Rupture process of the April 16, 2016 Kumamoto earthquake (Mjma7.3) using Seismic Back-Projection and K-NET/KiKnet waveforms

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I investigated the rupture process of the April 16, 2016 Kumamoto earthquake (Mjma7.3) using a seismic back-projection methodology and K-NET/KiKnet waveforms. The method is based on mapping amplitudes of seismogram envelopes observed around the source region, into a temporal and spatial image of the earthquake rupture (Pulido et al. 2008, Suzuki et al. 2016). The main target of this study is to understand the evolution of the rupture velocity during fault rupture propagation. For this purpose we set a horizontal grid mesh of 32 by 118km covering the regions around the Hinagu and Futagawa fault traces and beyond, as the target region for back-projection. Back-projection is calculated without any constraint on the starting point of rupture or rupture speed. We selected all the KNET/KiKnet stations that recorded the earthquake within 100 km (112 stations). The envelopes of acceleration waveforms used for back-projection were calculated as a vectorial summation of the acceleration waveforms band-pass filtered between 5Hz and 10Hz with their Hilbert transform. They start from the origin time of the earthquake and have a duration of 100 s.
Our results are consistent with a fault rupture starting exactly at the Hinet epicenter. The rupture progressed to the SW for approximately 3 s and then to the NE for 7s. The significant grid energy was released in a narrow region of 30km length (rupture zone), along the Futagawa fault. The average rupture velocity for the first 6 sec was very slow (~1.5s) and after 7 sec abruptly increased to a value significantly above the average shear wave velocity. Assuming a continuous rupture propagation this would imply a super shear rupture propagation. Further tests are required to confirm our initial results.

Keywords: strong motion, source process, High frequency

