特別セミナーのお知らせ/Special seminar announcement

日時/Time：6 月 1 日(木) 13:00～/ June 1 (Thursday), 13:00 ~

場所/Place：理学部 1 号館 462 号室（Science Building No. 1, 4th floor, Room 462）

Title：Full-waveform methods in seismic monitoring operations

Abstract: Microseismic monitoring became a common operation in many seismological and industrial applications, and in the last decade a significant effort has been spent to develop or improve methodologies able to perform seismological analysis for weak events at a local scale. This effort was accompanied by the improvement of monitoring systems, resulting in an increasing number of large microseismicity catalogues. The interest in microseismic monitoring operations, involving a synergy among different scientific communities, is in part due to their occurrence both as a consequence of natural processes in active regions, swarm areas, hydrothermal and volcanic environments, but also in relation to human activities, e.g., in the proximity of mining areas, geothermal systems, oil and gas fields, and water reservoirs. The analysis of microseismicity is challenging because of the large number of recorded events, often characterized by a low signal-to-noise ratio. A significant limitation of the traditional location approaches is that automated picking procedures are often done on each seismogram individually, making little or no use of the coherency information between stations.

In order to improve the performance of the traditional location methods, different full waveform location methods have been recently proposed. These methods exploit the coherence of the waveforms recorded at different stations and do not require any automated picking procedure. The main advantage of these methods relies on their robustness even when the recorded waveforms are very noisy. On the other hand, like any other location method, the location performance strongly depends on the accuracy of the available velocity model. When dealing with inaccurate velocity models, location results can be affected by large errors.

In this work we present a location method which combines some features of relative location techniques (such as the source specific station correction term [Richards-Dinger and Shearer 2000]) with a waveform based location method [Grigoli et al., 2016]. This location approach inherits all the advantages of the full waveform location methods without the main drawback which characterizes all the absolute location procedures. In fact, this method is less dependent on the knowledge of the velocity model and presents several benefits, which improve the location accuracy: 1) it accounts for phase delays due to local site effects, e.g. surface topography or variable sediment thickness 2) theoretical velocity models are only used to estimate travel time within the source volume, and not

along the entire source-sensor path. After successfully testing the method with synthetic data, we applied it to a real dataset related to fluid induced microseismicity associated with magmatic fluid migrations.

References:

Richards-Dinger, K. & Shearer, P., Earthquake locations in southern California obtained using source-specific station terms. Journal of Geophysical Research: Solid Earth (1978-2012) 105, 10939–10960 (2000).

Grigoli, F. et al. Automated microseismic event location using Master-Event Waveform Stacking. Sci. Rep. 6, 25744; doi: 10.1038/srep25744 (2016).