Waveform-based Gradient method for estimating hypocenter mechanism before observing aftershocks

*Louise Anne Cordrie[1], Hitoshi Mikada[2], Junichi Takekawa[2]

1. Ecole et Observatoire des Sciences de la Terre (Strasbourg), 2. Kyoto University

There are a lot of examples in numerical estimation of physical mechanisms of earthquakes. Due to the limitation in the number of available seismographs in the world in the past, the estimation either using CMT solutions or Monte-Carlo type inversion schemes has been dominant in the literature. The former assumes a hypocenter of an earthquake to be a point source, although the fault plain to the earthquake should have some finite physical dimensions, and estimates the mechanism of the earthquakes (strike-slip, normal or reverse). The latter assumes the hypocenter as a group of fault planes to cover the finite-scale earthquake fault and gives the idea which part of the fault plane has worked as asperities, etc. The methods have been used to quickly estimate what kind of earthquake has taken place in a short period after the occurrence of each earthquake but they have limitations. Indeed, the former models earthquakes only using the initial quarter to half the wavelength and ignores any tailing waveforms and the latter assumes the location of a fault plane that caused the earthquake using the distribution of aftershocks. Those have been remaining shortcomings, since we need to watch the distribution of aftershocks carefully to identify the fault location. Since the number of seismometers have been increasing, we may be able to improve the situation to utilize some leading-edge technologies such as wave theories. After the development of a 2D slip fault model, we try to estimate the location of hypocenter only with earthquake waveforms observed by an increased number of seismometers.

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