

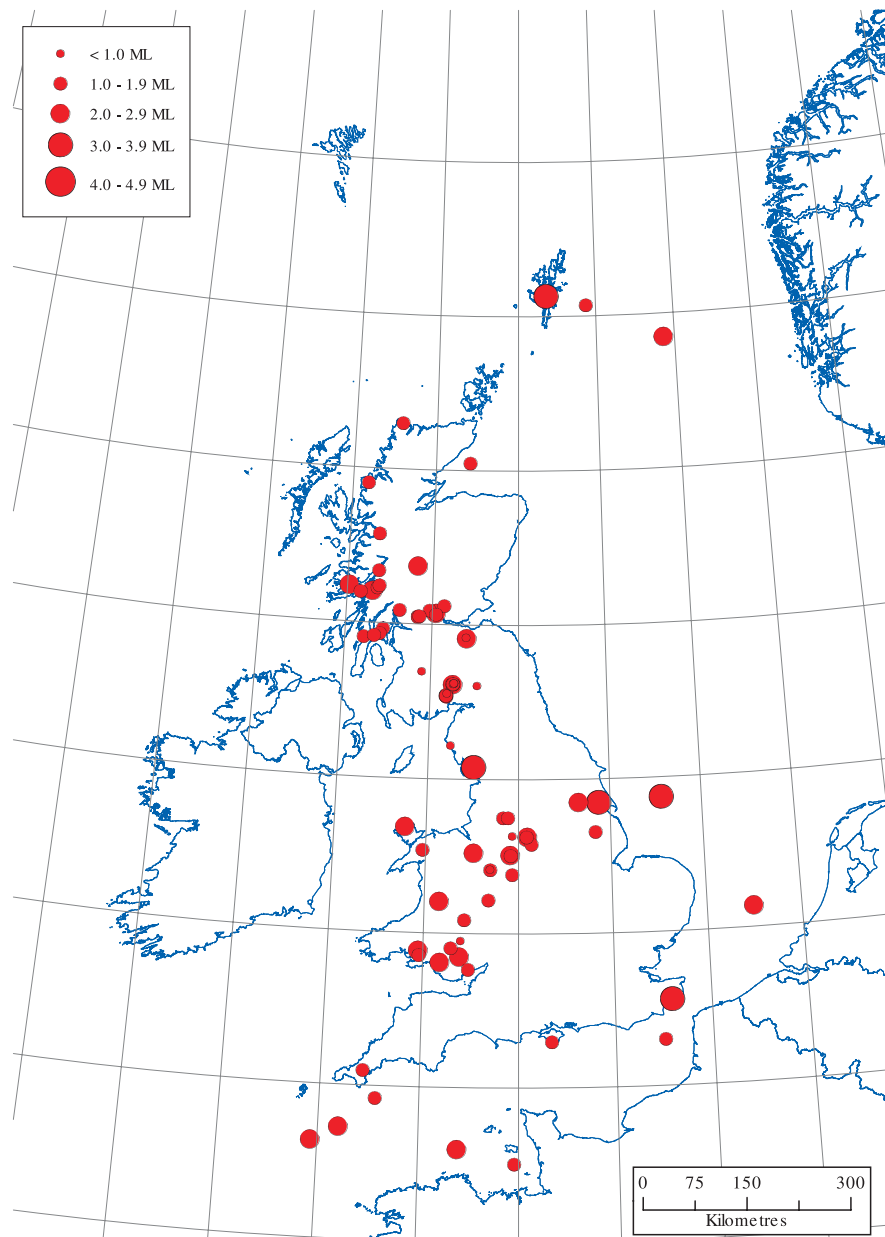
BRITISH GEOLOGICAL SURVEY

REPORT OR/10/028

Bulletin of British Earthquakes 2009

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1 Introduction

The British Geological Survey's (BGS) Seismic Monitoring and Information Service operate a nationwide network of seismograph stations in the United Kingdom (UK). Earthquakes in the UK, and coastal waters, are detected within limits dependent on the distribution of seismograph stations. Location accuracy is improved in offshore areas through data exchange with neighbouring countries. This bulletin contains locations, magnitudes and phase data for all earthquakes detected and located by the BGS during 2009, listed in Tables 1 and 2. Maps showing seismic activity in 2009 (Figure 1), and the larger magnitude events since 1979 (ML> 2.5) and since 1970 (ML> 3.5) are also included. The bulletin covers all of the UK land mass and its coastal waters including the North Sea (-11°W to 6°E and 47°N to 65°N).

All events believed to be of true tectonic origin are included. Coalfield events are also included. Acoustic disturbances, such as sonic booms from supersonic aircraft, are included when they are felt. The air-borne waves are readily identified by their slow travel time across an array or by their signature on a microphone, but they are frequently mistaken as small earthquakes by the public. They are indicated by 'SONIC' in both the locality and comments column of Table 1.

Significant non-natural events, such as explosions, which received media attention or were greater than magnitude 2.5 ML or felt by local residents, are also included in Table 1. Smaller events that are known, or suspected to be of explosive origin are excluded from the bulletin where possible. These include explosions due to quarrying, mining, weapon testing or disposal, naval exercises, geophysical prospecting and civil engineering. Unfortunately, identification by record character, location and time of occurrence is not always conclusive and some man-made events may be included in the bulletin or, more rarely, a small natural event may have been excluded.

2 The BGS UK Seismograph Network

The UK seismograph network consists of almost 100 stations with broadband, short period and/or strong motion accelerometers. Thirty sites are equipped with broadband seismometers and twenty-four have strong motion accelerometers, fifteen of which are co-located with broadband sensors. The remaining sites are equipped with short period seismometers. Data from nearly all stations are transferred in near real-time to the BGS offices in Edinburgh for automatic processing, analysis and archival. Seismic events are detected using automatic processing algorithms, but can also be extracted manually from our archive of continuous data, then analysed to determine event types, locations and magnitudes. Operational BGS seismograph stations are shown in Figure 2.

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 in December 2009. 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. Small events may go undetected unless they are felt and reported to BGS by local inhabitants, so the detection capabilities of this process are 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 greater, in the period 1979 to 2009. The data set is considered complete for these magnitudes in all localities onshore. Seismicity for the period 1970 to 2009 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.

3 Earthquake Parameters and Their Errors

HYPOCENTRE LOCATION

By accurately timing the signal onsets at a minimum of three stations, a location can be found for an earthquake that satisfies the observed pattern of arrivals. Instrumental locations in the bulletin were obtained using the computer program HYPOCENTER (Lienert and Havskov 1995) that iteratively adjusts a trial hypocentre (latitude, longitude, depth, and origin time) until the observed and computed arrival times coincide closely.

The accuracy of locations is dependent on distances from the closest stations, the distribution of the stations around the epicentre, the resolution to which signal onsets can be timed from the records, and the accuracy with which the seismic wave velocities through the Earth are known.

The accurate determination of earthquake depth presents a more difficult problem, mainly because phase arrival patterns at the seismographs can still be satisfied for a large range of depths merely by adjusting the origin time to suit. Depth is usually only well constrained when there is a station very close to the epicentre.

The best depth determinations are obtained when an earthquake or earthquake series occurs almost beneath a network. For events at larger distances the depth errors can be many kilometres. Where the depth error, ERZ in Table 1, is 0.0, this indicates that the depth has been fixed in the hypocentre calculation. This is the case for explosions, which are known to occur at the surface, and for events at larger distances, where depth control is poor.

MAGNITUDE

All earthquakes in the bulletin have been assigned a local magnitude (ML) as defined by Richter (1935):

$$ML = \log_{10} (A/A_0)$$

Where A is the maximum deflection (centre to peak in mm) registered on a Wood-Anderson seismograph and A₀ is that for a 'standard' magnitude zero earthquake at the same distance. The A₀ term is thus a distance correction factor, tabulated by Richter to 200 km, and later adjusted to

include up to 600 km. Although Richter intended his method to be an approximate quantification of earthquake size and his attenuation term, A_0 , strictly only applies to California, the formula is still used worldwide today. The ML magnitudes in this bulletin have been calculated according to Richter's formula after converting the output of the BGS instruments to an equivalent Wood-Anderson deflection. Ideally, the measurements are made on two horizontal instruments and averaged but, if this is not possible, the mean of the magnitudes from a number of verticals are used. Ground motion registered at a seismograph varies with site conditions, distance and direction from the earthquake, and the nature of the ray path. Consequently, it is important to take the mean from a good distribution of stations. The resulting errors on magnitudes quoted in the bulletin will normally be less than 0.4 ML.

INTENSITY

Intensity is a measure of the effect of the shaking produced by the earthquake on people, structures and objects. It decreases with distance from a maximum value (I_{max}) usually found close to the epicentre. The maximum felt intensity is quoted, where known, with reference to the European Macroseismic Scale (EMS), (Grünthal, 1993).

4 Summary of 2009 Seismicity

There were 86 earthquakes located by the BGS seismic monitoring network during the year, with 26 having magnitudes of 2.0 ML or greater and six having magnitudes of 3.0 ML or greater. Eleven events with a magnitude of 2.0 ML or greater were reported felt, together with a further four smaller ones, bringing the total to fifteen felt earthquakes in 2009.

The largest onshore earthquake of the year, with a magnitude of 3.7 ML, occurred near Ulverston, Cumbria, on 28 April at 10:22 UTC, at a depth of approximately 11 km (Figure 5). Data from over 800 questionnaires, collected online, were used to determine how widely the earthquake had been felt, with the most distant reports coming from the following places: to the north, Carlisle (80 km); to the northeast, Durham and Newcastle (115-135 km); to the southeast, Harrogate and Leeds (100 km); and to the south, Manchester (95 km). The results show that the highest intensity experienced was 5 EMS, which was observed over an area extending approximately 25 kilometres to the northeast and 35 kilometres to the south of the epicentre. Ulverston returned a high number of replies (over 80) being the closest, small settlement to the epicentre, and the highly populated Lancaster/Morecambe area returned over 400 replies. There were no reports of damage to property. The last earthquake in the region of comparable size had a magnitude of 3.0 ML and occurred around 12 km to the northeast, near Grange-over-Sands, in 1993. Historically, the most significant earthquake to have struck the area was in 1835 centred near Lancaster. It had a magnitude of 4.4 ML and caused some minor damage.

One of the largest offshore earthquakes, of 2009, occurred near the Shetland Islands on 15 January, at 05:32 UTC, with a magnitude of 3.3 ML (Figure 6). It was located approximately 50 km east of Lerwick and was felt throughout the Shetland mainland. Some reports stated that people were woken from sleep and that a few were frightened, indicating an intensity of at least 4 EMS. This was the largest earthquake to strike the region since a magnitude 3.5 ML earthquake on 12 October 2002, with an epicentre approximately 85 km to the southeast. On 15 September another earthquake, with a magnitude of 3.3 ML, occurred in the southern North Sea region, approximately 100 km east of Hull. A further four events occurred in the North Sea and adjacent waters during the year, with magnitudes ranging between 1.7 and 3.0 ML.

On 25 February, an earthquake with a magnitude of 1.4 ML was detected 6 km southeast of the town of Llanberis, Gwynedd. The BGS received a few reports from residents in Llanberis,

describing “the house shook gently” and “my cup seemed to shudder”. An intensity of 3 EMS was assigned to the earthquake.

An earthquake with a magnitude of 3.0 ML and at a depth of around 4 km occurred on 3 March, with a location under Folkestone, Kent (Figure 7). The BGS received several reports from residents in Folkestone and surrounding areas describing the earthquake as being "quick but very scary and noisy", "like an explosion" and with "quite strong rumbling". Some people described the event as being like "a large lorry driven by" or that it "felt like a pneumatic drill on the floor" and others reported that "crochery shook and rattled noticeably" and "the whole room rumbled and the desk shuddered", indicating an intensity of 4 EMS. It was around 200 times smaller than the magnitude 4.3 ML earthquake that struck Folkestone on 28 April 2007, causing some damage. Significant earthquakes also struck the Dover Straits in 1776 and 1580; the latter had an approximate magnitude of 5.7 ML and reportedly caused damage in London.

A magnitude 1.9 ML earthquake occurred on 24 March, with an epicentre about 3 km northwest of Bonawe, Argyll & Bute. The BGS received several reports from residents of Bonawe, Taynuilt, Connel and North Connel, describing, “the windows shook”, “the house rattled and dust was lifted from shelves” and “it sounded very much like a distant explosion”, indicating an intensity of at least 3 EMS. It locates approximately 24 km east of the magnitude 4.1 ML Oban earthquake of 29 September 1986 which was felt over an area of around 30,000 km² with a maximum intensity of 5 EMS.

On 11 April, an earthquake with a magnitude of 3.0 ML occurred near Goxhill, North Lincolnshire, approximately 10 km southeast of the centre of Hull (Figure 8). It was felt by several residents in the surrounding areas. Reports described the earthquake as being “a very short thud through the floor”, “a weak rumble, then intensified before stopping” and “the oven grill shelving rattled”, indicating an intensity of 3 EMS. This earthquake was around 2,000 times smaller in terms of energy release than the magnitude 5.2 ML earthquake that struck nearby at Market Rasen on 27 February 2008, causing some damage. Historically, an earthquake with a magnitude of 4.2 ML occurred on 15 December 1703 approximately 10 km to the southeast.

On 5 June, a magnitude 2.9 ML earthquake occurred in the Maesteg, Bridgend region of South Wales (Figure 9). The BGS received many reports from the Media and from residents in Bridgend describing “lying in bed and metal frame shook”, “the whole house creaked and it felt like it moved”, “the experience felt like a car had collided with the house” and “heard a rumbling sound”. An intensity of 4 EMS was assigned to the earthquake. This is the largest event to occur in this general area since a magnitude 3.8 ML earthquake on 23 May 1975, approximately 7 km southwest of Merthyr Tydfil. Historically, however, larger earthquakes, with magnitudes ranging from 4.9 to 5.2 ML, have been known to occur in the area, the last and largest of these being a magnitude 5.2 ML earthquake that occurred in 1906 close to Port Talbot. Known as the Swansea earthquake, this was one of the most damaging earthquakes in Britain throughout the whole of the 20th century.

A magnitude 2.2 ML earthquake occurred on 26 July, with an epicentre approximately 5 km south of Wylfa on the Isle of Anglesey, North Wales. The BGS received a few reports from the residents of Llanfachraeth and Camaes Bay describing “a deep roaring noise, immediately followed by the house shaking and the windows rattling”, indicating an intensity of 3 EMS.

An earthquake with a magnitude of 2.9 ML occurred at 13:04 UTC on 30 September, with a location 2 km northwest of Alkborough, North Lincolnshire. An intensity of 3 EMS was assigned to this event after a single report was received from a resident in Brigg describing, “a small quick rumble” and “the TV creaked”. The epicentre is approximately 30 km east of the magnitude 3.0 ML Goxhill earthquake on 11 April 2009 and 40 km northwest of the magnitude 5.2 ML Market Rasen earthquake on 27 February 2008.

On 16 November, a magnitude 2.0 ML earthquake occurred near Oban, Argyll and Bute. A number of reports were received from residents in Oban, describing “the house seemed to shake” and “various objects rattled”, indicating an intensity of 3 EMS. It locates approximately 15 km east of the magnitude 4.1 ML Oban earthquake of 29 September 1986 which was felt over an area of around 30,000 km² with a maximum intensity of 5 EMS.

On 13 December, an earthquake with a magnitude of 2.3 ML was detected 4 km south of the settlement of Salen, on the Isle of Mull, Argyll and Bute. Reports were received that it was felt in Salen, Sanna, Savary, Croggan, Strontian and Stromemore with intensities of at least 3EMS.

The following day, on 14 December, a magnitude 2.4 ML earthquake occurred near the village of Llangurig, Powys. The BGS received two reports from residents in the area describing “heard a rumbling similar to that of horses galloping nearby” and “the dogs downstairs all began to bark”, indicating an intensity of 3 EMS.

In Staffordshire, two events on 24 and 25 December with magnitudes of 2.1 ML and 1.7 ML, respectively, occurred near Stoke-on-Trent. The magnitude 2.1 ML event was felt (intensity 3 EMS) by three people in the town who described “a slight tremor” and “the windows and door shuddered”.

Between 8 August and 19 October, a swarm of nine small earthquakes were detected approximately 8 km SSE of Eskdalemuir, in an area between Eskdalemuir, in the Borders, and Langholm, in Dumfries and Galloway. These events occurred, at an average depth of 4.8 km and with magnitudes ranging between 0.3 and 2.4 ML.

