**The method of parameterization of convective cloudiness calculations**

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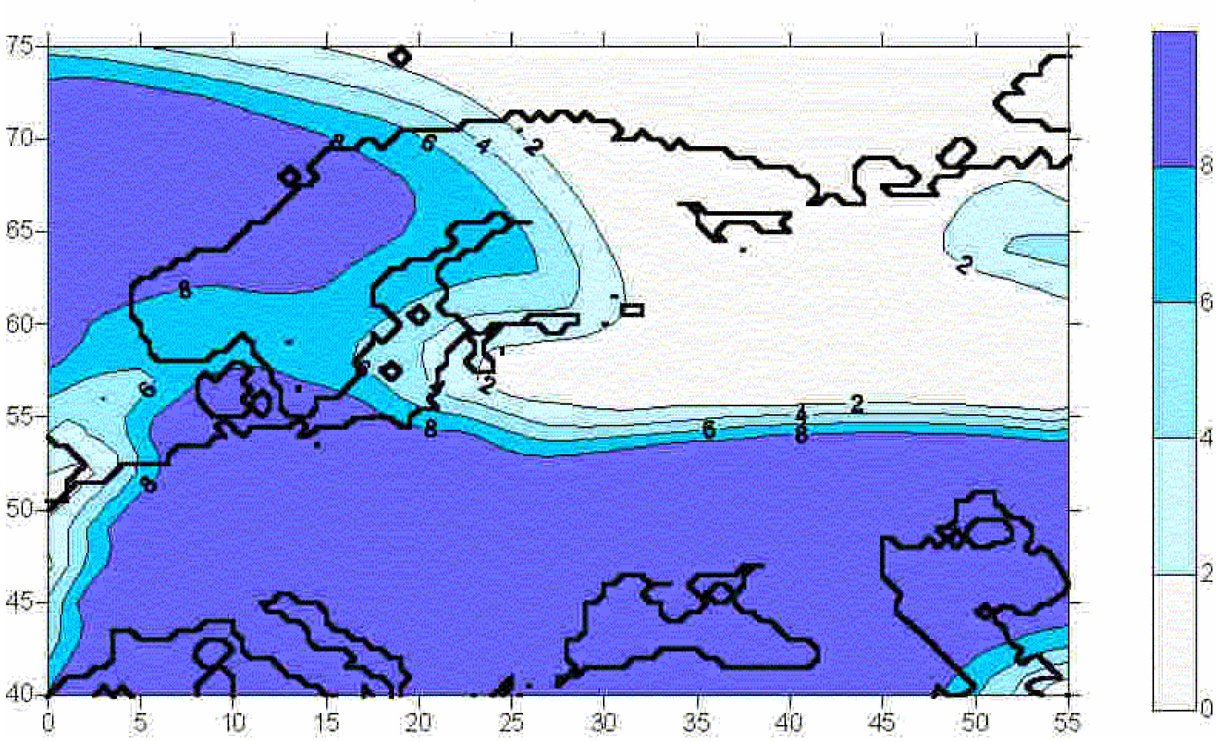
Within the framework of hydrodynamical methods of weather forecast cloudiness has been calculated in the lower, middle and upper levels as one of the principal elements of the forecast. The mentioned cloudiness, which has non-convective character, is the main type of cloudiness forming with the development of large-scale processes due to the evolution of a humidity field of synoptic scale. At the same time in the middle and high latitudes, where Russia is situated, during the warm season the originating cloudiness comprises a substantial part of cloudiness of convective type, which is often accompanied by shower-type precipitation of considerable intensity. Direct calculation of convective cloudiness has been carried out in mesoscale models. In hydrostatic models that describe synoptic processes convective cloudiness can be calculated using parameterization methods. In the algorithm we have implemented the index of convective instability (ICN) B is first calculated:

$$B = T_2 - T_k - \sum_{k=1}^{K} d_k\,, \quad d_k = T_k - T_{dk}\,,$$

where $T_2$ is the temperature at the level 2 m, $T_K$ is the temperature at the surface 500 hPa, $d_k$ is the dew-point $T_{dk}$ deficit, and the levels of 2 m, 925, 850, 700, 500 hPa heights correspond to the values of k = 1, 2, … K. The index B is the modified Whiting stability index, strongly differing nevertheless from the latter one by the fact that prognostic meteorological magnitudes at the levels 2 m and 925 hPa are taken into account. These data are of great importance, since one takes into account the distribution of temperature and humidity in the lower atmospheric layers, where the overwhelming amount of water vapour is grouped. To calculate the ball of convective cloudiness, the following scheme was suggested:

$$N = \frac{B - B_{cr}}{B_{\max} - B_{cr}}\,,$$

Here B is the current value of ICN, $B_{cr}$ is the value of B at which the development of convective cloudiness begins (at $B \le B_{cr}$ $N = 0$), at $B \ge B_{max}$ convective cloudiness is maximal, N = 1. The parameters $B_{cr}$ and $B_{max}$ vary for different geographic regions and different months of the warm season. These values are obtained empirically. For the Moscow area their means are as follows: $B_{cr} = 27$, $B_{max} = 37$. Fields of convective cloudiness have been calculated using the procedure described above. Convective cloudiness is not measured separately. How successful will be its calculation may be estimated by the amount of shower-type precipitation that has fallen and which is measured at a network of meteorological stations. Since in the formula for the cloudiness ball calculation the large-scale parameters are determined using meteorological fields of synoptic scale, the convective cloudiness correlates with the non-convective cloudiness fields. (To efficiently calculate local convective clouds mesoscale models of the atmosphere have to be used.) Such convective-type cloudiness of 8 – 10 balls ($N = 0.8 \div 1.0$) is often accompanied by moderate and heavy shower-type precipitation. The illustration presents the convective cloudiness field forecast for 36 h using the initial data of 8 July 2003 00 h UTC. It is presented in the form of colored background, in accordance with the given scale. This 36-h forecast corresponds to the diurnal period, when convective cloudiness actively develops. The characteristic features of the synoptic situation were a trough over Scandinavia, cyclones with the centers over the Mediterranean Sea and the Caucasus; over the rest of the Eastern Europe territory an area of high pressure was situated. In the region of Moscow within the period under investigation considerable amount of precipitation has fallen (15 – 35 mm per day), with a substantial share of shower rains, which is connected with the development of convective cloudiness. In particular, at the Moscow stations "Exhibition Center" and "Izmaïlovo" major amount of precipitation has fallen (27 and 38 mm a day, respectively), and at the station "Tushino" the lightest precipitation was observed (9 mm a day). In the average at the territory of Moscow the amount of diurnal precipitation was about 18 mm.




The convective cloudiness field forecast at 36 h.
Initial data for 8 July 2003 00 h UTC