

HOW 3-D FAULT GEOMETRY CONTROLS DYNAMIC EARTHQUAKE RUPTURES? VALIDATE PHYSICS-BASED MODELS WITH RECENT OBSERVATIONS

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We have made systematic validation to develop physics-based models to reproduce dynamic rupture processes of recent large earthquakes. Our models basically consist of those of regional stress fields, 3-D fault geometries and fault frictions, considered in the framework of the dynamic rupture simulations. In order to become the models testable, we constrain the models based on preseismic data as far as possible, and compare the results of the forward modeling with the coseismic observations. The numerical consideration of the realistic 3-D fault geometry have been made it possible with the Fast Domain Partitioning Boundary Integral Equation Method (FDP-BIEM), which is the $O(N^2)$ method for the fully dynamic problem in the elastic half space.

We have targeted several large and middle size earthquakes including the 2014 Northern Nagano earthquake (Ando et al., 2017, EPS), the 2016 Kaikoura (New Zealand) earthquake (Ando and Kaneko, 2018, GRL), the 2018 northern Osaka earthquake and the 2018 Hokkaido Eastern Iburi earthquake. In the case of the Kaikoura earthquake, we successfully reproduced the multi-fault rupture observed by InSAR and the strong ground motion records. We can also reproduce the locations of the rupture arrest on the obliquely oriented fault segments, as controlled by the fault orientations relative to the regional stress field.

Ando & Kaneko 2018, Dynamic rupture simulation reproduces spontaneous multifault rupture and arrest during the 2016 Mw 7.9 Kaikoura earthquake. GRL, doi: 10.1029/2018GL080550.

Ando, Imanishi, Panayotopoulos and Kobayashi, 2017, Dynamic rupture propagation on geometrically complex fault with along-strike variation of fault maturity: insights from the 2014 Northern Nagano earthquake, EPS, doi: 10.1186/s40623-017-0715-2.

