



On the forecast of the catastrophic events including disastrous wind and precipitation, floods and landslides at the territory of Russia and Europe

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This report is devoted to the development of the hydrodynamic-statistical model of forecast of catastrophic phenomena including the disastrous winds, likes tornadoes, and precipitation and study of correlations between landslides and floods with dangerous rainfalls and their hydrodynamic-statistical forecast. The probability of forecast of landslides is the function of intensity and duration of heavy rainfalls in the previous two - three days where those events are probable due to the soil structure of soil and the height over the sea level.

The model of the forecast of summer-season half-day precipitation exceeding 50mm/12h is developed using data of the objective analysis on the basis of statistical interpretation of output data of the operative hemispheric hydrodynamic model on the full equations of Hydrometeorological Center of Russia. Before that the problem was solved for selection of the most informative vector-predictor thus reducing the dimension of the space of parameters without noticeable losses of information. For this purpose the sample correlation matrix \mathbf{R} for all potential predictors is calculated. The correlation matrix of predictors \mathbf{R} may be reduced to a diagonal form in which the blocks with strongly dependent predictors are located near the diagonal. For diagonalization of the matrix \mathbf{R} we put it into one-to-one correspondence with a connected graph \mathbf{G} whose sides correspond to couple correlation coefficients r_{ij} of predictors. Depending on the given threshold \mathbf{r} of connectedness r_{ij} , we remove the sides of the graph whose $\mathbf{r}_{ij} > \mathbf{r}$. So the connected graph \mathbf{G} decays into several non-connected

subgraphs G_i and isolated vertices. The most informative vector-predictor includes representatives of the blocks and the predictors corresponding to isolated vertices (the criteria of the informativity are the criterion of the Mahalanobis distance and the criterion of the minimum entropy by Vapnik V.N). The optimum number of predictors in the vector-predictor is usually determined by the number 6-8. This number is connected with quantity of the eigen values of the matrix \mathbf{R} . The number of initial potential predictors for the forecast of dangerous precipitation was about 40 predictors. As the results of the said selection we have chosen the vector-predictor for recognition of dangerous precipitation with the numbers of predictors seven. For the given predictors the discriminant function \mathbf{F} was calculated on the data of objective analysis and was used for the forecast of these phenomena to 12, 24 and 36 h ahead.

For the forecast of storm wind (V more 24 m/c) to 12 - 36 h were placed such method of diagonalization of new matrix \mathbf{R}_1 and selection of the new informative vector-predictor with other discriminant functions $\mathbf{U}(\mathbf{X})$. For the forecast of squalls and tornadoes at the territory of Russia we usually use in the beginning the hydrodynamic-statistical forecast and then we use the expert systems of empirical rules of these events. At the report are given the examples of the forecasts of the floods and of landslides at the North Caucasus and the examples of tornadoes and dangerous squalls at the territory of Russia and Europe.