

OR/18/015 UK seismicity statistics

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Galloway, D D. 2018. Bulletin of British Earthquakes 2017. *British Geological Survey*. (OR/18/015).

In Figure 13, the histogram of earthquakes above magnitude 2.0 detected per year in different magnitude ranges, shows significant variation across the 48 years of modern instrumental monitoring. In the early years, the 1970s, instrumental coverage across the UK was sparse, and that influences the picture, although it was improving in the second half of the decade. The annual catalogues are thought to be complete at magnitude 3.5 ML or greater for 1970 to 1978, and for magnitude 2.5 ML and greater from 1979. Almost all of the earthquakes above 2.5 ML would be felt by people. Some of the peaks seen in Figure 13 have obvious explanations:

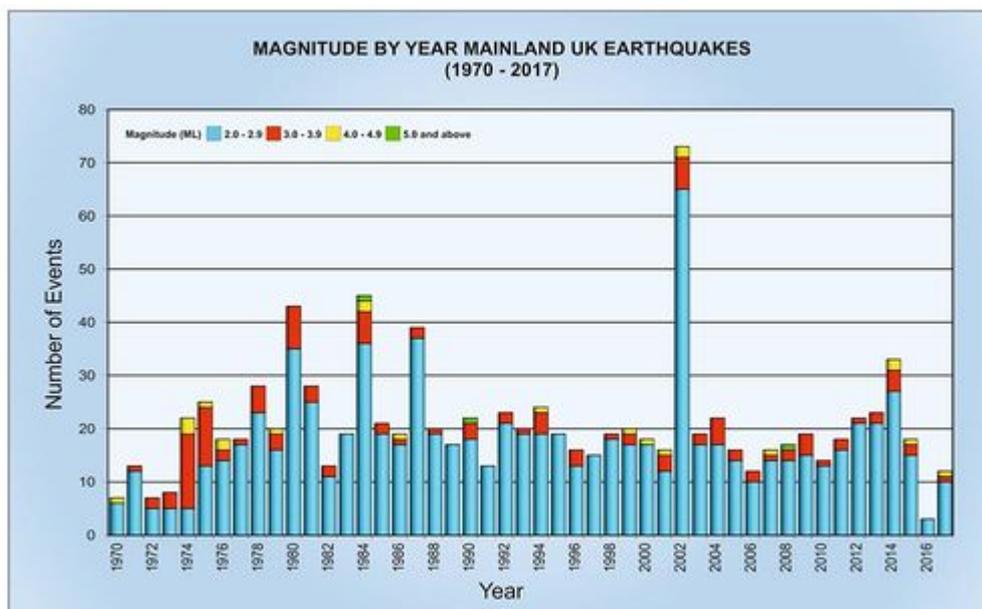


Figure 13 Histogram showing the number of events, magnitude 2.0 ML or greater, detected 1970–2017.

- In 1980, there was a continuing long aftershock sequence of the Carlisle earthquake of 26 December 1979 (4.7 ML). The largest two (both 3.8 ML) occurred in January and December 1980, the latter almost one year later than the mainshock. A local, temporary station was installed in a Longtown church three days after the mainshock, followed by three more distant stations in 1980.
- The largest onshore earthquake known in the UK's history occurred on the Lleyn Peninsula, Gwynedd in 1984 (19 July) with a magnitude of 5.4 ML. A multi-station monitoring network was installed, shortly afterwards, across North Wales. The aftershock sequence continued for more than a year and confirmed that the activity was relatively deep for UK earthquakes, at around 20 km.
- The high peak in 2002 is dominated by an earthquake sequence near Manchester, which started on 19 October 2002 and continued until January 2003. Some 53 events above magnitude 2.0 ML were recorded and 37 were felt, the largest with a magnitude of 3.9 ML. Temporary stations were deployed to record the smaller events.
- The peak in 2014, is the result of an extended coal-mining induced series of earthquakes near New Ollerton, Nottinghamshire, which were studied with a temporary mobile network of

monitoring stations. Some 65 events were felt, of which ten were magnitude 2.0 ML or greater.

- In 1974–75, there are clear peaks in earthquakes with magnitudes of 3.0 ML and greater during this period; around half of them were centred near Kintail, NW Scotland. There were few monitoring stations in the UK at this time, so it is not known whether they were accompanied by many or a few smaller magnitude events.
- The Bishops Castle, Shropshire, earthquake in April 1990 (5.1 ML) and the Market Rasen, Lincolnshire earthquake in February 2008 (5.2 ML), both showed very limited aftershock sequences despite being well monitored. The former had seven aftershocks (all less than or equal to 1.5 ML and none felt) and the latter had eleven aftershocks, with magnitudes ranging between 0.6 ML and 2.8 ML, (the largest felt locally).
- The year 2016 is quite remarkable for producing the fewest earthquakes in the whole 48 year series, in all magnitude ranges above 2.0 ML, with a total of only three events in the 2.0 ML–2.9 ML range and none above that.
- The largest earthquake in Scotland for 18 years, with a magnitude of 4.0 ML, occurred on Moidart, Highland in 2017 (4 August). Only five other earthquakes of this size or greater have been observed in Scotland, in the period of instrumental recording from 1970.

