

Tailored climate information for the preparation of regional adaptation plans to climate change and variability (on the example of the Leningrad region). Akentyeva E. M., Klueva M. V., Fasolko D. V., Samoylova E. P., Razova E. N. Proceedings of MGO. 2023. V. 2023. P. 8–29.

The main sectors of the economy of the Leningrad region are considered. The influence of climatic characteristics and their changes on the sustainable functioning of objects in these economy sectors is analyzed. The most significant weather and climate risks and their components in the region have been identified. The information obtained allows the development of strategies to manage these risks and adapt to climate change and variability at the regional level.

Keywords: climate change, adaptation, construction, transport, health

Tab. 1. Fig. 6. Ref. 23.

Correction of the analytical solution of the equation of atmospheric diffusion derived by A.S. Monin. Genikhovich E. L., Rumyantsev D. Yu. Proceedings of the MGO. 2023. V. 609. P. 30–47.

The analytical solution of the equation of atmospheric diffusion (EAD) derived by A.S. Monin, which was published in the book “Advances in Geophysics, v. 6, 1959”, does not satisfy the requirements of the dimensional homogeneity. We introduce a correction of the formula suggested by Monin, which is consistent with the requirements of the dimensional analysis. Results of calculations with the corrected formula are in very good agreement with the corresponding results of the numerical integration of the EAD under consideration. In practical applications, the corrected formula could be used in development, testing and evaluation of numerical climatic models and chemical transport models.

Keywords: Atmospheric diffusion, equation, air pollution, dimensional analysis, analytical solution, numerical solution.

Fig. 7. Ref. 4.

About the development of storm warning methods in the Northwest region based on heterogeneous geophysical information involving machine learning algorithms. Tarabukin I A, Dorofeev E. V., Lvova M. V., Mikhailovsky Yu. P., Dmitrieva O. A., Bogomazova E. Ya, Gorbatovskaya A. S., Kuzmenko P. Yu. Proceedings of the MGO. 2023. V. 609. P. 48–63.

The issues of collecting, processing, exchanging and displaying various kinds of hydrometeorological and geophysical information in the tasks of diagnosis and forecast of dangerous hydrometeorological phenomena are considered. Particular attention is paid to radiophysical means of monitoring the territory of the North-Western region. A review of existing solutions in matters of nocasting was carried out, including those involving artificial intelligence methods in the classification of hydrometeors, detection of patterns and forecasting changes in weather conditions.

Keywords: geophysical information; information system, hazardous weather phenomena, storm warning, recognition algorithms, machine learning, artificial intelligence.

Fig. 3. Ref. 13.

Hail clouds in the north-west of the Russian Federation. Sin'kevich A. A., Toropova M. L., Mikhailovskii Yu. P., Veremei N. E., Kurov A. B., Tarabukin I. A. Proceedings of MGO. 2023. V.609. P. 64–77.

The results of radar studies of hail clouds in the North-Western region of the Russian Federation are presented. Cases of observer-confirmed hail events for the period 2017–2022 were selected and corresponding clouds according to Doppler C-band weather radar (DMRL-C) data. The values of radar parameters of clouds during hailstorm were analyzed and statistical characteristics were obtained. The microphysical structure of clouds is considered. Strong correlations are shown between the volumes of clouds with hail and graupel and other radar parameters.

Keywords: hail, graupel, polarimetric radar characteristics, microphysical cloud structure.

Fig. 3. Tab. 1. Ref. 19.

Results of comparison of DMRL data and lightning detection systems.

Snegurov A. V., Snegurov V. S. Proceedings of MGO.V. 609. P. 78–102.

The paper shows that lightning detection systems register lightning discharges not only in thunderstorm and hail clouds, but also in clouds with convective precipitation of varying intensity. There is no high correlation between the number of lightning discharges and the number of meteorological occurrences according to Doppler Meteorological Radar data in ten-degree sectors at distances up to 200 km.

The most effective models are models that compare the densities of lightning discharges $\rho_{N(alw)}$, $\rho_{N(lf)}$ and the densities of meteorological phenomena $\rho_{N(oya)}$ over ten-kilometer intervals. In these intervals, the determination coefficients vary from 0.71 to 0.98. Approximation errors are 7.3 — 12,3 %.

Keywords: lightning direction finding systems, Doppler meteorological radar, meteorological phenomena, lightning discharges, efficiency, correlations, determination coefficients

Tab. 7. Fig. 10. Ref. 2.

The transparency of the atmosphere in Russia: current changes in the XXI century. Makhotkin A. N., Makhotkina E. L., Plakhina I. N. Proceedings of MGO. 2023. V.609. P. 103–119.

The features of a change in the transparency of the atmosphere in Russia in 2000–2022 are considered. The object of the study was the rows of menstruation and annual values of the turbidity factor T_2 and the aerosol optical thickness of the atmosphere of AOD for the main regions of Russia. The trends of the changes in T_2 and the AOD in various regions are analyzed, the average long-term T_2 and AOD and the features of their annual move are determined. It is shown that in XXI, the manifestation of regional features was intensified, expressed in stabilization and even a certain increase in the turbidity of the atmosphere in the southern regions of ETR and Middle Siberia. However, in most of Russia, the tendency to reduce the integral and aerosol turbidity of the atmosphere remains.

Keywords: atmospheric transparency, atmospheric aerosol, network observations, long-term averages, trends.

Tab. 4. Fig. 5. Ref. 17.

Experimental studies of ice-forming properties of aluminum oxide nanotube clusters. Zalikhanov M. Ch., Khuchunaev B. M., Gekkieva S. O., Budaev A. Kh. Proceedings of MGO. 2023. V. 609. P. 120–131.

