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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 27.3 km and 37.5 km, respectively (GCMT). To understand the interrelation between the main shock (M7.6) and the triggered event (M7.4), we check the role of coseismic coulomb stress triggering on aftershocks that follow the M7.6 main shock, the coulomb failure stress changes on both of the focal mechanism nodal planes for the triggered event (M7.4) are calculated. To evaluate the doublet source process of the events, we 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 1.5 km/s is assumed. Synthetic waveforms are calculated at the teleseismic stations for dislocations at each sub-faults. 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 result shows that the mechanism for the Mw7.6 main event shows more pure left-lateral strike-slip faulting with nodal plane of strike 116, dip 74, the NW-SE oriented nodal plane is almost parallel to Australian and Pacific Plates boundary. While result for the mechanism of the Mw7.4 event indicates thrust faulting on fault plane oriented WNW – ESE with two possible nodal plane of NP1 with strike 279, Dip 46, and NP2 with strike 104, Dip 44. The possibility for the triggered event (M7.4) as influence by the main shock was further examined in terms of Coulomb failure stress function. The components of strain tensor were calculated by using the subroutine DC3D (Okada, 1992). Using Hooke's law that leads to the stress tensor, we calculated the changes in normal and shear stress and obtained Coulomb failure stress function of +148.5 kPa and +88.5 kPa at the hypocenter for NP1 and NP2, respectively., in which both cases shows potential to encourage the probability likelihood of triggering the recipient fault.

Reference

M. Kikuchi and H. Kanamori, Note on Teleseismic Body-Wave Invsion Program, http://www.eri.u-tokyo.ac.jp/ETAL/KIKUCHI/

Okada (1992) [Bull. Seism. Soc. Am., 82, 1018-1040]. https://www.iris.edu/hq/iris