The Meandering Path Towards Mitigating Induced Earthquakes in North Texas

Heather DeShon*, Matthew Hornbach, M. Beatrice Magnani, Chris Hayward, and Brian Stump
Southern Methodist University, *hdeshon@smu.edu

Increased seismicity rates across the central United States have led to revised seismic hazard estimates and raised local and national concerns about the impact of shale gas and wet oil production on infrastructure and subsurface structures such as faults. Since 2008, the USGS has reported over 200 felt earthquakes in the Fort Worth (Barnett Shale) Basin located in north Texas, and SMU and collaborators currently operate 30+ temporary seismic stations to monitor activity in the basin. Most North Texas earthquake swarms have been linked to local wastewater injection associated with shale gas extraction, to variable degrees of certainty. Modeling of pore fluid pressure diffusion, poroelastic stresses, and other geomechanic approaches to design quantitative and predictive mitigation strategies remains limited by a lack of data. Here, I overview how high-resolution earthquake locations and earthquake source studies have been combined with information on subsurface geology and fault structure and 3D pressure diffusion modeling to provide insight into the relationship between fluid migration at depth and modern microseismicity along pre-existing fault structures in the Fort Worth basin. I will outline how improved monitoring, more timely access to high-resolution well data, and data sharing of subsurface fault information could move the science forward. Finally, I will discuss a set of unique datasets being collected in northern Oklahoma in summer 2016 that could push induced earthquakes studies in new directions. Understanding if and/or how injection of fluids into rocks in fault contact with the crystalline crust reactivates basement faults have important implications for seismology (i.e., fault physics), the energy industry, and society.