DOI: https://doi.org/10.37162/2618-9631-2024-1-6-23

Application of stochastic parameter perturbations in SL-AV model version for long-range forecasting / Alipova K.A., Tolstykh M.A., Fadeev R.Yu. // Hydrometeorological Research and Forecasting, 2024, no. 1 (391), pp. 6-23.

The paper examines the impact of applying the disturbances of parameters for the schemes describing subgrid-scale processes in the SL-AV atmosphere model on the characteristics of average monthly atmospheric circulation in ensemble subseasonal forecasts. 25-year retrospective forecasts are computed for different seasons with different perturbation sets, the results are compared with forecasts without perturbations. It is shown that perturbing three parameters reduces forecast errors of some variables as compared to undisturbed forecasts without introducing errors into integral characteristics.

Keywords: long-range weather forecasting, stochastic perturbation of parametrization parameters, SL-AV global atmospheric model

Tab. 3. Fig. 7. Ref. 25.

DOI: https://doi.org/10.37162/2618-9631-2024-1-24-40

Analysis of seasonal variability in wind wave spectra in the Black and Azov Seas based on classification / Rybalko A.D., Myslenkov S.A., Arkhipkin V.S. // Hydrometeorological Research and Forecasting, 2024, no. 1 (391), pp. 24-40.

Based on year 2020, the seasonal variability of wind wave frequency spectra in the Black and Azov Seas is studied. Eight points representing areas with different characteristics and wind wave regimes were selected for analysis. Frequency spectra for these points were obtained using the WAVEWATCH III model. To describe the variability of the spectra, 23 reference spectra were identified based on cluster analysis for further classification. The classes differed from each other in terms of the peak frequency and the value of the maximum spectral density. It was shown that in the Sea of Azov, spectra with low spectral density and peak frequencies above 0.2 Hz predominate. Even during the cold season, the peak frequency generally exceeds 0.15 Hz, and spectral density values rarely exceed 2 m^2/Hz. In the Black Sea, the peak frequency exceeds 0.1 Hz in all seasons. Spectral density values exceeding 5 m^2/Hz are primarily observed during the cold half of the year. Additionally, the classes repeatability depending on the direction of wave propagation across seasons was analyzed. It was shown that the dominant direction does not always coincide with the direction of wave propagation, whose spectra have the highest spectral density.

Keywords: Black Sea, Sea of Azov, seasonal variability of wind waves, frequency spectra of wind waves, reference spectra, spectra classification

Tab. 1. Fig. 4. Ref. 29.

DOI: https://doi.org/10.37162/2618-9631-2024-1-41-55

Recurrence of storms in the Laptev Sea, East Siberian and Chukchi Seas / Myslenkov S.A., Kruglova E.E., Bagatinsky V.A. // Hydrometeorological Research and Forecasting, 2024, no. 1 (391), pp. 41-55.

The analysis of number of storms in the Laptev Sea, East Siberian and Chukchi Seas according to modeling data from 1979 to 2021, taking into account the ice situation, is presented. The number of storm events is calculated based on the Peak Over Threshold method. The significant wave height of 2-5 m was taken as the threshold values. The number of storms with a wave height of more than 2 m in the Laptev Sea averages about 20 times a year, more than 3 m – about 8 times. In the East Siberian Sea, cases with a wave height of more than 2 m are observed on average about 23 times a year. In 1990, a local maximum of 28 storms with a height of more than 3 m was observed. Cases with a wave height of more than 2 m in the Chukchi Sea are observed on average about 39 times a year, more than 3 m – about 24 times. The trends in number of storms for all the seas under consideration are positive and significant.

Keywords: Laptev Sea, Chukchi Sea, East Siberian Sea, wave modeling, wind wave, number of storms, WAVEWATCH III

Fig. 6. Ref. 27.

DOI: https://doi.org/10.37162/2618-9631-2024-1-56-70

Influence of atmospheric circulation fluctuations on the Caspian Sea level / Nesterov E.S., Pavlova A.V. // Hydrometeorological Research and Forecasting, 2024, no. 1 (391), pp. 56-70.

Changes in the Caspian Sea level from 1950 to 2023 are considered. The focus is on the intense sea level drop from 2005 to 2023. During this period, as a result of global warming, the number of cases of westerlies blocking in the summer atmosphere increased, which led to an air temperature rise in the Caspian Sea region. The influence on these processes of the negative phases of the EA/WR (East Atlantic-Western Russia) and NAO (North Atlantic Oscillation) atmospheric circulation patterns that set in after 2000 is confirmed. It is assumed that the air temperature rise contributed to intense evaporation from the surface of the Caspian Sea and the drop of its level.

Keywords: Caspian Sea, sea level, atmospheric circulation fluctuations, global warming, evaporation

Fig. 6. Ref. 33.

