive cocci, as well as gram-negative coccobacilli, gram-positive staphylococci, gram-positive bacteria. A pigment-forming (chromogenic) colony of microorganisms – gram-positive polymorphic bacilli; gram-positive bacilli were also found.

Further, the experiment on a mass spectrometer was performed in order to obtain the clearest microbiological composition of the training farm. Thus, the following bacterial species were identified: *Acinetobacter baumannii* LMG 994 HAM, *Acinetobacter gernerii* DSM 14967T HAM, *Acinetobacter radioresistens*, *Bacillus mycoides*, *Bacillus pumilus*, *Clostridium sphenoides*, *Pseudomonas congelans*, *Stenocentonia*, *Stenocentonia*, *Stenocentonia*, *Stenocentonia*, *Stenotofonia*, *Stenotofonia*.

The Sabouraud medium with potassium tellurite is specifically used for the cultivation of mold and yeast fungi; therefore, it allows us to demonstrate clearly the mycological composition of air on a training farm.

The mycological composition of the air is represented by molds of the genus *Aspergillus*, including *A. kerveii*, *A. puniceus* and *A. pseudodeflectus*, *Penicillium*, *Rhizopus* – a representative of the class of Mucorales.

On Czapek medium, which is also specifically used for the cultivation of mold and yeast fungi, the mycological composition was approximately the same, except for one noteworthy detail. It was in this environment, when taking air samples in the sheep stall, that *Alternaria* was discovered – a genus of fungi that are plant saprotrophs or optional specific parasites and can be found mainly in soil or on seeds of cereal crops and hay. With an increased content of this type of fungi in the air, animals and humans can suffer from various respiratory diseases and allergies. In order to limit the growth of the population of this fungus, it is necessary to ventilate carefully the premises and treat the infected surfaces with antifungal agents.

Having done this work and evaluated the microbiological situation at the training farm of the Irkutsk State Agrarian University, we can draw conclusions about:

1. The qualitative composition of the air, namely the presence of representatives of fungi from the *Aspergillus*, *Rhizopus*, *Alternaria*, *Penicillium*.

2. The quantitative composition of the air: on the farm of the Irkutsk State Agrarian University, all places of animals keeping, except the rabbitry, comply with the standards.

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FULLERENES. WHAT ARE THEY?

Abstract. A reactor for the production of fullerene-containing soot has been launched. Qualitative and quantitative analysis of fullerene containing soot was performed using UV spectroscopy and HPLC.

Keywords: fullerene, reactor, synthesis, electric arc, fullerene-containing soot.

At the end of the last century, a new allotropic modification of carbon was discovered. It was the fullerene having a molecular structure. Fullerene molecules can contain from 20 to 540 carbon atoms interconnected by a covalent bond. The most stable of them turned out to be C₆₀ fullerene which has the shape of a soccer ball and C₇₀ fullerene – in the form of a rugby ball. The most interesting is fullerene C₆₀. Fullerenes are practically not found in nature. Traces of it are contained in such a mineral as shungite. The first fullerenes were isolated from condensed graphite vapors obtained by laser irradiation of solid graphite samples. In fact, they were traces of a substance. The next important step was taken in 1990 by V. Kretchmer, Lamb, D. Huffman and others, who developed a method for producing gram quantities of fullerenes by burning graphite electrodes in an electric arc in a helium atmosphere at low pressures. Since then, fullerenes have become more accessible and their active study begins.

In 1996, Kroto, Smalley, and Curl were awarded the Nobel prize in chemistry for their discovery of fullerenes. Fullerenes are actively used by research groups around the world to develop innovative materials that are widely applied in modern science and technology. The growing demand for the use of fullerenes (C₆₀ fullerenes; C₇₀ fullerenes; higher fullerenes; endohedral fullerenes, etc.) has led to the development of various synthesis methods, among which the main ones are: electric arc; laser and burning hydrocarbons in a flame.

This work is devoted to the production of fullerene-containing soot by electric arc evaporation of spectral graphite in a vortex flow of an inert gas. As a result, a fullerene-containing soot was obtained, in which the presence of individual C₆₀ and C₇₀ fullerenes was confirmed by liquid chromatography and UV spectroscopy.

The influence of various factors on the synthesis of fullerene structures was studied, such as the residual pressure during vacuuming of the working chamber, the current strength, the degree of purity and pressure of the inert gas in the interelectrode space, the gas flow rate, etc. Spectrally pure graphite rods were used as raw materials for the synthesis of fullerenes. Optimization of the technical conditions of synthesis at the moment allowed to increase the content of target fullerenes C₆₀ and C₇₀ in the resulting fullerene-containing soot to 8 wt.%. According to the published data, the content of fullerenes in the applied methods of electric arc synthesis does not exceed 12%.

Fullerene-containing soot can be used as a modifying carbon additive of industrial polymers of structural type (polyamide, polyethylene, polypropylene,

etc.), improving their performance characteristics, such as resistivity, permittivity, electrical strength, friction, wear resistance, thermal and heat resistance, strength, elasticity, etc.

Adding fullerene C60 to mineral lubricants forms a protective fullerene-polymer film with a thickness of 100 nm. The formed film protects against thermal and oxidative destruction, increases the lifetime of friction units in emergency situations by 3-9 times, the bearing capacity of friction units by 2-3 times, the thermal stability of mineral lubricants to 400-500 C, extends the operating pressure range of friction units by 1.5-2 times.

It is noted that fullerenes are used as additives in batteries and electric batteries.

Fullerenes can also be used as additives in the production of artificial diamonds using the high-pressure method. The yield of diamonds when adding fullerenes increases to 30%.

Fullerenes, despite the absence of hydrogen atoms that can be substituted as in the case of conventional aromatic compounds, can still be functionalized by various chemical methods. Fullerenes can also be hydrogenated to form products from C60H2 to C60H50.

Hydrated fullerenes have great prospects for medical use. They have a great antioxidant activity, much more than modern anti-oxidants. Fullerenes are highly active against cancer cells. They also have wound-healing, anti-inflammatory and antiviral effects.

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THE ROLE OF CANDIDATE GENE POLYMORPHISMS IN THE FORMATION OF VASCULAR PATHOLOGY AND METABOLIC DISORDERS

Abstract. At the moment, a significant amount of literature data has been accumulated on the Association of genetic polymorphisms with various health disorders, including cardiovascular diseases and metabolic disorders. The direct and indirect influence of nucleotide substitutions in the genes of endothelial nitric oxide synthase (eNOS), endothelin-1 (EDN1), paraoxonase (PON1), angiotensin (AGT), receptors activated by peroxisome proliferators (PPARG), fatty acid Transporter (FABP2), leptin and its receptor (LEP and LEPR) on the formation of the above pathology was noted.

Keywords: endothelial dysfunction, metabolic syndrome, cardiovascular disease.

The development of endothelial dysfunction and metabolic syndrome is influenced by genetic predisposition. Thus, a large number of independent genes

associated with cardiovascular diseases have now been identified, in the pathogenesis of which endothelial dysfunction plays an important role.

Identify the role of genetic factors in the development of endothelial dysfunction and metabolic disorders.

Identify associations of candidate genes for endothelial dysfunction and metabolic disorders with their phenotypic manifestations.

The theoretical and methodological basis of the research will be the works of domestic and foreign scientists dedicated to the study of metabolic syndrome, endothelial dysfunction, genetic research over the past 5-10 years. Hygienic, laboratory, mathematical and statistical methods will be used as special methods.

We plan to study the polymorphisms of candidate genes for metabolic disorders and endothelial dysfunction: leptin and its receptor (LEP, LEPR), the fatty acid Transporter (FABP2), the peroxisome proliferator-activated receptor (PPARG), paraoxonase (PON), endothelin-1 (END1), nitric oxide synthase (NOS), and angiotensinogen (ANG).

At this stage, a review of the literature on this issue has been conducted.

At the moment, a significant amount of data has been accumulated on the association of eNOS (NOS3) gene polymorphisms with cardiovascular diseases. Glu298Asp polymorphism in exon 7 is associated by some scientists with a low NO level and a decrease in vascular reactivity (Parkhomenko A. N. et al., 2008, Joshi M. S., 2007), and some researchers are associated with a dose-dependent decrease in the enzymatic activity of eNOS and a decrease in NO production (Golser R., 2003). Hypertension in the group of patients with a burdened family history is associated with the carrier of the allele Asn polymorphic genetic marker Lys198Asn of the EDN1 gene (Minushkina L. O. et al., 2009). It was found that the LysLys genotype is more common in healthy individuals compared to patients (55%; 67.5%, respectively), while the AsnAsn genotype is found exclusively in patients with hypertension. Sethi A. et al. have identified the relationship of M235T polymorphism of the AGT gene with the concentration of angiotensinogen in blood plasma, the level of systolic and diastolic pressure, hypertension, and the risk of myocardial infarction and coronary heart disease was studied. Representatives of the Caucasian race showed an increase in the concentration of AGT in blood plasma by 5 % in MT heterozygotes and 11 % in homozygotes TT (compared to carriers of the MM genotype). M235T polymorphism of the AGT gene is associated with the risk of developing hypertension in Caucasians and native Asians. M55I and Q192R polymorphisms in the PON1 gene are associated with coronary heart disease and an increased risk of carotid atherosclerosis. Gln192Arg heterozygotes and Arg192Arg homozygotes were significantly associated with stroke.

At the same time, the literature provides ambiguous data on the relationship between the LEPR gene polymorphism and the risk of developing cardiovascular diseases (Kravchun P. G. et al., 2017, de Faria A. P., 2017, Sugathadasa B. H., 2010). Some authors note that carriers of the homozygous Arg223Arg genotype are less physically active, consume energy more slowly, and have larger abdominal adipocytes. However, Gottlieb M. G. and co-authors (2009) considered that not

Arg223, but 223Gln allele in homozygous and heterozygous states (genotypes Gln223Gln and Gln223Arg) cause an increase in fat, leptin, and, respectively, a predisposition to MS (Gottlieb M. G., et al., 2009). Moreover, in Pacific islanders, the modified LEP allele has a "protective" effect, reducing the risk of developing obesity (T. Furusawa, 2010). A large contribution to the development of hypertriglyceridemia is made by an excess amount of fatty acids, which are bound by a protein encoded by FABP2. Several clinical studies have shown that Ala54Thr polymorphism FABP2 is associated with obesity (Cross D.S. et al., 2010, Mocking R.J. et al., 2013, Ishimura S. et al., 2013). The mutant 12Ala PPARG allele contributes to reducing triglyceride levels, increasing total cholesterol, HDL, and increasing tissue sensitivity to insulin (S. S. Deeb et al., 1998, I. A. Bondar et al., 2013).

