Monitoring seismicity near an active CO₂ EOR injection
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Cataloging Earthquakes

- Events cataloged from April 2015 to April 2017
- 2133 earthquakes were located in Sumner County, KS
- Magnitudes range from M₀ 0.4 to M₀ 3.5
- P-wave velocity calculated from well logs of KGS 2-32
- S-wave velocity is calculated from a Vp/Vs ratio
- Moment Magnitude calculated from energy spectrum of event and distance to event
- Magnitude of Completeness
  - 1.5 M₀ for Sumner County

Objective

The objective of the earthquake monitoring program at Wellington Oilfield is to ensure safe CO₂ injection in the Mississippian and Arbuckle with regards to induced seismicity. The research also provides information on the stress field of the shallow basement and the location of faults. This data can be used to advance the understanding of induced seismicity in the region as well as inform the regulation of fluid injection in the midcontinent.

Results

- CO₂ injection at Wellington field well KGS R-2-32 did not cause observable seismicity
- Seismicity likely caused from increased pore fluid pressure in basement and Arbuckle
- Over the last two years earthquakes have been advancing northward, from northern Oklahoma to southern Kansas
- Shear-wave splitting analysis presented here is the first direct evidence provided by seismological observations relating increase in pore fluid pressure to earthquakes in KS and OK
- Pressure monitoring in well KGS 1-2B confirms the pressure increase in KS and OK
- Shear-wave splitting methods can be used to mitigate seismic hazard associated with injection induced seismicity

Shear-Wave Splitting

Acknowledgements

This research has been supported by grants from the Kansas Geological Survey and the Kansas Interdisciplinary Carbonates Consortium (KICC) as well as DOE contract (DE-FE0006821). Equipment has also been based on loan through IRS and PAASCAL.

References