The BGS received reports of another two earthquakes being felt during the year. They occurred on 11 April, near Stithians, Cornwall (1.4 ML) and on 10 October, near Swinton, Greater Manchester (1.5 ML).

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Scottish Power

Scottish Water

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NORSAR (Oslo, Norway)

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University of Keele (Keele, UK)

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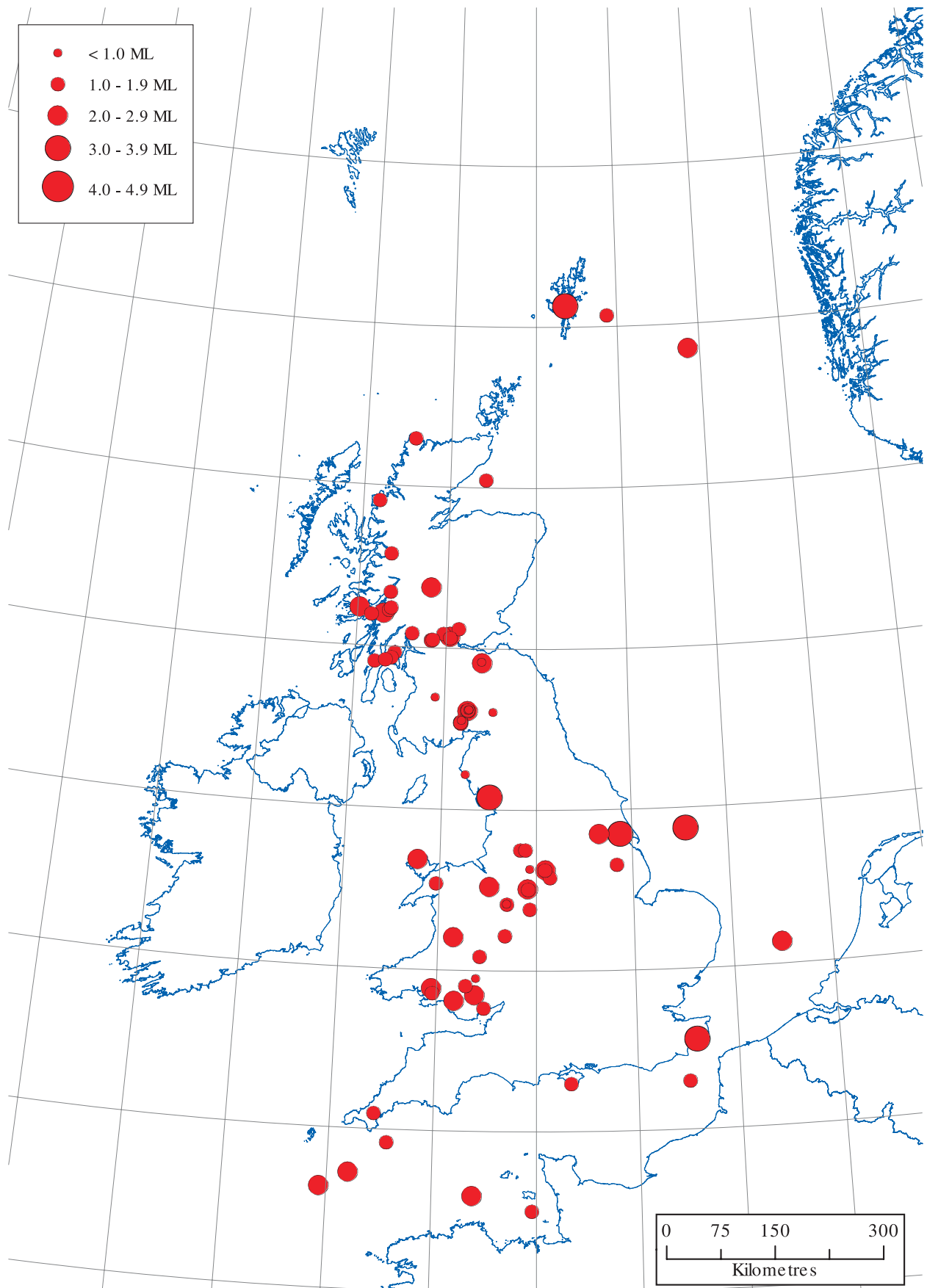


Figure 1. Epicentre map of earthquakes in 2009 as listed in Table 1.

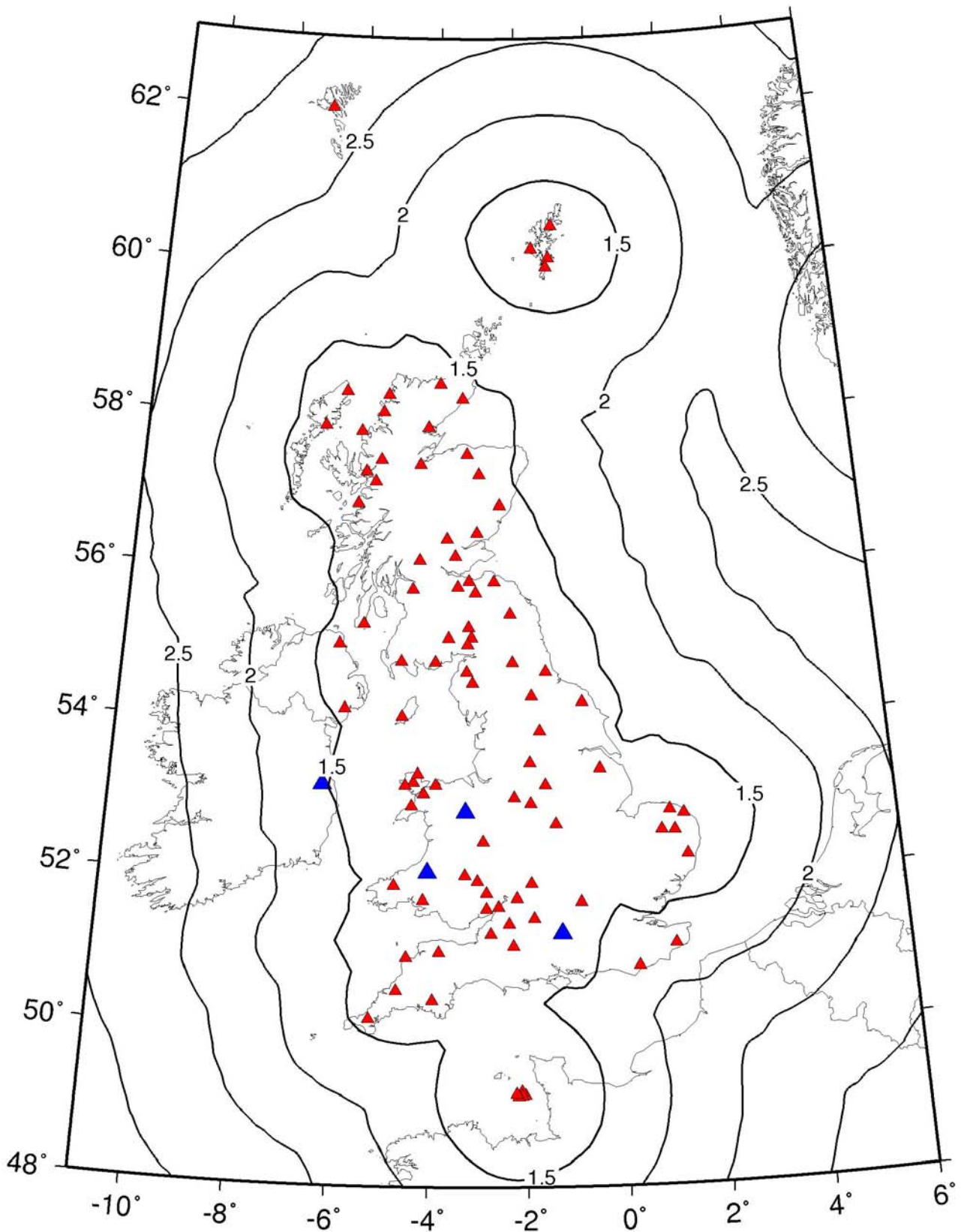


Figure 2. Seismograph stations operated by BGS during 2009 (red) along with station operated by other agencies in the British Isles and used for automatic detection (blue). The contours show earthquake detection capability in terms of Richter local magnitude (ML) calculated for average background noise conditions (4nm) where the detection criterion is that the signal has to exceed 4nm at 10Hz at 4 stations.

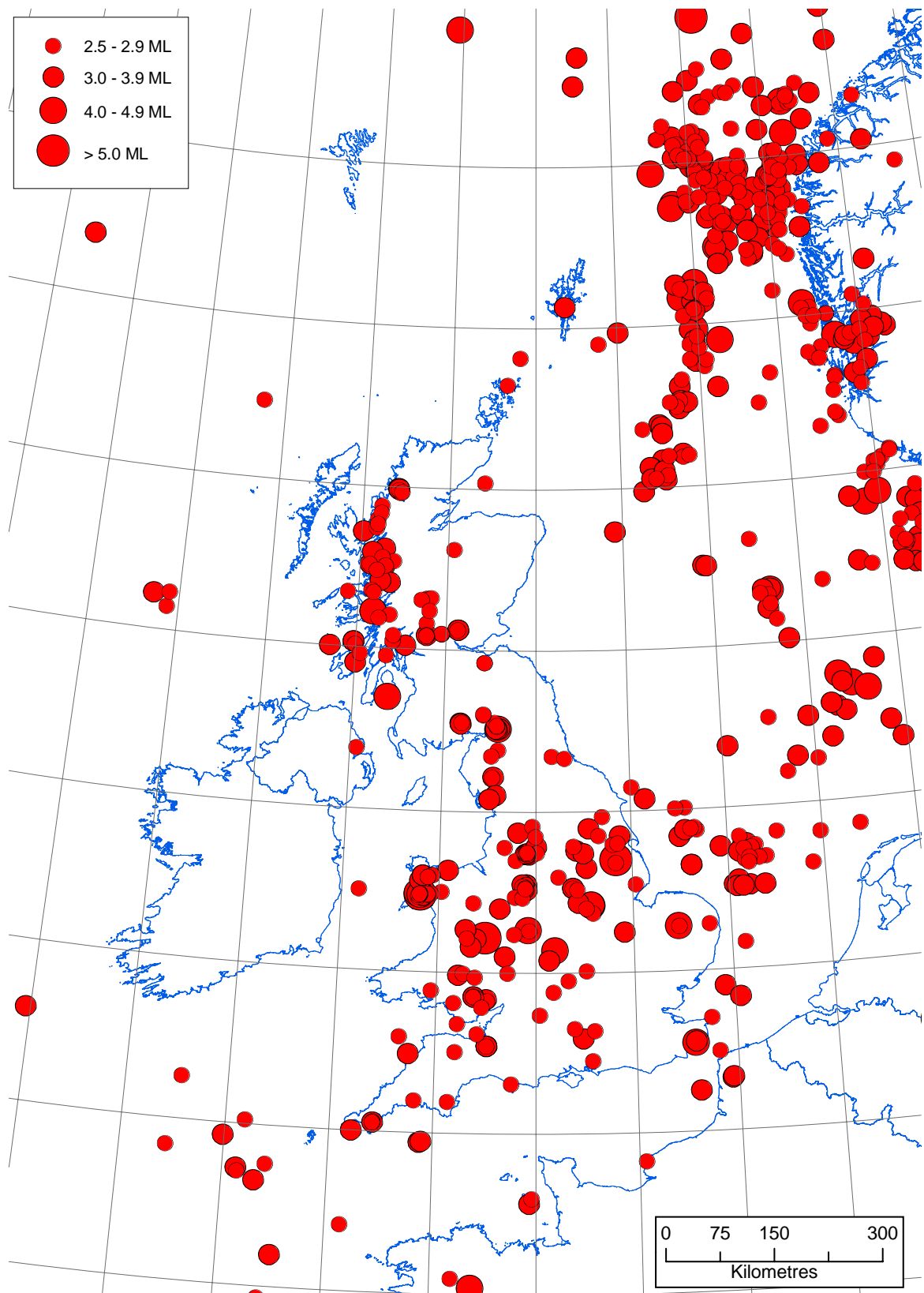


Figure 3. Epicentres of earthquakes with magnitudes of 2.5 ML and above, in the period 1979 to 2009.

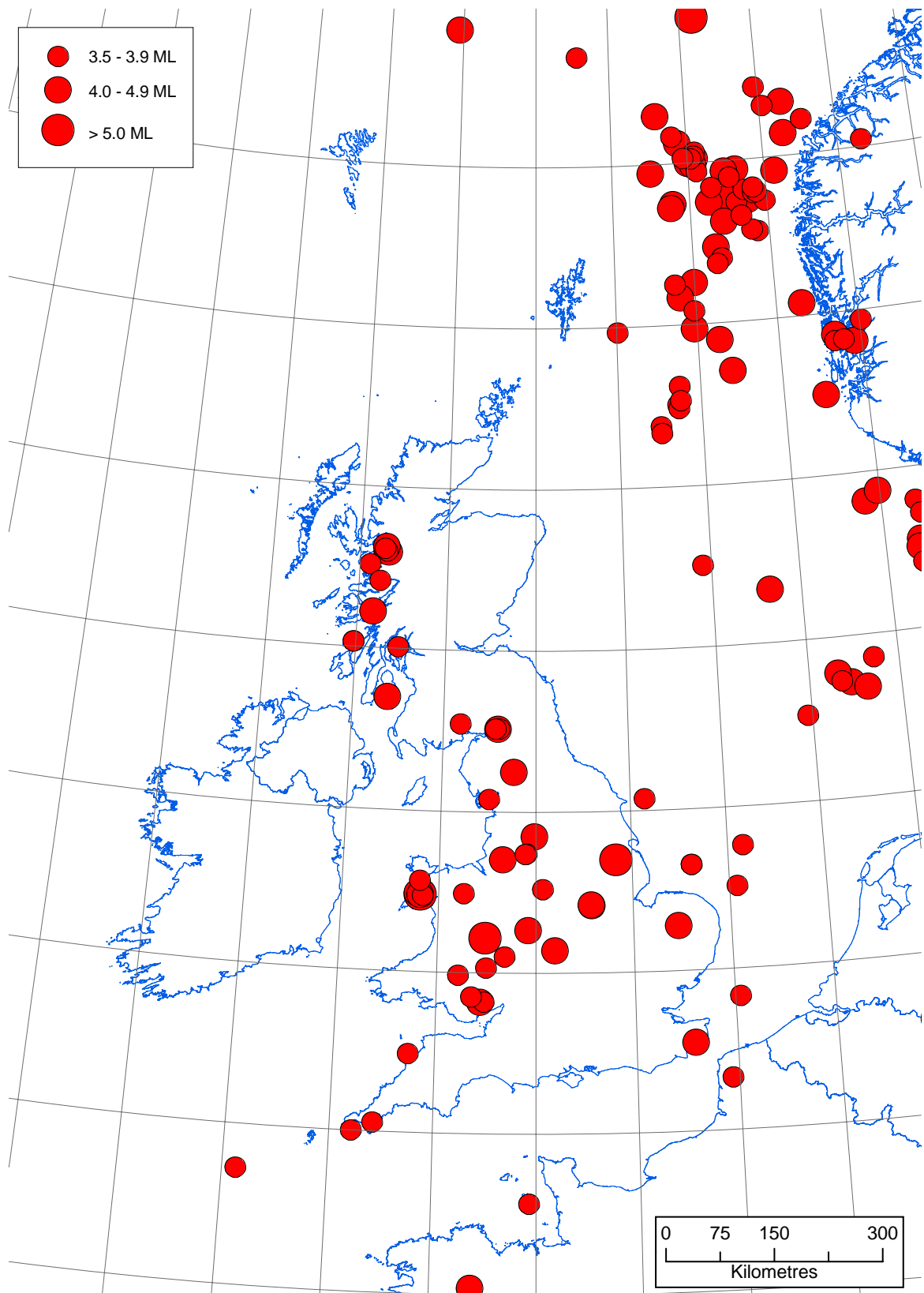


Figure 4. Epicentres of earthquakes with magnitudes of 3.5 ML and above, in the period 1970 - 2009.

