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Seismological analysis of strongest South-east Asia (Sumatra) EQ 26.12.2004

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The EQ 26.12.2004, M_w=9, in South-East Asia was the strongest in the world for last 40 years since the Alaskan EQ of 1964. Time series retrospective analysis by two seismic moment tensor invariants of its source area for the period 1976-2004 and aftershock sequence investigation for first four months after EQ were executed. For this purpose EQ catalogue with more then 800 events ($m_b \geq 4.7$) was used.

For retrospective analysis Ordering Index ($0 \leq K_{or} \leq 1$) and determinant of average seismic moment tensor matrix (DASMT) by the sampling interval were used. Let's remind, that Ordering Index (K_{or}) can be considered as a measure of chaotization and high ordering phases of seismic process and is determined through the norm of seismic moment tensor matrix as the ratio of average matrix norm by the sampling interval to the norm of average matrix. The value of determinant of average seismic moment tensor matrix from one side points out on dominated seism tectonic deformation mode in the considered space-temporal volume and from the other side on the fact is seismic process in this volume dominantly represented by double couple or non double couple (NDC) sources. For this purpose more than 200 seismic moment tensor matrixes of background events from CMT catalog (Harvard University) were used. K_{or} time series analysis has shown that from 1978 to 2003 the average value of K_{or} was rather low ($K_{orav} \approx 0.57$) though significant minima before and significant maximums after rather strong background events ($M_w \sim 7$) were observed. Absolute minimum of K_{or} (K_{or} = 0.28) was observed in 1995. Next not so deep minimum takes place in 1999-2000 (K_{or} = 0.45) before strong early foreshock (02.11.2002, M_w=7.3) of the EQ 26.12.2004. Temporal interval including this foreshock was tracked by rather high values of K_{or}($\sim$0.76). Then we have the last minimum (K_{or} = 0.465) immediately before EQ 26.12.2004 in second part of 2003. The main event takes place on the background of K_{or} increasing till K_{or} = 0.77. Time series DASMT analysis have

shown that from 1976 till the moment of EQ 26.12.2004 the dominated contraction mode was observed. The main feature observed was the sharp oscillation of determinant value between foreshock 02.11.02 and the main shock 26.12.04 when the tension mode of deformation replaced to contraction one.

Azimuth (Az) and incidence (Dp) of earthquake source south part (approximately till 8˚N) were estimated by the aftershock field of first few days as Az=326˚, Dp=3˚. These values are in good agreement with focal mechanism solution. Total source's horizontal length (L) was estimated as L≈1200-1300 km. For north part of the source (8˚-14˚N), so called area of slow slip, Az and Dp were estimated as Az≈0˚ and Dp≈2˚. It was shown that second strongest EQ, 28.03.05, M_S=8.5, in this area could be predicted by temporary course of the cumulative scalar seismic moment release during aftershock process development.

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