Kinematic and dynamic modeling of the 2015 M_w8.3 Illapel, Chile, earthquake

Hideo Aochi, BRGM, DRP, Orléans, France; Ecole Normale Supérieure Paris, Laboratoire de Géologie - UMR 8538, Paris, France and Sergio Ruiz, Universidad de Chile, Santiago, Chile

Abstract Text:

The purpose of our study is to construct the heterogeneous fault model of the 2015 Mw8.3 Illapel (Chile) earthquake from the view of dynamics, so as to be consistent with the past seismicity and geodetic coupling. In order to better constrain the position of heterogeneity, we carry out kinematic inversions by elliptical patch approximation using cGPS and strong ground motion data. A seismogenic patch is mathematically described by eight parameters such as positions(2), geometry(3), rupture velocity(1), rise time(1) and fault slip(1). We add two more parameters, time shift and rupture directivity. The inversions are carried out through Genetic Algorithm for different frequency bands of data. We find the largest patch in the north, separated from the hypocenter area. A favorite model also shows that the rupture directivity does not come directly from the hypocenter, but rather from depth with some delay (~ tenths seconds). These characteristics support the dynamic rupture model we proposed previously (Aochi & Ruiz, AGU, 2018). A question rises how the rupture has grown up from the hypocenter to the largest patch at distance. We test two cases; rupture grows slowly in a series or the second rupture is triggered at distance. According to the dynamic rupture simulations, the near field ground motion rather infers the second hypothesis in terms of the rupture directivity effects. Thus a reasonable model can be established by combining all the seismological and geodetical data, and such approach will be useful for constructing the scenarios earthquakes in the subduction zones.