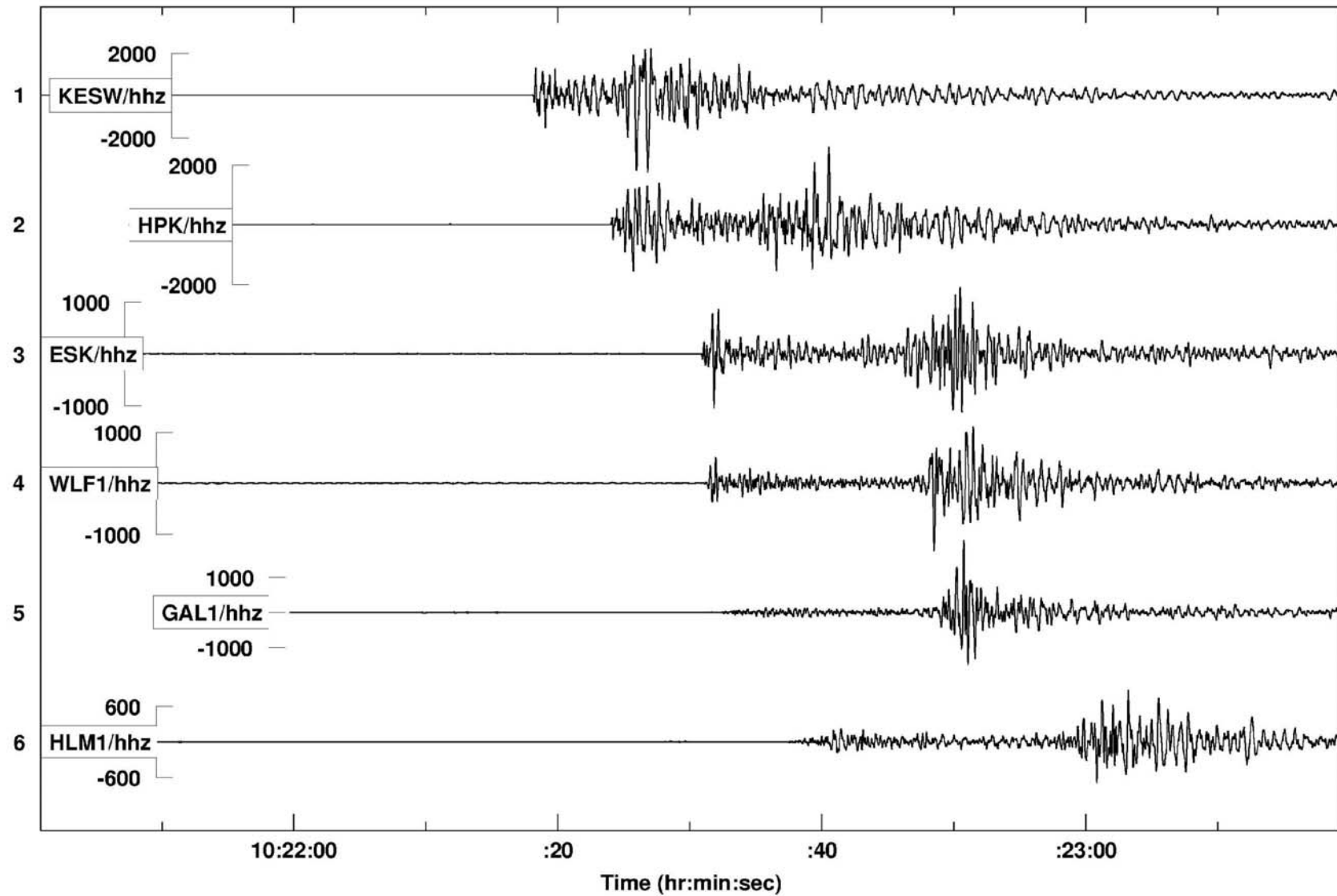


Figure 5. Seismograms of the ground displacement from the Ulverston, Cumbria earthquake, 28 April 2009, recorded by BGS seismograph stations.

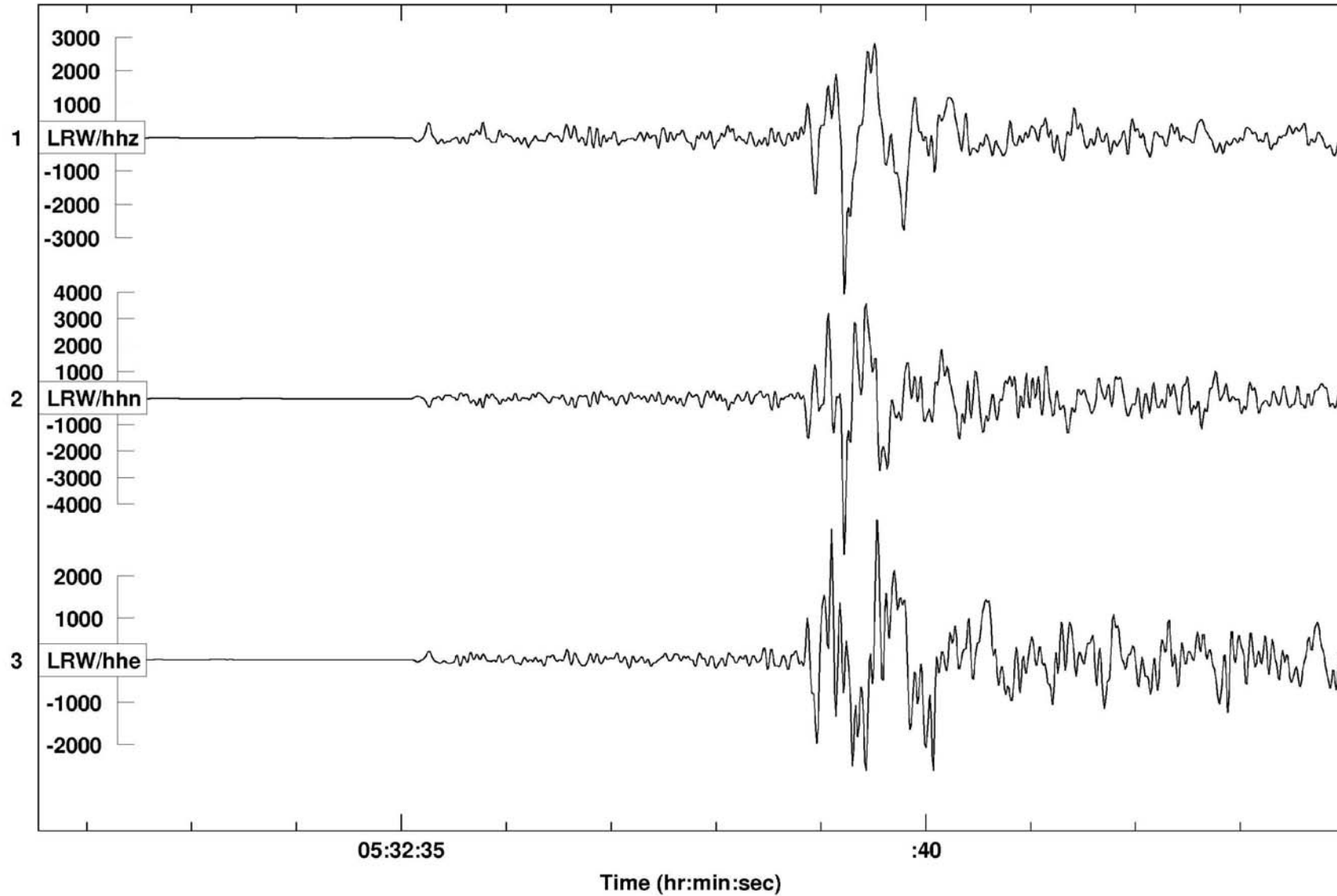


Figure 6. Seismograms of the ground displacement from the Shetland Islands earthquake, 15 January 2009, recorded by BGS seismograph stations.

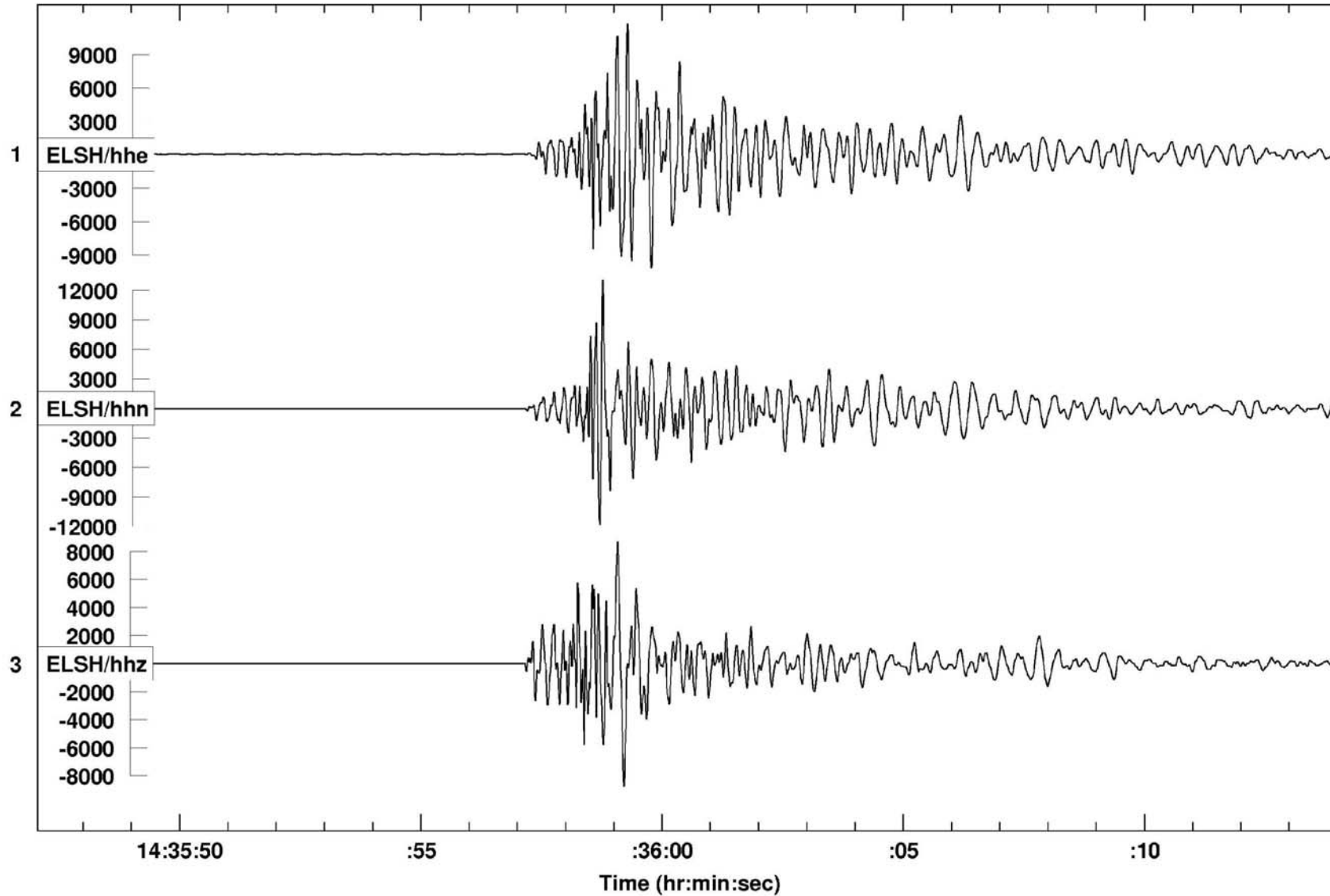


Figure 7. Seismograms of the ground displacement from the Folkestone, Kent earthquake, 3 March 2009, recorded by BGS seismograph stations.

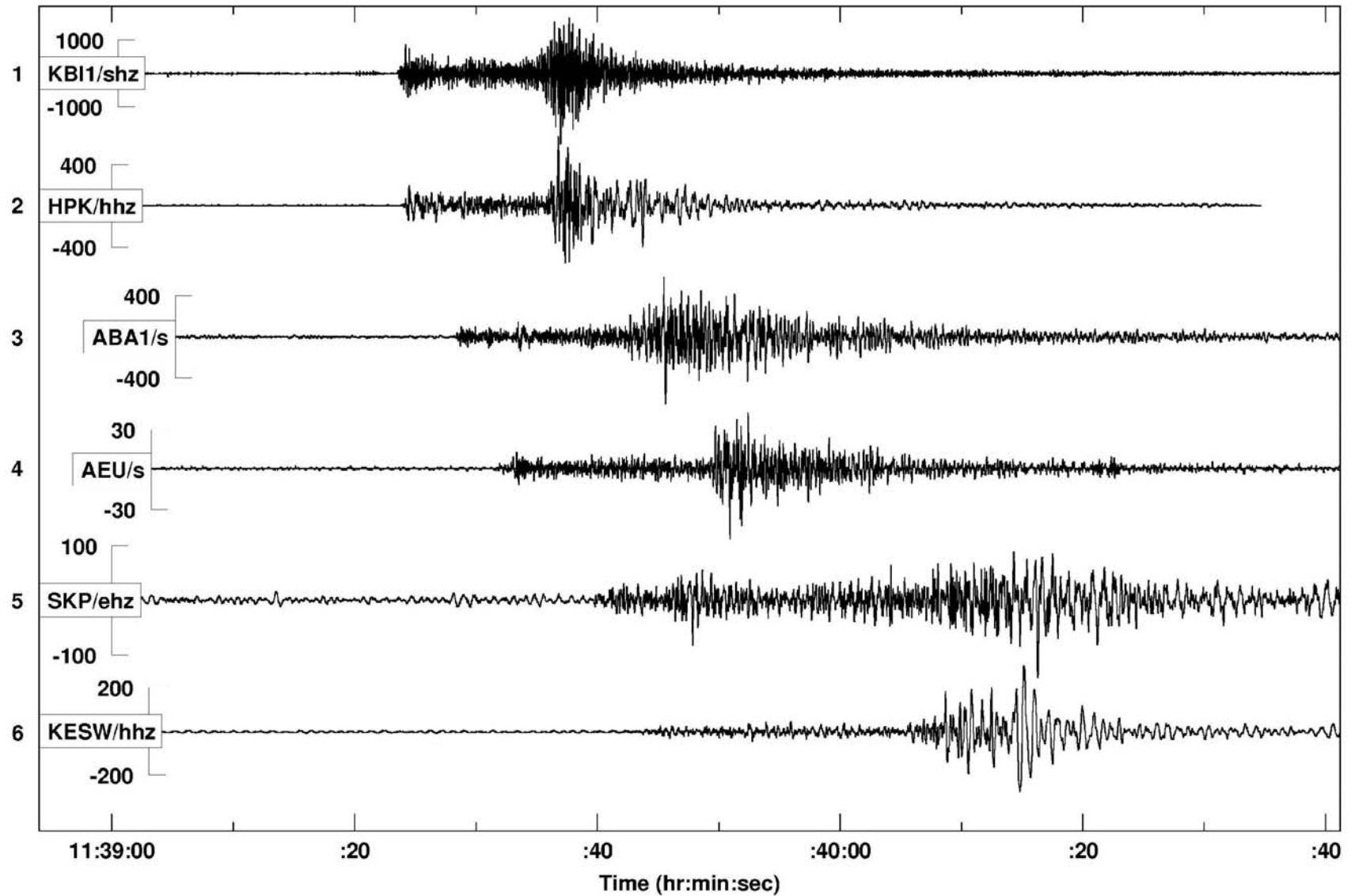


Figure 8. Seismograms of the ground displacement from the Goxhill, North Lincolnshire earthquake, 11 April 2009, recorded by BGS seismograph stations.