According to the analyzed materials, polymorphisms in the paraoxonase 1(PON1) and endothelial NO-synthase (eNOS) genes are associated with ischemic heart disease, increased risk of carotid artery atherosclerosis, stroke, myocardial infarction, and single-nucleotide substitutions in the endothelin – 1 (END) gene are associated with the development of arterial hypertension (Burns S. A. et al., 2016, Parkhomenko A. N., 2008, Debette S., 2009, Strambovskaya N. A., 2015). It is shown that the leptin (LEP), leptin receptor (LEPR), and other genes have certain significance in the development of metabolic syndrome. (Gahagan S., 2016, Bender N., 2011, Dominguez-Reyes T., 2015).

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STUDY OF THE APPLICABILITY OF COI GENE APPLICATION FOR A POPULATION-GENETIC ANALYSIS OF FRESHWATER SPONGES OF THE LUBOMIRSKIIDAE AND SPONGILLIDAE FAMILIES

Abstract. Here we show that popular, as molecular genetic marker COI is not suitable for population genetic studies of freshwater sponges. Microsatellites are proposed as alternative.

Keywords: population genetics, sponges, molecular markers, microsatellites, evolution.

Ключевые слова: популяционная генетика, губки, молекулярные маркеры, микросателлиты, эволюция

Freshwater sponges, are filter feeders and play an important role in river and lake ecosystems. Cosmopolitan representatives of freshwater sponges live in reservoirs with different hydrological regimes, which can make a significant contribution to the genetic structure of populations. Freshwater sponges living in the ancient rift lake Baikal formed a bouquet of endemic species that have specific features. These features clearly distinguish Baikal endemic sponges among freshwater cosmopolitans [1; 2]. Such features include the absence of gemmules and a long life cycle, which, undoubtedly, should affect the structure of endemic species populations. Endemic Baikal sponges make up the bulk of the lake benthos biomass. Now, events of mass diseases and mortality of sponges are observed on Baikal lake [3]. Similar events were noted in some marine ecosystems. A study of the population structure of sponges will make it possible to understand the causes of their mass morbidity and death. For marine sponges, such studies have been successfully conducted. As shown [4], changes in the structure of the sponge population are observed precisely in places where their mass mortality events were previously noted. Thus, the study of the population structure of Baikal endemic sponges will allow us to study the influence of sponge diseases on their population structure at the genetic level. To determine the influence of habitat conditions on the structure of populations and the ability of populations to recover, it is necessary to choose molecular markers correctly. The most popular markers are SNP and microsatellites.

In this work, we performed a comparative analysis of SNP found in two fragments of the COI gene for freshwater sponges belonging to 5 species of the 2 families of Spongillidae (*S. lacustris*, *S. arctica*, *S. alba*, *E. fluviatilis*) and Lubomirskiidae (*L.baikalensis*), collected in geographically remote points. Each sample was sequenced in two sections of the COI gene to assess the variability of each fragment and determine the suitability of the COI gene for species identification of freshwater sponges, as well as assess their genetic diversity. For the 5'-terminal fragment, the sequence length was 632 nucleotides. The fragment is located at positions 61-692 of the reference full-length COI gene from the gene bank KU759841.1 *S. lacustris*. For fragment I3-M11, the length of the sequences was 609 nucleotides. The fragment is located at positions 707-1315 of the COI reference gene.

For the species *L.baikalensis*, 8 samples were collected in the Northern, Middle, and Southern basins of Lake. Baikal. No differences were found among 8 samples, during the sequence analysis for the 5'-terminal portion of the COI. As for the I3M11 region, 2 haplotypes differing by 1 nucleotide were detected. The maximum value of p-distance was 0.2%, the average value was 0.04%. Values of

intraspecific variability indicate the unsuitability of the COI gene for analysis of the population structure of Baikal endemic sponges. Although this gene has been successfully used for population-genetic studies of marine sponges [5]. The reason for the lower variability of the COI gene in Baikal endemic sponges compared with marine sponges could be the later formation of the *L.baikalensis* species. An alternative way to study the population structure of freshwater sponges is microsatellite analysis since it is successfully used also for studying sea sponges [4; 6].

Four haplotypes were identified for the Spongillidae family, one of which was shown for the first time, which expands the database of freshwater sponges. A clear separation of the species of the Spongillidae family was revealed using the combined fragment of the COI gene. Clustering on a phylogenetic tree and values of interspecific variability estimated by the p-distance method suggest the possible suitability of the combined fragment of the COI gene for Spongillidae species identification. These data are significant because they show the possibility of using the COI gene as a barcode for sponges, which were previously considered unsuitable for these purposes.

Thus, despite the opened prospects of using COI as a barcode for species identification of freshwater cosmopolitan sponges, this fragment cannot be used as a marker for analysis of the population structure. Currently, work is underway to study the population structure of Baikal endemic sponges using microsatellite markers.

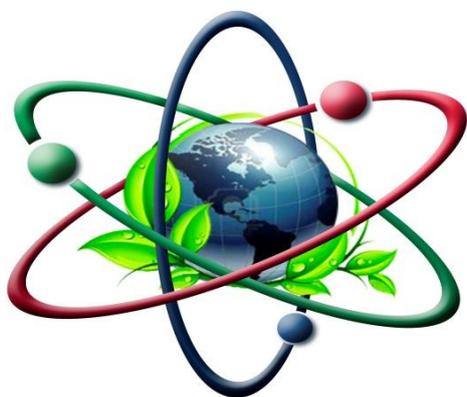
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Geosciences, Solar Sciences and Hydrosociences: New Frontiers

УДК 551.594.221

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**THE OCCURRENCE OF THUNDERSTORMS AND METHODS
FOR THEIR DETECTION**

IN THE ATMOSPHERE OF THE EARTH

Abstract. This article presents the mechanism of thunderstorm formation with the accompanying formation of thunderclouds and presents methods for observing thunderstorms.

Keywords: thunderstorm, lightning, thundercloud, lightning detection finding, leader.

Some of us are fascinated by a flash of lightning, some scare her, others idolize her. Before the advent of modern religions, each culture had a pagan god associated with lightning, the one who personified or created it. In the modern world, the origin of thunderstorms is a phenomenon that is being studied and quite explainable.

The fundamental reason why lightning discharges occur is the critical concentration of charges in the atmosphere due to air ionization. Ionization of air in the lower atmosphere occurs due to the emission of radioactive substances contained in the solid and liquid atmosphere of the earth. Under the influence of radioactive substances, ions are formed in the surface layer of the atmosphere and spread through turbulent exchange and vertical movements to heights of 4-5 km. In the upper atmosphere, ionization occurs due to the radiation of the sun and cosmic rays (proton flux), which give rise to secondary cosmic rays ionizing the lower layers of the atmosphere.

According to the type of linear discharges, three types of linear lightning are distinguished: descending, ascending, and intracloud ones (Fig. 1).

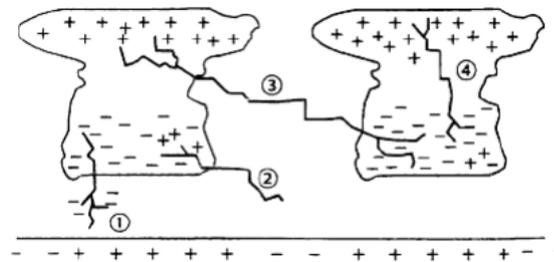


Fig. 1-Types of lightning

The accompanied phenomenon of thunderstorms is the formation of thunderclouds. The sun heats the earth, and the earth heats the air in contact with it. The accompanied phenomenon of thunderstorms is the formation of thunderclouds. The sun heats the earth, and the earth heats the air in contact with it. Heated air rises. As atmospheric pressure decreases with height, rising air expands. As the air expands, its adiabatic cooling occurs, this will be the first condition for the formation of a thundercloud. The second condition for creating a thundercloud is that this ascending air stream must contain water or humidity. As the rising air cools, the moisture in the air begins to condense. It condenses into very small microscopic drops of water, and millions of them are needed to form one drop of rain. Visible clouds are made up of these microscopic drops of water. If the rising air contains

moisture, heat is released as moisture condenses, and this heat heats the rising part of the air. Due to the condensation of water in the rising air stream, the rate of temperature drop in the stream decreases. If the temperature in the atmosphere decreases faster than the speed of the air flow temperature, then the air flow continues to rise in the atmosphere, that is, it remains warmer than the surrounding air, and the last requirement necessary to create a thundercloud is satisfied (Fig. 2). Therefore, the formation of thunderclouds depends on how quickly the air temperature decreases with height and on the air content at ground level. The charge of the formed cloud is ultimately three-polar.

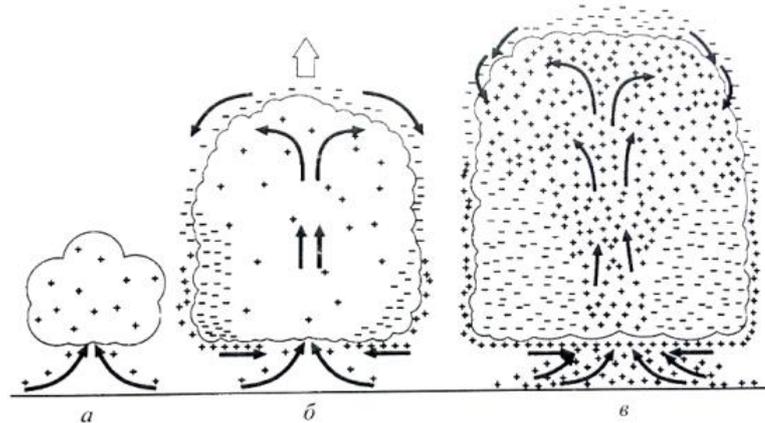


Fig. 2 - Formation of thunderclouds

As the cloud builds up to a height well above the level at which water freezes (i.e., the level of freezing), the recipient particles increase in size. At this stage, the cloud contains water droplets, oversaturated water droplets, ice crystals, and soft hail particles. As the particles of the soft hail particles become heavier, the rising air cannot keep them suspended, and they begin to fall. When they fall, they drag air with them, creating a downward flow. Thunderstorms are very strong during the mature stage, and clouds produce lightning and heavy rain. Falling rainfall causes downward flows throughout the cloud, drowning the upward flows. When soft hail particles reach higher levels, they melt and cause drops of water that fall to the ground in the form of rain. The cloud is deprived of a rich supply of warm humid air, droplets of clouds no longer form. Rain with downdrafts is gradually getting weaker. In general, lightning-fast activity takes place before strong downward flows are established. That is why one intense lightning is usually observed before a shower. Descending streams bring cool air from great heights to the earth. With a rich supply of warm, moist air, the cloud stops growing. Over time, even rainfall decreases. The rest of the cloud evaporates into the atmosphere and disappears.

