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Typical Scenario of Preparation, Implementation, and Aftershock Sequence of a Large Earthquake

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We have tried here to construct and examine the typical scenario of a large earthquake occurrence. The Harvard seismic moment GCMT catalog was used to construct the large earthquake generalized space-time vicinity (LEGV) and to investigate the seismicity behavior in LEGV. LEGV was composed of earthquakes falling into the zone of influence of any of the considerable number (100, 300, or 1,000) of largest earthquakes. The LEGV construction is aimed to enlarge the available statistics, diminish a strong random component, and to reveal in result the typical features of pre- and post-shock seismic activity in more detail. In result of the LEGV construction the character of fore- and aftershock cascades was examined in more detail than it was possible without of the use of the LEGV approach. It was shown also that the mean earthquake magnitude tends to increase, and the b-values, mean mb/mw ratios, apparent stress values, and mean depth tend to decrease. Amplitudes of all these anomalies increase with an approach to a moment of the generalized large earthquake (GLE) as a logarithm of time interval from GLE occurrence. Most of the discussed anomalies agree well with a common scenario of development of instability. Besides of such precursors of common character, one earthquake-specific precursor was found. The revealed decrease of mean earthquake depth during large earthquake preparation testifies probably for the deep fluid involvement in the process. The revealed in LEGV typical features of development of shear instability agree well with results obtained in laboratory acoustic emission (AE) study. Majority of the revealed anomalies appear to have a secondary character and are connected mainly with an increase in a mean earthquake magnitude in LEGV. The mean magnitude increase was shown to be connected mainly with a decrease of a portion of moderate size events (Mw 5.0 - 5.5) in a closer GLE vicinity. We believe that this deficit of moderate size events hardly can be caused by their incomplete registration; we cannot suggest a plausible interpretation of this phenomenon.