

**The  $\sigma$ -level algorithm for the spectral model of the Hydrometcentre of Russia /** Tsvetkov V.I. // Hydrometeorological Research and Forecasting, 2019, no. 2 (372), pp. 6-11.

An algorithm for selecting the  $\sigma$ -levels based on the roots of Chebyshev- Laguerre orthogonal polynomials is developed. This provides the highest algebraic accuracy of integration quadrature formulas. This fact allows increasing the accuracy of vertical interpolation of variables in the numerical scheme of the spectral atmosphere model without additional costs.

*Keywords:* vertical structure, quadrature formulas, polynomials

Fig. 4. Ref. 5.

**Operational precipitation nowcasting system based on radar data and comparative pointwise verification results for the warm and cold seasons/** Muravev A.V., Kiktev D.B., Smirnov A.V., Zaichenko M.Yu. // Hydrometeorological Research and Forecasting, 2019, no. 2 (372), pp. 12-40.

The article presents the results of testing the operational precipitation nowcasting system of the Hydrometcentre of Russia during the cold season (November 2017 – March 2018) based on data of nine radars located on the European territory of Russia. These results supplement the earlier testing for the warm season (May – September 2017). Key attention is given to the pointwise forecast verification compared to the similar quality assessment for the warm period. It is demonstrated that the precipitation nowcasting during the cold season is more informative as against the warm period, when evaluated using the correlation coefficient (COR), and that it is comparable in terms of the systematic bias (BIAS). Given that in the examined period the precipitation intensity was half the intensity observed in the previous warm season, the comparison based on categorical scores like the Pierce skill score (PSS) and the equitable threat score (ETS) has resulted in ambiguous conclusions for different intensity thresholds. Stronger effects of ground clutters and other radiolocation features on the verification results have been observed for the cold period.

*Keywords:* precipitation nowcasting, radar precipitation estimates, precipitation field forecast verification, comparative forecast quality characteristics for the warm and cold seasons

Tab. 6. Fig. 9. Ref. 10.

**Specific features of the conditions of occurrence of active convection accompanied by severe squalls /** Alekseeva A.A. // Hydrometeorological Research and Forecasting, 2019, no. 2 (372), pp. 41-58.

The results of quantification of the influence of the maximum convective velocity, surface air pressure Laplacian, and wind in the middle and lower troposphere on the velocity of severe squalls are presented. The study showed that the most informative predictors for the squall prediction are the maximum convective velocity and surface air pressure Laplacian. The surface air pressure Laplacian allows identifying a zone of the complete absence of squalls. The criteria of the considered atmospheric parameters favorable for the occurrence of severe squalls are found and substantiated. A significant role of the velocity of horizontal transport in the middle troposphere in the occurrence of severe squalls is corroborated. Its influence on the increase (by ~4-4.5 m/s) in the maximum wind speed during a squall is demonstrated, although its contribution is about four times smaller than that of vertical convective velocities and is 2-2.5 times smaller than that of the surface air pressure Laplacian.

*Keywords:* squall, the influence of atmospheric parameters on wind speed, maximum convective velocity, surface air pressure Laplacian, velocity of horizontal transport in the middle troposphere

Tab. 2. Fig. 5. Ref. 13.

**Regime of low clouds and ceiling forecasting at the aerodromes of Asian Russia** / Shakina N.P., Skriptunova E.N. // Hydrometeorological Research and Forecasting, 2019, no. 2 (372), pp. 59-75.

Based on the METAR aerodrome observations, data on the occurrence frequency of low clouds (the ceiling is  $\leq 1500$  m) at 41 aerodromes in Asian Russia and the neighboring republics of the former USSR are presented for the ceiling ranges, the annual cycle, and various wind directions and wind speed. The possibility of the ceiling short-range forecasting based on the COSMO-Ru13 model output data is estimated. Statistical relationships (with significant Peirce and Heidke skill scores) are obtained for the forecasts of clouds with the amount of  $\geq 5$  oktas with the ceiling of  $\leq 300$  m with the 12- and 24-hour lead time for 19 and 16 aerodromes, respectively. Model output data on temperature, humidity, wind speed, and cloud amount are used as predictors.

*Keywords:* low clouds, aerodrome observations, numerical prediction, post-processing, COSMO-Ru13 model, aviation forecasting

Tab. 6. Fig. 5. Ref. 10.

**The impact of large-scale atmospheric circulation in the Northwest Pacific on the group of interacting cyclones** / Pokhil A.E. // Hydrometeorological Research and Forecasting, 2019, no. 2 (372), pp. 76-91.

The movement and evolution of a group of three tropical cyclones (TC) in the Pacific Ocean in 2016 are investigated. The interaction of TCs with each other and with the surrounding atmosphere is analyzed using satellite data and the series of numerical experiments based on the barotropic atmosphere model. It is shown that the unusual trajectory of TC Lionrock is caused by its interaction with two other cyclones. This interaction was terminated as a result of the influence of the polar atmospheric front.

*Keywords:* tropical cyclones, interaction, satellite data, barotropic model, numerical experiments

Tab. 1. Fig. 9. Ref. 14.

**Peculiarities of deep cyclones formation in the North Atlantic autumn** / Nesterov E.S., Pokhil A.E., Fedorenko A.V. // Hydrometeorological Research and Forecasting, 2019, no. 2 (372), pp. 92-101.