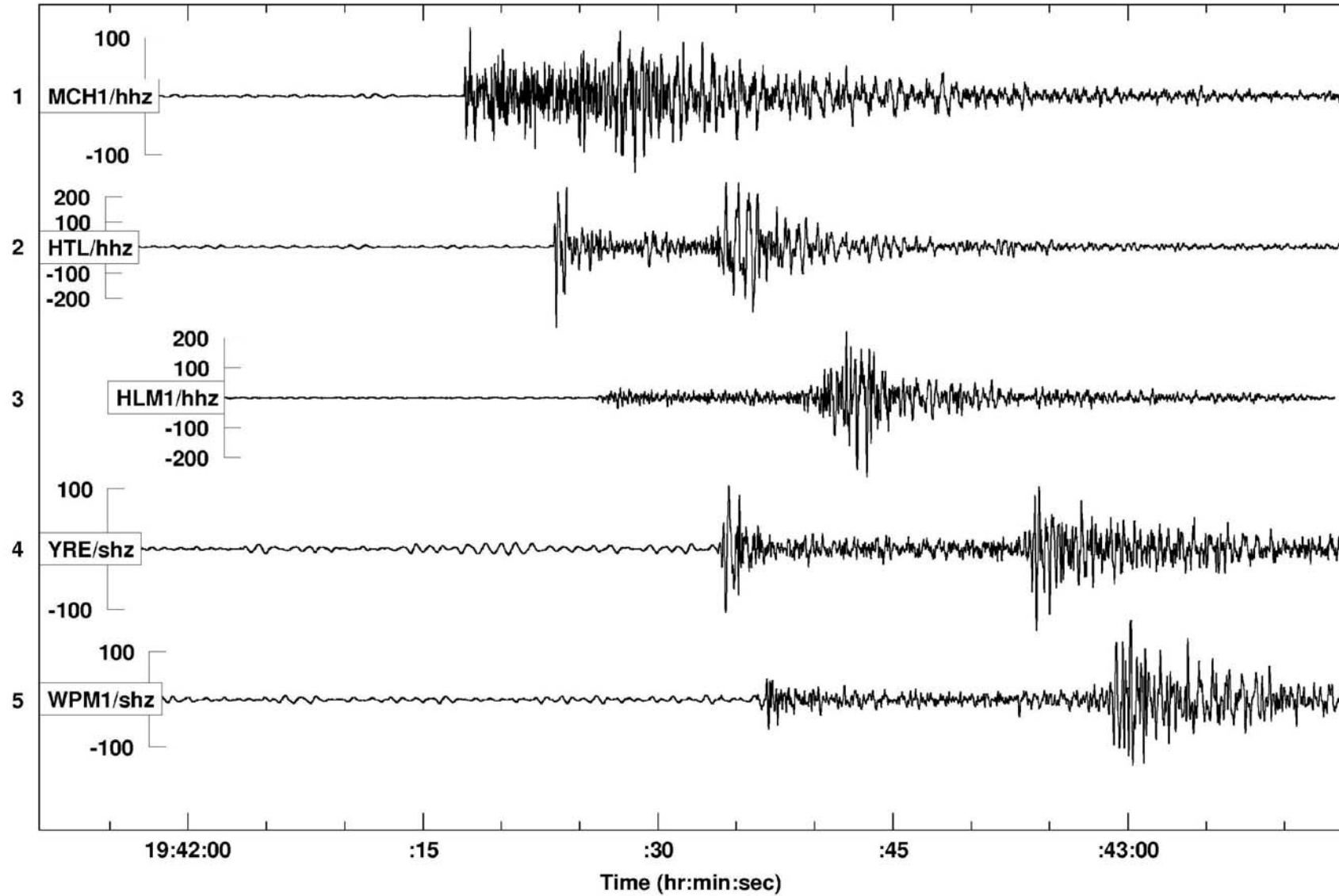


Figure 9. Seismograms of the ground displacement from the Maesteg, Bridgend earthquake, 5 June 2009, recorded by BGS seismograph stations.

TABLE 1 : CATALOGUE OF EVENTS : 2009

YearMoDy	HrMnSecs	Lat	Lon	kmE	kmN	Dep	Mag	Locality	Int	No	Gap	RMS	ERH	ERZ	Comments
20090101	145420.8	55.07	-3.63	296.0	575.9	3.1	1.1	DUMFRIES,D & G		9	149	0.40	3.91	0.80	
20090102	014338.0	55.08	-3.65	294.8	577.2	2.7	1.0	DUMFRIES,D & G		9	104	0.30	3.36	3.40	
20090103	190014.9	55.08	-3.64	295.3	577.5	2.5	1.1	DUMFRIES,D & G		11	104	0.40	4.38	7.10	
20090104	105541.7	58.09	-3.17	330.9	912.3	4.7	1.3	MORAY FIRTH		4	279	0.10	7.95	3.50	EAST OF HELMSDALE
20090105	085947.1	55.09	-3.63	295.7	578.7	2.4	1.2	DUMFRIES,D & G		9	102	0.40	4.55	4.90	
20090108	014202.3	53.27	-2.14	390.8	374.5	11.2	0.8	MACCLESFIELD, CHESHIRE		5	241	0.30	1.72	6.20	
20090110	232642.5	56.75	-4.37	255.3	764.6	6.5	2.4	LOCH ERICHT, HIGHLAND		14	145	0.40	8.13	8.50	
20090115	053229.7	60.27	-1.28	439.7	1153.6	28.9	3.3	SHETLAND ISLANDS	4	14	192	0.60	2.93	4.70	FELT SHETLAND
20090120	065105.9	49.20	-3.23	310.6	-77.4	13.1	2.1	ENGLISH CHANNEL		6	250	0.20	9.78	8.60	80KM WEST OF JERSEY
20090201	084543.9	55.08	-3.64	295.6	577.3	2.7	1.2	DUMFRIES,D & G		13	104	0.80	8.82	4.20	
20090215	103560.0	52.44	-2.64	356.7	282.1	17.4	1.1	LUDLLOW, SHROPSHIRE		3	258	0.00	1.02	0.30	
20090222	131853.4	56.45	-5.29	197.1	733.4	5.2	1.8	BONAWE, ARGYLL/BUTE		13	203	0.20	5.44	4.80	4KM WEST OF BONAWE
20090223	005804.6	50.60	1.01	613.1	82.3	5.0	1.6	ENGLISH CHANNEL		5	228	0.60			55KM S OF FOLKESTONE
20090225	195460.0	53.07	-4.07	261.3	355.0	5.8	1.4	LLANBERIS, GWYNEDD	3	8	152	0.30	4.53	5.10	FELT LLANBERIS
20090228	101150.8	64.72	0.57			10.3	3.0	NORWEGIAN SEA		5	246	0.30	4.23	2.40	500KM NNE OF LERWICK
20090303	143555.9	51.12	1.18	622.4	140.1	3.6	3.0	FOLKESTONE, KENT	4	23	135	0.50	8.10	2.30	FELT FOLKESTONE...
20090304	120427.1	51.53	-3.05	326.9	181.6	12.6	1.6	NEWPORT, SOUTH WALES		5	117	0.10	1.64	2.00	
20090316	024609.1	55.93	-5.13	204.4	675.1	7.2	1.2	DUNOON, ARGYLL/BUTE		10	217	0.30	7.92	7.20	13KM WSW OF DUNOON
20090324	075234.7	56.48	-5.25	199.6	736.5	7.5	1.9	BONAWE, ARGYLL/BUTE	3	14	199	0.50	3.16	0.90	FELT NORTH CONNEL..
20090329	030243.4	52.17	-3.15	321.6	253.5	15.1	1.1	GLADESTRY, POWYS		5	181	0.20	0.32	7.00	
20090407	030515.9	51.90	-3.22	316.2	223.1	4.8	0.8	BRECON, POWYS		4	315	0.10	9.01	9.80	12KM SE OF BRECON
20090408	225250.9	55.81	-5.57	176.6	663.3	9.6	1.5	TARBERT, ARGYLL/BUTE		11	206	0.40	7.76	6.60	9KM SW OF TARBERT
20090411	113907.2	53.70	-0.25	515.6	423.7	15.3	3.0	GOXHILL, NORTH LINCS	3	29	160	0.60	5.85	9.80	FELT HULL, SWANLAND...
20090411	233327.0	50.19	-5.15	175.1	37.5	3.2	1.4	STITHIANS, CORNWALL	3	4	315	0.20	6.38	1.00	FELT CROWLAS & RINSEY
20090420	023954.6	54.44	-3.52	301.7	505.6	2.5	0.7	BECKERMET, CUMBRIA		6	245	0.30	2.05	3.80	
20090422	141206.9	55.82	-3.19	325.1	659.4	4.5	2.0	PENICUIK, MIDLOTHIAN		12	56	0.50	4.35	0.00	
20090428	102209.4	54.16	-2.99	335.2	473.8	9.6	3.7	ULVERSTON, CUMBRIA	5	38	103	0.40	5.03	3.40	FELT CUMBRIA, LANCS
20090501	023321.0	55.10	-3.63	296.1	580.2	3.7	0.6	DUMFRIES,D & G		6	100	0.30	3.64	5.30	
20090501	182137.4	56.18	-4.06	272.0	700.3	7.0	1.5	DOUNE, STIRLING		8	84	0.50	6.85	9.60	
20090503	173508.0	55.84	-3.21	324.2	661.0	6.7	0.7	PENICUIK, LOTHIAN		5	95	0.50	0.74	9.70	
20090507	110825.0	56.40	-5.69	172.2	728.6	12.9	1.8	ISLE OF MULL		11	231	0.20	9.97	5.80	EAST MULL
20090511	130800.0							SONIC - EYEMOUTH	2						FELT EYEMOUTH...
20090604	042532.8	56.17	-4.76	228.4	701.1	11.6	1.5	LOCH LONG, ARGYLL/BUTE		14	159	0.60	9.81	6.70	3KM SSW OF ARROCHAR
20090605	194207.1	51.62	-3.65	286.1	192.9	3.6	2.9	MAESTEG, BRIDGEND	3	22	121	0.50	4.48	6.10	FELT BRIDGEND...
20090610	045956.4	51.81	-3.42	301.9	213.0	12.3	1.9	VAYNOR, MERTHYR TYDFIL		12	115	0.30	2.73	2.80	
20090614	090728.9	56.10	-4.33	255.0	692.1	3.2	1.6	BUCHLYVIE, STIRLING		14	134	0.50	9.14	0.20	
20090617	015716.5	49.84	-4.88	192.6	-3.0	6.0	1.3	LIZARD POINT, CORNWALL		6	263	0.40	0.78	7.10	25KM SE OF LIZARD PT
20090621	234314.0	56.68	-5.28	199.0	758.7	7.2	1.4	LOCH LINNHE, HIGHLAND		13	191	0.30	7.09	6.90	4KM SW OF ONICH
20090628	000521.0	56.24	-3.73	293.1	706.8	5.3	1.6	BLACKFORD, PERTH/KINROS		18	72	0.60	4.70	0.60	4KM SE OF BLACKFORD
20090628	001802.2	53.31	-0.33	511.2	381.0	17.8	1.5	MARKET RASEN, LINCS		3	281	0.40	2.67	7.70	
20090630	014720.8	50.59	-1.32	448.4	77.2	5.1	1.5	CHALE, ISLE OF WIGHT		10	130	0.50	7.45	8.60	NEAR BLACKGANG CHINE
20090701	192409.4	52.27	2.98	739.9	275.8	8.4	2.1	SOUTHERN NORTH SEA		6	285	0.10	8.23	5.80	125KM ENE OF IPSWICH
20090706	230934.5	56.09	-4.33	254.8	690.9	2.7	1.2	BUCHLYVIE, STIRLING		8	133	0.40	6.96	5.00	

TABLE 1 : CATALOGUE OF EVENTS : 2009

YearMoDy	HrMnSecs	Lat	Lon	kmE	kmN	Dep	Mag	Locality	Int	No	Gap	RMS	ERH	ERZ	Comments
20090707	214924.5	53.25	-1.81	412.7	372.9	1.1	2.0	BUXTON, DERBYSHIRE		4	121	0.20	2.33	2.00	COLLAPSE EVENT
20090708	154247.7	55.39	-4.21	260.1	612.9	7.8	0.8	CUMNOCK, EAST AYRSHIRE		6	146	0.60	3.73	9.60	
20090716	104056.0	57.15	-5.30	200.3	811.7	4.5	1.7	SHIEL BRIDGE, HIGHLAND		7	214	0.50	7.99	3.80	
20090721	183826.9	55.86	-5.21	199.5	667.8	7.5	1.3	KYLES OF BUTE		7	249	0.40	0.40	9.90	
20090722	051617.6	55.21	-2.94	340.0	591.3	8.3	0.9	LANGHOLM, D & G		7	199	0.30	7.71	9.20	7KM NE OF LANGHOLM
20090723	175206.5	56.10	-4.29	257.3	692.2	4.2	1.0	BUCHLYVIE, STIRLING		6	145	0.50	9.02	8.40	
20090726	121731.6	53.37	-4.46	236.1	389.1	7.5	2.2	ISLE OF ANGLESEY	3	11	146	0.20	1.66	1.00	FELT LLANFACHRAETH...
20090726	224630.9	59.70	1.72	609.2	1095.9	10.0	2.4	NORTHERN NORTH SEA		5	300	0.30	2.93	0.00	170KM ESE OF LERWICK
20090727	111115.9	58.59	-4.85	234.3	970.9	4.1	1.4	DURNESS, HIGHLAND		9	264	0.30	0.60	3.30	
20090808	144228.8	55.23	-3.49	305.3	593.8	4.2	2.4	JOHNSTONEBRIDGE, D & G		16	73	0.40	3.76	5.50	
20090808	144737.7	55.24	-3.47	306.5	594.6	4.7	0.3	JOHNSTONEBRIDGE, D & G		4	189	0.10	2.39	9.00	
20090808	145034.7	55.23	-3.48	305.6	593.5	4.9	1.2	JOHNSTONEBRIDGE, D & G		7	81	0.50	5.83	8.50	
20090808	181705.5	55.23	-3.49	305.4	594.2	5.2	0.7	JOHNSTONEBRIDGE, D & G		6	187	0.30	4.17	6.20	
20090809	103007.6	55.23	-3.49	305.5	594.4	4.7	0.8	JOHNSTONEBRIDGE, D & G		6	142	0.30	4.49	5.10	
20090810	143833.5	55.23	-3.49	305.2	593.4	5.3	1.4	JOHNSTONEBRIDGE, D & G		8	112	0.40	6.05	7.10	
20090814	082852.8	55.23	-3.50	304.4	594.0	4.5	1.7	JOHNSTONEBRIDGE, D & G		15	74	0.40	3.99	6.10	
20090827	134502.8	60.14	-0.25	497.1	1140.7	10.0	1.7	SHETLAND ISLANDS		1	360	0.00	0.82	0.00	50KM EAST OF LERWICK
20090827	225321.2	52.77	-2.14	390.8	318.6	5.2	1.1	STAFFORD, STAFFORDSHIRE		6	178	0.40	8.80	4.20	
20090903	172307.6	57.81	-5.63	184.1	885.6	3.9	1.2	LOCH EWE, HIGHLAND		7	142	0.10	1.39	2.00	
20090907	230620.0	55.23	-3.48	305.6	593.9	5.2	1.2	JOHNSTONEBRIDGE, D & G		12	73	0.40	4.20	5.10	
20090915	003022.2	53.74	1.12	605.6	432.2	5.7	3.3	SOUTHERN NORTH SEA		30	207	0.60	0.67	9.80	95KM EAST OF HULL
20090919	153354.7	55.83	-5.33	191.4	665.1	6.3	1.4	TARBERT, ARGYLL & BUTE		9	194	0.30	6.78	2.10	
20090926	175707.2	53.16	-1.72	418.6	362.1	13.7	1.9	BAKEWELL, DERBYSHIRE		11	114	0.30	4.34	3.40	6KM SW OF BAKEWELL
20090930	130456.7	53.70	-0.69	486.7	423.7	13.1	2.9	ALKBOROUGH, NORTH Lincs	3	5	196	0.40	8.24	5.00	FELT BRIGG...
20091006	050555.4	51.77	-4.10	255.1	210.4	11.7	2.5	LLANNON, CARMARTHENSHIR		18	146	0.50	5.06	6.10	
20091007	113607.5	50.63	-1.90	407.4	81.3	0.0	2.1	OFFSHORE SWANAGE	3	11	155	0.40	4.25	0.00	MINE DETONATION
20091010	041737.7	53.50	-2.33	378.0	400.6	7.9	1.5	SWINTON, GTR MANCHESTER	3	9	141	0.40	5.50	5.00	FELT SWINTON
20091013	103842.2	50.60	-1.60	428.0	78.3	0.0	2.3	OFFSHORE ALUM BAY	3	14	118	0.50	4.43	0.00	MINE DETONATION
20091014	112730.0							SONIC - COLERAINE	2	1					FELT COLERAINE
20091019	090959.5	55.24	-3.47	306.7	595.4	4.5	0.9	JOHNSTONEBRIDGE, D & G		6	142	0.30	4.00	3.40	
20091023	133430.9	55.85	-3.84	284.8	663.8	0.0	2.0	QB, SHOTTS, STRATHCLYDE	3	10	68	0.30	2.42	0.00	FELT SHOTTS
20091024	171212.3	49.45	-5.60	139.4	-43.5	5.0	2.1	LIZARD POINT, CORNWALL		3	331	0.70	5.14	0.00	60KM SW OF LIZARD PT
20091026	164219.7	51.71	-5.16	181.7	206.1	0.0	2.1	OFFSHORE MILFORD HAVEN	3	14	181	0.50	7.34	0.00	MINE DETONATION
20091110	153403.1	55.84	-3.78	288.6	662.3	0.0	2.2	QB, SHOTTS, STRATHCLYDE	2	10	118	0.50	6.62	0.00	FELT SHOTTS
20091116	154315.4	56.41	-5.41	189.5	729.7	7.7	2.0	OBAN, ARGYLL & BUTE	3	12	213	0.40	5.26	1.00	FELT OBAN
20091125	012118.2	49.27	-6.14	99.2	-62.2	5.0	2.2	ISLES OF SCILLY		3	341	0.80	4.48	0.00	70KM S OF ST ANGUS
20091202	175259.2	51.70	-3.24	314.5	200.6	8.5	2.1	BARGOED, CAERPHILLY		12	86	0.30	2.68	3.50	
20091209	052907.0	53.25	-1.82	411.9	372.8	1.1	1.6	BUXTON, DERBYSHIRE		7	121	0.20	3.49	2.60	COLLAPSE TYPE
20091213	053954.2	56.48	-5.96	156.3	738.4	11.2	2.3	ISLE OF MULL	3	14	191	0.30	7.76	7.30	FELT ISLE OF MULL...
20091214	232051.4	52.41	-3.69	285.3	280.8	6.1	2.4	LLANGURIG, POWYS	3	23	104	0.50	3.13	8.00	FELT GROSMONT...
20091215	152526.3	51.71	-4.08	256.0	203.2	8.2	1.6	LLANELLI, CARMARTHNSHIR		11	151	0.30	3.04	5.00	
20091217	152616.5	53.05	-2.96	335.3	350.2	7.5	2.0	WREXHAM, WREXHAM		15	106	0.30	3.09	6.60	
20091221	000721.0	56.13	-3.91	281.3	694.2	9.2	1.3	CAMBUSKENNETH, STIRLING		7	120	0.20	4.62	3.30	

