Geophysical Research Abstracts
Vol. 18, EGU2016-14025-1, 2016
EGU General Assembly 2016

Microseismic network design assessment based on 3D ray tracing

Sven Peter Näsholm, Andreas Wuestefeld, Paul Lubrano-Lavadera, Dominik Lang, Tina Kaschwich, and Volker Oye

NORSAR, Kjeller, Norway (peter@norsar.no)

There is increasing demand on the versatility of microseismic monitoring networks. In early projects, being able to locate any triggers was considered a success. These early successes led to a better understanding of how to extract value from microseismic results. Today operators, regulators, and service providers work closely together in order to find the optimum network design to meet various requirements.

In the current study we demonstrate an integrated and streamlined network capability assessment approach. It is intended for use during the microseismic network design process prior to installation. The assessments are derived from 3D ray tracing between a grid of event points and the sensors. Three aspects are discussed: 1) Magnitude of completeness or detection limit; 2) Event location accuracy; and 3) Ground-motion hazard. The network capability parameters 1) and 2) are estimated at all hypothetic event locations and are presented in the form of maps given a seismic sensor coordinate scenario. In addition, the ray tracing traveltimes permit to estimate the point-spread-functions (PSFs) at the event grid points. PSFs are useful in assessing the resolution and focusing capability of the network for stacking-based event location and imaging methods.

We estimate the performance for a hypothetical network case with 11 sensors. We consider the well-documented region around the San Andreas Fault Observatory at Depth (SAFOD) located north of Parkfield, California. The ray tracing is done through a detailed velocity model which covers a 26.2 by 21.2 km wide area around the SAFOD drill site with a resolution of 200 m both for the P-and S-wave velocities.

Systematic network capability assessment for different sensor site scenarios prior to installation facilitates finding a final design which meets the survey objectives.