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Broad-Band Source Process Deduced by Inversion of Low-Frequency Waveforms and High-Frequency Seismogram Envelopes : The M6.1 Earthquake of September 3, 1998 in Iwate, Japan (Abstract)

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We have investigated the source process of the M6.1 earthquake of September 3, 1998, in Iwate, Japan in a broader frequency range by simultaneously conducting inversion analyses of low-frequency waveforms and high-frequency seismogram envelopes. First, we executed an envelope inversion method developed by Nakahara *et al.* (1998) for the frequency band of 2-16 Hz by using envelopes of mean squared velocity seismogram recorded at 7 stations. The envelope Green functions are theoretically synthesized based on the radiative transfer theory including the effect of multiple scattering and intrinsic absorption. The fault plane was assumed as a square of 10 km×10 km. The rupture velocity was estimated at 70% of S-wave velocity. We found that high-frequency seismic wave energy was radiated from the southwestern part of the fault plane. By using the same stations and the same fault geometry as high-frequency analysis, we applied a waveform inversion method to three-component displacement records in the low-frequency band of 0.1-0.3 Hz. The source time function was expressed by three successive Box-car functions. The results show that seismic moment was released mainly at the shallow part of the fault. Total amount of moment release was 3.9×10^{17} Nm. Aftershock activity appears to be low at the region where a large amount of seismic moment was released. Comparing the results of high- and low-frequency analyses, we can find that high-frequency energy was strongly radiated from the periphery of the region where seismic moment was mainly released. This fact implies that radiation of high-frequency energy was associated with the arrest of rupture for this earthquake. The complementary relation between the locations of high- and low-frequency radiation suggests that the rupture propagated smoothly for the most part of the fault plane.