



Hydraulic fracturing and the earthquakes near Crooked Lake

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Summary

Recently, an increase in the rate of mid-continent earthquakes has been associated with the development of oil and gas resources. In light of induced seismicity, the Alberta Geological Survey has been working with passive seismic data to better understand the nature of seismicity and tectonics of the Western Canada Sedimentary Basin. In this presentation, I will review some of the work undertaken to improve the earthquake catalogue throughout Alberta and the installation of a new seismic network (RAVEN). Through the use of this recently established seismic network, we focus in on a case study of clustered earthquakes in a previously quiescent region near the town of Fox Creek. To bolster our results, we utilize double-difference relocations, matched filter detections, and moment tensor inversions. We find that earthquakes in this region are clearly distinguished into subsequences based on the overall shape of recorded waveforms, hypocentral location, and timing of subsequence. Furthermore, each unique subsequence recorded on our regional network can be related back to a corresponding hydraulic fracturing well in both time and space. In fact, the earthquakes in this region continue to be closely related (> 99.99% confidence) to corresponding hydraulic fracturing operations and, overall, we find that these operations are their most likely cause.