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

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On 12th and 13th April 2014, a pair of earthquakes with magnitudes Mw 7.6 and Mw7.4, respectively, occurred near Makira Island (San Cristobal) in the Solomon Islands. The depth of the main event (Mw 7.6) was 27 km and the depth of the second event (Mw 7.4) was 37 km respectively (USGS). The second event occurred 16 hours later after the Mw 7.6, approximately 20 km southwest of the location of the hypocenter of Mw 7.6. The study aims to analyze and evaluate the source mechanism for the two-doublet earthquake Mw 7.6 and Mw 7.4 and evaluates if any interrelation between the main event (Mw 7.6) and the second event (Mw 7.4). To understand "why the Solomon Islands has the highest 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). We utilize the role of static Coulomb stress function to evaluate if the Mw 7.4 earthquake was triggered by the static Coulomb stress changes. Initially, the teleseismic P waveform data were retrieved from more than 20 stations for both events from the Global Seismographic Network from azimuthal coverage distances between 30° and 90°. The retrieved P-waveform data were filtered to obtain the best-fit reduction variant between the observed waveform with the synthetic waveform. The retrieved P-wave form data were filtered separately for each event. The cutoff frequency for P –wave filtered separately between 0.04 Hz - 0.1 Hz. The Green's function is utilized to determine the slip distribution on the fault planes where the observed seismogram inverted. Based on the presumption that a fault plane with fixed strike and dip angles placed in the region of the earthquake hypocenter and divided into sub faults, a constant rupture velocity of 2.5 km/s is assumed and the synthetic waveforms are calculated at the teleseismic stations according to the dislocations of each sub faults. We calculated the values for the Coulomb Failure Stress function at the hypocenter for the mechanism of the second event and obtained +48.59 kPa for the north dipping fault and south-dipping fault to be +18.24 kPa. Furthermore, the spatial distribution of aftershocks for 16 hours seems to agree with the northern dipping fault for the triggered event. Both cases, however, show an increase of stress changes which encourages the likelihood that the recipient's fault triggered by static Coulomb Stress Changes. We proposed a model that might support the complexity of the region to produce these doublet events.

Keywords: Earthquake doublet, Source Mechanism, Coulomb Stress, Solomon Islands

