2012 Indian Ocean Coseismic Model: Joint Evaluation in 3-D Heterogeneous Earth Structure Inferred from GPS and Tsunami Data

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Determination of conjugate fault orientation in a complex oceanic intraplate earthquake is remaining challenging. Lack of observation network around the fault source region and extremely rare event give the estimation of fault structures become debatable. On April 2012, Mw 8.6 earthquake struck off the west coast of northern Sumatra about 300 km west of the Sunda trench. The 2012 Indian Ocean Earthquake, which is the largest intraplate earthquake in the history of instrumentally recorded events, has been reported to have a complex conjugate fault ruptured within multiple fault segments. The complex conjugate fault has been found to be NNE trending left-lateral fracture zones as the main features (Wei et al. 2013, Satriano et al. 2012) while other found to be WNW trending right-lateral faults structure had greater slip (Yue et al. 2012, Hill et al. 2015). Here, we propose a joint evaluation based on Global Navigation Satellite System (GNSS), ocean bottom pressure sensors, and tsunami waveform recorded at tide gauges by assuming heterogeneous earth structure to resolve the fault orientation. In this study, we develop three-dimensional heterogeneous earth models including subducting slab, 3-D earth velocity structure, topography and bathymetry as well as spherical earth using 3-D Finite Element Method (FEM) to evaluate previous coseismic model. In order to obtain the actual slip distribution within our model, we adjust slip distribution using slip scaling. We conduct iterative model-observation best fit calculation of reduced chi-squared until reach minimum misfit. Furthermore, we propose chi-squared misfit based on slip scaling as another consideration to evaluate the coseismic model.

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