DOI: https://doi.org/10.37162/2618-9631-2024-2-6-24

Eddy dissipation rate in aviation applications of turbulence intensity assessment / Ivanova A.R. // Hydrometeorological Research and Forecasting, 2024, no. 2 (392), pp. 6-24.

A review of papers on the use of the EDR (eddy dissipation rate) parameter in meteorological aviation service is presented. EDR is associated with the rate of dissipation of turbulent kinetic energy and is the cube root of its value. The EDR characteristic, independent of an aircraft type, has been designated by ICAO as the measure for determining turbulence intensity. The physical basis of the EDR application, methods for determining EDR in situ and in the surface layer of the atmosphere using remote sensing are discussed. Some approaches to forecasting turbulence in EDR units in numerical weather prediction models are considered.

Keywords: turbulence, eddy dissipation rate, methods for estimating turbulent kinetic energy, turbulence climatology, EDR forecasting

Fig. 2. Ref. 47.

DOI: https://doi.org/10.37162/2618-9631-2024-2-25-50

Identification of wind gusts during a squall from the DMRL-C network and numerical modeling data / Alekseeva A.A., Bukharov V.M. // Hydrometeorological Research and Forecasting, 2024, no. 2 (392), pp. 25-50.

Experimental methods are considered for identifying squalls in three intensity gradations according to the DMRL-C network data and refining the speed of gusts during a squall using numerical modeling. Particular attention is paid to the identification of severe squalls. The series of severe squalls on July 29, 2023 in the Middle Volga region was analyzed. The results of the verification of squalls using observational data from weather stations and wind gust speeds recorded by automatic weather stations are presented.

Keywords: radar monitoring, squall, wind gust, wind speed, severe weather event, DMRL-C data, verification

Tab. 2. Fig. 6. Ref. 14.

DOI: https://doi.org/10.37162/2618-9631-2024-2-51-64

Peculiarities of forecasting maximum surface wind gusts in the cold season: A case study for the Moscow region / Dmitrieva T.G., Smirnov A.V., Vasil’ev E.V. // Hydrometeorological Research and Forecasting, 2024, no. 2 (392), pp. 51-64.

An approach is proposed to forecasting maximum wind gusts, in particular, for developing storm warnings in the cold season using the results of the experimental nowcasting of wind gusts (for a period to two hours) based on radar data and the forecast of the COSMO-Ru model with the grid spacing of 2.2 km for the Moscow region. The case of the strong wind with gusts up to 19 m/s recorded at Vnukovo on January 11, 2024 is analyzed.

Ключевые слова: forecast of wind gusts, cold season, COSMO-Ru2.2 products, nowcasting of wind gusts, radar data

Tab. 1. Fig. 6. Ref. 7.

DOI: https://doi.org/10.37162/2618-9631-2024-2-65-85

Severe heat forecasting in Krasnoyarsk using the WRF-ARW regional model / Bykov A.B., Vetrov A.L., Kalinin N.A. // Hydrometeorological Research and Forecasting, 2024, no. 2 (392), pp. 65-85.

The reasons for the occurrence of a severe heatwave in Krasnoyarsk have been studied, and the accuracy of the forecasts of the WRF-ARW regional model has been assessed. Four episodes of hot weather in 2020, 2021, and 2023 have been analyzed. The heatwave in June 2023 was especially intense and met the criteria for a severe weather event. All examined cases were associated with the intense advection of warm tropical air in the leading edge of the upper-air trough. The formation of the urban heat island has been investigated, and its intensity in the nighttime was found to be 6.5°C. During daytime hours, the heat island was weaker than at nighttime. It has been determined that on the second day of forecasting, the WRF-ARW model accurately reproduces the urban heat island and the impact of the Yenisei River, although it underestimates the predicted amplitude of daily temperature variations. The absolute error in air temperature predictions for the time moments close to the time of daily maximum temperatures was 2.6°C (33 hours of model time).

Keywords: numerical prediction of temperature, severe heat, WRF, urban heat island, Krasnoyarsk

Tab. 6. Fig. 10. Ref. 26.

DOI: https://doi.org/10.37162/2618-9631-2024-2-86-110

Simulation of tides in z- and σ-models of marine circulation in the Sea of Okhotsk / Popov S.K., Fomin V.V., Panasenkova I.I. // Hydrometeorological Research and Forecasting, 2024, no. 2 (392), pp. 86-110.

The study considers the reproduction of tides by two marine circulation models implemented for the Sea of Okhotsk: the z-model with a spatial resolution of ~3.7 km implemented directly for the Sea of Okhotsk, and the σ-model with a spatial resolution of ~3.5 km implemented for the Sea of Okhotsk and the Sea of Japan. The z-model is based on the HyRMoS (Hydrometcenter of Russia Model of Sea) model developed by S.K. Popov at the Hydrometeorological Center of Russia, the σ-model is based on the INMOM (Institute of Numerical Mathematics Ocean Model).

