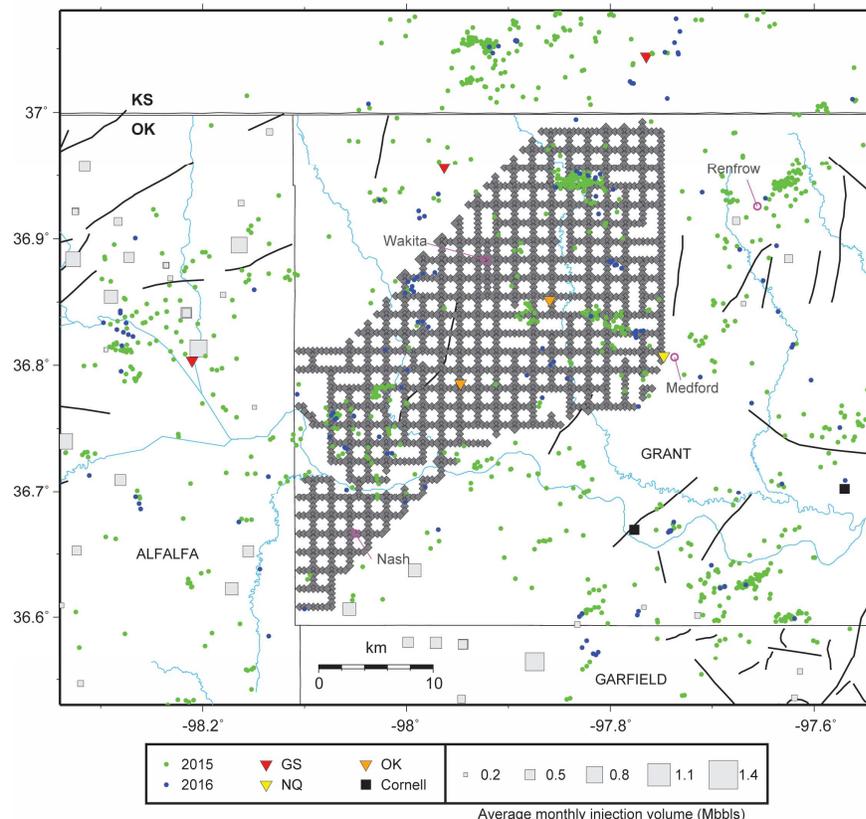


Large-n Seismic Survey in Oklahoma (LASSO): Probing injection-induced seismicity with a dense array

Sara L. Dougherty¹, Elizabeth S. Cochran¹, and Rebecca M. Harrington²

¹U.S. Geological Survey, Pasadena • ²McGill University

Injection-induced seismicity has a significant impact on seismic hazard, particularly in regions with low rates of natural seismicity; however, further understanding of the predictability of these events based on injection practices and geological structure is necessary before hazard can be quantified reliably. In Oklahoma, wastewater disposal volumes have increased rapidly since 2008 and during this time a drastic increase in seismicity has resulted in a significant rise in seismic hazard in this region. To enhance monitoring of potential injection-induced seismicity (including microseismicity) and elucidate any links between seismic observations and operational injection parameters and/or geologic structure, a seismic dataset with denser station coverage than is commonly available is needed. A large-N array of more than 1,800 vertical-component nodal seismic sensors was deployed over a 25-km-by-32-km region in northern Oklahoma for a period of 4 weeks in spring 2016, targeting a sequence of likely-induced seismicity in a region of active injection. This Large-n Seismic Survey in Oklahoma (LASSO) dense array will be used to assess the locations, frequency, magnitudes, source properties, and spatiotemporal evolution of micro- and small earthquakes in an effort to improve our understanding of the relationship(s) between injection parameters and induced seismicity, potentially leading to more accurate seismic hazard assessments and improved hazard mitigation. Information on the locations and orientations of subsurface faults will also be obtained to improve our understanding of where future locations of injection-induced seismicity may occur and potentially the maximum expected magnitudes. Tomographic imaging of the shallow crust will be performed to provide additional details on the geologic structure and any potential preferential location of seismicity in or along a particular unit or fault.



Map of array region showing M2+ seismicity (dots) from 1/1/2015-4/14/2016 (ANSS ComCat) colored by year, broadband stations (inverted triangles, black squares), and high-rate disposal wells (grey squares; OCC). LASSO stations are indicated by grey diamonds. Faults from the Preliminary Fault Map of Oklahoma (Holland, 2015) are also shown (black lines). Selected towns within and nearby the array are indicated by pink circles. County names are also shown.