In moving vertical streams inside clouds, ionization occurs due to collisions of particles rising up smaller particles with heavier particles coming down. The process of vertical movement of charged particles leads to the formation of a huge potential difference between the cloud and the earth. Due to the presence of this potential difference and a certain amount of free electrons and ions, they are

accelerated, additionally ionizing the air and creating conducting channels between the cloud and the earth. As a result of prolonged, repeated movement of charged particles inside such an ionization channel and heating of air there, a stable conductive formation is formed - the leader. A powerful avalanche-like pulsed electric current begins to flow through such a channel, which strongly heats and ionizes the air in the conducting channel. The combination of the descending and ascending leaders leads to the formation of a conductive channel connecting the cloud and the earth, and the emergence of an extremely powerful discharge current between the cloud and the earth. As a result of the flow of this discharge current, there is strong heating transferring the air inside the conducting channel from the state of highly ionized plasma, there is a bright glow, called lightning. Since the initial avalanche-like process is not stable, periodically fades and resumes, the leader propagation direction changes, and as a result, the channel with a powerful current is not straight, but with kinks and branches.

Having information about the location and development of lightning discharges, aircraft and ships can bypass evolving thunderous areas in advance, electric power systems and networks can take additional necessary lightning protection measures, so the problem of determining lightning discharges is quite relevant.

There are a number of methods for recording lightning activity discharges:

- visual-auditory meteorological observations that provide information on the number of days with a thunderstorm and the total duration of thunderstorms in hours per year, also include lightning discharge counters;

- radio engineering method: active, based on the principle of radar location of cumulonimbus clouds within a radius of 180 km and passive systems based on registration of electromagnetic radiation from lightning discharges, which are divided into multiposition systems and single-position lightning direction finders;

- satellite observations using optical detectors, providing information on the number of lightning strikes.

To date, thunderstorms continue to be investigated, various kinds of equipment are developed and operated that can prevent various kinds of dangerous situations associated with thunderstorm activity.

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HISTORY OF COSMIC RAY DISCOVERY AND RESEARCH

Abstract. The beginning of XXth century was an era of many discoveries that gave rise to the quantum physics, and discovery of cosmic rays was one of them. This work aims to summarize the history of the discovery of this phenomenon as well as of establishing how it works in layman's terms.

Keywords: cosmic rays, history of discovery.

Ключевые слова: космические лучи, история открытия.

The first evidence of existence of cosmic rays was discovered by Thomas Wilson. Wilson was working with a device called cloud chamber – his own invention – and in 1900, he discovered spontaneous ionization of the air inside it. Originally that ionization was attributed to then-recently discovered radioactivity, and specifically to the radioactive materials in the ground, as well as radioactive gases (such as radon) that they produce. In 1901, Wilson mentioned that this ionization might be caused by an outer space source, but couldn't prove this theory. [1]

In 1911-1913, a series of experiments, carried out by Austrian scientist Victor Hess, shed some more light on the subject. He used a free balloon and a recently invented device called electrometer to measure the ionization rate in relation to altitude. If that ionization would be caused by the radioactivity of the Earth, it was expected the ionization rate to fall with increasing altitude. However, Hess discovered that ionization rate, on the contrary, the ionization rate increased. In order to rule out the Sun as a source of ionization, Hess undertook his flights at night or during a solar eclipse. A German physicist Werner Kolhörster later confirmed Hess's results. In 1936, Hess was awarded the Nobel Prize for the discovery of cosmic rays.

After the WWI, the research of cosmic rays continued. In 1921-25, an American physicist Robert Millikan carried out a series of experiments on cosmic ray ionization and discovered that cosmic rays' absorption coefficient in lead was close to gamma rays that result from nuclear fission, which made him believe that the cosmic rays were gamma rays. Meanwhile, Soviet physicists L.V. Mysovskiy and L.A. Tuvim studied cosmic rays absorption in water and discovered that their absorption in water was 10 times weaker than that of gamma rays. They also

discovered the barometric effect – the cosmic ray intensity depended also on atmospheric pressure at the point of measurement. [2]

In 1927, Dutch scientist Jacob Clay discovered that the cosmic ray intensity at the sea level varied with geomagnetic latitude, which meant that cosmic rays were charged particles. This was confirmed by Bothe and Kolhörster in 1929. They used an array of Geiger counters in a coincidence circuit to discover cosmic ray particles with very high penetrating power [1]. Earlier in 1927, independently from them, D.V. Skobeltsyn used a magnetic field cloud chamber to discover charged particles with energies significantly higher than that of particles produced from radioactive decay. [2]

In 1930, Bruno Rossi predicted the so-called “East-West effect”. If the cosmic rays are charged particles that are deflected by Earth’s magnetic field, then the direction of their trajectory will depend on their charge (positive or negative). If a certain type of charge predominates, then the amount of particles arriving from the west and from the east will be unequal. Later experiments proved the east-west asymmetry [1]. Some of these experiments were carried out by the Soviet equatorial expeditions led by S.I. Vernov in 1937 and 1949. Vernov pioneered the use of radiosondes in the study of cosmic rays [2].

By then, the picture of nature of cosmic rays became more or less apparent: upon entering the atmosphere, the particles from outer space (primary cosmic rays) initiate a cascade of reactions with the atmospheric atoms. The products of these reactions (secondary cosmic rays) continue their descent to the Earth’s surface. The experiments during the years from 1937 to 1948 helped to shed more light on the subject. The investigations with high-altitude balloons revealed that the primary cosmic rays mainly consisted of protons (up to 90%, the rest – heavier nuclei) [1], while experiments with coincidence-circuited proportional counters separated with a layer of lead helped establish two components of secondary cosmic rays: the “soft” component (consisting of photons, electrons and positrons) and “rigid” component (consisting of muons) [2]. It is worth noting that both positrons and muons were discovered in the cosmic rays and these discoveries played a significant role in the development of physics.

In 1949, the Soviet expedition in Pamir mountains discovered the nuclear cascade process. They determined the primary cosmic rays to be primarily high energy protons, which form the nucleon component. On entering the atmosphere, these nucleons enter nuclear reactions with the atmospheric atoms. These reactions result in another nucleon (which will be a neutron with 30% probability) with less energy and a particle called pion (which can be neutral, positive or negative).

Normally pions are responsible for strong nuclear force, and have short decay time. Neutral pions decay into photons that create the electron-photon cascade (resulting in the “soft” component), charged pions decay into muons (giving rise to the “rigid” component). Muons themselves are unstable with decay time depending on their energy, and decay into electrons or positrons depending on their charge. With a sufficiently high energy of a primary cosmic ray, some of these particles can reach Earth’s surface. [3]

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HISTORY OF AVALANCHE STUDIES

Abstract. The purpose of this work is to trace the development of avalanche science as a branch of glaciology. The relevance of the study of avalanches is associated with an increase in the effectiveness of avalanche protection of people in places potentially exposed to avalanches.

Key words: avalanche, snow, avalanche services, avalanche science.

Despite the great danger posed by avalanches to humans, they have begun to study their nature relatively recently. Only in the last 70–80 years have the conditions of their occurrence and the possibility of forecasts been studied in more detail, and engineering protection systems have been actively developed and built.

A large amount of information about the stages of development of rescue and avalanche measures has been accumulated by the peoples living in the Alps. In Switzerland, about a thousand years ago, a detachment was created at the monastery, built in the 10th century near the Great Saint-Bernard pass, through which the road

went to Italy, to help people caught in avalanches. The first avalanche warning service in the Alps was created in Switzerland in 1917, but only on a small section of the Kur – Davos railway.

In 1942, the construction of the Swiss Federal Institute for the Study of Snow and Avalanches (Institute for Snow and Avalanche Research - SLF) with a special refrigerator, workrooms, and laboratories was completed in Davos. The well-known Swiss glaciologist and avalanche specialist Marcel de Querven was appointed its leader. He did a lot of classification of avalanches and the task of creating a single language for their description, and, in the end, together with Hefeli, prepared the first version of the morphological classification, which was taken as the basis for the development of the International Morphological Classification of Avalanches. The SLF Institute is still successfully operating, including issuing avalanche hazard bulletins twice a day throughout the country, using information received from 170 alpine observation stations located in the Swiss Alps, as well as from weather stations.

Now in all alpine countries (Austria, Germany, France, Italy, Slovenia, Liechtenstein) there are avalanche hazard maps compiled under the general supervision of the SLF Institute, and local avalanche services continue to conduct relevant research and improve avalanche control measures. All avalanche control points are interconnected, exchange information, and in fact are a single network for collecting and processing information for research and forecasting avalanches in the Alps, where in total there are almost 20 thousand places for their descent [1].

In other developed countries where mountain territories are widespread, for example, in Iceland, the Czech Republic, Slovakia, Poland, Romania, Canada, the USA and others, there are also services involved in monitoring avalanches and their research. For example, in the USA, the American Avalanche Association, the Forest Service (part of the US Department of Agriculture), the University of Colorado's Arctic and Alpine Research Institute, and others are engaged in the study of avalanches. However, in the United States, avalanche forecasts are regularly prepared and transmitted only for those mountain areas there are ski centers or mining enterprises and adjacent settlements.

