Realization experimental operation of the local area weather radar "Monocle". Tarabukin I. A., Dmitrieva O. A., Lvova M. V., Kuzmenko P. Yu., Dorofeev E. V., Zanyukov V. V., Dmitrieva M. A., Gorbatovskaya A. S. Proceedings of MGO. 2024. V. 614. P. 8–38.

The article discusses the operating principle of the local area weather radar (LAWR) "Monocle", the possibility of its use in the Roshydromet network and the process of experimental operation at the "Saint Petersburg" position. Particular attention is paid to the procedure for qualitative and quantitative comparison of radar and meteorological information with DMRL-C Voeikovo data. In the conclusion it was summarized the quality of work of the LAWR based on the results of experimental operation.

Keywords: local area weather radar, technical characteristics, experimental operation, comparison, hazardous weather phenomena, reflectivity, Doppler velocity.

Fig. 13. Tab. 5. Ref. 13.

On the structure of a thundercloud over the city of Saint-Petersburg. Kurov A. B., Sin'kevich A. A., Tarabukin I. A., Toropova M. L., Veremei N. E., Mikhailovskii Yu. P. Proceedings of MGO. 2024. V. 614. P. 39–59.

Investigation of a thundercloud structure which developed on the 9th of June, 2020 over the city of Saint-Petersburg and Leningrad region is presented in the paper. It is based on field observations and results of simulation of a convective cloud using a low-dimensional non-stationary numerical model. It is shown that lightning started at the period of an increase of the volume of supercooled part containing the graupel. The major changes of the cloud structure occurred after the lightning starts. The results of numerical simulation show that the increased electrification of the cloud is associated with the presence of large ice particles: the hail water content increases before the lightning. It is shown that in the case of cloud seeding with a crystallizing reagent in the layer with optimal temperature the intensity of hail decreases, but at the same time the intensity of rain increases. The most efficient is seeding at a time when a sufficiently large mass of liquid water has accumulated in the cloud, but natural ice formation has not yet begun. This makes it possible not only to solve the problem of reducing hail, but also to use hail clouds as a resource for increase of rain intensity in the interests of various sectors of the economy.

Keywords: clouds, thunderstorm, hail, precipitation intensity, numerical simulation, cloud seeding, weather radar, severe weather phenomena.

Fig. 6. Ref. 31.

Investigation of effectiveness of hail cloud seeding. Toropova M. L., Veremei N. E., Sin'kevich A. A., Kurov A. B., Fedotova G. D. Proceedings of MGO. 2024. V. 614. P. 60–72.

A three-dimensional numerical simulation of the evolution of a convective cloud for the observed conditions was performed. The characteristics of the cloud during natural development and with cloud seeding (AV1 and AV2) are investigated. The studied methods differ in the way of determining the layer of injection of the crystallizing reagent: in AV2 the layer is determined using temperature inside cloud. The case study of formation and development of thunderstorm with hail in the North Caucasus region of Russia on May 1, 2021 is considered. The dynamics of cloud evolution and microphysical structure during the period of the most intense hail are investigated. It was found that the use of the proposed seeding technique in the case under consideration leads to a slight improvement in the cloud seeding effect: the maximum value of the intensity of hail precipitation decreases, as well as the maximum amount of hail per unit area and area with a hail intensity ≥ 5 mm/h.

Keywords: convective cloud, cloud seeding, numerical modeling, hail.

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

Resource convective clouds development forecast using small-dimensional numerical model. Veremei N. E., Akselevich V. I., Kuzmenko P. Yu., Toropova M. L. Proceedings of MGO. 2024. V. 614. P. 73–94.

A new method is proposed for identifying resource convective clouds for seeding by crystallizing reagent in order to artificially cause (enhance) precipitation. This method is based on using the small-dimensional numerical convective cloud model developed in MGO. For the selected period (summer seasons 2022 and 2023) the days with the expected development of resource clouds were determined using radar data. Calculations using the model were performed for these days. The characteristics of convective clouds developing under given conditions in the atmosphere were obtained. Depending on the temperature of the upper boundary and the peculiarities of development, clouds were classified as resource or non-resource. The results of the analysis of these calculations show that the proposed method is applicable to identify clouds suitable for artificially causing (enhance) precipitation, in particular for extinguishing forest fires.

Keywords: resource clouds, precipitation, cloud seeding.

Fig. 4. Tab. 1. Ref. 25.

Calculation of the electric field reduction coefficient near the ellipsoidal surface in the electrode layer. Timoshenko D. V. Proceedings of MGO. 2024. V. 614. P. 95–109.

The paper investigates the problem of interpreting data from atmospheric-electrical observations conducted under conditions of heterogeneous relief of the Earth's surface. The inhomogeneities are represented as ellipsoids with different ratios of semi-axes. The representation of the reduction coefficient as a product of two independent quantities is considered, one of which reflects the influence of the geometry of the electrode surface, and the second — the action of the electrode effect on the distribution of electric field strength in the surface layer of the atmosphere.

