Assessment of magnitude of aftershocks due to the earthquake of 2018.01.09, M 3.4 in Khibiny

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The estimation of the probability of aftershocks due to an earthquake of 2018.01.09 at 03:01:01: 00.34 UTC, M3.4 in the Khibiny massif is considered. The essence of the model is to present an aftershock process by the product of the laws of Gutenberg-Richter and Omori-Utsu. Assuming that the number of aftershocks in the time interval has a Poisson distribution, and summing up all the variants using the formula for the total probability, we obtained the probability distribution of the magnitude of the strongest aftershock (M1) as a double exponent. The estimated M1 is the mode of this distribution. The obtained distribution depends on b-value of the Gutenberg-Richter law and the c, p values of the Omori-Uts law. The verification of the M1 model for the earthquake in the Khibiny massif was carried out by the following scheme. The model parameters (b, c, p) were estimated using the data for 0.25 + k days after the mainshock (k = 1,..,31) with Bayes method. M1 was estimated from 0.25 + k to 53 days after the mainshock. Two ways of parameter estimation were tested: (1) without a priori information; (2) using a priori information about the probable values of the parameters obtained from the analysis of empirical distributions of aftershock sequences isolated from the global catalog of earthquakes ANSS ComCat of the United States Geological Survey (USGS). As a priori information, it was assumed that the model parameters have Gaussian distributions with the following characteristics: for parameter b, the average value is 1.12, the standard deviation is 0.3; for parameter p average 1.05; standard deviation 0.15; for parameter lg (c), mean -1, standard deviation 0.74. Calculations showed that for method (1) the average difference between the observed and estimated magnitudes of the strongest aftershock in all time intervals is 0.1, the standard deviation is 0.2; maximum modulus of difference 0.6; for method (2), the mean difference is 0, the standard deviation is 0.1; maximum modulus of difference 0.3. When estimating the parameters according to the data using time up to 5 days after the mainshock, the deviation of the values of M1 estimated by method (1) from the observed values is greater than for those estimated by method (2). That is, when estimating the model parameters with a less of input data, a priori information determines the accuracy of the forecast. Thus, the use of a priori information about the values of the model parameters of significantly improves the forecast compared.