The first scientific studies of avalanches in Russia began in the middle of the last century in connection with the laying of roads through the passes of the Main Caucasian Range. The enthusiast of this research was the talented Russian engineer B. Statkovsky, who drew up the first avalanche hazard maps for the cross sections and began the construction of avalanche facilities on the Georgian Military Highway. The next stage of avalanche research began already in Soviet times, and

was associated with the work of the Tbilisi Institute of Structures, whose specialists began the study of snow in the Caucasus mountains in the early 30s and already in 1932 in the vicinity of the village of Upper Rocky used to study the properties of snow cover the same technique that was used to determine the mechanical properties of soils. Two years later, avalanche studies were started in the Khibiny, where in the winter of 1936/1937 the first permanent station for forecasting avalanches at the Apatit enterprise began to operate in the USSR [2]. In the mid-30s, employees of the Tbilisi Institute of Construction and specialists of the Apatit Trust developed many problems, including such as the theory of avalanche movement, calculation of snow stability on a slope, avalanche forecast, design of avalanche structures.

Now in Russia, the Avalanche Service of Roshydromet, which is subordinate to the Ministry of Natural Resources and Ecology of the Russian Federation, is engaged in research and prevention of avalanches that are dangerous for settlements, ski resorts, tourist centers, roads and communications. This service includes regional avalanche centers (Zabaykalsky, Kamchatsky, etc.), the Roki and Elbrus avalanche units of the North Caucasian militarized service and many snow avalanche stations and units in various mountainous regions of the country.

The scientific and methodological management of avalanche operations is carried out by the Alpine Geophysical Institute of Roshydromet (Nalchik). Previously, the All-Russian Center for Monitoring and Forecasting Emergencies of the Ministry of Emergencies of Russia (Center "Antistichia") was still involved in this, but at the end of 2019 it was disbanded. Many important and necessary studies are carried out by employees of the laboratory of snow avalanches and mudflows of the geographical faculty of Moscow State University, created back in 1964 on the initiative of the famous glaciologist G.K. Tushinsky.

As for the rescue teams in the mountainous regions of the Russian Federation, they work in the systems of the Ministry of Emergencies, the Russian Mountaineering Federation [3], the All-Russian Association of Ski Instructors, non-governmental organizations, etc. Rescue services and personnel have the necessary knowledge, skills, equipment and specially trained dogs for people search in avalanche blockages.

In the Baikal region, the first regular observations of snow avalanches were organized in 1934-1946 by employees of the "snow-landslide station" on the Circum-Baikal section of the East Siberian Railway. After some time, snow avalanche surveys began in the area of the future BAM construction, their initiator was the founder of Russian avalanche science G.K. Tushinsky, who in the years

1946-1949 as part of the Zheldorproject expedition made aerial and ground surveys of the mountainous regions of the Northern Baikal region.

In the years 1965-1967, under the leadership of G.K. Tushinsky employees of the Problem Laboratory of Avalanches and Mudflows of Moscow State University resumed aerovisual and ground surveys of avalanche-hazardous areas in the ridges of the Baikal region. They formed the first ideas about the features of avalanche formation and the spread of avalanches throughout the territory, which were then described in a series of articles and the fundamental monograph "Avalanche-hazardous areas of the Soviet Union" [4].

The first recommendations on how to protect BAM from avalanches, taking into account the proposals of the Zheldorproject, were developed by the Problem Laboratory of Snow Avalanches and Mudflows of Moscow State University in 1969-1970. In 1976-1977, the SANI offered recommendations for the protection of BAM, taking into account economic efficiency, and in 1979-1980 they were updated on the basis of new data from observations of avalanches. Subsequently, their recommendations regarding mainly engineering protection measures were detailed by the employees of Sibgiprotrans and NIIZhT.

In 1975, with the onset of snow avalanche observations conducted by the staff of the Irkutsk (1975-1986) and Trans-Baikal (from 1975 to 1990, 1975-1980 together with SANII) UGKS Goskomgidrometa, a qualitatively new stage in the study of snow avalanches in the Baikal region. The informational basis of this generalization was the data of snow and snow avalanche observations in the river basin. Kunerma in the Baikal ridge in 1975-86, desk processing of maps, aerial and satellite images, as well as information from reference and literature sources [5].

From this moment to this day, only periodic measurements of snow cover are carried out on the BAM railway territory and foothill territories in the Baikal region - there are no regular studies of the state of snow cover contributing to the formation of avalanches.

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A MACHINE LEARNING MODEL FOR ESTIMATING THE INTENSITY OF THE AURORA BOREALIS BASED ON GPS DATA

Abstract. Assessment of the position of the border of the auroral oval is an urgent and rather complex task. In this paper, a new approach to solving this problem is proposed, based on the use of a machine learning model for estimating incoming energy from the Magnetosphere based on GPS data, using the Ovation Prime model as a priori.

Keywords: ionosphere; ionosphere maps; auroral oval; machine learning model; random forest; total electron content; GPS; GLONASS.

In recent years, global navigation satellite systems (GNSS) such as GPS, GLONASS, and Galileo have provided extensive material for studying the Earth's ionosphere, namely, for observing the ionosphere and ionospheric inhomogeneities on a global and regional scale. Thus, global ionospheric maps of total electronic content (TEC) GIM [1], ROTI maps [2], and TEC variation maps [3] can be distinguished.

TEC variation maps indicate the constant presence of ionospheric inhomogeneities in the auroral oval region, and the dynamics of the ionospheric inhomogeneities region corresponds to the dynamics of the auroral oval [4]. Therefore, we can expect that the intensity of these ionospheric inhomogeneities will be determined by the energy entering the magnetosphere from charged particles of the Solar wind, which in turn is responsible for the process of luminescence in the high layers of the atmosphere and causes the Aurora. This indicates the potential for

estimating the position of the border of the auroral oval and the distribution of incoming energy based on GNSS data.

Purpose of work:

The purpose of this work is to build a machine learning model that allows us to obtain the distribution of energy entering the magnetosphere on a large sample of TEC variation maps.

The Ovation Prime model is used as input information about the incoming energy and intensity of the auroral oval.

As hyperparameters (control parameters) for the machine learning model, data from the global TEC distribution is used, taken from the maps of TEC variations, Kp-index, and f10.7. In addition, the time of year (seasonality) is taken into account.

For each map of TEC variations with a specific time of day and year, and an additional set of data, the sliding window method is used, which is a square with a specified size equal to degrees of latitude and longitude. Getting the output averaged window data and statistical characteristics of the TEC distribution, then these data, supported by the physical parameters of the Auroral oval, are fed to the input of the Random Forest machine learning model along with the a priori energy values of the Ovation Prime model to build an approximation (dependence) between them and build maps of the intensity distribution of the auroral oval based on GNSS data.

Analysis:

To evaluate how well the machine learning model works with certain specified hyperparameters, use the error value on the dataset that is not used for training. The standard error is used as a quality metric.

At the moment, the model uses a large sample of data for different times of the day and day of the year, and at the output of the model makes a forecast of the distribution of energy density in zones that do not correspond to the auroral oval of the distribution character. However, it is worth noting that the selection of the optimal size for the sliding window method is important. The greater the restriction on geographical latitude and longitude, the higher the probability of accurately determining the maximum intensity of the auroral oval in comparison with the a priori Ovation Prime model, which is well shown in Fig. 1 as a comparison map based on the Ovation Prime model and Fig. 2, Fig. 3, with different window sizes.

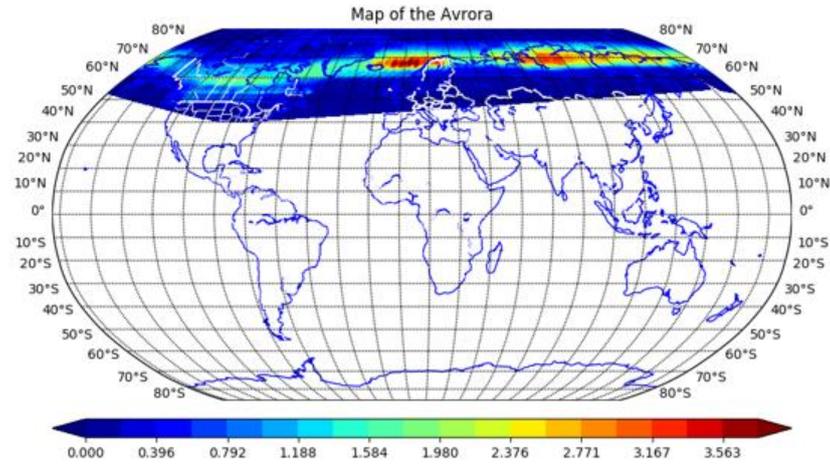


Fig.1 shows a map of the energy density distribution of the auroral oval according to the a priori Ovation Prime model for 08.02.2019

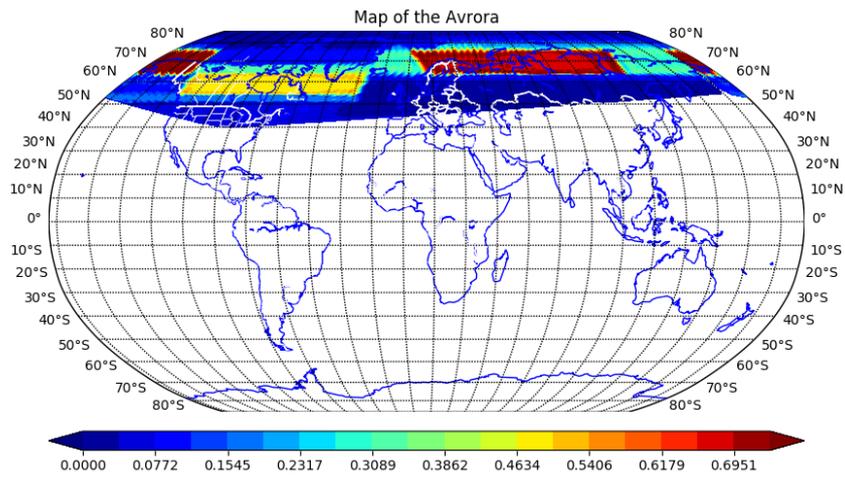


Fig. 2 presents the forecast of the Random Forest model - a map of the distribution of the energy density of the auroral oval for the degree of latitude and longitude (data selection by the sliding window method) equal to 5.