The results of a study of the ice-forming properties of aluminum are presented with the aim of possibly increasing the efficiency of pyrotechnic compositions used in anti-hail products of the Alazan-6 and Alazan-9 types. Clusters of aluminum oxide nanotubes were obtained in the presence of water vapor at subzero temperatures. The size and shape of the clusters depend on the sublimation temperature, pressure and gas components of the medium in which the sublimation occurs. It was revealed that clusters of Al₂O₃ nanotubes have ice-forming properties with a crystallizing threshold of -3°C . A special set of equipment and a technique for conducting experiments in the presence of water vapor have also been created.

Keywords: cloud active effects, pyrotechnic composition, reagent, ice-forming particles, aluminum, aluminum oxide, clusters, nanotubes.

Tab.1. Fig.4. Ref. 12.

The results of testing the hail forecast based on the output data of the global atmospheric model in the area of responsibility of the North-Caucasus Special Service on Weather Modification. Zalikhanov M. Ch., Kagermazov A. Kh., Sozaeva L. T. Proceedings of MGO. 2023. V. 609.P. 132–143.

In the course of the research, atmospheric parameters are calculated according to the global atmospheric model GFS NCEP with a lead time of 30 hours, according to which the hail forecast is carried out. Such a hail forecasting scheme has been tested on the territory of responsibility of the North Caucasus Special Service on Weather Modification. The results of the approbation showed an overall justifiability equal to 87%, and the prevention of the presence of the phenomenon 76%. The forecast quality criteria also showed high values. The conclusion is made about the good prospects of the proposed approach for integration into operational practice of anti-hail services.

Keywords: global atmospheric model, aerological sounding, meteorological parameters of the atmosphere, hail forecasting.

Tab.2. Fig.1. Ref. 12.

Results of zoning the territory of Kabardino-Balkaria according to the intensity and frequency of hailstorms. Inyukhin V. S., Cherednik E. A. Proceedings of the GGO. 2023. V. 609. P. 144–155.

The CBD is an area often subject to hail damage. On average, 30 days with hail are observed on its territory during the summer season. Based on long-term radar observations of hail processes, the territory of Kabardino-Balkaria was zoned according to the intensity and frequency of hail. Administrative regions that are most unfavorable for the production of agricultural plants have been identified. For the first time, a map of the integral urban hazard of the study area was obtained for the period 2003-2022. As a criterion for assessing territories with unfavorable conditions for agricultural production, a regional hail hazard indicator k_i was introduced.

Keywords. Database, hail clouds, radar data, hail size, hail kinetic energy flow, administrative region, regional hail hazard index.

Fig. 4. Ref. 13

Hail in the central part of the North Caucasus. Liev K. B., Kushchev S. A. Proceedings of the GGO. 2023. V. 609. P. 156–164.

Statistics for the past 20 years (2003-2022) on the distribution of hail days by months have been provided. The most hail-prone month for this area has been identified. A map of hail cloud formation in the Central Caucasus region has been created. The time of hail cloud formation and the time of their maximum development during the peak of reflectivity have been determined.

Keywords: hail, hail cells, hail hazard, hail clouds, central Caucasus, hail, MRL-5, reflectivity.

Fig. 3. Ref. 5.

Backscattering of radio waves from columnar cloud crystals.

Zalikhhanov M. Ch., Sozaeva L. T. Proceedings of MGO. 2023. V. 609. P. 165–175.

Calculations of backscattering cross sections of radio waves from columnar cloud crystals have been carried out. The shape of real columnar crystals can be approximated by spheroids according to experimental data. Calculations were carried out using the separation of variables method for non-spherical (spheroidal) particles SVM. It is shown that the backscattering cross sections of real crystals differ from the cross sections in the spherical approximation. A conclusion is made about the need to take into account the shape of crystals in mathematical modeling and remote sensing of hail clouds.

Keywords: backscattering cross sections, variable separation method, cloud ice crystals, radar, polarized electromagnetic waves.

Tab.1. Fig. 1. Ref. 14.

Influence of aerosol pollution of the atmosphere on the electric field strength in the area of open pit mining.

Zekoreev R.Kh. Proceedings of the GGO. 2023. V.607. P. 176–184.

The results of a study of the influence of anthropogenic pollution on the state of the electric field in the surface layer of the atmosphere in clear weather in the area of the Mukulan quarry in the North Caucasus are presented. It has been established that the increased values of the electric field strength are due to aerosol pollution in the open pit area. Data are given on the average size and concentration of aerosol particles in the area of the quarry, formed, formed in the process of mechanical crushing and destruction of rocks, as well as during the movement of heavy vehicles in the process of mining inside the quarry. It is proposed to use measurements of the electric field strength in the surface layer of the atmosphere as an indicator of aerosol air pollution in mining areas.

Keywords: Aerosol particles, pollution, rock, quarry, electrization, electric field strength, fluxmeter.

Fig.2. Ref.16.

The role of solar activity in the daily dynamics of the electric field of the surface atmosphere. Adzhiev A. Kh., Cherkesov A. A. Proceedings of the MGO. 2023. V. 609. P. 185–191.

The influence of solar activity on the diurnal course of variations in the intensity of the electric field of the surface atmosphere is considered. For this purpose, the values of the field strength of the surface atmosphere at different solar activity intensities were compared. In order to exclude the possible influence of weather phenomena on the values of the field strength, the values obtained during the "good weather" were selected during the analysis. It is shown that the formation of a local scale electric field is influenced by the number and intensity of C-, M-, and X-class solar flares. Under conditions of "good weather" with increased solar activity, the amplitude of the diurnal course of the electric field strength of the surface atmosphere can increase by about 2 times compared to the values typical for the natural background.

Keywords. Solar-terrestrial relations, solar wind speed, solar wind proton density, electric field strength, solar flare

Fig. 2. Ref. 11.