The movement and evolution of tropical cyclones Omar and Helen in the North Atlantic are analyzed. It is shown that satellite information in the water vapor range ( $6.2 \mu\text{m}$ ) gives a good idea of how the interaction between the tropical and polar-front cyclones leads to the transfer of tropical cyclone energy to extratropical cyclones and to their strengthening. Extratropical cyclones powered by tropical cyclones have a significant impact on weather in Western Europe and cause storm waves in the seas.

*Keywords:* tropical cyclones, North Atlantic, interaction, water vapor

Fig. 9. Ref. 12.

**Surface ozone regime at Kara Dag station in Crimea according to observations in 2009-2018** / Shalygina I.Yu., Kuznetsova I.N., Lapchenko V.A. // Hydrometeorological Research and Forecasting, 2019, no. 2 (372), pp. 102-113.

The characteristics of seasonal and daily variations of surface ozone values on the coast of Crimea (at Kara Dag background environmental monitoring station) averaged over the ten-year period (2009-2018) are presented. The interannual variability and trends in the average annual surface ozone are discussed. It is found that the surface ozone regime at the station is close to the surface ozone characteristics at the lowland stations in the middle and low latitudes of Europe. However, it is characterized by the higher concentrations due to the prevalence of increased concentrations in the dark. In the annual course, there are two maxima of surface ozone: in April and August; the annual minimum of surface ozone is observed in October to February. The average daily variations in surface ozone are almost not pronounced in winter; in the other seasons, the average daily surface ozone amplitude is  $15 \mu\text{g}/\text{m}^3$ , and it is equal to  $\sim 20 \mu\text{g}/\text{m}^3$  in summer. The highest surface ozone values observed in dry hot weather are of advective nature. An abnormally high surface ozone level in 2011 and possible causes for this phenomenon are discussed.

*Keywords:* surface ozone, trace gases, nature reserve, seasonal and daily variations, maximum permissible concentrations

Tab. 2. Fig. 3. Ref. 27.

**Estimation of swell parameters for the storm prediction** / Kovalev P.D., Kovalev D.P., Khuzeeva M.O. // Hydrometeorological Research and Forecasting, 2019, no. 2 (372), pp. 114-128.

A further detailed study of storm waves on the southeastern coast of Sakhalin Island is carried out using data of swell measurements at two points of the coastal zone and weather charts. It is found that the periods of swell before the storm decreased following the nonlinear law. The analysis of weather charts revealed that the cyclones moving over the Asian continent to the east or from the south to the northeast as they move to the east contribute to the development of northeastern winds over the Sea of Japan. These are the synoptic conditions which cause the generation of long waves of swell in the Sea of Japan which comes to the area of the wave gage location. The estimates of the rate of temporal variation in the swell period showed that the wave period decreases with time nonlinearly and is approximated by a polynomial. The calculations of the swell period variation rate allow estimating the time of the storm arrival to the observation point based on the measured swell periods and using it together with other hydrometeorological information as a storm harbinger which allows increasing the safety of small-size vessel navigation.

*Keywords:* swell, wave dispersion properties, group velocity

Fig. 7. Ref. 15.

**An automated method for the short-range forecasting of water level in the basin of the Middle Ob and Lower Irtysh** / Burakov D.A., Volkovskaya N.P., Ivanova O.I. // Hydrometeorological Research and Forecasting, 2019, no. 2 (372), pp. 129-143.

A mathematical model is proposed for the short-range forecasting of water level in the basin of the Middle Ob and Lower Irtysh. The features of the runoff formation on the analyzed territory are shown. A method for the forecast calculation is presented. The model consists of submodels whose modules for the altitudinal zones of each region provide calculations of snow accumulation, snowmelt, water yield from thawed and rain water, surface inflow, and channel lag. The developed model software allows the experiments based on the modeling of the value of daily water discharge and water level during the summer-autumn period for the following locations: Nizhnevartovsk, Belogor'e, Khanty-Mansiysk, Omsk, Tara, Tevriz, Ust'-Ishim. According to the accepted standards, the results allow assessing the forecast model quality as good.

*Keywords:* Lower Irtysh, Middle Ob, hydrological and mathematical model, spring flood forecast, snowmelt, water yield from thawed and rain water, surface inflow, channel lag

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

**The main features of the influence of weather conditions on the productivity of grain crops in the Republic of Tatarstan** / Mustafina A.B. // Hydrometeorological Research and Forecasting, 2019, no. 2 (372), pp. 144-153.

The influence of weather conditions on the productivity of grain crops in the Republic of Tatarstan during 1995-2017 is analyzed. The correlation between the productivity of grain crops and some parameters of temperature and humidity conditions is found. The climatic component of variability of grain crop yields is calculated by the technique by V.M. Pasov according to which moderate and steady yields are observed in the Republic of Tatarstan. It is shown that the productivity of grain crops increases if enough rainfall is registered in the first half of the vegetation period, and, on the contrary, high air temperatures at the beginning of the vegetation period lead to the productivity reduction. The negative dependence between the productivity of grain crops and the Ped's aridity index is revealed.

*Ключевые слова:* productivity of grain crops, V.M. Pasov's technique, air temperature, precipitation, drought, Ped's aridity index

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