TABLE 1 : CATALOGUE OF EVENTS : 2009

YearMoDy	HrMnSecs	Lat	Lon	kmE	kmN	Dep	Mag	Locality	Int	No	Gap	RMS	ERH	ERZ	Comments
20091224	154558.6	56.14	-3.91	281.3	696.1	11.1	2.1	CAMBUSKENNETH, STIRLING		10	70	0.20	2.75	3.60	
20091224	161242.9	53.02	-2.17	388.3	346.7	0.5	2.1	STOKE-ON-TRENT, STAFFS	3	11	121	0.30	3.90	2.40	FELT STOKE
20091225	090009.8	53.01	-2.17	388.8	345.9	0.9	1.7	STOKE-ON-TRENT, STAFFS		11	141	0.40	5.37	3.20	
20091227	110221.1	53.50	-2.23	385.0	400.8	3.4	1.5	GREATER MANCHESTER		8	83	0.40	4.56	0.10	
20091228	233103.4	49.01	-2.09	393.5	-99.0	5.0	1.8	JERSEY, CHANNEL ISLES		3	312	0.40	8.13	0.00	20KM S OF JERSEY
20091231	062655.3	52.83	-2.62	358.5	326.0	5.6	0.7	MARKET DRAYTON, SALOP		5	276	0.20	5.98	4.90	12KM SW OF M DRAYTON
20091231	175704.1	52.83	-2.61	359.1	325.8	6.1	1.1	MARKET DRAYTON, SALOP		5	276	0.20	5.95	4.70	12KM SW OF M DRAYTON

TABLE 2 : PHASE DATA

<p>June 10 2009 Time: 04:59 56.4 UTC Magnitude: 1.9 ML Lat: 51.807N Lon: -3.423W Depth: 12.3 km Grid Ref: 301.90 kmE 213.05 kmN RMS: 0.30 secs Locality: VAYNOR, MERTHYR TYDFIL Velocity model: Mid Wales Xnear: 150.0 Xfar: 300.0</p>										<p>KPL HE 77.1 AML 23:43 39.67 22 0.24 KPL HN 77.1 AML 23:43 39.70 20 0.18 EAB SZ 79.7 IP C 23:43 27.10 -0.15 KAC SZ 91.5 EP 23:43 29.33 0.27 ELO SZ 99.2 EP 23:43 29.95 -0.37 MDO SZ 102.0 EP 23:43 30.30 -0.38 PGB1 HZ 108.0 EP 23:43 31.89 0.22 PGB1 HE 108.0 ES 23:43 44.34 -0.25 PGB1 HN 108.0 AML 23:43 45.46 9 0.58 PGB1 HE 108.0 AML 23:43 49.97 7 0.42 EAU SZ 147.0 EP 23:43 37.48 0.12 EDI HZ 154.0 EP 23:43 38.75 0.32 EDI HN 154.0 ES 23:43 56.35 0.06 EDI HE 154.0 AML 23:44 01.47 4 0.44 EDI HN 154.0 AML 23:44 02.53 6 0.52 MME1 SZ 158.0 EP 23:43 39.12 0.15 MCD SZ 159.0 EP 23:43 39.73 0.63 MCD SE 159.0 AML 23:44 00.04 14 0.18 MCD SN 159.0 AML 23:44 03.99 9 0.34 DRUM HZ 173.0 EP 23:43 41.55 0.58 DRUM HN 173.0 ES 23:44 00.62 -0.05 DRUM HN 173.0 AML 23:44 02.96 16 0.38 DRUM HE 173.0 AML 23:44 03.87 6 0.10 ESK HN 199.0 AML 23:44 08.87 2 0.54 ESK HE 199.0 AML 23:44 14.77 3 0.28</p>									
<p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES MCH1 HZ 36.1 EP 05:00 02.76 -0.18 MCH1 HE 36.1 ES 05:00 07.68 0.06 MCH1 HN 36.1 AML 05:00 07.83 193 0.10 MCH1 HE 36.1 AML 05:00 07.94 238 0.19 HEX SZ 86.5 IP C 05:00 10.71 -0.19 HLML HZ 87.4 IP C 05:00 10.74 -0.31 HLML HN 87.4 ES 05:00 21.21 -0.37 HLML HE 87.4 AML 05:00 22.53 34 0.17 HLML HN 87.4 AML 05:00 22.81 44 0.21 SSW EZ 110.0 EP 05:00 14.24 -0.16 SWN1 HE 117.0 ES 05:00 29.23 0.05 HTL HZ 117.0 EP 05:00 15.40 -0.03 HTL HE 117.0 ES 05:00 29.08 -0.04 HTL HE 117.0 AML 05:00 30.00 22 0.12 HTL HN 117.0 AML 05:00 32.27 20 0.17 SWN1 HZ 117.0 EP 05:00 15.97 0.50 SWN1 HE 117.0 AML 05:00 30.30 45 0.19 SWN1 HN 117.0 AML 05:00 30.78 54 0.20 FOEL HZ 121.0 EP 05:00 16.62 0.45 FOEL HE 121.0 ES 05:00 30.32 -0.05 FOEL HN 121.0 AML 05:00 32.71 26 0.23 FOEL HE 121.0 AML 05:00 33.39 28 0.57 DYA HZ 157.0 EP 05:00 21.17 -0.16 DYA HN 157.0 AML 05:00 39.55 36 0.19 DYA HE 157.0 AML 05:00 40.00 27 0.34 WOL BE 162.0 ES 05:00 40.38 -0.03 WOL BE 162.0 AML 05:00 41.59 26 0.31 WOL BN 162.0 AML 05:00 42.05 40 0.37 WPM1 SZ 165.0 EP 05:00 22.68 0.34 WLF1 HZ 178.0 EP 05:00 23.82 -0.10 WLF1 HE 178.0 AML 05:00 45.89 8 0.25 WLF1 HN 178.0 AML 05:00 46.54 6 0.11 YRC SZ 179.0 EP 05:00 24.40 0.36</p>										<p>June 28 2009 Time: 00:05 21.0 UTC Magnitude: 1.6 ML Lat: 56.242N Lon: -3.725W Depth: 5.3 km Grid Ref: 293.11 kmE 706.83 kmN RMS: 0.60 secs Locality: BLACKFORD, PERTH/KINROSS Velocity model: Lownet Xnear: 100.0 Xfar: 200.0 Comment: 4KM SE OF BLACKFORD</p>									
<p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES ELO SZ 25.5 IP C 00:05 25.64 -0.23 EAB SZ 38.4 IP C 00:05 27.50 -0.33 EAU SZ 47.4 EP 00:05 29.41 0.17 EDI HZ 48.8 EP 00:05 28.85 -0.56 EDI HE 48.8 ES 00:05 35.22 -0.35 EDI HN 48.8 AML 00:05 37.10 10 0.32 EDI HE 48.8 AML 00:05 37.99 14 0.24 PGB1 HZ 67.3 EP 00:05 32.04 -0.25 PGB1 HE 67.3 ES 00:05 40.14 -0.42 PGB1 HN 67.3 AML 00:05 43.41 17 0.36 PGB1 HE 67.3 AML 00:05 45.35 21 0.36 ESY SZ 78.0 EP 00:05 34.44 0.45 DRUM HZ 107.0 EP 00:05 38.24 -0.16 DRUM HN 107.0 ES 00:05 50.55 -0.58 DRUM HE 107.0 AML 00:05 55.07 42 0.12 DRUM HN 107.0 AML 00:05 55.29 33 0.18 ESK HZ 108.0 EP 00:05 39.58 0.96 ESK HN 108.0 ES 00:05 51.37 -0.15 ESK HE 108.0 AML 00:05 54.92 22 0.20 ESK HN 108.0 AML 00:05 55.30 18 0.24 ECK SZ 124.0 EP 00:05 41.90 0.80 MME1 SZ 128.0 EP 00:05 42.24 0.50 MDO SZ 139.0 EP 00:05 44.10 0.82 KSB SZ 150.0 EP 00:05 45.64 0.84 MCD SZ 152.0 EP 00:05 45.71 0.60 MCD SE 152.0 ES 00:06 02.80 0.06 MCD SE 152.0 AML 00:06 05.23 39 0.36 MCD SN 152.0 AML 00:06 05.59 28 0.12 GAL1 HZ 165.0 EP 00:05 47.74 0.78 GAL1 HN 165.0 ES 00:06 05.32 -0.62 GAL1 HE 165.0 AML 00:06 07.98 18 0.48 GAL1 HN 165.0 AML 00:06 08.00 14 0.54 KPL HZ 170.0 EP 00:05 48.65 1.13 KPL HN 170.0 ES 00:06 06.27 -0.64 KPL HE 170.0 AML 00:06 09.25 6 0.28 KPL HN 170.0 AML 00:06 09.27 8 0.24 KAC SZ 170.0 EP 00:05 47.48 -0.09 KESW HZ 188.0 EP 00:05 51.55 1.66 KESW HE 188.0 AML 00:06 14.91 5 0.78 KESW HN 188.0 AML 00:06 15.61 5 0.40 MVH1 SZ 190.0 EP 00:05 52.49 2.46</p>																			
<p>June 14 2009 Time: 09:07 28.9 UTC Magnitude: 1.6 ML Lat: 56.100N Lon: -4.331W Depth: 3.2 km Grid Ref: 255.03 kmE 692.13 kmN RMS: 0.50 secs Locality: BUCHLYVIE, STIRLING Velocity model: Lownet Xnear: 100.0 Xfar: 200.0</p>										<p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES EAB SZ 9.9 EP 09:07 30.89 -0.18 PGB1 HZ 33.5 EP 09:07 34.92 -0.14 PGB1 HE 33.5 ES 09:07 39.12 -0.45 PGB1 HE 33.5 AML 09:07 39.37 59 0.20 PGB1 HN 33.5 AML 09:07 39.56 37 0.28 ELO SZ 56.3 EP 09:07 38.32 -0.53 EAU SZ 62.0 EP 09:07 39.98 0.28 EDI HZ 74.0 EP 9 09:07 40.06 -1.45 EDI HN 74.0 ES 9 09:07 48.51 -0.77 EDI HE 74.0 AML 09:07 49.75 17 0.22 EDI HN 74.0 AML 09:07 50.19 21 0.30 EBL SZ 88.3 EP 09:07 43.98 0.19 ESY SZ 109.0 EP 09:07 47.24 0.26 ESK HZ 112.0 EP 09:07 48.07 0.59 ESK HN 112.0 ES 09:08 00.64 -0.42 ESK HN 112.0 AML 09:08 04.04 21 0.16 ESK HE 112.0 AML 09:08 05.83 17 0.34 ECK SZ 127.0 EP 09:07 50.45 0.64 KSB SZ 141.0 EP 09:07 52.10 0.32 DRUM HZ 145.0 EP 09:07 52.27 -0.13 DRUM HN 145.0 ES 09:08 08.76 -0.81 DRUM HE 145.0 AML 09:08 12.48 16 0.38 DRUM HN 145.0 AML 09:08 13.05 17 0.46 MME1 SZ 159.0 EP 09:07 55.44 1.00 KPL HZ 160.0 EP 09:07 55.47 1.00 KPL HE 160.0 AML 09:08 15.25 11 0.22 KPL HN 160.0 AML 09:08 17.08 8 0.52 MCD SZ 178.0 EP 09:07 56.69 -0.28 MCD SE 178.0 AML 09:08 20.55 11 0.66 MCD SN 178.0 AML 09:08 23.52 11 0.46</p>									
<p>June 17 2009 Time: 01:57 16.5 UTC Magnitude: 1.3 ML Lat: 49.837N Lon: -4.885W Depth: 6.0 km Grid Ref: 192.58 kmE -2.96 kmN RMS: 0.40 secs Locality: LIZARD POINT, CORNWALL Velocity model: Cornwall Xnear: 200.0 Xfar: 500.0 Comment: 25KM SE OF LIZARD PT</p>										<p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES DYA HZ 95.2 EP 01:57 32.18 -0.87 DYA HN 95.2 ES 01:57 45.91 0.09 DYA HE 95.2 AML 01:57 46.97 6 0.26 DYA HN 95.2 AML 01:57 47.50 11 0.30 HTL HZ 132.0 EP 01:57 38.58 0.13 HTL HE 132.0 ES 01:57 55.71 0.34 HTL HE 132.0 AML 01:57 59.09 8 0.48 HTL HN 132.0 AML 01:57 59.15 10 0.52 JSA HN 209.0 ES 01:58 13.00 -0.08 JLP SZ 212.0 ES 01:58 13.91 0.30 JRS SZ 215.0 ES 01:58 13.96 -0.28 JQE SZ 218.0 ES 01:58 15.39 0.40</p>									
<p>June 21 2009 Time: 23:43 14.0 UTC Magnitude: 1.4 ML Lat: 56.677N Lon: -5.282W Depth: 7.2 km Grid Ref: 198.96 kmE 758.71 kmN RMS: 0.30 secs Locality: LOCH LINNHE, HIGHLAND Velocity model: Lownet Xnear: 100.0 Xfar: 300.0 Comment: 4KM SW OF ONICH</p>										<p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES SWN1 HZ 108.0 EP 01:47 38.09 -0.49 SWN1 HN 108.0 ES 01:47 52.10 0.53 SWN1 HN 108.0 AML 01:47 55.57 19 0.74 SWN1 HE 108.0 AML 01:47 57.90 20 0.46 SKP EZ 131.0 EP 01:47 41.31 -0.75 SKP EZ 131.0 ES 01:47 57.76 0.18 SSW EZ 157.0 EP 01:47 46.37 0.46 SSW EZ 157.0 ES 01:48 04.24 0.00 JLP SZ 160.0 EP 01:47 45.65 -0.55</p>									

