Source mechanism and triggering process for the April 12th and 13th 2014 earthquake doublet in Solomon Islands

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This abstract is the result of the study carried out on two earthquakes that occurred on 12th and 13th April 2014 in the Solomon Islands., The pair of earthquakes with magnitudes Mw 7.6 and Mw7.4, respectively, occurred near Makira Island (San Cristobal). The depth of the main event (Mw 7.6) was 27 km and depth of the second event (Mw 7.4) was 37 km (Global Centroid Moment Tensor (GCMT). The second event occurred 16 hours later after the Mw 7.6, approximately 20km southwest of the location of the hypocenter of the first event. our study aims to analyze and evaluate the source mechanism for the doublet earthquakes and evaluate the interrelation between the two events, especially to investigate “Why the Solomon Islands has a high rate of doublet earthquakes” (Lay and Kanamori, 1979; Schwartz et al., 1989; Felzer et al., 2004, Yamamoto et al., 2002 and Xu and Schwartz, 1993). The study aims to establish a framework in which to understand the mechanisms of the triggering process for these large doublet events. The study uses static Coulomb stress function to evaluate if the Mw 7.4 earthquake was triggered by static stress changes. Initially, the slip distributions of ruptured faults for the two events was determined to evaluate their source process. This was done by the inversion method of Kikuchi and Kanamori (1991). The teleseismic P waveform data from more than 20 stations Global Seismographic Network in a distance range of 30° *to* 90°, were used in the inversions for both events. The P-waveform data were band-passed filtered between 0.04 and 0.10 hz to obtain the best-fits between the observed waveform and the synthetic waveform. The Green’s functions were calculated and used to determine the slip distribution on the fault planes. Based on an assumed fault plane with fixed strike and dip angles placed in the region of the earthquake hypocenter and divided into subfaults, a constant rupture velocity of 2.5 km/s is assumed and the telseismic data inverted for the slip of each subfaults

The results show that the mechanism for the Mw 7.6 first event is left-lateral strike-slip faulting for a fault plane of strike 116, dip 74, and rake 24 degrees. , The results for the mechanism of the Mw7.4 event indicates thrust faulting on a fault plane-oriented WNW –ESE with two dip angles, i.e. a south dipping fault plane with strike 104 degree, dip 46, rake 86 (Fig 1.7) and a north dipping fault with strike 279, dip 44 and rake 94.

We calculated the values for the Coulomb Failure Stress function at the hypocenter for the second event and obtained a value of +48.59 kPa for the north dipping fault and a value of +18.20.64 kPa for the south dipping plane.

The spatial distribution of aftershocks for 16 hours seems to be more consistent with the northern dipping fault for the triggered event. Both cases, however, show increase of stress changes which encourages the likelihood that the second event was triggered by static Coulomb stress. We proposed a model that might support the complexicity of the region to produce these doublet events.