

Doublet Earthquake Triggering for the April 2014 Events in the Solomon Islands

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In 2014 at 20:14 (UTC) on April 12th and 12:36 on April 13th, a doublet earthquake with moment magnitudes of M7.6 and M7.4, respectively occurred near Makira Island (San Cristobal) in the Solomon Islands. The depths of the events were 27 km and 37 km, respectively (GCMT). To understand the interrelation between the first (M7.6) and second (M7.4) events, we check the role of Coulomb stress triggering on aftershocks that follow the M7.6 main shock and the coulomb failure stress changes on both of the focal mechanism nodal planes for the second event. To understand if the coulomb stress triggering played a role in the evolution of the triggered event M7.4 earthquake, we evaluate the transient aftershocks from the M7.6 to see if it promoted failure on the rupture plane for the second event (M7.4). We evaluate the doublet source process of the events and recover the slip distribution on each of the faults. We use an iterative inversion method by Kikuchi and Kanamori (1991) for the teleseismic P waveforms recorded from more than 20 stations of the Global Seismographic Network in a distance range of 30° to 90°. A fault plane with fixed strike and dip is placed in the region of the earthquake hypocenter and divided into subfaults, and a constant rupture velocity of 2.5 km/s is assumed. Synthetic waveforms are calculated at the teleseismic stations for dislocations at each subfault. Using the synthetic Green's functions, the observed seismograms are inverted to determine the fault plane and obtain the distribution of slips for the two events. The results show that the mechanism for the Mw7.6 first event is left-lateral strike-slip faulting for a plane of strike 116, dip 74, and rake 24. The other NW-SE oriented nodal plane is almost parallel to Australian and Pacific plate boundary. Results for the mechanism of the Mw7.4 event indicates thrust faulting on fault plane oriented WNW –ESE with two possible nodal planes. The first plane (NP1) has strike 279, dip 46, rake 86 and the second (NP2) has strike 104, dip 44 and rake 94. The possibility for triggering the second event (M7.4) as influence by the main shock was examined in terms of the Coulomb failure stress function. The components of strain tensor were calculated by using the program DC3D (Okada, 1992). We calculated the changes in normal and shear stress and obtained a value for the Coulomb failure stress function of +148.5 kPa and +88.5 kPa at the hypocenter for NP1 and NP2, respectively. Both cases show increase of stress which encourages the likelihood of triggering on the recipient fault.

Keywords: Earthquake doublet, Triggering, Aftershock, Solomon Islands