

The main features of climatic conditions in the winter season of 2023/2024 according to monitoring and forecasts / Sumerova K.A., Khan V.M., Tishchenko V.A., Vilfand R.M. // Hydrometeorological Research and Forecasting, 2024, no. 3 (393), pp. 6-22.

The main results of the comprehensive analysis of the Northern Hemisphere large-scale atmospheric circulation features are presented for the 2023/2024 winter season. Skill scores of the consensus forecast for the 2023/2024 Northern Eurasia winter season are discussed in the context of reproducing the temperature and humidity regime. The qualitative analysis of the multimodel forecast from WMO's Lead Center and the consensus forecast issued by NEACOF for seasonal anomalies in air temperature and precipitation for the winter of 2023/2024 resulted in the conclusion of the superior accuracy of the consensus forecast. This forecast was based on the data of three Russian models SL-AV, MGO, and INM with equal weighting coefficients.

Keywords: air temperature, precipitation, forecast skill, large-scale atmospheric circulation, sea surface temperature, NEACC, NEACOF, circulation indices, Arctic ice, snow cover, extreme weather, economic loss

Tab. 1. Fig. 6. Ref. 16.

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Short-term forecasting of waterspout-risk conditions for the coastal water of the Black Sea based on the improved index WRI / Kalmykova O.V. // Hydrometeorological Research and Forecasting, 2024, no. 3 (393), pp. 23-41.

The paper considers the issues of improving the quality of short-term forecasts of waterspout-risk conditions for the Black Sea coastal water. The results related to the development of new versions for calculating the regional waterspout risk index (WRI) for both the warm (WRI₂₁) and cold (WRI_w) seasons are presented. The WRI is used to identify zones of high-risk waterspout formation and subsequent localization of waterspout-risk areas of the coast. Calculations of the WRI fields are based on the output of the COSMO-Ru2 mesoscale model with a grid spacing of 2.2 km. Calculations are carried out in real time within the technology for assessing the risk of waterspouts. The skill of forecasting new WRI versions for different periods is analyzed. It is shown that the probability of waterspout detection in the warm season can reach 82% on average. At the same time, there is also a high false alarm rate (about 70%), mainly due to the excessively predicted waterspout risk in certain areas of the coast (Sochi and Tuapse). In the cold season, as expected, a significantly smaller number of waterspout-risk days is predicted as compared to the warm period. Examples of forecasts for different seasons are presented. Recommendations on the use of forecasts for preparing storm warnings are given.

Keywords: waterspout, waterspout-risk conditions, forecast, COSMO-Ru2 model, regional waterspout risk index WRI, waterspouts formation predictors, forecast technology

Tab. 3. Fig. 5. Ref. 9.

DOI: <https://doi.org/10.37162/2618-9631-2024-3-23-41>

Integration of a chemical transport model and an artificial neural network for PM₁₀ concentration forecasting / Borisov D.V., Kuznetsova I.N. // Hydrometeorological Research and Forecasting, 2024, no. 3 (393), pp. 42-63.

A hybrid model for forecasting PM₁₀ surface concentrations in the Moscow region, consisting of a chemical transport model (CTM) and an artificial neural network (ANN), with the use of PM₁₀ automatic measurements data was developed and tested. The ANN was trained to predict PM₁₀ concentrations based on the forecasts of CTM concentrations and meteorological parameters on a 2 km grid. The results of testing the ANN based on independent samples, including the episodes of high PM₁₀ pollution, are discussed.

Keywords: artificial neural network, hybrid model, numerical forecasting of air pollution, PM₁₀, CHIMERE

Tab. 2. Fig. 8. Ref. 10.

DOI: <https://doi.org/10.37162/2618-9631-2024-3-42-63>

The effect of intense precipitation on air pollution in the city of Vladivostok / Vasilevsky D.N., Vasilevskaya L.N., Lisina I.A., Kuvaeva D.A., Shpak A.S. // Hydrometeorological Research and Forecasting, 2024, no. 3 (393), pp. 64-76.

Concentrations of the main substances polluting the atmosphere over Vladivostok (sulfur dioxide, carbon monoxide, nitrogen dioxide, and PM_{2.5}, PM₁₀ particles) before, during, and after stormwater solid and liquid precipitation on December 21–23, 2022 and June 8–9, 2023, respectively, are considered. The development of synoptic processes that caused this precipitation, air particle trajectories (using the HYSPLIT model), and the variation pattern of pollutant concentrations recorded using the GMAO satellite monitoring during these periods are analyzed. It is shown that heavy rainfall significantly cleanses the atmosphere from aerosol pollution, and during snowfalls, carbon monoxide is better washed out of the atmosphere, and PM₁₀ and PM_{2.5} particles almost completely fall on the underlying surface.

Keywords: heavy snow, heavy rain, atmospheric pollution, Primorsky Krai, reverse atmospheric transport

Fig. 6. Ref. 11.

DOI: <https://doi.org/10.37162/2618-9631-2024-3-64-76>

Applicability of spline approximation in recovering the initial water temperature field in the problem of forecasting the Caspian Sea ice thickness / Pressman D.Ya. // Hydrometeorological Research and Forecasting, 2024, no. 3 (393), pp. 77-89.

The method of crude approximation of an initial profile of temperature of seawater and the underlying ground layer from the data on 10 m wind speed, atmosphere bottom temperature and pressure, ice thickness, ground type, and long-term temperature at the bottom of the distinguished ground layer is considered. An example of applying such profile as initial in 3-day forecasting of the sea ice thickness is presented. Throughout the entire forecast period, the values of 2 m air temperature, 10 m wind speed, and surface pressure and radiation fluxes must be specified.