The results of model simulations were compared with the data of harmonic constants of the main tidal harmonics presented at 98 coastal stations located in the Sea of Okhotsk and the Tatar Strait. An analysis of the calculation results showed that the accuracy scores are comparable for both models. The difference in the values of tidal harmonics revealed in the study and obtained from the z-and σ-models is primarily due to the accuracy and features of the bottom topography used and is also related to the location of the open boundaries and the configuration of the grid domains.

Keywords: tides, numerical modeling, z-model, σ-model, the Sea of Okhotsk

Tab. 1. Fig. 7. Ref. 19.

DOI: https://doi.org/10.37162/2618-9631-2024-2-111-129

Forecasting the characteristics of the flood in 2024 on the Ishim, Tobol and Ural rivers / Borsch S.V., Simonov Yu.A., Khristoforov A.V., Yumina N.M. // Hydrometeorological researches and forecasts, 2024, no. 2 (392), pp. 111-129.

The Hydrometeorological Center of Russia has developed a system of methods for forecasting spring flood characteristics, which was implemented for eight stations on the Ishim, Tobol, and Ural rivers in 2024. Specific features of the methods are the simplicity of their obtaining and implementation for a particular river reach and a possibility of the fast correction of forecasts as the current information is available.

The peak water level at the station was predicted based on its dependence on the peak water level at the upstream station. The date of the flood peak was predicted with account of the data of the peak at the upstream station and probable values of the travel time from the upstream gauge to the predicted downstream one. The date of the water level drop to the level of a severe event was forecasted taking into account the height and date of the flood peak using the calculated recession curve obtained by the statistical analysis of flood recessions in the previous years. The date of the water level drop to the level of an adverse event was predicted by extrapolating the flood recession observed during 10–15 days after the flood peak. The mean forecast lead time is 9 days.

The forecasts were issued in a deterministic and probabilistic form and gave quite satisfactory results, which were used in the organization and implementation of measures to protect the population and economic facilities from the floods observed in 2024. The efficiency of the developed methods allows recommending them for use in predicting flood characteristics in various regions of Russia.

Keywords: flood characteristics, river gauge, water level, statistical analysis, forecast, deterministic and probabilistic form, flood protection

Tab. 7. Fig. 3. Ref. 22.

DOI: https://doi.org/10.37162/2618-9631-2024-2-130-145

Short- and medium-term forecasting of water levels of the Tobol basin rivers / Khristoforov A.V. // Hydrometeorological Research and Forecasting, 2024, no. 1 (391), pp. 130-145.

In order to provide the necessary hydrological information for operational decisions on the use of water resources and protecting the population from dangerous floods for the rivers of the Tobol river basin, a methodology for daily forecasting of average daily water levels with a lead time of 1 to 10 days has been developed. The hydrograph extrapolation method was used, which takes into account water levels for the date of the forecast and for the 5 previous days. The methodology was developed for 64 sections located on the Tobol River and its tributaries of various orders. To estimate the parameters of the scheme for obtaining forecasts and their verification, hydrological observation data for the period from 1985 to 2022 were used. For most rivers in the basin, the methodology provides satisfactory results. In general, the accuracy of forecasts and their lead time increase with increasing catchment area. The methodology can be used within an automated system for preparing and issuing forecasts.

Keywords: hydrograph extrapolation, water levels, forecast, lead time; verification, error and accuracy of forecasts

Tab. 5. Fig. 3. Ref. 13.

DOI: https://doi.org/10.37162/2618-9631-2024-2-146-172

Development of methods for agrometeorological observations in the Roshydromet system in 1936–2023 / Pasechnyuk A.D. // Hydrometeorological Research and Forecasting, 2024, no. 2 (392), pp. 146-172.

The analysis of methods for agrometeorological observations of major agricultural crops and wild plants during the period of 1936–2023 is presented.

An analysis of eight guidance documents published over the past 87 years in the Roshydromet system of agrometeorological observations showed that the number of crops for which methods for agrometeorological observations were proposed increased from 39 to 140, the respective number for wild plants increased from 43 to 112. The number of parameters recorded during agrometeorological observations that characterize the condition of plants, their habitat, agricultural techniques for cultivating crops, damage to plants due to adverse weather events, pests, and diseases, etc. has increased to 111. The peculiarities of the organization of observation sites at observation units are described. The dates of the beginning of observations of the main agrometeorological parameters are given.

Keywords: agrometeorological observations, agrometeorological parameters, observation periods, observation sites, phases of plant development, forms for recording observation results

Tab. 1. Ref. 12.