Keywords: atmosphere, electric field, electrode effect, reduction coefficient, spherical inhomogeneity, surface layer, turbulence.

Fig. 6. Tab. 2. Ref. 12.

Experimental assessment of the possibility to transferring of a unit of meteorological optical range measurement to nephelometers. Zimenkov P. S., Rodionov A. A., Kurov A. B. Proceedings of MGO. 2024. V. 614. P. 110–119.

The article presents the results research of the stability of reproduction of the optical density of artificial fog in a fog chamber and the results research of the relative error of a nephelometer using a device for monitoring the linearity of the optical system of the nephelometer and infrared filters.

Keywords: nephelometer, meteorological optical range, standard, fog chamber, transmission of a unit of magnitude, linearity control, spectral light transmittance, scattering coefficient, transmissometer.

Tab. 4. Ref. 14.

Evaluation of the possibility of maintaining the homogeneity of radiation flux series during the transition to new equipment at the Moscow State University Meteorological Observatory. Gorbarenko E. V., Bunina N. A. Proceedings of MGO. 2024. V. 614. P. 120–139.

To make a decision on the possibility of continuing to monitor the radiation parameters of the atmosphere using “Kipp & Zonen” instruments, parallel observations with standard and purchased instruments have been carried out at the MO MSU for two years. Based on them, the work presents the results of comparing data with different time averaging. A conclusion has been made about the possibility of replacing the new complex of standard actinometric instruments with devices without losing the homogeneity of the series. The necessary requirements for monitoring with the new complex have been formulated.

Keywords: instruments, monitoring, solar radiation, long-wave fluxes.

Fig. 7. Tab. 3. Ref. 11.

Testing results of hail forecast based on global atmospheric model’s output data, taking into account natural and climatic zones of North Caucasus central part. Kagermazov A. H., Sozaeva L. T. Proceedings of MGO. 2024. V. 614. P. 140–151.

During the research, atmospheric parameters were calculated according to the global GFS NCEP model with a lead time of 30 hours for three natural and climatic zones (steppe, foothill and mountainous), followed by a hail forecast. The testing of this approach was carried out in the territory of responsibility of the North-Caucasus Special Service on Weather Modification in the hail hazardous period of 2024. The analysis of the results showed that the tested forecast method meets the criteria for the quality of forecasts. It is concluded that it is possible to improve the quality of forecasts by using discriminant functions based on predictive data separately for each natural zone.

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

Fig. 2. Tab. 3. Ref. 12.

Radar characteristics of powerful hail clouds. Inyukhin V. S., Cherednik E. A. Proceedings of MGO. 2024. V. 614. P. 152–160.

The paper studies some radar characteristics of powerful hail clouds. The group of powerful hail clouds included objects of impact of category IV. For them the following conditions must be simultaneously met: radar reflectivity Z10 must exceed 65 dBZ, and the thickness of the supercooled layer ΔH45 must exceed 4,0 km. Over 21 years (from 2003 to 2023) 69 such cells were identified in the central part of the North Caucasus.

The distributions of some cell characteristics during the period of their maximum development were constructed and studied. A comparison of the obtained distributions with similar distributions of other weaker clouds was carried out.

Keywords: hail, speed of movement of hail clouds, direction of movement of clouds, cell lifetime, height of the upper boundary of the cloud.

Tab. 7. Ref. 7.

Microphysical characteristics of super-powerful hail cells in the Central Caucasus. Inyukhin V. S., Cherednik E. A. Proceedings of MGO. 2024. V. 614. P. 161–168.

The paper studies the microphysical characteristics of super-powerful hail clouds. The criterion for a cell to be included in the group of super-powerful hail cells was the radar reflectivity Z10, which had to exceed 67 dBZ. Over 21 years of observations (from 2003 to 2023) 35 such cells were identified in the central part of the North Caucasus. Until now, these hail cells have not been combined into a single group for separate consideration.

The distributions of some microphysical characteristics of such cells during the period of their maximum development were constructed and studied. A comparison of the obtained distributions with similar distributions of other types of clouds was carried out.

Keywords: hail, hail cells, microphysical characteristics, radar reflectivity, maximum hail size.

Fig. 2. Ref. 10.

Experiment on artificial precipitation increase by rocket method. Liev K. B., Gergokov A. H., Kushchev S. A. Proceedings of MGO. 2024. V. 614. P. 169–180.

This paper presents the results of an experiment on artificial precipitation enhancement using the rocket method in the Krasnodar Krai region. The main cloud seeding concepts with ice-forming agents, their effectiveness, and application conditions are described. Criteria for cloud suitability for active interventions, as well as radar-based impact assessment data, are presented. The experimental results demonstrated the feasibility of successfully applying the rocket method for meteorological modification in the North Caucasus.

Keywords: convective clouds, precipitation, rain, MRL-5, reflectivity, artificial precipitation enhancement.

Fig. 3. Tab. 4. Ref. 7.