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Blast vibration reduction

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Blasting operations in quarries are accompanied by ground vibrations which can endanger buildings nearby. A production blast is made of several holes with a small distance to each other, which are blasted with a time delay, for the purpose of production and to reduce the ground vibrations. These production blasts produce a specific radiation pattern. It would be favorable to focus the ground vibrations to a less sensitive direction or area. We want to be able to predict the ground vibrations for a realistic inhomogeneous case at an area around the iron ore mine at mount Erzberg in Austria. Therefore a numerical forward modeling on a 3D model of the iron ore mine and its surrounding area was performed with a 3D elastic code with topography. The 3D model itself is the result of a tomographic travel time inversion. One problem is that the spectral response of a single blast is unknown and therefore we had to find a transfer function which transfers the numeric spectral response to the observed spectral response. After applying the transfer function the amplitude spectra of the numerical solution show a good match to the amplitude spectra of the observed production blasts. In this study, we investigate, if a reduction of ground vibrations can be achieved by blasting simultaneously two arrays with optimized time delays. To achieve that optimized time delays we developed a global search algorithm, based on Markov chain Monte Carlo method which finds potential blast configurations, with minimum impact to critical locations near the quarry. This study is part of the EU-funded project SLIM (Sustainable Low Impact Mining, www.slim-project.eu).