DOI: https://doi.org/10.37162/2618-9631-2023-3-6-58

Verification of the radar precipitation nowcasting / Muravev A.V., Kiktev D.B., Smirnov A.V. // Hydrometeorological Research and Forecasting, 2023, no. 3 (389), pp. 6-58.

The application of the Fraction Skill Score (FSS) to the radar nowcasting of precipitation fields is considered. The main feature of the method is that the quality is estimated not at the points (or cells) of the fields, but in their neighborhoods. Verification of field forecasts acquires a probabilistic character, due to which the well-known "double penalty" danger is eliminated when advancing from coarse computational grids to finer ones. Moreover, the method makes it possible to distinguish such range of scales within which the tested model generates forecasts that are acceptable or useful for both weather forecasters and third-party consumers of forecast products. The features and advantages of the FSS are demonstrated using the data of radar precipitation nowcasting in the warm and cold seasons of 2017–2018. An information archive of observation and forecast fields in the coverage areas of nine DMRL-C radars on the territory of the Central and Northwestern federal districts was used. Due to the large time spent to calculate the skill score, the possibility of obtaining summary estimates based on random samples was tested. Based on the output tabular and graphical verification products, meaningful general and partial conclusions are formulated that are stratified by seasons, radars, thresholds for exceeding the precipitation intensity, and the forecast lead time.

Keywords: precipitation field nowcasting, radar observations, spatial forecast verification, neighborhood verification method, Fractions Skill Score (FSS)

Tab. 8. Fig. 17. Ref. 80.

DOI: https://doi.org/10.37162/2618-9631-2023-3-59-74

Simulation of climatic characteristics of precipitation over the Black Sea with the data of regional climate models / Polonsky A.B., Sukhonos P.A. // Hydrometeorological Research and Forecasting, 2023, no. 3 (389), pp. 59-74.

The ability of 16 regional climate models (RCMs) from the CORDEX project to adequately simulate the average values and long-term trends in precipitation over the Black Sea is assessed. The results of the simulations performed using the RCMs are compared with the data of the ERA5 reanalysis for the control period (1959–2005). Average annual precipitation and average seasonal precipitation for winter and summer, as well as long-term trends in precipitation for all months in a wide range of quantiles, are analyzed. It was found that average seasonal precipitation over the Black Sea is satisfactorily simulated by most RCMs in winter and by six RCMs in summer. At the same time, the monthly precipitation trends estimated on the basis of forecast calculations are close to those based on the ERA5 data only for one RCM.

Keywords: precipitation, quantile regression, Black Sea, CORDEX

Tab. 1. Fig. 5. Ref. 16.

DOI: https://doi.org/10.37162/2618-9631-2023-3-75-92

The influence of short-term variations in atmospheric forcing on the large-scale structure of oceanographic fields / Resnyanskii Yu.D., Zelenko A.A., Stepanov V.N., Strukov B.S. // Hydrometeorological Research and Forecasting, 2023, no. 3 (389), pp. 75-92.

The dependence of the large-scale structure of oceanographic fields on short-term variations in atmospheric forcing (AF) at the ocean surface has been studied. Estimates of this dependence were obtained by comparing the results of two numerical experiments with the NEMO model in the ORCA1 configuration used as a computational core in the data assimilation system at the Hydrometeorological Center of Russia. The experiments similar in all other respects differed only in the discreteness of the AF data: 3–24 hours in the main experiment and 1 month in the experiment with time-averaged AF. Large-scale characteristics were compared: kinetic energy averaged over large regions, Atlantic Meridional Overturning Circulation, meridional heat transport, mixed layer depth, sea ice volume. It is shown that neglecting high-frequency AF variability can significantly distort the long-term evolution of oceanographic fields reproduced by ocean models and thereby affect the quality of model forecasts.

Keywords: oceanographic fields, large-scale structure, NEMO model, atmospheric forcing, short-term variations

Fig. 3. Ref. 48.

DOI: https://doi.org/10.37162/2618-9631-2023-3-93-111

The timing variability of maximum water levels in the rivers of the North Caucasus / Mironenko A.A. // Hydrometeorological Research and Forecasting, 2023, no. 3 (389), pp. 93-111.

The intra-annual distribution of the timing of maximum water levels in the rivers of the North Caucasus has been studied. Observation data from 54 hydrological gauges for the period from 1961 to 2017 were used. The intra-annual distribution of these dates was typified, according to which for each season of the year their frequency may exceed 80%, be in the range from 50 to 80% or not exceed 50%. On this basis, the zoning of river sections in the North Caucasus is proposed according to the type of variability in the timing of maximum water levels. The geographical validity of the proposed zoning is confirmed by its good enough correspondence to the existing ideas about the peculiarities of flow formation and water regime of the studied rivers. The obtained results can be used to estimate the probability of dangerous floods in the rivers of the North Caucasus in different seasons of the year.

Keywords: the rivers of the North Caucasus, maximum water levels, timing of water level peaks, types of seasonal distribution, zoning

Tab. 5. Fig. 1. Ref. 21.

