

Estimates of concentration distribution statistics: standard calculations vs the Monte Carlo simulation. Ziv A. D. Proceedings of MGO. 2021. V. 603. C. 6–28.

The paper considers the issue of the estimating of the concentration statistics, mean, variance, 95th and 98th quantiles, by means of the standard models currently used in Russian Federation and by the Monte Carlo simulation. The latter is based on one of the models presented in the 2017 Air Pollution Calculation Standard and the known in advance the distributions of the determining meteorological parameters. The use of this kind distribution is also regulated by the Standard. The results of the test runs for the several examples show, in overall, a good agreement between the values of the statistics. However, some discrepancies are should be noted, which is might be partly attributed to the a priori assumption of the lognormal distribution of concentrations, which is not utilized in case of Monte-Carlo simulation. Though high computational cost, Monte Carlo simulation is advantageous in some cases. Among possible applications are the calculating statistics in the case of non-stationary emissions and evaluating of the background concentrations.

Keywords: air pollution calculations, concentration statistics, standard models, Monte Carlo method, lognormal distribution, non-stationary emissions, background concentrations

Tab. 2. Fig. 5. Ref. 18.

Microclimatic zoning of St. Petersburg area for the purpose of optimizing water resources management. Pigoltcina G.B., Fasolko D.V. Proceedings of MGO. 2021. V. 603. C.29–36.

The article presents the microclimatic zoning of the territory of St. Petersburg, based on meteorological data for the period 2000-2020. The zoning was carried out according to a complex of specialized climatic indices that affect the state of water bodies and water disposal systems.

Keywords: microclimatic zoning, specialized indices, water supply, water disposal

Tab. 2. Fig. 1. Ref. 11.

Application of GIS technologies for applied climatic zoning (on the example of the Far Eastern federal district. Samoylova E. P., Zadvornyykh V. A. Proceedings of MGO. 2021. V. 603. C.37–48.

The article illustrates the expediency of using modern methods of mathematical and cartographic modeling for objective applied climatic zoning of the territory.

A map of the climatic regions of the Far Eastern Federal District has been constructed for technical purposes. On the territory of the region, the boundaries of four climatic regions included in GOST 16350-80 have been clarified, a new district has been allocated.

Keywords: climatic zoning, geoinformation system, Far Eastern Federal District, QGIS program, GIS technologies.

Tab. 1. Fig. 7. Ref. 8.

Modeling natural illumination in a cloudless atmosphere. Gorbarenko E. V., Rublev A. N., Bunina N. A. Proceedings of MGO. 2021. V. 603. C. 49–65.

On the basis of model calculations of the integral solar radiation by the Monte Carlo method, theoretical estimates of the illumination of the earth's surface were made for an extensive set of input parameters that determine its variability in a cloudless atmosphere. By approximating the data of a mathematical model, an analytical formula was obtained that allows calculating the illumination values for any geographical point, at any time. Based on long-term observations carried out at the Moscow State University, an empirical model of illumination in cloudless conditions was obtained. The models and formulas were validated by direct comparison of the results obtained from them with the data of independent measurements. The use of the model, formula and empirical relationships is recommended when the sun is above 15 degrees. The accuracy of the proposed methods is comparable to the accuracy of illumination measurements.

Keywords illumination, mathematical modeling, long-term observations, empirical equations.

Tab. 1. Fig. 7. Ref. 18.

Formation of snow cover in a shallow lowland swamp. Kalyuzhny I. L. Proceedings of MGO. 2021. V. 601. C. 66–78.

Wind flow is the main factor that forms the snow cover in the swampy stream valley. It has been established that in this case a zone of intense snow demolition and a zone of snow accumulation are formed. The snow-carrying area exceeds $\frac{1}{2}$ the area of the swampy valley, and the average snow depth in it is close to 14 cm. In the zone of snow accumulation, confined to shrub and woody vegetation, steep slopes, channel and riverbed, the snow height is several times higher (from 60 to 300 cm). The potential snow transfer corresponding to the open area of the stream valley is $686 \text{ m}^3/\text{linear m}$. In real conditions, the volume of transported snow is $343 \text{ m}^3/\text{linear m}$. The results of field observations make it possible to design snow protection measures for industrial facilities or linear structures located in a swamp.

Key words: shallow bog, wind flow, snow demolition, snow accumulation.

Tab. 4. Fig. 1. Ref. 10.

To the experimental evaluation of lightning currents. Snegurov A. V., Snegurov V. S. Proceedings of MGO. 2021. V. 603. P. 79–129.

The paper considers the ratios for estimating the current of lightning discharges into the ground of different polarity. The analysis of lightning currents depending on the distance, the direction of arrival of electromagnetic radiation of lightning, the number of sensors involved in the calculations and the magnitude of the synchronization interval were carried out. It is shown that almost all of these factors affect the estimation of the current of lightning discharges. The amplitudes of the strength of the electric and magnetic field, the currents of lightning are distributed according to a logarithmically normal law. The lightning current differences calculated from the data of the 2, 3 and 4 sensors of the Vaisala lightning detection system and the four indicators of the Alwes system are 9.2, 2.8 and 1.4 kA.

Keywords: lightning direction finding systems, amplitudes of electric and magnetic field, lightning currents, checking the normality of distributions, logarithmic-normal distribution of currents, statistical parameters of current models, correlation between the measured parameters.

Tab. 11. Fig. 22. Ref. 67.

Mesoscale features of the distribution of radar characteristics of cumulonimbus clouds and their relationship with surface meteorological values. Mikhaylushkin S. Y. Glibchuk S. A., Zamorin I. S., Kuznetsov A. D., Solonin A. S. Proceedings of MGO. 2021. V. 603. P. 130–144.

The article considers mesoscale features of the spatial distribution of radar characteristics (duration of the radio echo of thunderstorms, the height of the upper boundary of clouds) and surface meteorological values (air temperature, wind parameters) in May over the territory of $400 \times 400 \text{ km}^2$ around St. Petersburg with the center at Pulkovo airport. The work is being carried out in order to improve the quality of the forecast of the development of powerful convective clouds and weather phenomena associated with these clouds that are dangerous for aviation flights.

Keywords: climatic characteristics, frequency of thunderstorms, automated weather radar complex, AWRC, dangerous weather events, weather forecast for aviation.

Tab. 6. Fig. 5. Ref. 5.

Comparison of statistical data on thunderstorm and hail activity in the North Caucasus. Zharashuev M.V. Proceedings of MGO. 2021. V. 603. C. 145–154.

The article compares radar and thunderstorm direction finding data on thunderstorm activity observed on the territory of the North Caucasus region in the period from 2009 to 2020.

As a result of the comparison of lightning direction finding and radar information, the facts of failures of the lightning direction finding network of the North Caucasus were revealed, which had a significant impact on the results of the study. VHF sensors were particularly prone to malfunctions. At the same time, it was found that cloud-earth discharges tend to repeat cycles of hail activity. The factor preventing the detection of lightning activity cycles is the short period of lightning direction finding operation and frequent failures in its operation.

Keywords: Statistics, analysis, lightning direction finding, radar, automation, MRL-5.

Tab. 3. Fig. 2. Ref. 11