**Zhao, X.P., J.M. Reyes-Montes, and R.P. Young. (2013) Time-lapse velocities for locations of microseismic events - a numerical example.** ***The 75th EAGE Annual Meeting*****, London, UK.**

# Time-lapse velocities for locations of microseismic events - a numerical example

## Abstract

The accuracy in the location of microseismic (MS) events relies, among other factors, on the use of a realistic velocity model in the forward calculation of travel times. During the hydraulic stimulation of deep rock reservoirs, the physical properties of the rock are altered and therefore the velocity structure is subject to changes along the treatment. In this paper, a numerical study using the distinct element method and the cross-correlation technique is carried out to measure velocities in a naturally fractured geothermal reservoir in order to better understand the relationship between induced microseismicity and fractures, fluid pressure and seismic velocity anisotropy. The fracture damage zone and fluid permeable zone were successfully correlated with the time-lapse velocity changes extracted from the numerical model. The model offers the unique ability to examine directly the microprocesses leading to macroscopic velocity changes. Validated models could be extended to quantitatively calibrate velocities required for microseismic locations over time, and predict the fracture propagation and fluid migration within a field-scale engineered reservoir.

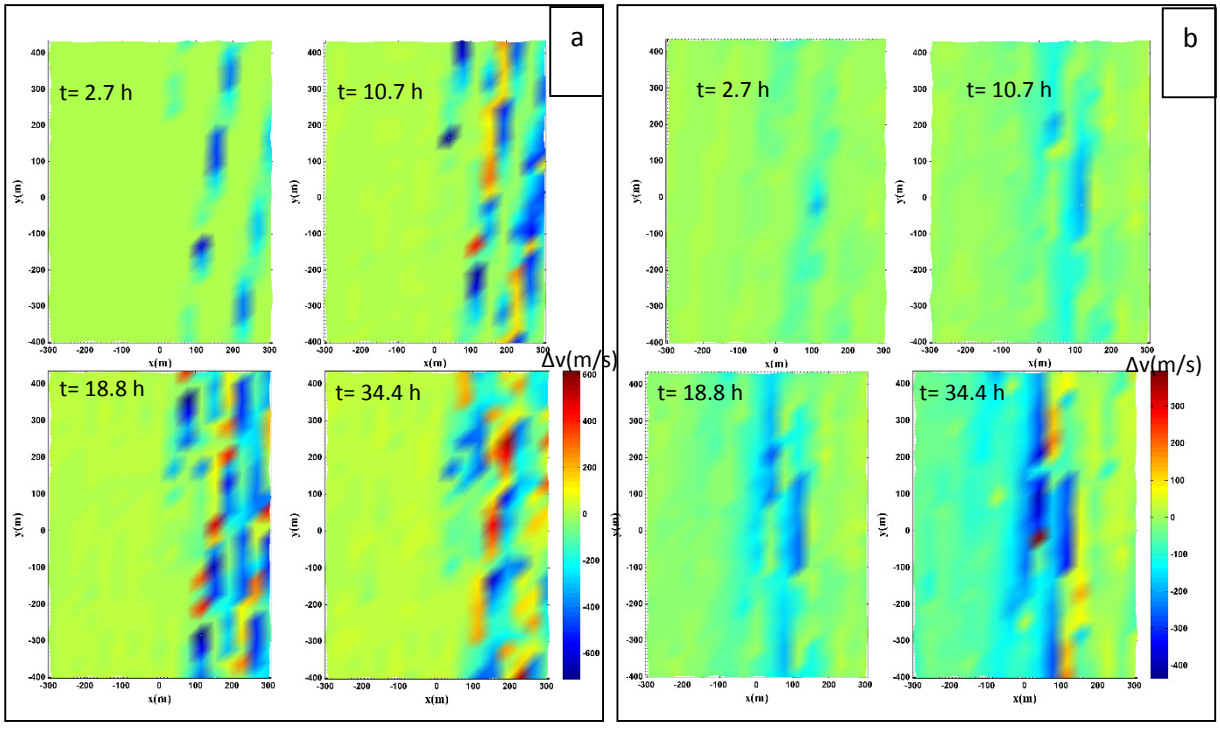


***Figure:*** *time-lapse velocities along x-direction (a) and the y-direction (b) during hydraulic fracturing in the modeled reservoir. The plotting area is about 410m by 830m corresponding to the area of receiver particles.*

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