Geophysical Research Abstracts
Vol. 18, EGU2016-14889, 2016
EGU General Assembly 2016

Improved detection of induced seismicity using beamforming techniques: application to traffic light systems

Stephen Hicks (1,3), James Verdon (2), J-Michael Kendal (2), and Phil Hill (1)

(1) Güralp Systems Limited, Midas House, Calleva Park, Reading, United Kingdom (shicks@guralp.com), (2) School of Earth Sciences, University of Bristol, Wills Memorial Building, Queen's Road, Bristol, United Kingdom, (3) Liverpool Earth Observatory, School of Environmental Sciences, University of Liverpool, 4 Brownlow Street, Liverpool, United Kingdom

Unconventional methods of hydrocarbon extraction, such as hydraulic fracturing, have the potential to reactivate existing faults, causing induced seismicity. Traffic Light Schemes have been implemented in some regions; these systems ensure that drilling activities are paused or shut-down if seismic events larger than a given magnitude are induced. In particular, the United Kingdom has imposed a traffic light scheme based on magnitude thresholds of Ml = 0.0 and Ml = 0.5 for the amber and red limits, respectively. Therefore, an effective traffic light scheme in the UK requires monitoring arrays capable of detecting events with Ml < 0.0. However, achieving such low detection thresholds can be challenging where ambient noise levels are high, such as in the UK.

We have developed an algorithm capable of robustly detecting and locating small magnitude events, which are characterised by very low signal-to-noise ratios using small arrays of surface broadband seismometers. We compute STA/LTA functions for each trace, time shift them by theoretical travel-times for a given event location, and combine them via a linear stack.

We test our method using a dataset from a surface array of Güralp 3T broadband seismometers that recorded hydraulic fracturing activities in the central United States. Our beamforming and stacking approach identified a total of 20 events, compared to only 4 events detected by traditional picking methods. We therefore suggest that our approach is suitable for use with low magnitude traffic light schemes, especially in noisy environments.