Figures 14 and 15 show the statistics for all earthquakes known to be felt from 1979 to 2017, including those below magnitude 2.0 ML. As might be expected, Figure 14 shows three of the same peaks as for the event occurrences seen in Figure 13; namely the 1984 Lleyn, 2002 Manchester and 2014 New Ollerton events. However, there were many events felt with magnitudes below 2.0 ML, and these were mainly related to coal mining.

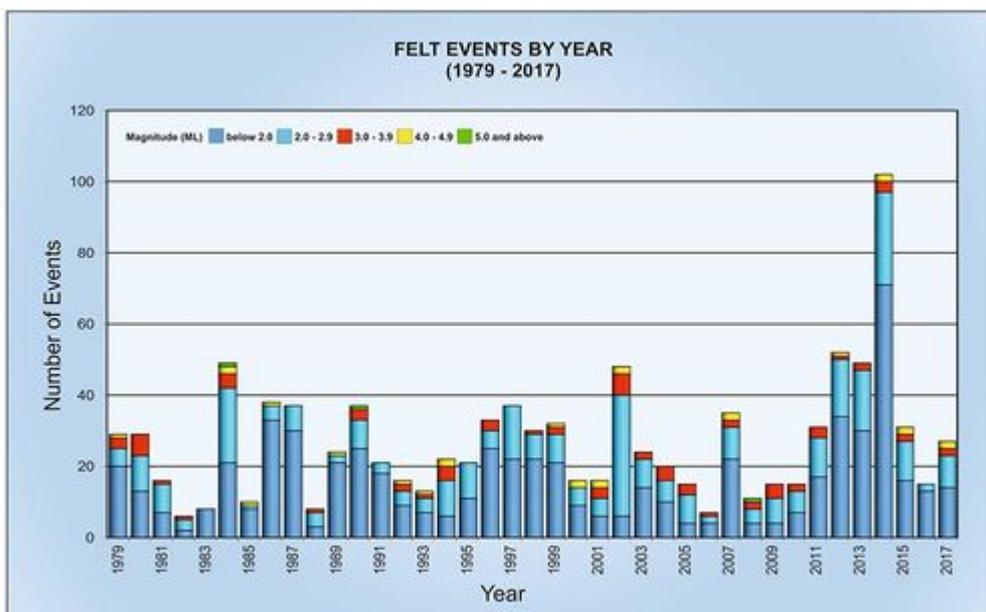


Figure 14 Histogram showing the number of felt events, 1979–2017.

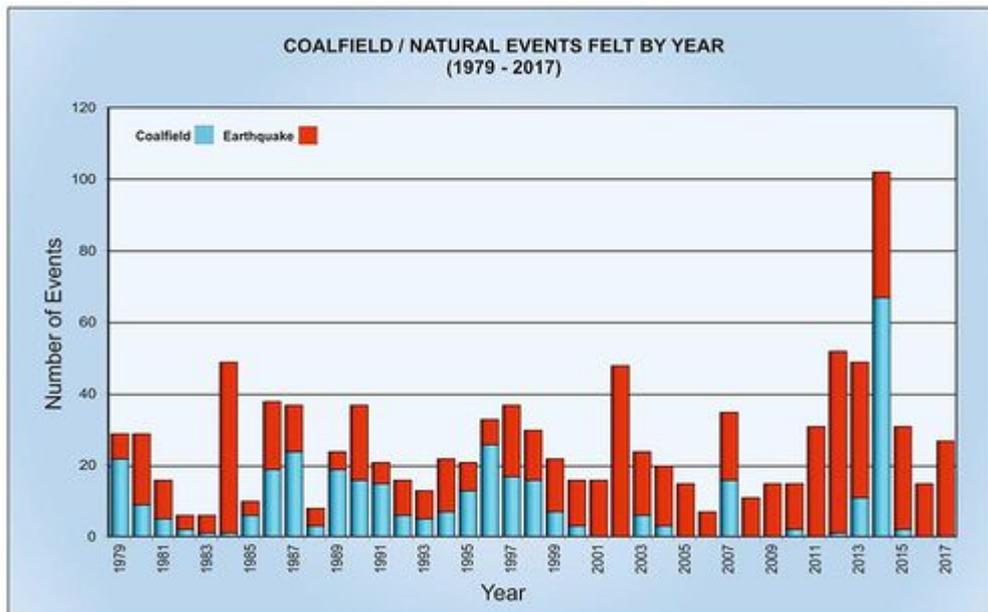


Figure 15 Histogram showing the split between the number of felt events in coalfield areas and those which are natural earthquakes, 1979-2017.

Figure 15 shows the split between the number of felt events in coalfield areas (most of them mining-induced) and those which are natural earthquakes. It can be seen that the coalfield event distribution across the 39 years (1979-2017), largely mirrors the distribution of smaller events (2.0 ML or less) in Figure 14. As UK mining-induced events almost always occur within one km of the surface, they are felt at low magnitudes as they are close to the communities exposed. Natural earthquakes in the UK are generally in the depth range 3-20 km. By the year 2000, deep coal mining across the UK was tailing off and the upsurge in the mining-induced events in 2014 was associated with the Thoresby mine at New Ollerton, Nottinghamshire, which closed in 2015. The lack of mining events in 1984 is caused by the general miners' strike that year.

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