TABLE 2 : PHASE DATA

<p>JQE SZ 163.0 EP 01:47 47.41 0.72</p> <p>JRS SZ 165.0 EP 01:47 47.48 0.49</p> <p>JRS SE 165.0 ES 01:48 05.97 -0.14</p> <p>JSA HZ 168.0 EP 01:47 47.93 0.59</p> <p>JSA HE 168.0 ES 01:48 06.62 -0.09</p> <p>JSA HE 168.0 AML 01:48 12.00 8 0.26</p> <p>JSA HN 168.0 AML 01:48 12.30 6 0.56</p> <p>ELSH HZ 183.0 EP 01:47 49.12 -0.20</p> <p>DYA HZ 186.0 EP 01:47 49.11 -0.63</p> <p>DYA HN 186.0 ES 01:48 10.53 -0.33</p> <p>DYA HN 186.0 AML 01:48 14.34 4 0.58</p> <p>DYA HE 186.0 AML 01:48 15.16 4 0.52</p> <p>MCH1 HZ 196.0 EP 01:47 50.74 -0.13</p> <p>MCH1 HE 196.0 ES 01:48 13.17 0.34</p> <p>MCH1 HE 196.0 AML 01:48 15.50 6 0.44</p> <p>MCH1 HN 196.0 AML 01:48 15.53 5 0.40</p>	<p>EAB SZ 89.3 EP 15:43 02.45 -0.03</p> <p>KESW HZ 114.0 EP 15:43 07.07 0.80</p> <p>ESY SZ 116.0 EP 15:43 06.44 -0.24</p> <p>July 16 2009 Time: 10:40 56.0 UTC Magnitude: 1.7 ML</p> <p>Lat: 57.153N Lon: -5.302W Depth: 4.5 km</p> <p>Grid Ref: 200.30 kmE 811.72 kmN RMS: 0.50 secs</p> <p>Locality: SHIEL BRIDGE, HIGHLAND</p> <p>Velocity model: Lownet Xnear: 200.0 Xfar: 300.0</p> <p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES</p> <p>KSB SZ 9.6 IP D 10:40 57.84 -0.42</p> <p>KAC SZ 38.5 EP 10:41 03.22 0.14</p> <p>MDO SZ 65.1 EP 10:41 07.17 -0.08</p> <p>MVH1 SZ 109.0 EP 10:41 14.68 0.65</p> <p>MCD SZ 132.0 EP 10:41 18.29 0.69</p> <p>MCD SE 132.0 ES 10:41 32.54 -0.80</p> <p>MME1 SZ 142.0 EP 10:41 18.70 -0.38</p> <p>DRUM HZ 173.0 EP 10:41 23.36 -0.01</p> <p>DRUM HN 173.0 ES 10:41 43.54 0.22</p> <p>DRUM HN 173.0 AML 10:41 45.51 11 0.24</p> <p>DRUM HE 173.0 AML 10:41 45.99 8 0.10</p>	<p>July 1 2009 Time: 19:24 09.4 UTC Magnitude: 2.1 ML</p> <p>Lat: 52.275N Lon: 2.984W Depth: 8.4 km</p> <p>Grid Ref: 739.91 kmE 275.84 kmN RMS: 0.10 secs</p> <p>Locality: SOUTHERN NORTH SEA</p> <p>Velocity model: Lownet Xnear: 400.0 Xfar: 800.0</p> <p>Comment: 125KM ENE OF IPSWICH</p> <p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES</p> <p>AWI1 SZ 121.0 EP 19:24 29.24 0.13</p> <p>AEU SZ 125.0 EP 19:24 29.63 -0.05</p> <p>AEU SN 125.0 ES 19:24 44.49 -0.01</p> <p>ABAL SZ 142.0 EP 19:24 32.37 0.23</p> <p>ELSH HZ 179.0 EP 19:24 37.13 -0.10</p> <p>ELSH HN 179.0 ES 19:24 57.77 0.20</p> <p>ELSH HE 179.0 AML 19:25 06.18 20 0.48</p> <p>ELSH HE 179.0 AML 19:25 08.58 21 0.70</p> <p>HLM1 HZ 400.0 EP 19:25 04.84 -0.08</p> <p>HLM1 HN 400.0 ES 19:25 45.38 -0.09</p> <p>HLM1 HN 400.0 AML 19:26 10.13 5 0.65</p> <p>HLM1 HE 400.0 AML 19:26 10.37 4 0.62</p> <p>MCH1 HZ 411.0 EP 19:25 05.96 -0.25</p> <p>MCH1 HN 411.0 AML 19:25 50.07 2 0.56</p> <p>MCH1 HE 411.0 AML 19:25 51.62 2 0.14</p>	
<p>July 6 2009 Time: 23:09 34.5 UTC Magnitude: 1.2 ML</p> <p>Lat: 56.089N Lon: -4.334W Depth: 2.7 km</p> <p>Grid Ref: 254.80 kmE 690.92 kmN RMS: 0.40 secs</p> <p>Locality: BUCHLYVIE, STIRLING</p> <p>Velocity model: Lownet Xnear: 150.0 Xfar: 300.0</p> <p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES</p> <p>EAB SZ 11.1 IP C 23:09 36.24 -0.67</p> <p>PGB1 HZ 32.2 EP 23:09 40.33 -0.14</p> <p>PGB1 HN 32.2 ES 23:09 44.27 -0.55</p> <p>PGB1 HE 32.2 AML 23:09 44.72 24 0.20</p> <p>PGB1 HN 32.2 AML 23:09 44.92 23 0.26</p> <p>EDI HZ 73.8 EP 9 23:09 48.05 0.89</p> <p>EDI HN 73.8 ES 9 23:09 56.48 -0.81</p> <p>EDI HE 73.8 AML 23:09 57.30 7 0.24</p> <p>EDI HN 73.8 AML 23:09 57.60 6 0.15</p> <p>ESK HZ 111.0 EP 23:09 53.30 0.28</p> <p>ESK HE 111.0 ES 23:10 06.18 -0.36</p> <p>ESK HN 111.0 AML 23:10 09.37 10 0.16</p> <p>ESK HE 111.0 AML 23:10 11.17 8 0.34</p> <p>ECK SZ 126.0 EP 23:09 55.86 0.52</p> <p>GALL HZ 138.0 EP 23:09 57.33 0.27</p> <p>GALL HN 138.0 ES 23:10 13.69 0.16</p> <p>GALL HE 138.0 AML 23:10 14.82 9 0.24</p> <p>GALL HN 138.0 AML 23:10 15.21 4 0.16</p> <p>DRUM HZ 146.0 EP 23:09 58.45 0.22</p> <p>DRUM HE 146.0 ES 23:10 15.32 -0.23</p> <p>DRUM HE 146.0 AML 23:10 17.57 6 0.50</p> <p>DRUM HN 146.0 AML 23:10 20.03 8 0.52</p> <p>KPL HZ 161.0 EP 23:10 00.89 0.59</p> <p>KPL HE 161.0 AML 23:10 20.55 4 0.24</p> <p>KPL HN 161.0 AML 23:10 23.18 4 0.62</p>	<p>July 22 2009 Time: 05:16 17.6 UTC Magnitude: 0.9 ML</p> <p>Lat: 55.212N Lon: -2.943W Depth: 8.3 km</p> <p>Grid Ref: 340.00 kmE 591.27 kmN RMS: 0.30 secs</p> <p>Locality: LANGHOLM, D & G</p> <p>Velocity model: Lownet Xnear: 100.0 Xfar: 200.0</p> <p>Comment: 7KM NE OF LANGHOLM</p> <p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES</p> <p>ECK SZ 12.3 IP C 05:16 20.48 0.05</p> <p>ESK HZ 20.3 EP 05:16 21.95 0.32</p> <p>ESK HE 20.3 ES 05:16 24.89 0.31</p> <p>ESK HN 20.3 AML 05:16 25.06 23 0.10</p> <p>ESK HE 20.3 AML 05:16 25.19 20 0.21</p> <p>BHH SZ 21.9 EP 05:16 21.94 0.07</p> <p>BHH SE 21.9 ES 05:16 24.32 -0.68</p> <p>BHH SN 21.9 AML 05:16 24.68 54 0.20</p> <p>BHH SE 21.9 AML 05:16 25.20 33 0.20</p> <p>BB01 SZ 56.3 EP 05:16 27.76 0.57</p> <p>BB01 SN 56.3 ES 05:16 34.25 0.04</p> <p>BB01 SE 56.3 AML 05:16 35.29 8 0.44</p> <p>BB01 SN 56.3 AML 05:16 35.99 6 0.12</p> <p>KESW HZ 70.1 EP 05:16 29.41 0.07</p> <p>KESW HN 70.1 ES 05:16 37.63 -0.30</p> <p>KESW HN 70.1 AML 05:16 38.47 4 0.27</p> <p>KESW HE 70.1 AML 05:16 39.16 4 0.34</p> <p>EDI HN 80.7 ES 05:16 40.16 -0.56</p> <p>EDI HN 80.7 AML 05:16 40.39 7 0.32</p> <p>EDI HE 80.7 AML 05:16 40.89 4 0.36</p> <p>GALL HZ 119.0 EP 05:16 37.01 0.06</p> <p>GALL HN 119.0 ES 05:16 51.20 0.11</p> <p>GALL HN 119.0 AML 05:16 52.31 6 0.32</p> <p>GALL HE 119.0 AML 05:16 53.49 3 1.14</p>		
<p>July 7 2009 Time: 21:49 24.5 UTC Magnitude: 2.0 ML</p> <p>Lat: 53.253N Lon: -1.809W Depth: 1.1 km</p> <p>Grid Ref: 412.74 kmE 372.94 kmN RMS: 0.20 secs</p> <p>Locality: BUXTON, DERBYSHIRE</p> <p>Velocity model: Lownet Xnear: 100.0 Xfar: 200.0</p> <p>Comment: COLLAPSE EVENT</p> <p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES</p> <p>KB11 SZ 18.8 EP 21:49 28.42 -0.03</p> <p>STNC HZ 32.1 EP 21:49 30.66 -0.03</p> <p>STNC HE 32.1 ES 21:49 35.19 -0.03</p> <p>STNC HN 32.1 AML 21:49 38.60 122 0.50</p> <p>STNC HE 32.1 AML 21:49 40.89 156 0.58</p> <p>MCH1 HZ 161.0 EP 21:49 50.90 0.24</p> <p>MCH1 HN 161.0 ES 21:50 09.94 0.18</p> <p>MCH1 HN 161.0 AML 21:50 12.08 38 0.38</p> <p>MCH1 HE 161.0 AML 21:50 12.29 26 0.40</p> <p>KESW HZ 171.0 EP 21:49 52.63 0.52</p> <p>KESW HE 171.0 ES 21:50 12.09 -0.18</p> <p>KESW HN 171.0 AML 21:50 14.78 18 0.42</p> <p>KESW HE 171.0 AML 21:50 15.01 15 0.74</p>	<p>July 23 2009 Time: 17:52 06.5 UTC Magnitude: 1.0 ML</p> <p>Lat: 56.101N Lon: -4.295W Depth: 4.2 km</p> <p>Grid Ref: 257.27 kmE 692.17 kmN RMS: 0.50 secs</p> <p>Locality: BUCHLYVIE, STIRLING</p> <p>Velocity model: Lownet Xnear: 150.0 Xfar: 300.0</p> <p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES</p> <p>EAB SZ 10.1 IP 17:52 08.60 -0.31</p> <p>PGB1 HZ 34.3 EP 17:52 12.72 0.03</p> <p>PGB1 HE 34.3 ES 17:52 16.73 -0.50</p> <p>PGB1 HE 34.3 AML 17:52 17.15 19 0.16</p> <p>PGB1 HN 34.3 AML 17:52 17.25 8 0.48</p> <p>EDI HE 71.8 ES 17:52 26.66 -0.61</p> <p>EDI HE 71.8 AML 17:52 27.27 5 0.44</p> <p>EDI HN 71.8 AML 17:52 32.42 7 0.62</p> <p>ESK HZ 111.0 EP 17:52 25.09 0.50</p> <p>ESK HN 111.0 ES 17:52 37.70 -0.12</p> <p>ESK HN 111.0 AML 17:52 41.70 3 0.30</p> <p>ESK HE 111.0 AML 17:52 42.08 3 0.44</p> <p>ECK SZ 126.0 EP 17:52 27.71 0.80</p> <p>DRUM HZ 143.0 EP 17:52 29.98 0.61</p> <p>DRUM HE 143.0 ES 17:52 45.68 -0.41</p> <p>DRUM HN 143.0 AML 17:52 50.79 6 0.48</p> <p>DRUM HE 143.0 AML 17:52 52.44 5 0.38</p>	<p>July 8 2009 Time: 15:42 47.7 UTC Magnitude: 0.8 ML</p> <p>Lat: 55.390N Lon: -4.209W Depth: 7.8 km</p> <p>Grid Ref: 260.09 kmE 612.89 kmN RMS: 0.60 secs</p> <p>Locality: CUMNOCK, EAST AYRSHIRE</p> <p>Velocity model: Lownet Xnear: 100.0 Xfar: 200.0</p> <p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES</p> <p>ESK HZ 64.2 EP 15:42 58.19 -0.39</p> <p>ESK HE 64.2 AML 15:43 11.50 4 0.16</p> <p>ESK HN 64.2 AML 15:43 12.32 5 0.12</p> <p>GALL HZ 66.5 EP 15:42 59.90 0.99</p> <p>GALL HE 66.5 ES 15:43 06.23 -0.83</p> <p>GALL HE 66.5 AML 15:43 11.11 7 0.54</p> <p>GALL HN 66.5 AML 15:43 11.84 6 0.46</p> <p>ECK SZ 72.4 EP 15:42 59.72 -0.16</p>	<p>July 26 2009 Time: 12:17 31.6 UTC Magnitude: 2.2 ML</p> <p>Lat: 53.373N Lon: -4.464W Depth: 7.5 km</p> <p>Grid Ref: 236.10 kmE 389.10 kmN RMS: 0.20 secs</p> <p>Locality: ISLE OF ANGLESEY</p> <p>Velocity model: LleyN Xnear: 50.0 Xfar: 200.0</p>

