ESC2016-316, 2016
35th General Assembly of the European Seismological Commission

35th General Assembly of the European Seismological Commission
4–10 September 2016 Trieste

Initial P-wave amplitude evolution for the 2008, Iwate-Miyagi (Japan) earthquake sequence

Simona Colombelli, Gaetano Festa, and Aldo Zollo
Department of Physics "E. Pancini", University of Naples, Federico II

In a recent paper, Colombelli et al. (2014) observed that the initial slope of the P-wave peak displacement could be a discriminant for the final earthquake size, so that small and large ruptures show a different behaviour in their initial stage.

In the present work, we investigated the effect of amplitude decay with distance on the time evolution of the early P-wave amplitude for a small set of co-located events, recorded at the same set of stations and in the same source-to-receiver geometries. We looked at 9 events of the 2008, Iwate-Miyagi sequence, occurred between 2008-06-14 and 2008-06-17. The events have magnitude between 3.2 and 7.2 and have been recorded at 306 stations, for a total of 800, 3-component records. The epicentral coordinates of the events vary in a pretty narrow range, with a maximum distance among the epicenters of about 15 km.
We measured the initial Peak Displacement (Pd) as the absolute value of the vertical component of displacement records, starting from the P-wave arrival time and progressively expanding P-wave Time Window (PTW). For each event, we computed the average logarithm of Pd as a function of the P-wave time window (hereinafter, the LPDT curve), after correcting the observed Pd values at different stations for the distance effect. Similarly, we measured the initial Peak Velocity (Pv) and the initial Peak Acceleration (Pa) on the unfiltered velocity and acceleration records and built the corresponding average functions (i.e. log. Pv vs. PTW, named LPVT curve and log. Pa vs. PTW, named LPAT curve).
We found that the overall shape of the curves is consistent with what has been previously observed for a larger dataset by Colombelli et al. (2014). Globally, for all the three parameters, the initial amplitude begins with small values and then increases with time, until a stable, plateau level is reached and, generally, the greater is the magnitude, the higher is the observed final level.

Based on these observations we further developed a practical approach to rapidly distinguish a small event from a large earthquake, which measures the time evolution of the early recorded peak amplitude parameters. Using the earthquake data of the 2008, Iwate-Miyagi sequence, we investigated a methodology to measure the initial slope variation of the recorded signal. The proposed approach could be used in real-time, in the context of Earthquake Early Warning Applications, to quickly infer the expected size of the ongoing event and eventually activate the issuance of a warning.