DOI: https://doi.org/10.37162/2618-9631-2024-1-71-117

Selection of methods for streamflow forecasting / Borshch S.V., Simonov Yu.A., Khristoforov A.V. // Hydrometeorological Research and Forecasting, 2024, no. 1 (391), pp. 71-117.

The selection of methods for streamflow forecasting is considered, taking into account factors that limit the lead time and accuracy of forecasts, consumer requirements, and the results of applying these methods for specific water bodies. Methods that allow their mass implementation in an automated mode are recommended as the most effective. Examples of successful implementation of these recommendations in streamflow forecasting in Russia based on the methods developed at the Hydrometcentre of Russia are shown. The proposed recommendations are aimed to increase the scientific validity and efficiency of implementing operational decisions on the use of water resources and protection from dangerous hydrological events.

Keywords: Streamflow, forecasts, methods, lead time, accuracy, comparison, factors, economic efficiency, mass implementation, automated mode, selection, recommendations

Tab. 8. Ref. 60.

DOI: https://doi.org/10.37162/2618-9631-2024-1-118-134

Short- and medium-range streamflow forecasting of the Don basin rivers / Khristoforov A.V. // Hydrometeorological Research and Forecasting, 2024, no. 1 (391), pp. 118-134.

For the rivers of the Don basin, the Hydrometcentre of Russia has developed a methodology for daily short- and medium-range forecasting of streamflow and water levels. Average daily discharges and water levels are predicted throughout the year with a lead time of 1 to 10 days based on the hydrograph extrapolation method, which takes into account their values for the date of the forecast and for the previous 5 days. To estimate the parameters of the forecasting scheme, hydrological observation data for each river section are used.

The technique gives satisfactory results and can be used within the framework of an automated system for preparing and issuing forecasts in order to provide necessary forecast information for making operational decisions on the use of water resources of the Don basin rivers and protecting the population from dangerous floods.

Keywords: Water discharge, water levels, forecast, lead time, verification, error, forecast accuracy

Tab. 5. Fig. 3. Ref. 14.

DOI: https://doi.org/10.37162/2618-9631-2024-1-135-151

Assessment of the climatic and anthropogenic contribution to long-term fluctuations in seasonal river runoff in the Ural river basin / Yumina N.M., Magritsky D.V. // Hydrometeorological Research and Forecasting, 2024, no. 1 (391), pp. 135-151.

The analysis of long-term fluctuations in seasonal runoff of the Ural basin rivers is performed, statistical relationships between runoff and the main meteorological factors (air temperature and precipitation) are estimated. Weather stations with the highest correlation between the main meteorological factors and seasonal runoff of the Ural, Sakmara, and Ilek rivers are selected. Empirical dependences of seasonal runoff on air temperature and total precipitation are substantiated for three hydrological stations located on these rivers during the period with minimum anthropogenic load on water resources (slightly disturbed runoff). Their statistical and graph-analytical analysis showed that they have a fairly high correlation for the period of spring flooding and the summer-autumn season, and the dependences for the period of winter low water are much less accurate. Based on the constructed dependencies for a period of significant anthropogenic load on the water resources of the region, a comparative analysis of the calculated (undisturbed) seasonal runoff of the Ural, Sakmara, and Ilek rivers with the observed one is performed.

Keywords: Ural, seasonal runoff, air temperature, precipitation, empirical dependences, correlation

Tab. 3. Fig. 2. Ref. 26.

DOI: https://doi.org/10.37162/2618-9631-2024-1-152-170

Regional features of the dynamics of thermal comfort indicators in a changing climate / Semenova A.A., Saltykova M.M., Banchenko A.D. // Hydrometeorological Research and Forecasting, 2024, no. 1 (391), pp. 152-170.

The regional changes in climate comfort for the territories located in different climate zones are analyzed. The Universal Thermal Climate Index (UTCI) is used to assess bioclimatic conditions. The eight-time observation data on the following parameters from six Roshydromet weather stations were used for calculations: air temperature, wind speed, relative humidity, soil surface temperature, and cloudiness for 56 years from 1966 to 2021. It was found that climate change and its impact on human comfort in different climate zones occur at different rates. For all territories, cold stress decreases in the cold season, and heat stress increases in the warm season. It is noted that the average annual total number of extremely discomfort days has decreased over 56 years. The main factor determining the revealed dynamics of UTCI and characteristic for cities both in the continental part of Russian Federation and on the coast of the oceans is the air temperature rise in winter and summer and the wind speed decrease in winter.

Keywords: climate change, comfort, thermal comfort, regional features, public health, Universal Thermal Climate Index (UTCI)

Tab. 8. Fig. 2. Ref. 28.