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Source process of the Solomon Islands earthquake of April 1st, 2007 (Mw8.1) based on SAR data

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A Mw8.0 earthquake occurred on April 1st, 2007, in the Solomon Islands and caused disasters including tsunami of 10m height. The Solomon Islands are residing on the Pacific plate and the Australian plate and Woodlark plate are subducting beneath the islands. A ridge dividing these plates is subducting in the middle of the source area of the earthquake. It is thus of interest to investigate the source process to clarify the significance of the effect of ridge subduction for the earthquake generation. We used SAR (Synthetic Aperture Radar) data to derive the crustal deformation in the islands. Three tracks that cover the source areas are used and the image data taken before and after the earthquake were processed to make the interferograms. First, we used the previous two source model that were obtained by the seismic wave form inversion were employed. However, noe of the models were able to reproduce the crustal deformations derived from SAR data analysis. Then, we considered some other geophysical information to constrain the source geometry. The multichannel reflection data showed that the main thrust in this region is about 10 degree and a few high-angle splay faults are indicated. Also, vertical deformations using coral reef survey in the region constrained the location of the source faults. Considering these lines of evidence, we introduced two possible source geometry; one is single-segment model and the other is two-segment model. The former model assumes that the rupture propagated on a single shallow dipping (10 degree) fault, and the latter consists of two fault planes; one is high angle splay fault of 30 degree dip and the other is shallow dipping (10 degree) thrust fault. Inversion analysis were conducted and ABIC (Akaike's Baysian Information Criterion) was used to choose the best model. The best model seems to have similar ABIC and cannot be judged which is better. However, considering the observed vertical deformation and CMT solutions suggested that the two-segments model would be preferrable. Estimated slip distribution shows that there are two areas of large slips (asperity) in the north and in the south of the area of ridge subduction. It seemed that the rupture started in the southern asperity and the rupture jumped to the northern asperity. Hot and ductile ridge might decrease the stress accumulation of plate coupling at the ridge subduction. Amounts of slips are generally larger than seismological estimates. This might be because the slip estimates by SAR data might include the effect of post-seismic slip, which was not able to be segregated in the present study. This problem is left for the future study.