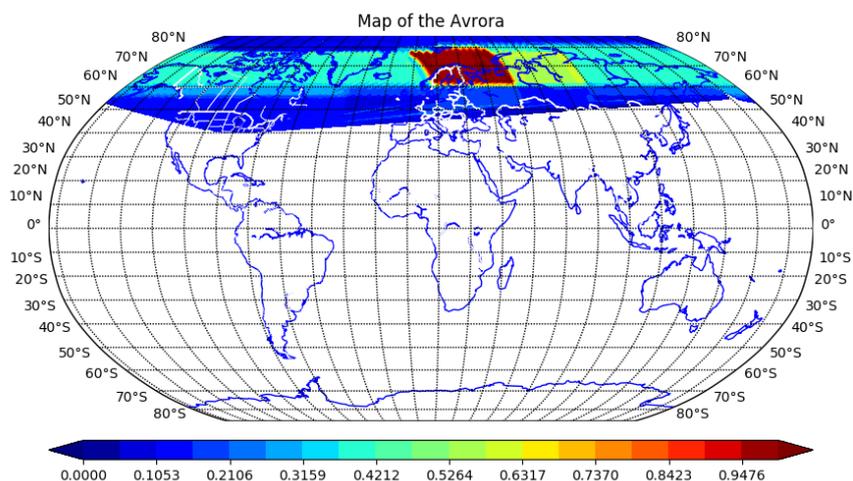


Fig.3 shows the forecast of the Random Forest model—a map of the distribution of the energy density of the auroral oval for the degree of latitude and longitude (data selection by the sliding window method) equal to 3.

Conclusion:

Thus, a new empirical model based on machine learning is presented, which allows us to obtain the distribution of energy flow in the auroral zone based on maps of TEC variations. Currently, the model is the first stage of the test, the expected improvement with addition to the input parameters of the data-encoded medium according to certain criteria, add the additional physical parameters (geomagnetic indices, solar wind data from the spacecraft DISCOVER), responsible for the internal processes of the magnetosphere and the auroras in the auroral region.

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SOLAR FLARES

Abstract. In this paper, the study of solar flares as separate objects of solar activity is presented. Stages of development and phases of solar flares.

Keywords: Sun, magnetic field, solar flares, sunspots, weak events.

Flares are the explosive rise of electromagnetic and corpuscular radiation coming from areas of active regions that have magnetic fields of complex structure. The powerful impact of solar flares to the near-terrestrial environment defines practical interest to study of these phenomena.

In the chromosphere, flares are observed nearby the sunspots and an inversion line of the magnetic field polarities. A flare starts with the sudden appearance of several bright points located on both sides of the inversion line. The brightness increase can cover significant ratio of the area of the visible hemisphere. All flares evaluate approximately the similar way. There is a rapid flux rise up to maximum intensity, which lasts a very short time, and then a slow return to the level of previous brightness. A typical flare rises within 5-10 minutes, and decays about 1-3 hours; the some events live several hours. Solar flares are not rare phenomena.

The most characteristic parameter of flare is its emission in the soft x-ray range. The initial detection of flare flux in soft X-ray indicate onset and developing of these phenomena mainly in the corona but not in the chromosphere. The x-ray burst related with a flare was identified with a system of loops filled by plasma with a temperature of ≥ 5 MK.

Powerful flares occur in groups of sunspots, but there could be smaller-scale events, so-called, spotless flare.

Physical conditions in solar flares are mainly obtained from an analysis of their spectra. Spectral analysis shows that all lines of hydrogen and metals in the spectra of flares are broadened. The nature of the observed extension indicates high speeds in the upper part of the chromospheric flare up to 100 km / s and a high electron density ($N_e = 10^{13}$ cm⁻³) in the region of the chromospheric flare. Such density is about ten times higher than the density of the unperturbed chromosphere. Thus, a rise in the plasma emission in a flare could be explained by an increase in the plasma density, and the suddenness of the process gives it the character of an explosion, i.e., rapid and strong compression of matter in a certain volume of the chromosphere. The energy of the chromospheric flare observed in the visible range of the spectrum can reach 10³⁰ erg. During a flare, radiation in the ultraviolet and x-ray ranges is amplified, and the generation of solar energetic particles increases. Solar flares often are followed by a mass ejections with an average speeds of 500 km / s. According to observations on the limb the solar disk, they rise up to heights of the order of 10⁵ km and return to the solar surface along the same path. Faster mass ejections are also observed, with speeds reaching $\sim 10^3$ km / s. Space observations of the Sun in X-rays and ultraviolet rays show that the flare affects not only the chromosphere: during the flare, complex processes also occur in the corona. The rising arcade of bright loops is a characteristic picture of a flare in the short wavelength range.

In the publications by M. Katsova, M. Livshits, 2002; M. Katsova, M. Livshits, 2006 it is shown that from the point of view of physical processes, it is advisable to consider three phases of the flare: the initial, impulsive and the decay phase.

The physical mechanisms of these phases are as follows:

1. for the initial phase – turbulent heating of the current sheet. The initial phase is relatively long (hours or even tens of hours) the phase of appearance and formation (extension) of the current sheet. Apparently, the Joule plasma heating by the current in the layer predominates here;

2. for impulsive phase – generation of accelerated particles as a result of eruption of the current sheet. The impulsive phase is of the greatest interest, because in a short time (seconds/tens of seconds), when a current sheet breaks, a huge energy is released stored in its magnetic field. This energy is released in the form of energy of hydrodynamic flows (layer disruption is accompanied by rapid plasma movements), powerful heat fluxes from the region of discontinuity of the current sheet, and in the form of energy of accelerated particles. Plasma is ejected from the layer region at high speed;

3. for the decay phase, cooling of the hot region arising from the heating of the chromospheric and coronal plasma by energy particles.

Currently, we are studying weak solar flares. The main interest in their study is to these events are considered as one of the possible agents for plasma heating in the chromosphere and corona. Moreover, the mechanisms of emission generation and the plasma properties of these phenomena are poorly studied. One of the reasons is that for a long time for most of these events there was no information about emission in the microwave range due to the insufficient sensitivity of instruments observing in this range. A new generation instrument, the Siberian RadioHeliograph 4-8 GHz (SRH), has been receiving unique data since 2016 that allow studying solar flares of classes C and B (according to the GOES classification).

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FERRIMAGNETIC MINERALS OF THE UPPER MUNA (YAKUTIAN DIAMONDIFEROUS PROVINCE)

Abstract. Magneto-mineralogical and chemical studies of the ferrimagnetic fraction minerals of kimberlites of the Upper Muna kimberlite deposit of the Yakutian- diamondiferous province were carried out. It is shown that the main carrier minerals of natural residual magnetization of kimberlites are titanomagnetites characterized by the content of chemical elements FeO from 20 to 90 wt%, TiO₂ up to 18 wt %, MgO from 2 to 22 wt % and Curie points of about 570 °C. The magnetic structure of titanomagnetites belongs to a pseudo single-domain ensemble of particles

that are characterized by high magnetic and paleomagnetic stability. The time of magnetization of kimberlites is estimated as late Devonian-early Carboniferous, which does not contradict geochronological data.

Keywords: Yakutian Diamondiferous Province, kimberlites, diamonds, ferrimagnetic fraction minerals, titanomagnetites, magnetic hysteresis, Curie points.

Recently, the study of minerals of the ferrimagnetic fraction of kimberlites in the Yakutian diamondiferous province has been assigned one of the important roles. In addition to the fact that they are indicator minerals of diamond, they can provide additional information about the age, thermodynamic conditions of formation of geological processes (including kimberlites, basites, etc.), etc.

In order to estimate the paleomagnetic age of kimberlites of the Upper Muna kimberlite deposit (Deimos, Zapolyarnaya, Komsomolskaya-Magnitnaya, Novinka and Poiskovaya pipes), magneto-mineralogical and chemical studies of ferrimagnetic fraction minerals were performed. The kimberlites of the studied pipes are of the magnesia-ferruginous type, which is the most common within the diamond-bearing kimberlite fields. The distribution of oxide mineralization in the bulk of kimberlites is uneven. Magnetite mineralization is widely developed in the studied pipes (Fig. 1 A), characteristic of oxidized conditions. It should be noted that the content of the magnetic fraction of minerals in kimberlites depends, on the one hand, on the petrochemical type of kimberlites, and on the other – on the degree of development of late hydrothermal-metasomatic processes in them. The more pronounced the secondary low-temperature processes in kimberlites, the more magnetite they contain. Pure magnetite without admixture of Ti, Mg, Si, Al in the main mass is quite rare, but its individual manifestations can be found in the veined form, confined to the deformation zones, accompanied by hydrothermal-metasomatic alteration of kimberlites. Magnezioferrite (Fig. 1 B) forms both separate micrograins (10-60 μm in size) and accretions with perovskite, as well as external borders around chromspinelids. Its total content varies from a fraction of a percent to wt 1-3 %. The dominance of the heavy fraction of magnezioferrite enriched with impurity elements is predetermined by the high-temperature nature of the Upper Muna kimberlites.

The magnetic structure of titanomagnetites belongs to a pseudodomain ensemble of particles (Fig. 1 C), which are characterized by Curie points of about 570 °C (Fig. 1 G) and high magnetic and paleomagnetic stability. Rocks composing kimberlite pipes are characterized by natural residual magnetization (EON) of different nature and age. The primary EON of a thermally stable nature was preserved in the ground mass of kimberlites. Its carrier is titanomagnetites with an increased Mg content of up to 22 wt %. The paleomagnetic pole with coordinates: $\Phi=27^\circ$ W, $\Lambda=141^\circ$ W, $dp/dm=4.8/5.0^\circ$ corresponding to the late Devonian-early Carboniferous epoch of tectonic-magmatic activation (370-350 million years ago) was calculated from clusters of vectors of the primary EON of kimberlite pipes.