Keywords: spline interpolation, convective and wind-induced mixing, difference approximation, heat conductivity equation, dynamical velocity, point of heat flux jump

Fig. 7. Ref. 8.

DOI: <https://doi.org/10.37162/2618-9631-2024-3-77-89>

Forecast of ice cover thickness in coastal areas of the Kara and Okhotsk seas / Jupanov V.D., Nesterov E.S. // Hydrometeorological Research and Forecasting, 2024, no. 3 (393), pp. 90-104.

Based on the CICE viscoplastic sea ice model, the ice cover of the Gulf of Ob and the northwestern Okhotsk Sea was simulated for the winter seasons of 2021/2022, 2022/2023, and 2023/2024. The description of the seasonal variability of sea ice characteristics in these areas and examples of their numerical modeling are given. Using atmospheric forcing based on the WRF-ARW nonhydrostatic atmospheric model, the sea ice thickness in the northwestern Okhotsk Sea was predicted for April 2024. A comparison of the forecasts with the ice maps of the Hydrometcentre of Russia and sea ice thickness measurements at the Ayan and Bolshoy Shantar stations gave satisfactory results.

Keywords: CICE sea ice model, ice cover, Gulf of Ob, northwestern Okhotsk Sea

Tab. 3. Fig. 3. Ref. 26.

DOI: <https://doi.org/10.37162/2618-9631-2024-3-90-104>

Development of the snow cover dynamics model of the Hydrometeorological Center of Russia / Simonov Yu.A., Semenova N.K. // Hydrometeorological Research and Forecasting, 2024, no. 3 (393), pp. 105-123.

Conceptual models of runoff formation used in the operational practice of hydrological forecasting by the Hydrometeorological Center of Russia include simplified parameterization of snow cover dynamics based on the use of snow cover melting coefficient, water-retaining capacity of snow and secondary freezing of meltwater in case of return of negative air temperatures. This schematization of the process is well established for the reliable calculation of the snow water equivalent for subsequent use in the calculation of meltwater inflow to the catchment surface and the calculation of streamflow characteristics. At the same time, the lack of calculation of snow density and snow height in the used schematization restricts the use of schemes for calculating of soil freezing depth in hydrological models, which seems to be extremely important for modelling runoff on mid-latitudes rivers, i.e. for the most Russian rivers. To overcome this disadvantage, the snow density and snow height parameterization was added to the calculation scheme of the model, which was verified using Roshydromet's snow measurement routes data and shown a good and satisfactory quality of modeling of model characteristics.

Keywords: snow cover model, hydrological forecasts, conceptual hydrological model
Tab. 3. Fig. 7. Ref. 24.

DOI: <https://doi.org/10.37162/2618-9631-2024-3-105-123>

Features of the Yenisei River long phases of increased/decreased water flow (downstream from the confluence of the Angara River) / Georgiadi A.G., Milyukova I.P., Barabanova E.A., Alentyev Yu.Yu.// Hydrometeorological Research and Forecasting, 2024, no. 3 (393), pp. 124-141.

The article presents the results of studying long phases of decreased and increased conditionally natural annual and seasonal water flow of the Yenisei River at Kyzyl City, Nikitino and Bazaikha settlements. The retrieval of long-term water flow time series (with excluded anthropogenic changes) at Nikitino and Bazaikha settlements is based on the transformation of the annual hydrograph of daily water discharges using the Kalinin–Milyukov method. Long phases of annual and seasonal water flow were revealed on the basis of cumulative deviations curves. For the entire observation period of 1936–2021, two long contrasting phases were revealed for winter flow, which are typical for many studied rivers in Russia. At the same time, long-term changes in runoff of the combined season of snowmelt flood and summer-autumn rain floods, as well as annual water flow, were characterized by a four- to five-fold change in contrasting phases. The duration of contrasting phases reached more than 50 years, and the phases of decreased water flow were significantly longer than the phases of increased flow. The difference in the water flow of contrasting phases of the Yenisei River is most significant for winter flow and is on average equal to 20–40 %, and the one for annual flow and flow in the season of snowmelt floods and summer-autumn rain floods is 9–12 %.

Keywords: annual and seasonal water flow, long-term changes, long phases, hydrograph transformation method, cumulative deviation curve
Tab. 6. Fig. 4. Ref. 25.

DOI: <https://doi.org/10.37162/2618-9631-2024-3-124-141>

Assessment of the possibility of using satellite information for monitoring droughts in the southern regions of Russia / Kleshchenko A.D., Savitskaya O.V. // Hydrometeorological Research and Forecasting, 2024, no. 3 (393), pp. 142-157.

A brief description of the automated operational system for 10-day monitoring of droughts developed and operating at the Drought Monitoring Center of the All-Russian Research Institute of Agricultural Meteorology is provided. The system uses meteorological information from the network of weather stations. To obtain more detailed information on the spatial distribution of droughts, it is proposed to use satellite information (VIRS scanner of the SUOMI NPP satellite) along with ground-based data. For this purpose, it is proposed to calibrate satellite information (VCI index) based on ground information (HTC index) using test sites located near weather stations. Calculations of the aridity assessment for the territory of the considered federal districts using the proposed method are presented. Satisfactory convergence with the data obtained from ground information is observed. It is planned to refine the proposed procedure to operational application.

Keywords: drought, satellite information, NDVI, VCI, Selyaninov hydrothermal coefficient, calibration curves

Tab. 1. Fig. 5. Ref. 11.

DOI: <https://doi.org/10.37162/2618-9631-2024-3-142-157>