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Automatic forecast of low-level clouds height

N. Sh. Huseynov and B. M. Malikov
"Azerairnavigation" ATM, Azerbaijan (melikov@azans.az)

One of the primary requirements of aeronautical meteorology is provision of automatically prediction of weather conditions in particular, the low clouds height at the taking off and landing zone. Automatic methods of measurement and processing of the meteorological data in airdromes increases efficiency of the meteorological information.

In this research the regression equations were used for calculation of low level clouds height (30, 60, 90, 120, 150, 180, 210, 240 and 300 m) at various synoptic processes.

The heights distributions integrated curves analysis showed that this curves can be represented as functions of low-level clouds height. In this purposes the equation of logic curve was used

$$P_{>H_i} = \frac{1}{1 + e^{\alpha H_i + \varphi}} \tag{1}$$

$P_{>H_i}$ – probability of excess of low-level clouds height at fixed valueH_i; α and φ - factors.

The function monotonously decreasing, changes within the limits of $0 < P_{>H_i} < 1$ for all values of argument that corresponds to required properties of an integrated curve of distribution of probabilities.

After transformation of the equation (**??**) we have:

$$\ln \frac{1-p}{p} = \alpha \left| H \right| + \varphi \tag{2}$$

Having designated $\ln \frac{1-p}{p}$ through Y, we have linear dependence:

$$Y = \alpha H + \phi \tag{3}$$

The factors α and φ could be calculated using conditional probabilities [1, 2] of the fixed heights calculated with the help of the mentioned above regression equations and applying a method of the least squares:

$$\alpha = \frac{n \sum HY - \sum H \cdot \sum Y}{n \sum H^2 - \left(\sum H \right)^2} \tag{4}$$

$$\varphi = \frac{\sum Y \sum H^2 - \sum H \cdot \sum HY}{n \sum H^2 - \left(\sum H \right)^2} \tag{5}$$

n – Quantity of points used for calculations.

The calculations for the fixed values of heights (30, 60, 90, 120, 150, 180, 210, 240, 270, 300 ì)

$$\alpha = 0,00023 \sum HY - 0,03 \sum Y \tag{6}$$

$$\varphi = 4,4 \sum Y - 0,03 \sum HY \tag{7}$$

show, that sometimes the probabilities of heights exceeding can be 1; in this case probable height of low-level clouds is 300 m; in case when probabilities of excess of the same heights are 0, probable height is conventionally 30 m.

At the landing of the plane it is necessary to know the probable excessive height of low-level clouds in comparison with the valid landing minimum [3]. In each concrete case the determined probabilities will be various. Besides, it is necessary to define, whether this probability exceeds the threshold probability fixed for the given plane.

The evaluation of alternative forecasts show, that objective classification of synoptic processes increases forecasts approval with prediction 6, 3 and 1 h.

The main quadratic deviation of the probabilities of low-level clouds heights excess changes from 5 up to 12 %.

Probability of low-level clouds height was evaluated with the accuracy specified by international standard of ICAO [4, 5].

The possibility of implementation of the automatic forecast of low-level clouds height testifies the advantage of the given method.

References

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