3D Modeling of kinematic and dynamic ruptures in anisotropic media

G. Brietzke[1], H. Igel[1], Y. Ben−Zion[2],
Ludwig−Maximilians−Universität, München, Germany[1]
University of Southern California, Los Angeles, USA[2]

We study the behavior of expanding sources and their radiated wave fields in the context of fault zone typical velocity structures and anisotropy (due to cracking) in the surrounding material.

We solve the set of elasto−dynamic equations for the three−dimensional anisotropic case [2] using standard finite difference scheme.

Fault zones are thought to consist of a narrow zone of reduced seismic velocities and considerable material anisotropy due to aligned cracks and fractures. In this study we focus on two questions: How does material anisotropy in the fault zone effect the radiated wave field of expanding directed sources, and how does dynamic rupture propagation interact with the anisotropic media and reduced seismic velocity in the fault zone.

We start with a simple kinematic rupture propagation to search for robust signals in the recorded seismograms and try to classify the effects caused by anisotropy, by velocity variations and by geometry and size of the fault.

The dynamic behavior of seismic rupture processes is controlled by a more complex interaction between pre−existing stress distributions, assumed friction law and the feedback of the radiated wave field. We apply simple slip and slip−rate weakening friction at the fault zone boundary using stress glut method [1]. We study how the anisotropic medium effects the dynamics of the rupture and the recorded seismograms by comparison to the isotropic medium and the kinematic models.

[1] D. J. Andrews, 1999, Test of two methods for faulting in finite−difference calculations. BSSA, 89(4):931−937, 1999.

[2] H. Igel, P. Mora, and B. Riollet. Anisotropic wave propagation through finite difference grids. Geophysics, 60(4):1203−1216, 1995.