



## **Automated Statistical Forecast Method to 36-48H ahead of Storm Wind and Dangerous Precipitation at the Mediterranean Region**

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Development of successful method of forecast of storm winds, including squalls and tornadoes and heavy rainfalls, 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 48 hour) makes possible to reduce the losses. Prediction of the phenomena involved is a very difficult problem for synoptic till recently. The existing graphic and calculation methods still depend on subjective decision of an operator.

Nowadays in Russia there is no hydrodynamic model for forecast of the maximal precipitation and wind velocity  $V > 25\text{m/c}$ , hence the main tools of objective forecast are statistical methods using the dependence of the phenomena involved on a number of atmospheric parameters (predictors).

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 different teaching samples of present and absent of this storm wind and rainfalls 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  $R$  of the predictors and extraction of diagonal blocks of strongly correlated predictors. Thus for these phenomena the most informative predictors were selected without losing information. The statistical decisive rules for diagnosis and prognosis of the phenomena involved  $U(X)$  were calculated for choosing informative vector-predictor. We used the criterion of distance of Mahalanobis and criterion of minimum of entropy by Vapnik-Chervonenkis for the selection predictors.

Successful development of hydrodynamic models for short-term forecast and improvement of 36-48h forecasts of pressure, temperature and others parameters allowed us to use the prognostic fields of those models for calculations of the discriminant functions in the nodes of the grid  $150 \times 150\text{km}$  and the values of probabilities  $P$  of dangerous wind and thus to get fully automated forecasts.

In order to change to the alternative forecast the author proposes the empirical threshold values specified for this phenomenon and advance period 36 hours.

In the accordance to the Pirsey-Obukhov criterion ( $T$ ), the success of these automated statistical methods of forecast of squalls and tornadoes to 36–48 hours ahead and heavy rainfalls in the warm season for the territory of Italy, Spain and Balkan countries is  $T = 1 - a - b = 0,54: 0,78$  after author experiments.

A lot of examples of very successful forecasts of summer storm wind and heavy rainfalls over the Italy and Spain territory are submitted at this report. The same decisive rules were applied to the forecast of these phenomena during cold period in this year too. This winter heavy snowfalls in Spain and in Italy and storm wind at this territory were observed very often. And our forecasts are successful.