

'The Surrey Earthquake Swarm'
by
Dr Steve Hicks, Imperial College London

13th January 2021

“Earthquakes induced by subsurface industrial activities are a globally emotive issue, with a growing catalogue of induced earthquake sequences. However, attempts at discriminating between natural and induced causes, particularly for anomalously shallow seismicity, can be challenging. An earthquake swarm during 2018–2019 in southeast England with a maximum magnitude of 3.2 received great public and media attention because of its proximity to operating oilfields. It is therefore vital and timely to provide a detailed characterization of the earthquake sequence at present, and to decide based on current evidence, whether the earthquakes were likely natural or induced. We detected 168 low-magnitude earthquakes and computed detailed source parameters of these events. Most earthquakes occurred at a shallow depth of 2.3 km, >1km deeper than the geological formations targeted by the oilfields, and laterally >3km away from the drill sites. We combine the east–west-trending cluster of the seismicity with 2D seismic reflection profiles to find the causative fault system for the earthquakes. Strike-slip faulting mechanisms are consistent with tectonic reactivation along a pre-existing fault. Overall, we find no indicators in the earthquake parameters that would strongly suggest an induced source. Nor do we find any clear trends between seismicity and drilling activities based on operational logs provided by the operators. Injected volumes are near zero and monthly production amounts are many orders of magnitude smaller than other reported cases of extraction-induced seismicity. On balance, and based on the available evidence, we find it currently unlikely that nearby industrial activities induced the seismic swarm. Most likely, the Surrey earthquakes offer a uniquely detailed insight into shallow seismicity within sedimentary basins. Nevertheless, self-reporting of injection and production times and volumes by operators, and the lack of easily and publicly available oilfield operational data continues to be a point of concern for local residents.”