DOI: https://doi.org/10.37162/2618-9631-2023-3-112-124

Long-range forecasting of the ice break-up dates for the Yukon River by the synoptic statistical method / Pavroz Yu.A. // Hydrometeorological studies and forecasts. 2023. No. 3 (389). pp. 112-124.

A scheme for obtaining a long-range forecast of the dates of ice break-up is proposed for the Yukon River (North America). The scheme is based on a well-proven national practice of ice forecasting, namely, on the meteorological statistical method. The method utilizes a linear dependence of the predicted value on the characteristics of temperature and pressure fields in the North Atlantic and the North Pacific. The most informative predictors are selected. Statistical stability of the forecast formula parameters is verified. The average forecast lead time is 40 days. The verification of the proposed methodology performed for three stretches of the Yukon River on the basis of independent data for the period from 2009 to 2015 showed that it allows obtaining quite satisfactory results with a fairly low root-mean-square error and a fairly high accuracy of forecasts.

Keywords: river ice break-up, long-range forecast, synoptic statistical method, temperature and pressure fields, predictors, stability, method verification

Tab. 2. Fig. 3. Ref. 8.

DOI: https://doi.org/10.37162/2618-9631-2023-3-125-138

Spatial distribution of meteorological conditions in the Zeravshan River basin and their correlation with the Zeravshan River runoff / Normatov I.Sh., Sharofzoda F.A., Normatov P.I., Ashurov M. // Hydrometeorological research and forecasts, 2023, no. 3 (389), pp. 125-138.

Correlations between average long-term values of meteorological parameters at weather stations over the period of 1950–2021 are investigated for the western, central, and eastern subregions of the Zeravshan River basin. The analysis of the data made it possible to obtain the information about the air masses transporting moisture, as well as about the distribution of precipitation depending on local orography, geographic latitude, and elevation. The seasonal distribution of long-term average annual runoff of the Zeravshan River is studied. The correlation analysis revealed that the maximum value of the correlation coefficients between the period of maximum runoff (VI-VIII) and the value of precipitation and temperature corresponds to the spring (III-V) and summer (VI-VIII), respectively.

Keywords: correlation, Zeravshan River, precipitation, temperature, river runoff

Tab. 2. Fig. 8. Ref. 15.

DOI: https://doi.org/10.37162/2618-9631-2023-3-139-151

Changes in cloud characteristics on the territory of Russia / Korshunova N.N., Dementieva T.V. // Hydrometeorological Research and Forecasting, 2023, no. 3 (389), pp. 139-151.

Such characteristics of the cloud cover as the frequency of cloudy (8-10/10) and clear (0-2/10) sky are investigated. The analysis of the seasonal frequency of these characteristics revealed some regional features. To be included in the national cloud monitoring system, the normals for the new base period of 1991-2020 for the average amount of total and low-level clouds, the frequency of cases with different sky conditions (clear, semi-cloudy, cloudy) for total and low-level clouds, as well as the frequency of various forms of clouds were calculated. Long-term changes in the frequency of clear and cloudy sky are analyzed, which revealed an almost universal decrease in the frequency of clear sky for the total cloud cover in all seasons.

Keywords: total cloud cover, low-level clouds, cloud forms, cloudy sky, clear sky

Tab. 1. Fig. 7. Ref. 21.

DOI: https://doi.org/10.37162/2618-9631-2023-3-152-164

Spatiotemporal variability of thunderstorm activity in the North Caucasus / Adzhiev A.H., Kerefova Z.M., Gyatov R.A. // Hydrometeorological Research and Forecasting, 2023, no. 3 (389), pp. 152-164.

The analysis of the long-term observations (2008–2019) of thunderstorm activity in the North Caucasus using the High-mountain Geophysical Institute lightning detection network with LS8000 and LS7002 sensors is performed. Climatic and orographic regional factors forming the spatial heterogeneity of thunderstorm activity in the analyzed region are identified. It is shown that the number of thunderstorm events, their direction and lightning discharge intensity determine microphysical processes in the atmosphere, namely, the intensity of cloud and precipitation formation.

Keywords: thunderstorm activity, climate, lightning, lightning detection network, precipitation, radar

Tab. 1. Fig. 5. Ref. 12.

DOI: https://doi.org/10.37162/2618-9631-2023-3-165-174

Characteristics of Hail Processes on the Northeastern Slope of the Lesser Caucasus / Guseinov Dzh.S., Guliev Z.G., Ibragimova I.T. // Hydrometeorological Research and Forecasting, 2023, no. 3 (389), pp. 165-174.

Features of active convective processes with the formation and fall of hail on the northeastern slope of the Lesser Caucasus located on the territory of Azerbaijan during 1979–2020 are analyzed. The analysis was carried out using mathematical, statistical, and cartographic methods. The frequency of hail processes and the schematic map of the vertical distribution of average annual parameters of the number of hail days is presented. It is shown for the mountain part of the territory that there is an increasing frequency of hail processes, while their reduced number was registered in flat areas. The consequences of regional climate change and a long-term trend in the parameters of hail processes are investigated. It was found that hail processes in the region in the recent years have been more frequent, the frequency is higher in the afternoon.

Keywords: convective processes, severe atmospheric events, hail processes, frequency, climate change, trend, MRL-5 radar data

Tab. 4. Fig. 2. Ref. 12.