Hydraulic fracturing operations within an extremely complex stress regime: The case of Fort St. John, British Columbia, Canada

Rebecca O. Salvage and David W. Eaton
University of Calgary, Dept. of Geoscience, Calgary, Canada (beckysalvage@gmail.com)

On 30 November 2018, three felt earthquakes occurred in quick succession close to the city of Fort St. John, British Columbia, likely as a direct response to a hydraulic fracturing operation in the area. Events appear tightly clustered spatially within the upper 10 km of the crust. Hypocenters locate at the confluence between a large scale reverse faulting regime (in the north-west, probably due to the influence of the Rocky Mountain fold and thrust belt) and an oblique strike slip faulting regime (in the south-east, probably due to the influence of the Fort St. John Graben), resulting in a variety of focal mechanisms and a very complex local stress regime. Further analysis of the principal stresses suggests that $\sigma_1$ is well constrained and close to horizontal, whereas $\sigma_2$ and $\sigma_3$ are poorly constrained, and can alternate between the horizontal and the vertical plane. Here, we present an overview of the temporal and spatial evolution of this seismic sequence and its relationship to hydraulic fracturing operations in the area, and examine the influence of large-scale regional tectonic structures on the generation of seismicity on this occasion.