



Reyes-Montes, J.M., Pettitt, W.S., Haycox, J.R., Hemmings, B. and Young, R.P. (2009) Microseismic analysis for the quantification of crack interaction during hydraulic stimulation. *The 79th SEG Annual Meeting*. Houston, USA. p. 1652-1656.

Microseismic analysis for the quantification of crack interaction during hydraulic stimulation

Abstract

The cluster index provides a means to identify the seismic activity corresponding to the development of connected fracturing that creates paths for fluid transmission during hydraulic stimulations. The location of induced microseismic events is combined with their source dimension, interpreted from the frequency content, to interpret the degree of interaction between the induced fractures. The spatial and temporal evolution of the degree of interaction is provided by the cluster index, which allows the characterization of events in terms of their potential interactivity. This is analyzed for four example well stimulations, describing two distinct behavior patterns for damage evolution: damage initiating as growth of connected fractures followed by scattered isolated fracturing, and fracturing initiating by the induction of scattered fractures followed by coalescence and growth of dominant fracturing.

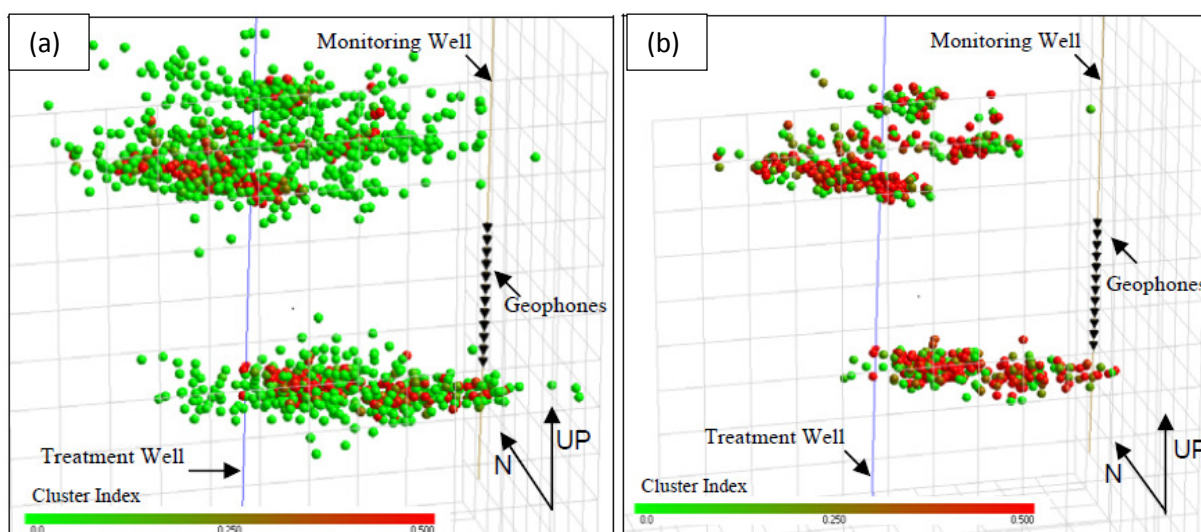


Figure: a) Located MS events during a single stage well stimulation (Well 1) color scaled to the value of the cluster index. b) MS events with $CI > 0$, indicating a degree of interaction. Grid spacing is 82 ft.

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