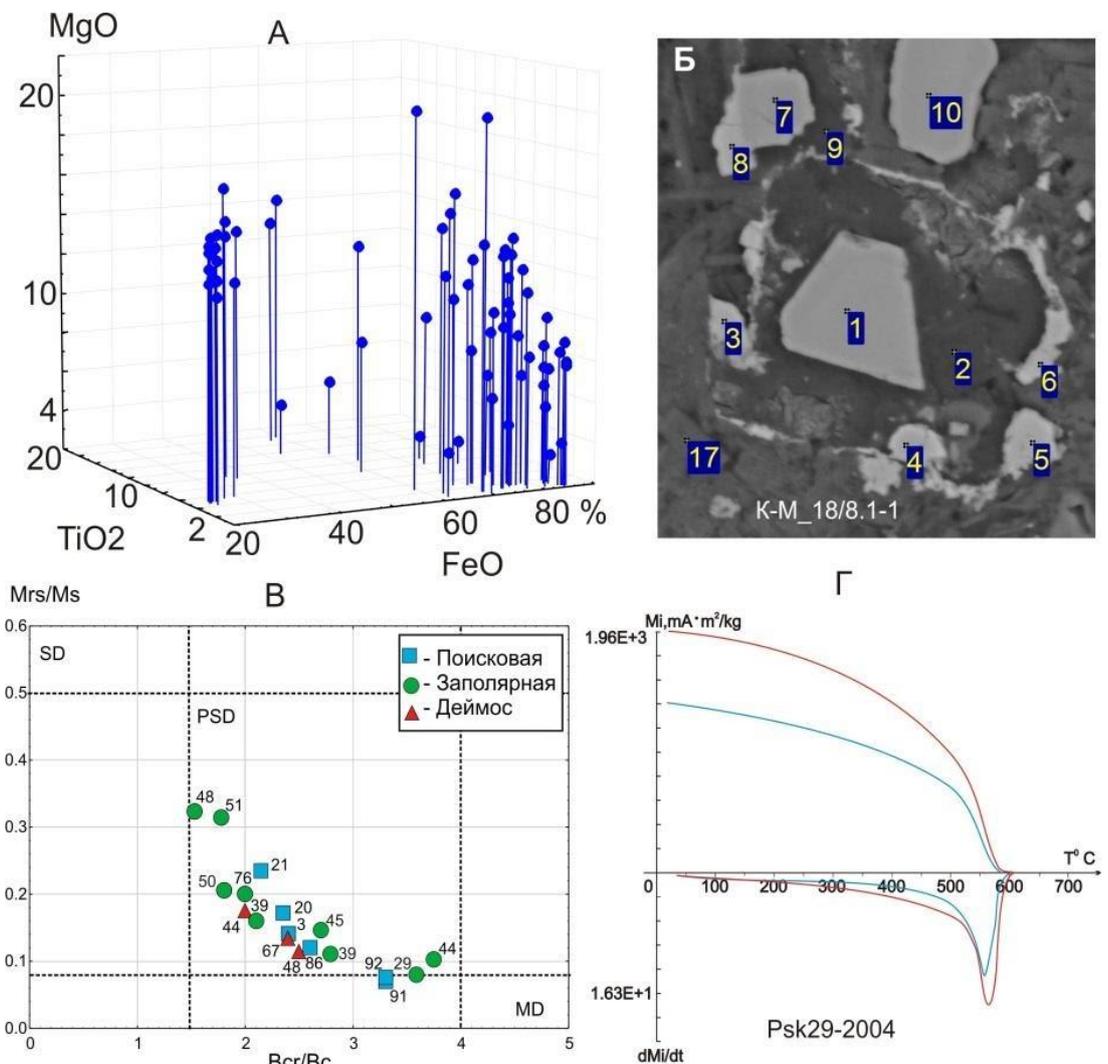


Fig. 1. A – chemical composition of the ferrimagnetic fraction minerals from kimberlites. B – zone spinel in the groundmass (Komsomolskaya-Magnitnaya pipe). The corepart is represented by chromite (point 1), the marginal zone – by magnesioferrite (points 3, 4, 5, 6). B-domain structure of titanomagnetites (Zapolyarnaya – circles, Poiskovaya – squares, Deimos – triangles). Values of the specific magnetic moment of saturation (M_s), the coercive force (V_s) on the inductive magnetization curve the specific magnetic moment of residual saturation (M_{rs}) and the field destroying M_{rs} (B_{cr}). SD, PSD and MD are the distribution regions of single, pseudo- and multi-domain particles. The numbers show the sample numbers. G-graph of $\lg(B_c)$ versus $\lg(B_{cr})$. G-thermomagnetogram of the Poiskovaya pipe kimberlites. Red (blue) curve – the process of the first (repeated) heating.

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Speech activity: current trends

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REPRESENTATION OF OLD CHINESE PROPER NAMES IN CHINA'S MYTHOLOGICAL WORLDPICTURE

Abstract. The main objective of the article is to identify how Old Chinese proper names are represented in China's mythological worldpicture. In this regard, the article discloses distinctive features of the Chinese mythological picture of the world, performs semantic analysis of the onyms selected from the ancient Chinese dictionary "Erya". It has been found that the selected onyms represent in ancient Chinese ideas about the space and firmament through a particular system that divides the firmament into four areas ruled by ancient cultural heroes.

Keywords: onym, worldpicture, worldview, constellation, semantic characteristics.

The article is concerned with identifying the characteristics of representation of Old Chinese proper names in China's mythological worldview. Proper names are an essential part of any national culture that reflects the history of its people. Consequently, analysis of onyms of a particular culture implies an introduction to the worldview of its culture. As regards the growing interest in Chinese language and culture, areas of special interest in this respect include issues related to the formation of the Chinese national worldview, which originates from ancient times and contains information about people's thinking, mentality and their ancient ideas about the world.

The study attempts to specify characteristics of Chinese ancient worldview and forms the following conclusions.

Chinese ancient worldview is characterized by a precise system of values that is reflected in the words and actions of the Chinese and permeates all spheres of society.

In the encyclopedia "Spiritual Culture of China", it was noted that one of the specific features of Chinese mythology is the historization (euphemerization) of mythical characters, who were interpreted as real figures of ancient times relatively early due to the influence of a rationalistic Confucian view.

Chinese people believed that the creation of the world occurred by separating the firmament from the earth. According to these ideas, the universe was originally a chaos.

Another characteristic feature of Chinese ancient worldview is religious syncretism and the corresponding syncretic mythology. The penetration of Buddhism in China led to the unification of various mythological systems, the creation of religious syncretism and the corresponding syncretic mythology.

There is a well-known fact following the hypothesis of linguistic relativity, the Sapir-Whorf hypothesis, that any natural language has its own specific way of conceptualization, perception and organization of the world, which is reflected in language. It means that people's world outlook and their attitude to the world are translated into the texts of culture, which formed a major part of the knowledge of the language in ancient times, which in turn gives an idea of the world of ancient people. In Chinese culture, there are many valuable texts-cultural monuments that are sources for studying Chinese ancient worldview, in particular, in terms of its representation through onyms. One of these valuable sources is Chinese ancient dictionary "Erya", which is the key to the reality of ancient China, according to many researchers. In this vein, the problem of nominating objects of the world in terms of their role in the worldview representation is one of the central issue in linguistics.

An approach to the study of Chinese onyms from a linguocultural perspective is grounded in the works by L. R. Kontsevich, E. A. Hamaeva. However, the question of onyms as representatives of China's ancient mythological worldview was not the subject of special analysis. Thus, the relevance of the research topic is related to the development of a general problem of determining the role played by onyms in Chinese culture.

In the research process a number of onyms were selected from the Chapter "Shi tian 釋天" ("Explaining Heaven") of the Chinese ancient dictionary "Erya" by full selection method, the characteristics of the representation of Chinese ancient onyms in the dictionary "Erya" were highlighted using the aspects of identifying semantic characteristics of the onyms, the onyms were systematized in terms of their quantitative composition, structure and semantics.

During the selection of onyms, it turned out that they are the names of constellations. V. E. Eremeev in his "Symbols and numbers of "Book of changes"" wrote that in ancient times Chinese people distinguished 28 constellations or lunar stations. The 28 lunar stations were divided into 4 "palaces" symbolized by mythical animals. Each palace included 7 sectors, which corresponded to the 4 cardinal directions:

- Eastern Palace – the Azure dragon
- Northern Palace – the Black tortoise
- Western Palace – the White tiger
- Southern Palace – the Vermilion bird

The selected constellations onyms, including the Azure dragon's horn 角, Neck 亢, Root 本, House 房, Basket 箕, Heart 心, and Tail 尾, associated with the Eastern Palace, which was symbolized by the Azure dragon.

During the analysis, the following conclusions were drawn. The presented onyms are lexical units with a specific meaning, in the dictionary "Erya" refer to the Chapter "Explaining Heaven" with the differentiating feature "Celestial bodies".

According to the referential-denotative criterion, the onyms are constellations. According to the meaning criterion, they represent a set of astrological mythological knowledge, symbolized by animating through a mythological animal and its home.

Thus, onyms play an important role in the holistic structuring of the worldview and in identifying ethnically determined principles of mentality. In addition, onym`s fixation by hieroglyphic sign introduces additional meaning of symbolic information.

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FEATURES OF RUSSIAN AND CHINESE LANGUAGE PICTURES OF THE WORLD

Abstract. The article gives an idea of the concept of a linguistic picture of the world. The author proposes to consider the philosophical understanding of the linguistic picture of the world, gives a classification of pictures of the world. Analysis of Chinese and Russian language pictures of the world occupies a major place in the work.

Keywords: pictures of the world, linguistic picture of the world, intercultural communication, Russian, Chinese.

There is no consensus among scientists as to who first coined the term “pictures of the world” into scientific circulation. It was used by the Austrian

philosopher and logician Ludwig Wittgenstein in his "Logical and Philosophical Treatise" at the end of the XIX century.

A. Gurevich in his study of the medieval picture of the world comes to the conclusion that the picture of the world is a historically determined concept. He emphasizes that each historical era has its own ways and forms of experiencing the world.

The picture of the world is direct and indirect. The direct picture of the world is called cognitive: it is reflected in the consciousness of the individual. The direct picture exists in the consciousness "autonomously" because it does not require "intermediaries" for the creation and functioning.

S. G. Ter-Minasova identifies three pictures of the world, arguing that "the world around a person is presented in three forms: a real picture of the world, a cultural (or conceptual) picture of the world, a linguistic picture of the world" ("Language and intercultural communication", 2004). The linguistic picture of the world reflects reality through the cultural picture of the world. Moreover, there are primary and secondary pictures of the world. Given these reflections, one can trace the following chronology of transformations of the picture of the world: (1) mythological, (2) renaissance, (3) rationalistic picture of the world.

Classify the picture of the world using a variety of criteria. One of them is, for example, a method of socio-geographical division of society. Thus, one can distinguish *the ethnic picture of the world* that is characteristic of all members of a certain ethnic group (Jews, Chinese, Russians, Armenians). Next, we single out a picture of the world of the inhabitants of one country or another (British, Russians, Koreans), one or another city (Peking, Irkutsk, Moscow), one or another settlement (villagers, citizens, residents of the capital).

Employees in a particular professional field have *a general picture of the world*. For example, schoolteachers and researchers of higher educational institutions of the country will have a similar worldview, etc.