TABLE 2 : PHASE DATA

<p>STNC HE 125.0 ES 23:21 27.46 STNC HN 125.0 AML 23:21 27.83 83 0.26 0.75 STNC HE 125.0 AML 23:21 29.25 91 0.30 STRD HZ 126.0 EP 23:21 12.11 0.16 SSW HZ 135.0 IP 4 C 23:21 33.05 19.81 BATH HZ 143.0 EP 23:21 15.14 0.83 BATH HE 143.0 ES 23:21 31.37 0.35 BATH HN 143.0 AML 23:21 32.63 102 0.40 BATH HE 143.0 AML 23:21 36.78 160 0.46 HEX SZ 150.0 EP 23:21 15.95 0.58 SWN1 HZ 164.0 EP 23:21 18.61 1.29 SWN1 HN 164.0 ES 23:21 38.08 1.85 SWN1 HN 164.0 AML 23:21 39.13 71 0.37 SWN1 HE 164.0 AML 23:21 39.70 68 0.41 HTL HZ 167.0 EP 23:21 18.79 1.00 HTL HE 167.0 ES 23:21 37.45 0.40 HTL HN 167.0 AML 23:21 38.93 48 0.28 HTL HE 167.0 AML 23:21 39.77 28 0.23 KB11 SZ 173.0 EP 23:21 18.75 0.17 LHO EZ 176.0 EP 23:21 18.96 -0.05 DSB BN 204.0 ES 23:21 45.15 0.22 DSB BN 204.0 AML 23:21 47.03 18 0.37 DSB BE 204.0 AML 23:21 47.88 15 0.27 HPK HE 220.0 ES 23:21 48.23 -0.41 HPK HN 220.0 AML 23:21 53.99 78 0.23 HPK HE 220.0 AML 23:21 54.49 62 0.39 DYA HZ 221.0 EP 23:21 24.38 -0.16 DYA HE 221.0 ES 23:21 48.74 0.02 DYA HN 221.0 AML 23:21 51.87 16 0.20 DYA HE 221.0 AML 23:21 56.35 22 0.60</p>	<p>December 21 2009 Time: 00:07 21.0 UTC Magnitude: 1.3 ML Lat: 56.126N Lon: -3.910W Depth: 9.2 km Grid Ref: 281.29 kmE 694.22 kmN RMS: 0.20 secs Locality: CAMBUSKENNETH, STIRLING Velocity model: Lownet Xnear: 75.0 Xfar: 150.0</p>	<p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES EAB SZ 27.5 EP 00:07 25.90 -0.32 PGB1 HZ 50.1 EP 00:07 29.90 0.25 PGB1 HE 50.1 ES 00:07 35.91 -0.09 PGB1 HE 50.1 AML 00:07 36.37 11 0.19 PGB1 HN 50.1 AML 00:07 36.41 24 0.32 EDI HZ 50.4 EP 9 00:07 21.44 -8.24 EDI HN 50.4 ES 9 00:07 27.30 -0.50 EDI HN 50.4 AML 00:07 27.39 72 0.64 EDI HE 50.4 AML 00:07 27.82 19 0.19 EBL SZ 66.9 EP 00:07 32.25 -0.03 ESY SZ 84.0 EP 00:07 35.27 0.35 ESK HZ 100.0 EP 00:07 37.52 0.11 ESK HE 100.0 ES 00:07 49.29 -0.14 ESK HE 100.0 AML 00:07 52.29 4 0.38 ESK HN 100.0 AML 00:07 52.48 6 0.30 DRUM HZ 124.0 EP 00:07 40.29 -0.46 DRUM HN 124.0 ES 00:07 55.16 -0.04 DRUM HE 124.0 AML 00:07 58.59 13 0.40 DRUM HN 124.0 AML 00:07 59.34 13 0.48</p>	<p>December 24 2009 Time: 15:45 58.6 UTC Magnitude: 2.1 ML Lat: 56.143N Lon: -3.911W Depth: 11.1 km Grid Ref: 281.28 kmE 696.11 kmN RMS: 0.20 secs Locality: CAMBUSKENNETH, STIRLING Velocity model: Lownet Xnear: 75.0 Xfar: 150.0</p>	<p>December 15 2009 Time: 15:25 26.3 UTC Magnitude: 1.6 ML Lat: 51.709N Lon: -4.085W Depth: 8.2 km Grid Ref: 255.96 kmE 203.25 kmN RMS: 0.30 secs Locality: LLANELLI, CARMARTHNSHIRE Velocity model: Lownet Xnear: 100.0 Xfar: 200.0</p>	<p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES LPW BZ 45.1 EP 15:25 34.24 0.14 LPW BE 45.1 ES 15:25 39.88 0.05 MCH1 HZ 81.4 EP 15:25 39.37 -0.40 MCH1 HE 81.4 ES 15:25 49.18 -0.45 MCH1 HE 81.4 AML 15:25 49.72 21 0.17 MCH1 HN 81.4 AML 15:25 49.83 23 0.13 HTL HZ 84.2 EP 15:25 40.36 0.19 HTL HE 84.2 ES 15:25 50.08 -0.25 HTL HE 84.2 AML 15:25 52.54 23 0.16 HTL HN 84.2 AML 15:25 52.64 34 0.13 MONM HZ 89.6 EP 15:25 41.20 0.19 MONM HE 89.6 ES 15:25 52.05 0.27 MONM HE 89.6 AML 15:25 52.70 25 0.14 MONM HN 89.6 AML 15:25 53.11 22 0.24 OLDB HZ 106.0 EP 15:25 43.84 0.27 HLML HZ 122.0 EP 15:25 46.01 -0.08 HLML HN 122.0 ES 15:26 00.20 -0.37 STRD HZ 133.0 EP 15:25 47.81 0.22 STRD HN 133.0 ES 15:26 03.54 0.37 DYA HZ 142.0 EP 15:25 48.68 -0.23 DYA HE 142.0 AML 15:26 05.89 14 0.34 DYA HN 142.0 AML 15:26 07.10 11 0.12 YRE SZ 143.0 EP 15:25 49.13 0.04 FOEL HZ 145.0 EP 15:25 49.60 0.30 FOEL HN 145.0 AML 15:26 08.04 10 0.39 FOEL HE 145.0 AML 15:26 08.33 4 0.36 WPML SZ 173.0 EP 15:25 53.42 0.23</p>	<p>December 24 2009 Time: 16:12 42.9 UTC Magnitude: 2.1 ML Lat: 53.017N Lon: -2.175W Depth: 0.5 km Grid Ref: 388.26 kmE 346.68 kmN RMS: 0.30 secs Locality: STROKE-ON-TRENT, STAFFS Velocity model: Lownet Xnear: 125.0 Xfar: 250.0 Comment: FELT STROKE Intensity: 3</p>	<p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES STNC HZ 8.5 EP 16:12 44.92 -0.16 STNC HN 8.5 ES 16:12 46.49 -0.15 STNC HN 8.5 AML 16:12 46.80 2349 0.22 STNC HE 8.5 AML 16:12 47.13 3003 0.37 KB11 SZ 50.7 IP C 16:12 52.36 -0.05 FOEL HZ 70.3 IP C 16:12 55.65 0.14 FOEL HN 70.3 ES 16:13 04.64 -0.04 FOEL HE 70.3 AML 16:13 12.13 22 0.43 FOEL HN 70.3 AML 16:13 12.25 45 0.65 HLML HZ 73.1 EP 16:12 55.80 -0.14 HLML HN 73.1 ES 16:13 05.50 0.08 HLML HE 73.1 AML 16:13 08.74 32 0.35 HLML HN 73.1 AML 16:13 11.32 25 0.25 HPK HZ 111.0 EP 16:13 02.50 0.75 HPK HN 111.0 ES 16:13 15.15 -0.34 HPK HE 111.0 AML 16:13 18.68 119 0.24 HPK HN 111.0 AML 16:13 19.58 110 0.11 MCH1 HZ 127.0 EP 16:13 03.76 -0.41 MCH1 HN 127.0 ES 16:13 19.29 -0.37 MCH1 HN 127.0 AML 16:13 22.51 28 0.21 MCH1 HE 127.0 AML 16:13 23.04 47 0.43 STRD HZ 138.0 EP 16:13 05.66 -0.26 MONM HZ 138.0 IP C 16:13 06.24 0.37 MONM HN 138.0 ES 16:13 22.75 0.14 MONM HN 138.0 AML 16:13 26.26 79 0.43 MONM HE 138.0 AML 16:13 26.51 110 0.29 YRE SZ 151.0 EP 16:13 08.16 0.38 LPW BZ 163.0 EP 16:13 10.00 0.55 BATH HZ 176.0 EP 16:13 11.11 -0.11</p>	<p>December 17 2009 Time: 15:26 16.5 UTC Magnitude: 2.0 ML Lat: 53.045N Lon: -2.965W Depth: 7.5 km Grid Ref: 335.31 kmE 350.22 kmN RMS: 0.30 secs Locality: WREXHAM, WREXHAM Velocity model: Lownet Xnear: 100.0 Xfar: 200.0</p>	<p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES FOEL HZ 23.4 IP C 15:26 21.29 0.23 FOEL HE 23.4 ES 15:26 24.42 0.03 FOEL HE 23.4 AML 15:26 25.52 76 0.28 FOEL HN 23.4 AML 15:26 26.00 166 0.28 HLML HZ 58.9 IP D 15:26 26.55 -0.01 HLML HN 58.9 ES 15:26 33.55 -0.34 HLML HN 58.9 AML 15:26 34.02 104 0.14 HLML HE 58.9 AML 15:26 34.19 126 0.20 WPML SZ 67.2 IP D 15:26 27.89 0.06 YLL SZ 81.4 EP 15:26 30.16 0.16 WME SZ 97.6 EP 15:26 32.75 0.25 YRE SZ 98.3 IP C 15:26 32.76 0.14 KB11 SZ 98.9 EP 15:26 32.81 0.07 WLF1 HZ 99.5 EP 15:26 32.81 0.02 WLF1 HN 99.5 ES 15:26 44.04 -0.63 WLF1 HN 99.5 AML 15:26 44.94 45 0.40 WLF1 HE 99.5 AML 15:26 44.98 31 0.26 YRC SZ 110.0 EP 15:26 34.39 -0.04 MCH1 HZ 117.0 EP 15:26 35.19 -0.27 MCH1 HN 117.0 ES 15:26 48.71 -0.59 MCH1 HE 117.0 AML 15:26 52.33 23 0.10 MCH1 HN 117.0 AML 15:26 52.45 28 0.36 LPW BZ 128.0 EP 15:26 37.24 0.13 LPW BN 128.0 ES 15:26 52.51 0.35 HPK HZ 135.0 EP 15:26 38.15 -0.04 HPK HE 135.0 ES 15:26 53.60 -0.42 HPK HN 135.0 AML 15:26 54.94 116 0.18 HPK HE 135.0 AML 15:26 55.57 102 0.18 MONM HZ 135.0 EP 15:26 38.61 0.51 MONM HE 135.0 ES 15:26 54.41 0.54 MONM HN 135.0 AML 15:26 55.64 37 0.52 MONM HE 135.0 AML 15:26 56.30 33 0.40 STRD HZ 151.0 EP 15:26 41.13 0.62 KESW HN 172.0 AML 15:27 05.15 21 0.34 KESW HE 172.0 AML 15:27 05.26 18 0.48</p>	<p>December 25 2009 Time: 09:00 09.8 UTC Magnitude: 1.7 ML Lat: 53.010N Lon: -2.167W Depth: 0.9 km Grid Ref: 388.80 kmE 345.90 kmN RMS: 0.40 secs Locality: STROKE-ON-TRENT, STAFFS Velocity model: Lownet Xnear: 125.0 Xfar: 250.0</p>	<p>STAT CO DIST PHAS WT P HrMn SECS AMPL PERI RES STNC HZ 9.4 EP 09:00 11.43 -0.56 STNC HE 9.4 ES 09:00 13.11 -0.44 STNC HE 9.4 AML 09:00 13.33 1653 0.22 STNC HN 9.4 AML 09:00 13.34 1780 0.24 KB11 SZ 50.7 IP C 09:00 18.78 -0.21 FOEL HZ 70.7 EP 09:00 22.28 0.15</p>
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TABLE 2 : PHASE DATA

STAT	CO	DIST	PHAS	WT	P	HrMn	SECS	AMPL	PERI	RES
December 27 2009 Time: 11:02 21.1 UTC Magnitude: 1.5 ML										
Lat: 53.503N Lon: -2.226W Depth: 3.4 km										
Grid Ref: 385.01 kmE 400.75 kmN RMS: 0.40 secs										
Locality: GREATER MANCHESTER										
Velocity model: Lownet Xnear: 100.0 Xfar: 200.0										
FOEL	HE	70.7	ES			09:00	31.26			0.17
FOEL	HE	70.7	AML			09:00	34.48	11	0.72	
FOEL	HN	70.7	AML			09:00	38.40	20	0.47	
HLML	HZ	72.9	EP			09:00	22.36			-0.11
HLML	HN	72.9	ES			09:00	31.14			-0.54
HLML	HE	72.9	AML			09:00	33.46	12	0.19	
HLML	HN	72.9	AML			09:00	35.13	7	0.14	
HPK	HZ	111.0	EP			09:00	29.02			0.61
HPK	HE	111.0	ES			09:00	42.01			0.05
HPK	HE	111.0	AML			09:00	44.89	48	0.25	
HPK	HN	111.0	AML			09:00	46.09	54	0.13	
WPML	SZ	120.0	EP			09:00	30.24			0.56
MCH1	HZ	126.0	EP			09:00	30.23			-0.43
MCH1	HE	126.0	ES			09:00	45.82			-0.05
MCH1	HN	126.0	AML			09:00	49.18	12	0.18	
MCH1	HE	126.0	AML			09:00	49.65	22	0.37	
MONM	HZ	137.0	EP			09:00	32.98			0.64
YRE	SZ	152.0	EP			09:00	34.34			-0.06
LPW	BZ	163.0	EP			09:00	36.60			0.60
GALL	HZ	266.0	EP			09:00	48.90			-0.12
December 28 2009 Time: 23:31 03.4 UTC Magnitude: 1.8 ML										
Lat: 49.009N Lon: -2.089W Depth: 5.0 km										
Grid Ref: 393.49 kmE -99.00 kmN RMS: 0.40 secs										
Locality: JERSEY, CHANNEL ISLES										
Velocity model: Lownet Xnear: 500.0 Xfar: 1000.0										
FOEL	HE	70.7	ES			09:00	31.26			0.17
FOEL	HE	70.7	AML			09:00	34.48	11	0.72	
FOEL	HN	70.7	AML			09:00	38.40	20	0.47	
HLML	HZ	72.9	EP			09:00	22.36			-0.11
HLML	HN	72.9	ES			09:00	31.14			-0.54
HLML	HE	72.9	AML			09:00	33.46	12	0.19	
HLML	HN	72.9	AML			09:00	35.13	7	0.14	
HPK	HZ	111.0	EP			09:00	29.02			0.61
HPK	HE	111.0	ES			09:00	42.01			0.05
HPK	HE	111.0	AML			09:00	44.89	48	0.25	
HPK	HN	111.0	AML			09:00	46.09	54	0.13	
WPML	SZ	120.0	EP			09:00	30.24			0.56
MCH1	HZ	126.0	EP			09:00	30.23			-0.43
MCH1	HE	126.0	ES			09:00	45.82			-0.05
MCH1	HN	126.0	AML			09:00	49.18	12	0.18	
MCH1	HE	126.0	AML			09:00	49.65	22	0.37	
MONM	HZ	137.0	EP			09:00	32.98			0.64
YRE	SZ	152.0	EP			09:00	34.34			-0.06
LPW	BZ	163.0	EP			09:00	36.60			0.60
GALL	HZ	266.0	EP			09:00	48.90			-0.12
December 31 2009 Time: 06:26 55.3 UTC Magnitude: 0.7 ML										
Lat: 52.830N Lon: -2.616W Depth: 5.6 km										
Grid Ref: 358.50 kmE 326.04 kmN RMS: 0.20 secs										
Locality: MARKET DRAYTON, SALOP										
Velocity model: Mid Wales Xnear: 80.0 Xfar: 200.0										
Comment: 12KM SW OF M DRAYTON										
STAT	CO	DIST	PHAS	WT	P	HrMn	SECS	AMPL	PERI	RES
HLML	HZ	39.0	IP			06:27	02.21			0.05
HLML	HN	39.0	ES			06:27	07.27			0.21
HLML	HE	39.0	AML			06:27	07.70			0.21
HLML	HN	39.0	AML			06:27	07.91	8	0.30	
FOEL	HZ	39.8	IP		D	06:27	02.57			0.27
FOEL	HE	39.8	ES			06:27	07.11			-0.19
FOEL	HN	39.8	AML			06:27	09.49	10	0.76	
FOEL	HE	39.8	AML			06:27	11.96	5	0.56	
MCH1	HZ	96.2	EP			06:27	11.55			-0.04
MCH1	HE	96.2	ES			06:27	22.96			-0.33
MCH1	HE	96.2	AML			06:27	25.39	5	0.23	
MCH1	HN	96.2	AML			06:27	27.84	5	0.28	
YRE	SZ	123.0	EP			06:27	15.55			-0.19
LPW	BZ	127.0	EP			06:27	16.09			-0.23
LPW	BE	127.0	ES			06:27	31.70			0.28
December 31 2009 Time: 17:57 04.1 UTC Magnitude: 1.1 ML										
Lat: 52.828N Lon: -2.607W Depth: 6.1 km										
Grid Ref: 359.11 kmE 325.82 kmN RMS: 0.20 secs										
Locality: MARKET DRAYTON, SALOP										
Velocity model: Mid Wales Xnear: 80.0 Xfar: 200.0										
Comment: 12KM SW OF M DRAYTON										
STAT	CO	DIST	PHAS	WT	P	HrMn	SECS	AMPL	PERI	RES
HLML	HZ	39.1	IP		C	17:57	11.06			0.14
HLML	HN	39.1	ES			17:57	16.03			0.19
HLML	HE	39.1	AML			17:57	16.53	20	0.28	
HLML	HN	39.1	AML			17:57	18.50	19	0.26	
FOEL	HZ	40.5	EP			17:57	11.29			0.14
FOEL	HN	40.5	ES			17:57	16.10			-0.13
FOEL	HN	40.5	AML			17:57	18.93	19	0.64	
FOEL	HE	40.5	AML			17:57	21.83	19	0.84	
MCH1	HZ	96.2	EP			17:57	20.37			0.04
MCH1	HN	96.2	ES			17:57	31.60			-0.43
MCH1	HN	96.2	AML			17:57	37.11	11	0.22	
MCH1	HE	96.2	AML			17:57	37.35	9	0.34	
YRE	SZ	124.0	EP			17:57	24.31			-0.22
LPW	BZ	127.0	EP			17:57	24.88			-0.19
LPW	BN	127.0	ES			17:57	40.48			0.29

