HYDRODYNAMIC - STATISTICAL MODEL OF OPERATIVE FORECAST TO 12-36H AHEAD OF STORM WINDS INCLUDING SQUALLS AND TORNADOES AT THE TERRITORY OF SIBERIA

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The territory of Siberia is more great then territory of European part of Russia. Development of successful method of forecast of storm summer winds, including squalls and tornadoes, that often result in human and material losses, could allow one to take proper measures against destruction of buildings and to protect people. Well-in-advance successful forecast (from 12 hours to 36 hour) makes possible to reduce the losses. Prediction of the phenomena involved is a very difficult problem for synoptic of Siberia till nowdays. The existing graphic and calculation methods still depend on subjective decision of an operator.

At the present time in Russia there is no hydrodynamic model for forecast of the maximal speed of wind over then 25m|c, hence the main tools of objective forecast are statistical methods using the dependence of the phenomena involved on a number of atmospheric parameters (predictors). We have adapted for the territory of Siberia our statistical operative method of forecast of storm wind for Europe /1/.

. Statistical decisive rule of the alternative and probability forecast of these events was obtained in accordance with the concept of “perfect prognosis” using the data of objective analysis. For this purpose the teaching samples of present and absent of this storm wind at the territory of Siberia were automatically arranged that include the values of forty physically substantiated potential predictors.

Then the empirical statistical method was used that involved diagonalization of the mean correlation matrix of the predictors and extraction of diagonal blocks of strongly correlated predictors. Thus for this phenomenon the most informative predictors were selected without loosing information, those predictors being either a representative of each block or an independent informative predictors. The statistical decisive rules for diagnosis and prognosis of the phenomena involved were calculated for the most informative vector-predictor that includes the most informative (we used the criterion of distance of Mahalanobis and criterion of minimum of entropy by Vapnik-Chervonenkis) and slightly dependent predictors. Successful development of hydrodynamic models for short-term forecast and improvement of 36h forecasts of pressure, temperature and others parameters allow us to use the prognostic fields of those models for calculations of the discriminant functions and the values of probabilities of dangerous wind in the nodes thus to get fully automated forecasts.

For prognosis of the phenomenon of the wind with velocity over 25m|c involved with the given advance period 12,24,36 hours the values of the discriminant function and the probabilities of this phenomenon were calculated using the prognostic values of operative hemispherical model of Hydrometeorological Center of Russia in the nodes of the rectangular mesh 150x150 km over the territory of Siberia. In order to change to the alternative forecast the author proposes the empirical threshold values specific for this territory and for phenomenon of two classes (the first class - the wind with velocity V more then 18m/s and the second class – the wind with velocity V more than 24m/s) advance periods 12, 24,36 hours.

According the values of prognostic production (to12-36h ahead) of hemispheric model calculate we the values of prognostic discriminant functions and the prognostic probability values in the nodes of greed for shot-term forecast up to 36h. We carried out the verification

of this hydrodynamic-statistical method for the territory of Siberia. This method turned out successful enough.

The prediction even 36h advance of the summer storm wind (velocity more 24m/s) was so exact:

-V=25m/s in the south of Krasnoyarskiy areal on 18.06.05;

-V=27m/s in Novosibirsk on 24.06.05;

-V=37m/s in Altay on 24.06.05 too;

-V=25m/s in the North Siberia (Turukhansk) on 4.07.05;

-V=26v/s in the South of Teimyr peninsula on 20.07.05.

-V=28m/s in the Chita areal on 24.05.05;

One case of the storm wind V=26m/s in Chita wasn't warned. The value of estimate of the warning is 86%. The error of "false alarm" is not very high, and so the value of Pirsy-Obukhov criterion is T=0,78. We are going to apply this method to the forecast of storm wind at cold season as in European part of Russia /2/. This problem is very actually for Siberia.

For the recognizing of tornadoes at the territory of Siberia we suppose new method of forecast of tornadoes by expert system. Our expert system is developed for any territory and can be applied in other countries /3/.

The territory of Siberia has not very many meteorological stations and so hydrodynamic forecast of storm wind is not successful, but this new statistical method is successful, objective and automated.

The forecast of summer storm wind calculate every day two times per day for day and for night to 12, 24, 36 hours advance. This method is included into operative system of Hydrometeorological Centre of Russia.

Besides we developed the statistical method of forecast of the velocity values of storm wind in separate points by calculation prognostic regression equation. This method isn't operative at our Centre, but all of synoptic of Russia can to use it at your regional meteorological departments.

References

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