

OR/18/015 The BGS UK seismograph network

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

The UK seismograph network consists of 110 (78 permanent and 32 temporary) stations with broadband, short period and strong motion accelerometers. Of the permanent sites, some 44 are equipped with broadband seismometers and 29 have strong motion accelerometers, 23 of which are co-located with broadband sensors. The remaining 28 sites are equipped with short period seismometers. Data from all stations are transferred in near real-time to the BGS offices in Edinburgh for automatic processing, analysis and archiving. Seismic events are detected using automatic processing algorithms, but they can also be extracted manually from the archive of continuous data, then analysed to determine event types, locations and magnitudes. Operational BGS seismograph stations are shown in Figure 2.

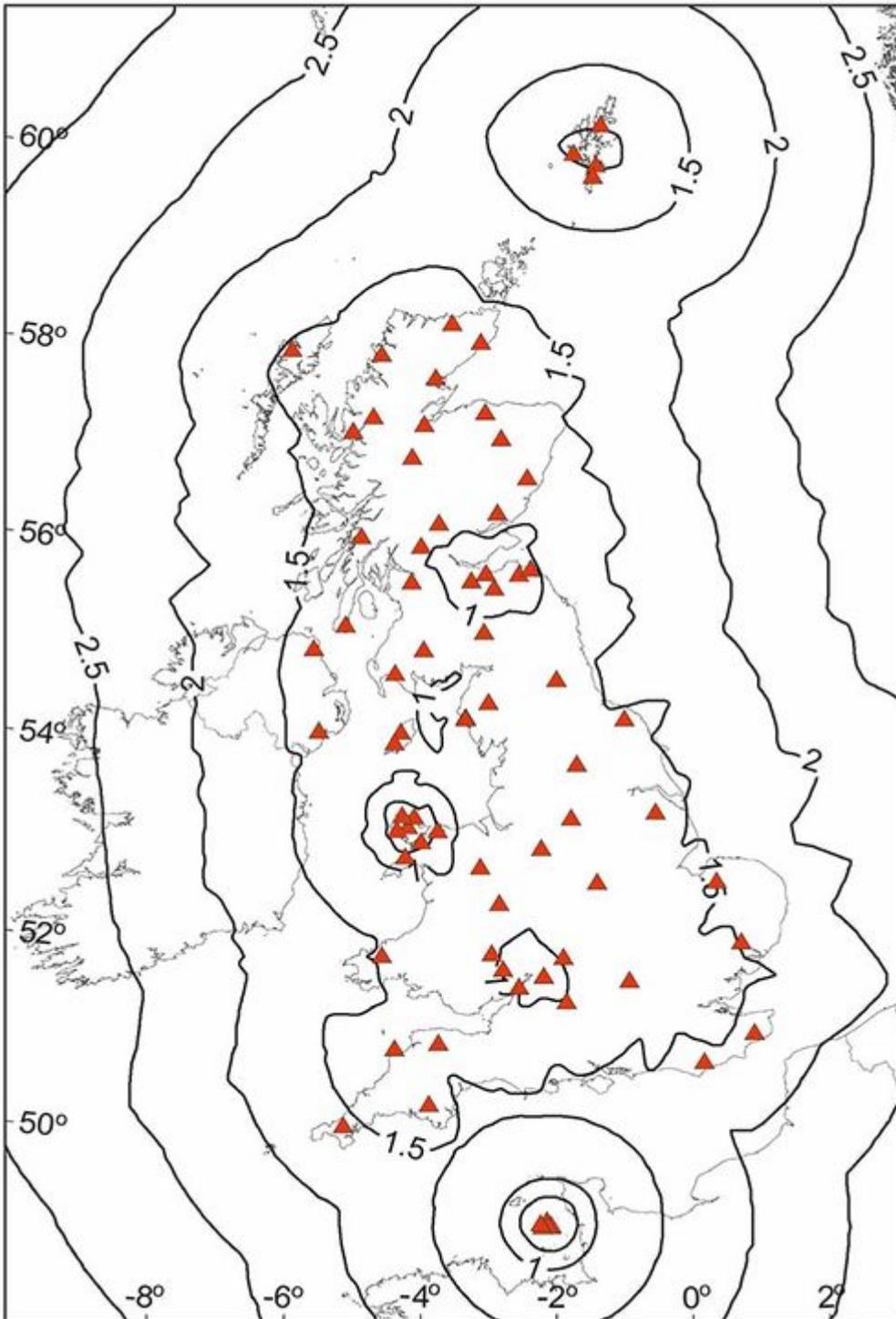


Figure 2 Seismograph stations operated by BGS during 2017. The contours show earthquake detection capability in terms of Richter local magnitude (ML) calculated for average background noise conditions (4 nm) where the detection criterion is that the signal has to exceed 4 nm at 10 Hz at 4 stations.

The detection capabilities of a network depend upon station distribution, instrument sensitivity and background noise levels. Figure 2 also shows the magnitude detection thresholds for the seismograph stations operational during 2017. The contours illustrate the lower threshold magnitude for an earthquake to significantly exceed 4 nanometres of noise (average) at 10 Hz on at least four seismographs. These detection levels hold true only if data from all stations are continuously monitored. Smaller events may go undetected unless they are felt and reported to BGS by local inhabitants, in which case detection can be strongly dependent on the population density.

The whole of the UK is covered by the seismograph network for approximately magnitude 1.5 ML, and above, at times of average ambient noise levels. Noise sources such as wind, ocean waves and traffic vary considerably with time (typically 0.5 to 15 nanometres, at 10 Hz) causing the magnitude thresholds to increase or decrease. In conditions of high noise, 0.8 ML should be added to the contour values, causing the threshold to rise to about 2.3 ML. Normally, however, an earthquake of this size would be felt, if not detected, in the areas of poorer instrumental coverage. The bulletin can, therefore, be assumed to be complete for all earthquakes of magnitude 2.3 ML and above.

Given the variability in the earthquake detection threshold, as governed by ambient noise conditions and the geometry of the observing network, the bulletin is biased towards certain localities. Figure 3 shows only earthquakes with magnitude 2.5 ML or above, in the period 1979 to 2017. The data set is considered complete for these magnitudes in all localities onshore. Seismicity for the period 1970 to 2017 is shown in Figure 4 with a threshold magnitude of 3.5 ML. This is the period covered by BGS instrumentation that, in the early years, only consisted of the network around Edinburgh (LOWNET) and Eskdalemuir (ESK) and a station near Kyle of Lochalsh (KYL). The data set is likely to be complete for such magnitudes.



Figure 3 Epicentres of earthquakes with magnitudes of 2.5 ML and above, in the period 1979 to 2017.



Figure 4 Epicentres of earthquakes with magnitudes of 3.5 ML and above, in the period 1970-2017.

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