TABLE 3

GEOGRAPHIC COORDINATES OF SEISMOGRAPH STATIONS, 2009

Code	Name	Lat	Lon	E (km)	N (km)	Ht (m)	Comp
ABA1	BACONSTHORPE	52.8884	1.1453	611.58	337.00	74	1R
AEA	EAST ANGLIA UNIV	52.6208	1.2403	619.30	307.53	45	3M
AEU	EAST ANGLIA	52.6202	1.2347	618.93	307.45	28	SMR
APAE	PACKWAY	52.3006	1.4782	637.12	272.68	58	1R
AWH	WHINBURGH	52.6297	0.9507	599.67	307.68	64	1R
AWI1	WITTON	52.8319	1.4471	632.17	331.65	46	1R
BATH	BATH	51.4429	-2.3292	377.22	171.60	131	BBR
BBH	BRUNTSHEIL	55.1333	-2.9299	340.72	582.50	216	1R
BBO1	BOTHEL	54.7367	-3.2464	319.76	538.69	209	3R
BCC1	CHAPELCROSS	55.0153	-3.2201	321.99	569.66	138	1SMR
BDL	DOBCROSS HALL	54.8030	-2.9385	339.68	545.76	157	1R
BHH	HOWATS HILL	55.0931	-3.2181	322.27	578.31	216	3R
BIGH	UPPER BIGHOUSE	58.4932	-3.9102	288.75	957.69	70	BBR
BTA	TALKIN	54.9057	-2.6844	356.12	557.00	279	3R
BWH	WARDLAW	55.1758	-3.6549	294.62	588.09	269	1R
CCA1	CARNMENELLIS	50.1866	-5.2277	169.62	36.90	210	BBR
CWF	CHARWOOD FST	52.7385	-1.3076	446.74	315.91	203	BBR
DRUM	DRUMTOCHTY	56.9123	-2.4865	370.48	780.23	208	BBR
DYA	YADSWORTHY	50.4353	-3.9310	262.88	61.34	292	BBR
EAB	ABERFOYLE	56.1887	-4.3373	254.97	702.02	279	1R
EAU	AUCHINOON	55.8454	-3.4474	309.38	662.30	359	1R
EBH	BLACK HILL	56.2476	-3.5084	306.54	707.13	375	1R
EBL	BROAD LAW	55.7723	-3.0445	334.48	653.71	436	1R
ECK	CAULDKAINE HILL	55.1810	-3.1292	328.10	588.00	351	1R
EDI	EDINBURGH	55.9233	-3.1875	325.80	670.66	125	BBR
EDU	DUNDEE	56.5477	-3.0110	337.85	739.97	421	1R
ELO	LOGIEALMOND	56.4703	-3.7112	294.59	732.21	523	1R
ELSH	ELHAM	51.1482	1.1345	619.32	143.44	126	BBR
ESK	ESKDALEMUIR	55.3165	-3.2052	323.52	603.16	261	3MLGBBR
ESY	STONEYPATH	55.9175	-2.6141	361.62	669.55	337	1R
FOEL	FOEL WYLFA	52.8898	-3.2012	319.27	333.15	449	BBR
GAL1	GALLOWAY	54.8664	-4.7114	226.02	555.78	117	3MLGBBR
GCD	CASTLE DOUGLAS	54.8630	-3.9403	275.48	553.76	184	1R
GCL	CUSHENDALL	55.0783	-6.1264	136.66	583.77	278	1R
GMK	MULL OF KINTYRE	55.3458	-5.5934	172.19	611.64	164	1R
GMM	MTNS OF MOURNE	54.2377	-5.9498	142.66	489.67	155	1R
HEX	EXMOOR	51.0664	-3.8026	273.71	131.28	230	1R
HGH	GRAY HILL	51.6379	-2.8057	344.25	193.59	223	1R
HLM1	LONG MYND	52.5184	-2.8807	340.25	291.57	429	BBR
HMNX	HERSTMONCEUX	50.8674	0.3363	564.49	110.15	26	BBR
HPE	PEMBROKE	51.9372	-4.7746	209.29	230.21	349	1R
HPK	HAVERAH PARK	53.9581	-1.6241	424.66	451.42	233	BBR
HSA	SWANSEA	51.7500	-4.1532	251.38	207.94	293	1R
HTL	HARTLAND	50.9943	-4.4849	225.64	124.66	86	3MLGSMBBR
HTR	TREWERN HILL	52.0785	-3.2679	313.12	243.04	337	1R
JDC	DAM (CREST)	49.1947	-2.0469			39	SMR
JDG	DAM (GALLERY)	49.1947	-2.0469			7	SMR
JLP	LES PLATONS	49.2486	-2.1039			129	1R
JQE	QUEENS EAST	49.2000	-2.0383			58	1R
JRS	MAISON ST LOUIS	49.1922	-2.0922			56	3LGR
JSA	ST AUBINS	49.1878	-2.1717			39	BBR
JVM	VALLE D.L.MARE	49.2169	-2.2067			64	1R
KAC	ACHNASHHELLACH	57.4989	-5.2988	202.36	850.19	206	1R
KAR1	ARISAIG	56.9188	-5.8290	166.98	787.34	186	1R
KB1	BIRLEY GRANGE	53.2543	-1.5279	431.49	373.17	272	1R
KESW	KESWICK	54.5886	-3.1048	328.70	522.05	282	BBR
KEY2	KEYWORTH	52.8790	-1.0770	462.13	331.73	76	SMR
KPL	PLOCKTON	57.3391	-5.6527	180.21	833.50	13	3LGSMBBR
KSB	SHIEL BRIDGE	57.2099	-5.4214	193.40	818.40	417	1R

TABLE 3

GEOGRAPHIC COORDINATES OF SEISMOGRAPH STATIONS, 2009

Code	Name	Lat	Lon	E (km)	N (km)	Ht (m)	Comp
KSY	SYSTON	52.9642	-0.5872	494.88	341.73	121	1R
KTG1	TILBROOK GRNGE	52.3264	-0.4019	508.90	271.06	83	1R
KUF	UFFORD	52.6170	-0.3907	508.94	303.39	38	1R
KWE	WEAVER FARM	53.0164	-1.8412	410.65	346.61	328	1R
LCP	CASSOP	54.7370	-1.4744	433.84	538.14	185	1R
LHO	HOLMEFIRTH	53.5453	-1.8548	409.62	405.44	462	1R
LMK1	MARKET RASEN	53.4573	-0.3274	511.15	396.92	133	BBR
LRN	RICHMOND	54.4165	-1.8007	412.93	502.37	313	1R
LRW	LERWICK	60.1360	-1.1779	445.66	1139.27	98	3MLGBBR
LWH	WHINNY NAB	54.3338	-0.6717	486.36	493.97	277	1R
MCD	COLEBURN DISTIL	57.5828	-3.2541	325.02	855.42	293	3MLGSMR
MCH1	MICHAELCHURCH	51.9974	-2.9983	331.47	233.74	219	SMBBR
MDO	DOCHFOUR	57.4409	-4.3633	258.17	841.39	415	1R
MLA1	LATHERON	58.3055	-3.3627	320.15	935.98	188	1R
MME1	MEIKLE CAIRN	57.3149	-2.9647	341.90	825.32	475	1R
MONM	MONMOUTH	51.8396	-2.8054	344.61	215.98	145	BBR
MVH1	ACHVAICH	57.9250	-4.1825	270.75	894.90	185	1R
OLDB	OLDBURY	51.6609	-2.5514	361.95	195.94	6	BBR
PCO1	CORRIE	55.9880	-4.1002	269.00	679.21	267	1R
PGB1	GLENIFFERBRAES	55.8115	-4.4837	244.38	660.37	199	BBR
PMS1	MUIRSHIEL	55.8459	-4.7452	228.15	664.82	351	1R
POB1	OBSERVATORY	55.8458	-44299	247.88	664.06	34	MLGR
REB	EISG-BRACHAIDH	58.1194	-5.2802	206.82	919.16	100	1R
RRH	RHENIGDALE	57.9197	-6.6881	122.43	901.86	103	1R
RRR	RUBHA REIDH	57.8577	-5.8067	174.19	891.68	61	3MLGSMR
RSC	SCOURIE	58.3485	-5.1683	214.61	944.33	60	1R
RTO	TOLSTA	58.3778	-6.2092	153.95	950.93	74	1R
SAN1	SANDWICK	60.0179	-1.2392	442.41	1126.08	150	1R
SKP1	KOPHILL	51.7218	-0.8096	482.22	203.29	212	1R
SMD	MENDIPS	51.3083	-2.7170	350.03	156.88	310	1R
SOFL	SORNFELLI	62.0689	-6.9658			721	BBR
SSW	STOW-ON-WOLD	51.9667	-1.8499	410.31	229.86	291	1R
STNC	STOKE	53.0913	-2.2062	354.95	386.19	234	BBR
STRD	STROUD	51.7763	-2.1643	388.77	208.64	200	BBR
SWK	WARMINSTER	51.1483	-2.2471	382.72	138.87	266	1R
SWN1	SWINDON	51.5137	-1.8007	413.83	179.49	192	3MLGSMBBR
WAL1	WALLS	60.2564	-1.6173	421.18	1152.46	167	1R
WIM	ISLE OF MAN(South)	54.1475	-4.6738	225.39	475.73	386	1R
WLF1	LLYNFAES	53.2894	-4.3966	240.27	379.65	58	BBR
WME	MYNDD EILIAN	53.3969	-4.3032	246.88	391.40	129	1R
WPM1	PENMAENMAWR	53.2581	-3.9048	272.95	375.18	353	1R
XAL	ALLENDALE	54.8617	-2.2147	386.22	551.91	458	1R
XSO	SOURHOPE	55.4924	-2.2510	384.14	622.10	516	1R
YEL1	YELL	60.5509	-1.0830	450.29	1185.55	203	1R
YLL	LLANBERIS	53.1402	-4.1704	254.84	362.57	159	1R
YRC	RHOSCOLYN	53.2508	-4.5753	228.21	375.77	22	1R
YRE	YR EIFL	52.9810	-4.4254	237.19	345.42	197	1R

Component Codes:

- 1 Single vertical seismometer
- 3 Orthogonal set of 3 seismometers
- M Low-frequency microphone
- LG Single low-gain vertical seismometer
- SM Strong motion seismometers
- BB Broadband Instrument
- R Station coordinates registered with the International Seismological Centre (ISC), England and the National Earthquake Information Centre (NEIC), USA

TABLE 4**Depth / crustal velocity models used in earthquake locations**

Structural area	Depth to top of layer (km)	P-wave velocity (km/sec)	Vp/Vs
North Sea	0.00	6.20	1.73
	12.00	6.50	
	23.00	7.10	
	31.00	8.05	
Lownet and general UK	0.00	4.00	1.73
	2.52	5.90	
	7.55	6.45	
	18.87	7.00	
	34.15	8.00	
Borders	0.00	4.10	1.71
	3.00	5.60	
	4.10	6.15	
	17.00	6.60	
	30.00	8.00	
North Wales (Lleyn)	0.00	5.40	1.68
	2.00	6.05	
	13.00	6.50	
	25.00	6.80	
	34.00	8.00	
Mid Wales	0.00	5.40	1.72
	3.80	6.05	
	15.50	6.65	
	34.30	8.00	
Cornwall	0.00	5.50	1.77
	0.30	5.76	
	15.00	6.90	
	30.00	8.00	

Appendix 1 Key to Bulletin Encoding

YearMoDy	Year, month and day of event.
HrMn Secs	Time of occurrence of event in hours, mins and secs, (UTC).
Lat	Latitude of the event, positive latitude indicates north.
Lon	Longitude of the event, positive longitude indicates east.
kmE	UK National Grid Reference in kilometres east of grid origin.
kmN	UK National Grid Reference in kilometres north of grid origin.
Dep	Depth of the hypocentre in kilometres.
Mag	Richter local magnitude of the event.
Locality	A geographical indication of the epicentral area, usually the nearest town followed by the region. A key to the abbreviations used in the locality column are given below.
Int	Maximum EMS intensity. 2+ indicates felt, no macroseismic details. 3+, 4+ etc indicates felt at 3 or 4, but no survey carried out. 3, 4, 5 etc describes the maximum EMS intensity produced by the event.
Comments	Additional comments about the event eg: C/F, see below under comments abbreviations.

The following abbreviations are extracted from the output of the location program HYPO71 (Lee and Lahr,1975)

No	Total number of P and S readings used in the event location.
Gap	Largest azimuthal separation in degrees between stations.
RMS	Root Mean Square of the travel time residuals in seconds.
ERH	Standard error of the epicentre in kilometres. When this column is blank, the error is large and indeterminate.
ERZ	Standard error of the focal depth in kilometres. When this column is blank, the error is large and indeterminate.

Locality abbreviations

Sonic	Sonic boom
Bucks	Buckinghamshire
D & G	Dumfries and Galloway
Lincs	Lincolnshire
Notts	Nottinghamshire

Comments abbreviations

...	and felt elsewhere
N,S,E,W	North, South, East, West

Appendix 2 Key to Phase Data Encoding

Time	Time of occurrence of event in hours, mins and secs, (UTC).
Lat	Latitude of the event, N indicates North.
Lon	Longitude of the event, W indicates West, E indicates East.
Depth	Depth of the hypocentre in kilometres.
Grid Ref	UK National Grid Reference in kilometres east (kmE) and kilometres north (kmN) of grid origin.
RMS	Root Mean Square of the travel time residuals in seconds.
Velocity Model	Velocity model used in location.
Magnitude	Richter local magnitude of the event.
Locality	A geographical indication of the epicentral area, usually the nearest town followed by the region.
Intensity	Maximum EMS intensity. 2+ indicates felt, no macroseismic details. 3+, 4+ etc indicates felt at 3 or 4, but no survey carried out. 3, 4, 5 etc describes the maximum EMS intensity produced by the event.
Comments	Additional comments about the event eg: C/F see list of comments abbreviations below.
STAT	Station name
CO	Station component S=short period Z=vertical N=north south E=east west
DIST	Distance from earthquake to station (km)
PHAS	Phase identifier; the first letter characterizes onset E=emergent I=impulsive, the second indicates the phase eg P, S, PG and PN. AML
WT	Hypo weighting factor to arrival. 0 or blank=full weighting to 4=zero weighting (ignore). 9=use P S interval only for this line.
P	Polarity C=Compression/up D=Dilatation/down
HrMn	Hour, Minute of event
SECS	Seconds of event
AMPL	Amplitude centre to peak in nanometres (nm)
PERI	Period in seconds
RES	Station residual

Appendix 3 The European Macroseismic Scale (EMS 98)

1 - **Not felt**

Not felt, even under the most favourable circumstances.

2 - **Scarcely felt**

Vibration is felt only by individual people at rest in houses, especially on upper floors of buildings.

3 - **Weak**

The vibration is weak and is felt indoors by a few people. People at rest feel a swaying or light trembling.

4 - **Largely observed**

The earthquake is felt indoors by many people, outdoors by very few. A few people are awakened. The level of vibration is not frightening. Windows, doors and dishes rattle. Hanging objects swing.

5 - **Strong**

The earthquake is felt indoors by most, outdoors by few. Many sleeping people awake. A few run outdoors. Buildings tremble throughout. Hanging objects swing considerably. China and glasses clatter together. The vibration is strong. Top heavy objects topple over. Doors and windows swing open or shut.

6 - **Slightly damaging**

Felt by most indoors and by many outdoors. Many people in buildings are frightened and run outdoors. Small objects fall. Slight damage to many ordinary buildings eg; fine cracks in plaster and small pieces of plaster fall.

7 - **Damaging**

Most people are frightened and run outdoors. Furniture is shifted and objects fall from shelves in large numbers. Many ordinary buildings suffer moderate damage: small cracks in walls; partial collapse of chimneys.

8 - **Heavily damaging**

Furniture may be overturned. Many ordinary buildings suffer damage: chimneys fall; large cracks appear in walls and a few buildings may partially collapse.

9 - **Destructive**

Monuments and columns fall or are twisted. Many ordinary buildings partially collapse and a few collapse completely.

10 - **Very destructive**

Many ordinary buildings collapse.

11 - **Devastating**

Most ordinary buildings collapse.

12 - **Completely devastating**

Practically all structures above and below ground are heavily damaged or destroyed.

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A complete description of the EMS-98 scale is given in: Grunthal, G., (Ed) 1998. European Macroseismic scale 1998. Cahiers du Centre European de Geodynamique et de Seismologie. Vol 15.