A group picture of the world can be distinguished based on other criteria, for example, by age, by social status, by preferences regarding leisure activities. For example, pictures of the world will be different for a child and a teenager. Different pictures of the world will be in people of different social classes.

An individual picture of the world develops under the influence of all of the above factors: it depends on which ethnic group a person belongs to, in which country he was born and lives, where he works, how he spends his free time, etc. Language influences the formation of an individual picture of the world, and is a part of it, and at the same time serves as a means of describing, verbalizing an individual picture of the world.

The individual picture of the world is closely connected with the national, because society consists of individual individuals who represent those other nations. *The national picture of the world* is manifested in the general ideas of people belonging to the same ethnic group about reality; in their reactions of the same type to typical situations, in similar assessments and judgments, in proverbs, aphorisms,

sayings. There are as many *national linguistic pictures of the world* as there are languages.

The special position of the language determines the special place of *the linguistic picture of the world* in the structure of pictures of the world in general: the linguistic picture of the world is both a means of forming other pictures of the world, and their result.

The problem of studying the linguistic picture of the world is closely related to the problem of *the conceptual picture of the world*, which reflects the specifics of human life, its relationship with the world, the conditions of its existence. The linguistic picture of the world explicates various pictures of the world of man and displays the general picture of the world.

The totality of “information about the world”, recorded in the systemic meanings of the language, and cultural, national-specific features of the individual are taken into account in the definition of “linguistic and cultural identity”. The function of the linguistic picture of the world is to fix in the national linguistic consciousness the national way of seeing the world and transmit it from generation to generation.

Chinese is the most important representative of the Sino-Tibetan language family, it is spoken not only by the people of the People’s Republic of China (about 1.3 billion people), but also by most of the population of Southeast Asia, including Thailand, Indonesia, Laos, Singapore. At least 450 million ethnic Chinese live outside the PRC. This is the “largest” language in the world, it is spoken by at least every fifth inhabitant of our planet.

Chinese is a multitude of local dialects, whose speakers often do not understand each other. The northern and southern dialects are especially different. If you look at the map of China, then it is easy to see that the dialect diversity increases from north to southeast, and the largest river in China, the Yangtze, serves as a kind of “watershed” between the northern and southern dialects

All this variegated variety of dialects is wonderfully connected. The basis of this connection is a single written tradition (hieroglyphs) and culture.

Some methods of fragmentation of reality exist in the Chinese language, how situations of transition from one state to another are described.

1. The Chinese language is characterized by a desire for a more precise fixation of the transition from one state to another than in European languages. Verbs describing instant events in the Chinese language behave differently than, for example, similar verbs in Russian: they cannot be used to describe situations of the process of transition from one state to another.

2. The Chinese language strives for a logically clearer, relevant real state of affairs, reflection of the situation. In Chinese all similar verbs are made from one-root pairs.

3. Here is a group of verbs in Chinese that describe the "world of sounds." In Chinese we can state a complete disregard for the "polyphony" of the world. The famous linguist Tan Aoshuang, speaking about the reflection of a naive picture of the world in the linguistic consciousness of the Chinese, offers the following “Chinese portrait”: The Chinese are anthropocentric, but the person is not considered

in isolation from the entire human race. A person's dominant position in relation to "ten thousand things" reflects a desire to strictly distinguish a person from the rest of the world.

The Chinese are rational in their thinking. Language is distinguished by a high degree of pragmatism and logical construction. A native speaker of Chinese is deeply contemplative in relation to the surrounding world. He can ignore the opposition of the singular and the plural.

Among the universal features of the linguistic picture of the world, for example, it is possible to single out the role of guardian of emotions for a certain organ. So, in Chinese traditional medicine, the liver is considered the focus of anger, anger, lust. The Russian expression "sitting in the liver" means something boring, traumatic to the essence of man.

The originality of the linguistic picture of the world can also be manifested to varying degrees of concretization of the phenomenon and its demonstration. For example, the concept of "communication with people" has a different content in Russian and Chinese cultures. Chinese people speak and listen with a smile on their faces, thus expressing politeness and respect for the addressee, while Russians consider such behavior to be hypocrisy. In Russians, tact is often associated with patience.

The organization of space also differs: in Russians it is organized vertically (tall grass, tall as a pole), and in Eastern cultures – horizontally (long as a river) and time.

Of great importance for many peoples is the expression of color in the language. For example, in Chinese there are no separate designations of blue and green. These two colors are indicated by one hieroglyph. The basic color terms in the Chinese picture of the world are based on universal natural, national-cultural and personal associations. The chromatic basis of Chinese culture, which has unambiguous cosmological semantics, has influenced the formation of the core of the color concept in its modern form.

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TO THE QUESTION OF STUDYING THE “OWN-ALIEN” CONCEPTOSPHERE

Abstract. The article presents an overview of scientific ideas about the concept and the conceptosphere. The study of the term “conceptosphere” is related to the issues of the intercultural interaction and is considered in relation to the “own-alien” opposition of the native speakers mentality/ consciousness

Keywords: concept, binary oppositions, “own-alien” opposition, communication, intercultural communication, conceptosphere.

The issues of intercultural communication and intercultural interaction are of particular concern for modern society. First of all, we are talking about the results of the interaction of cultures, history, and traditions of native speakers of the language and culture, at the same time all processes have a social character and are built within groups of representatives of a particular ethnic group.

Changes in the social lifestyle are always linked to changes in cultural attitudes. Comparing the events of an “alien” culture with the norms of “own” culture, a person perceives the latter as something positive / native, and everything else is incomprehensible /alien. The word “alien” in this case has a dual meaning. On the one hand, it is something neutral, partly even positive, that arouses interest and curiosity. On the other hand, the concept “alien” is associated with negative assessments and is fraught with threat. In this situation, we can talk about the formation of the "own-alien" opposition in human consciousness.

The purpose of this research is to study terms ‘concept’ and ‘conceptosphere’ in relation to the study of the "own-alien" opposition.

In our work, we consider the “own-alien” opposition, using the terms ‘concept’, ‘concept sphere’, ‘concept-opposition’, ‘binary oppositions’. To this end, we will highlight the main characteristics of the phenomena under consideration.

According to some scientists, the term ‘concept’ appeared in the scientific literature only in the middle of the 20th century, although its earlier use was recorded in 1928 in the article "Concept and word" by S. A. Askoldov. As an essential feature of the concept, the author understands “a mental formation that replaces an indefinite number of objects of the same kind in the process of thought”. After S. A. Askoldov, V. I. Karasik defines ‘concept’ as "a bunch of life experience, recorded/fixed in the memory of a person".

The "own-alien" concepts we explore are conceptual oppositions or concepts-oppositions. The term "concept-opposition" goes back to such terms as "opposition" and "binary opposition". We used the term "opposition" (from Lat. *oppositio* – opposition, objection) in the context of studying binary opposition. The term "binary opposition" (Lat. *binarius* – double, dual, consisting of two parts) appeared in linguistic science thanks to the scientist of the Prague Linguistic School N. S. Trubetskoy. This term, in his opinion, is a universal means of rational description of the world and is used to study two opposite concepts, namely asserting some quality and denying it. One part of binary opposition is considered marked positive, the other – negative.

The relations of difference that underlie the opposition are also characteristic of the concepts forming a conceptsphere. In Russian science the term "conceptsphere" was introduced by academician D. S. Likhachev. The conceptsphere, according to D.S. Likhachev, is a set of concepts of the nation and it is formed by all potentials of the concepts of native speakers. The conceptsphere of people is broader than the semantic sphere represented by the meanings of words. The richer the culture of the nation, its folklore, literature, science, art, historical experience, and religion are, the richer the conceptsphere of people is, according to Likhachev.

Concept can be expressed by language signs or it can exist based on an alternative sign system (for example, gestures, music, art) and always has a connection with a certain language. At the same time, the conceptsphere is considered to be a "mental area" comprised of concepts, which are elements with no relation to a certain language sign.

The content of concepts depends on the depth of sociocultural transformations affecting the basic parameters of human life. Thus, we can talk about some universal "own-alien" concept-opposition, which is formed in the people's consciousness.

It becomes possible to obtain comprehensive knowledge about any part of the conceptsphere only by studying the corresponding semantic space of the language. The concepts of binary opposition, the principles of their structuring, the content and structure of knowledge in it are subjects to research as a part of the semantic space study of the "own-alien" conceptsphere.

Further scientific interest, in our opinion, is a comparative analysis of "own-alien" concepts in the language consciousness of representatives of different ethnic groups.

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THE IMPORTANCE OF STUDYING ETHNIC STEREOTYPES IN ARTIFICIAL BILINGUALISM

Abstract. The article offers an analysis of the study of national stereotypes. The author emphasizes the importance of understanding the role of national stereotypes in the culture of the country of the language being studied. The article identifies some ethnic differences that lead to the formation of negative stereotypes.

Keywords: stereotype, national stereotype, bilingualism, artificial bilingualism, communication barrier, cultural differences.

The development of cultural and linguistic contacts is associated with increased interest in the problems of bilingualism. Russian-Chinese relations have become increasingly important in the last decade, therefore, interest in studying foreign - Russian and Chinese - in these countries is growing.

By the method of mastering a foreign language, artificial and natural bilingualism is distinguished. Artificial bilingualism is a type of bilingualism in which a second language is acquired in an unnatural way. It is a language that is taught by a bilingual and bilingual himself hardly uses the learned language for constant communication with its speakers.

Not all Chinese who want to know Russian very well can go to Russia to learn it. Russian students also learn Chinese not in China, but in Russia. A rare opportunity to practice the country of the studied language leads to a misunderstanding of some national characteristics, customs and traditions. This creates difficulties and barriers in communication.

A special place in the formation of bilingual is occupied by the study of the - a stereotype - a “cognitive bias” (the term Hu Wenzhong), which affects people's true judgments about the objective world, can cause negative consequences: intergroup threats, intergroup emotions, group prejudices and intergroup conflicts, which are the main variable that affects group relationships. Among them, ethnic stereotypes are one of the important types of stereotypes; they belong to typical stereotypes of cultural categories [1]. Ethnic stereotypes are based on national culture and ethnic differences.

Ethnic stereotypes reflect specific communicative attitudes and differences in ethnic identity between ethnic groups, since they represent an understanding and cognition of the inner personality, patterns of behavior and characteristics of their habits, and the stability of a particular ethnic group [2]. The national stereotype itself is colored by national feelings and has an emotional component, which is the reason for the existence of the memory of an ethnic group, which will be more subjective and empirically related to members of another group.

