



Simushire Earthquakes of 2006 – 2007 ($M_s=8.3, 8.1$) in Mid Kuriles

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Earthquake of 15.11.2006 ($M_S=8.3$) near. Simushire island (Mid Kuriles) was the strongest for the total period of seismic observations in the area of Mid Kuriles. Magnitudes of the strongest seismic events for region of Mid Kuriles (45° - 48° N) up to 2006 did not exceed 7.5 - 7.7, that approximately on a unit below, than for adjacent segments of an arch.

The seismic history analysis of this part of the Kuril arch, however, very short - hardly more than 100 years, on a course of liberation of the cumulative scalar seismic moment (M_{0cum}) has shown, that practically, since the middle 60th years of XX century, strongly pronounced enough seismic quiescence was observed here. For more then 40 years the earthquakes with magnitude more than 6.8 - 6.9 here were absent. For the time interval from 1965 to 2005 the average total scalar seismic moment for all earthquakes of this region was $M_0 \approx 5.1 \times 10^{18}$ N·m per year whereas for the last 64 years - 2.2×10^{19} N·m per year, i.e. mid-annual M_0 liberation was almost in 4 times less.

Process of M_{0cum} liberation (analogue of Benioff schedule in terms of the scalar seismic moment) for 1901 to 1964 is well enough approximated by log-liner dependence with correlation factor of ~ 0.92 . Extrapolation of this dependence to the middle of November, 2006 and its comparison with actual M_{0cum} value has shown, that by this moment the deficiency in M_{0cum} liberation was at a rate of $\sim 5.7 \cdot 10^{20}$ N·m, that is equivalent to earthquake with $M_W \approx 7.8$. The analysis of a time course of average seismic moment tensor matrix norm (that is called as ordering index (κ)) for period

from 1976 to 2006 has revealed presence of significant κ minimum for 1999 to 2002 (three-year sampling interval were used) and its subsequent abnormal growth directly ahead of 15.11.2006 earthquake. Both of these factors specified an opportunity of occurrence a strong earthquake with $M_W \sim 8$ in Mid Kuriles at least some months prior to its occurrence.

For a month and a half before the earthquake of 15.11.06 a high magnitude foreshocks swarm was preceded (26.09.06 - 13.10.06). Magnitudes (M_S) of four events of the swarm were in range from 6 up to 7. The swarm had been sharply broken on 13.10.06 that was testified to incompleteness of seismic process. The subsequent seismic activation has begun on 12.11.06, and on its background on November, 15th the earthquake with $M_W = 8.3$ occurred. The foreshock process development allowed to predict on deficiency of the scalar seismic moment liberation to the middle of November the earthquake of $M_W \geq 7.5$ occurrence. This value is close enough to an estimation received on the basis of the general analysis of a seismic situation for the period 1901 – 2006.

Aftershock process of 15.11.06 earthquake developed extremely languidly, considering its very high magnitude. It's enough to tell, that almost for two months (15.11.06 - 11.01.07) the share of the seismic moment which has been liberated during the aftershock process, was less than 1.2 % from M_0 of the November, 15th event. The course of M_{0cum} liberation during aftershock process of November, 15th, 2006 earthquake specified an opportunity of occurrence in this area of repeated very strong earthquake with magnitude $M_W \sim 8.0 - 8.1$ which has been occurred on January, 13th, 2007.