Ethnic stereotypes have characteristics and properties of common stereotypes, both negative and positive. Positive national stereotypes contribute to the strengthening of positive trust between ethnic groups, reduce the psychological distance between ethnic groups, increase mutual contacts, interactions and contribute to the spread of national culture. Negative ethnic stereotypes impede interethnic communication, are subject to relative deprivation and ethnic competition, causing ethnic prejudice and discrimination, affecting ethnic communication and the spread of excellent national cultures.

Ethnic is a product of a common national culture, it is extracted from the prototype of a “common culture,” that is, universal knowledge characteristic of representatives of a particular ethnic group is an inevitable result of social influence.

Ethnic stereotypes are inert when it comes to the possibilities of their changes. Stereotypical cognition is difficult to change once it is formed and changes occur only when social, political and economic changes occur. And when relations between ethnic groups become tense, national stereotypes become more pronounced

and hostile. The suppression of ethnic stereotypes requires great cognitive efforts of individuals. Therefore, the main issues for scientific research, in our opinion, are: 1) the change in negative stereotypes and prejudices between different ethnic groups; 2) a decrease in cognitive bias; 3) the weakening of aggressive consciousness and conflicts between ethnic groups; 4) the study of the psychological mechanisms underlying them.

Ethnic stereotypes are an important psychological mechanism for ethnic exchanges and interethnic interactions. If there are too many ethnic stereotypes among ethnic groups, especially negative ones, negative interethnic relations or ethnic prejudices directly affect the intercultural communication of different ethnic groups.

We are talking about China and Russia, between which, as in other cases, there are certain differences in the economy, customs, language and beliefs. When these two people interact, they retain a certain degree of ethnic stereotypes. The subject of research in our work is Russian-Chinese cultural and linguistic contact. So, Russia and its citizens in the eyes of the Chinese: "Russia is a militant nation", "there are more Russian women than men and this is bad", "all Russians love alcohol", "all Russians believe in Orthodoxy". China and its citizens in the eyes of the Russians: "all Chinese people own Kung Fu," "all Chinese are uncultured," "Chinese are mostly poor people," "Chinese eat only rice," "all products from China are of poor quality," and so on.

The main communicative barrier is the different "baggage" of stereotypes, which are based on national culture and comes out of it. So, the *goal of our study is to determine the main reasons for the formation of ethnic stereotypes in Sino-Russian intercultural communication for to find an effective way to neutralize negative ethnic stereotypes in Sino-Russian communication.*

A more detailed examination of the similarities and differences between the two contacting cultures - Russian and Chinese - will help to find the origins of cognitive bias. We highlight the main differences that affect, in our opinion, the effectiveness of intercultural dialogue.

1. Dichotomy "collective - personality." Chinese culture attaches great importance to the team. Russian culture, by contrast, attaches greater importance to the individual. Chinese culture promotes collectivism, where it is customary to belittle oneself to respect the other, and Russian culture promotes individual concepts, emphasizes the independent spirit of the individual and attaches great importance to personal life. In social interactions, the Chinese pay great attention to humility in both words and behavior. These differences often cause negative stereotypes. For example, the Chinese believe that "the Russians are too self-confident and arrogant," and the Russians believe that "the Chinese are weak and insincere."

2. The relationship between nature and man. Chinese culture is a culture of harmony between man and nature, which is based on a group principle, emphasizing the harmonious unity of moral reason and natural mind. Russian culture is a contemplative view of the separation of nature and man, based on the understand-

ing when an external object is regarded as an objective world, without emphasizing integration with it.

3. Recognition of national identity. In intercultural communication between China and Russia, there are similar mechanisms of mutual perception. Thus, ignorance of the individual realities of Chinese life can cause disappointment, misunderstanding and become a source of the formation of negative stereotypes that impede intercultural communication. The most striking example of creating a stereotype that deepens misunderstanding and estranges representatives of the nation from each other is the attitude of the Chinese to plants in yards, squares, where they collect leaves, flowers (dandelions, mainly), etc. Only knowledge of the urbanistic existence of many visitors from China will allow us to understand what such a “naive” attitude towards vibrant nature is just the result of the harsh everyday life of the inhabitants of large Chinese cities.

4. Features of the type of thinking. The Chinese have a combined model of thinking, they are accustomed to think from a holistic perspective, that is, to emphasize the connection of part and whole. The Russians pay attention to logic and solve problems, first of all, based on the details, dividing the whole into several parts. In trade negotiations, such thinking specifically manifests itself in a thorough study of the details of the contract, although often there are no general provisions of the contract. As a result, there are thoughts that “the Russians are inflexible and stubborn,” and the Russians believe that “the Chinese are unprincipled.”

In intercultural communication, communicators should not only focus on knowledge of the grammar and vocabulary of the Chinese or Russian language, but also effectively absorb the knowledge of Russian or Chinese national customs, culture and history. Russians and Chinese should be aware of and respect the differences between their cultures, develop their interest and curiosity in the cultural knowledge, lifestyle, values, behavior and other cultural traditions of the partner, that is, improve their intercultural communication skills.

Social pragmatic mistakes can be avoided by understanding that due to historical changes, geographical environment, and a number of other reasons, China and Russia have formed their own unique cultural traditions, and they are clearly reflected in their language. Therefore, in intercultural communication between China and Russia, communicators must adhere to the principle, as the Russians say, “they don’t go to someone else’s monastery with their charter”, understand and abide by the rules and cultural norms of the Russian and Chinese languages.

Not understanding the cultural diversity and uniqueness of each national culture does not contribute to cultural coexistence. The emergence of stereotypes in intercultural communication is largely due to limited thinking and cultural centralism, which are expressed in the unconscious fulfillment by communicators of cultural prerequisites corresponding to cultural centralism on both sides.

Russian-Chinese bilingualism in the context of increased contacts between Russia and China is becoming an important component of economic, social, cultural contacts. Economic relations and integration have brought relations between countries to a new level, therefore clashes caused by negative ethnic stereotypes are

inevitable and sometimes painful for their representatives. The high world status of the two cultural powers does not allow mistakes in communication, therefore, consideration of the similarities and differences between the two contacting cultures - Russian and Chinese and understanding of the main cultural differences will help to avoid communication barriers and help to achieve mutual understanding in different areas of cooperation between the two countries.

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THE MAIN DIFFERENCES BETWEEN THE INTERPRETATIONS OF CHINESE BASIC CHARACTERS

Abstract: The theses represent a brief discussion of the existing approaches to the interpretation of basic characters of the Chinese script, taking into account the diachronic retrospective. There is proposed and briefly described the model of comparative analysis of the interpretations of basic characters in diachrony and synchrony.

Keywords: Chinese script, “ShuoWen Jie Zi”, Xu Shen, interpretation, basic character, radical.

The Chinese script has been studied for many centuries as part of Chinese linguistic tradition. Interpretation of the meanings of Chinese characters is the oldest branch of Chinese linguistics which reflects high level of Ancient China's culture and education. In 121 the scientist of the Han Dynasty Xu Shen created the "Shuo Wen Jie Zi" dictionary, the title of which can be literally translated as "Explaining Graphs and Analyzing Characters". In the dictionary, a huge number of hieroglyphic signs were first systematized and categorized by 540 determinatives or radicals. The special importance of "Shuo Wen Jie Zi" for Chinese linguistics and Chinese culture is due to the fact that nowadays arrangement and systematization of characters in Chinese dictionaries in accordance with radicals remains the general instrument of modern Chinese lexicographers and Xu Shen's interpretations of characters have been remaining the basis of etymological researches of Chinese since the construction of this dictionary. Therefore, these 540 radicals of the "Shuo Wen Jie Zi" dictionary are commonly referred to as basic characters of the Chinese script.

Nevertheless, since the discovery of more ancient styles of the Chinese script in the 19th century, the problem of interpretation of basic characters has taken on a burning relevance because Xu Shen did not know anything about these ancient styles of the Chinese scripts which are able to reflect the way of life of the most ancient society. In line with solving the problems of this field, the objectives of our research are: 1) to establish problematic aspects of Xu Shen's interpretations of basic characters; 2) to identify the key approaches to the interpretation of Chinese basic characters; 3) to conduct the comparative analysis of these approaches; 4) to identify cultural differences reflected in different interpretations of basic characters on the basis of analysis.

In the course of solving the stated objectives the following results were obtained. The Han Dynasty era, when "Shuo Wen Jie Zi" was created, was characterized by major scientific advances which still remain relevant. During the same period, a lexical tradition arose, which started Chinese linguistics. A radical in a Chinese dictionary acts as a semantic indicator which indicates a field covered by a word which is written in a definite character. Xu Shen also classified basic characters for the first time in six categories: pictograms, ideograms, combined ideograms, phonograms, transfer characters, loan characters.

Despite the fundamental importance of Xu Shen's dictionary, his approach and the results of interpreting characters are criticized by modern linguists. Several aspects of criticism stand out: using active meanings of characters by Xu Shen in order to describe their graphical forms; the lack of factual material for etymological research; the impact of Lao Tzu's and Confucius' philosophy on Xu Shen's approach to the hieroglyphic script. Therefore, this approach is considered to be one-sided. Moreover, the interpretations of basic characters given by Xu Shen correspond with the Han Dynasty era's active meanings of characters which are considered to be close to their modern meanings. This may indicate that Xu Shen's interpretations and descriptions of graphic forms of characters are based on active meanings. As for cultural aspect, there is also some difference between considered interpretations.

This provision can be supported with several points structured in tabular form. This table would allow to evidently demonstrate the general differences between Xu Shen's and modern scientists' interpretations of basic characters, as well as the matches between Xu Shen's interpretations and active meanings of characters of the Han Dynasty era.

To sum up, the comparative analysis of the "Shuo Wen Jie Zi" dictionary and modern linguists' works can lead to the following conclusions: indeed, Xu Shen's interpretations of basic characters are one-sided because of using active meanings of his era. Hence, Xu Shen's interpretations do not match in many ways with the prior experience of interpretations of characters which are mentioned in modern linguists' works. These conclusions may be included in the further development of the problem of interpretation of Chinese basic characters.

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Материалы научной конференции

**SCIENCE PRESENT AND FUTURE: RESEARCH LANDSCAPE
IN THE 21ST CENTURY**

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