ISSN 0967-859X
THE SOCIETY FOR EARTHQUAKE AND
CIVIL ENGINEERING DYNAMICS

NEWSLETTER

Volume 25 No 1
January 2014

In this issue

Barriers to Earthquake Preparedness: A Risk Representation Approach

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Editor: As Professors Joffe and Rossetto note in the following, this is a summary of the work they presented at the SECED November technical meeting. This was a very timely presentation, as it was announced a few days later than Joffe had been awarded the Lloyd's Science of Risk prize for this work with co-authors Rossetto, Christian Solberg, and Cliodhna O'Connor. Their full paper appeared in the May 2013 issue of Earthquake Spectra, and is well worth a read. The presentation also generated some intense Twitter-buzz, with @SECED_UK followers, @harriettestone and @tomnewby, livetweeting the event for those of us who could not make it along on the night.

At the 27th November 2013 evening meeting Profs Helene Joffe (UCL, Psychology Department) and Tiziana Rossetto (UCL, Civil, Environmental and Geomatic Engineering) gave a presentation on the findings of a large research project funded by the EPSRC (EP/F012179/1), which is the only current, cross-cultural study concerned with how members of the public in highly seismic areas of the world represent and prepare for earthquakes. The focus of the talk was on what drives people to take preparatory actions. Within the following text the "seismic adjustments" or "preparatory actions" referred to represent actions undertaken by individuals and households that have the capacity to either reduce risk of damage and loss during an earthquake (e.g. seismic retrofit or securing the contents of houses) or to aid post-impact recovery (e.g. stockpiling food, water and medicine, having insurance or planning for the reunion of one's family).

Overview of the study

The project studied demographically-matched samples of people in three earthquake-prone cities – Seattle, Izmir and Osaka. The results challenge the conventional assumption that people's action to reduce their risk results from perceiving the risk as likely and severe. Questionnaire data collected alongside interviews indicated that despite universally high awareness of earthquake threat, participants in all three cities did little to prepare for earthquakes or mitigate their risk. Out of a list of nineteen risk-reducing actions participants in all locations reported having done (on average) less than half, though the Americans had adopted a significantly greater number of actions than either the Turkish or Japanese participants (see Figure 1).

Qualitative analysis of the interview data threw light on people's failure to act to reduce their earthquake risk. Analysis indicated that important contributors towards whether people acted or not lay in their emotional responses to earthquake threat. While the Japanese and particularly the Turkish respondents associated earthquakes with intense panic, fear and anxiety, American respondents displayed a much more moderate level of concern. The Turkish interviews were also notable for the intensity of their anger, blame and distrust of the state and of building construction authorities, whose negligence and corruption were positioned as the cause of earthquake damage. Furthermore, while US and Japanese participants distanced themselves from the earthquake threat by favourably comparing themselves to places that they saw as more seismic, Turkish participants sharply deviated from this pattern: they also compared themselves with other countries, but this resulted in seeing themselves as extremely vulnerable to earthquake damage.

These emotional responses to earthquake threat interacted with a cluster of feelings relating to a sense of agency and control in relation to earthquakes. Almost all participants demonstrated that they were aware that actions to reduce earthquake risk were available. However, alongside this awareness lay a strong trend towards fatalism in all three cities, with respondents asserting that human action is pointless in the face of earthquake threat. These fatalistic tendencies were clearly culturally grounded and were rooted in different belief-systems in the three countries. US and Japanese fatalism largely followed from cultural representations of earthquakes as acts of nature, a sphere immune from human influence. The fatalism present in the Turkish

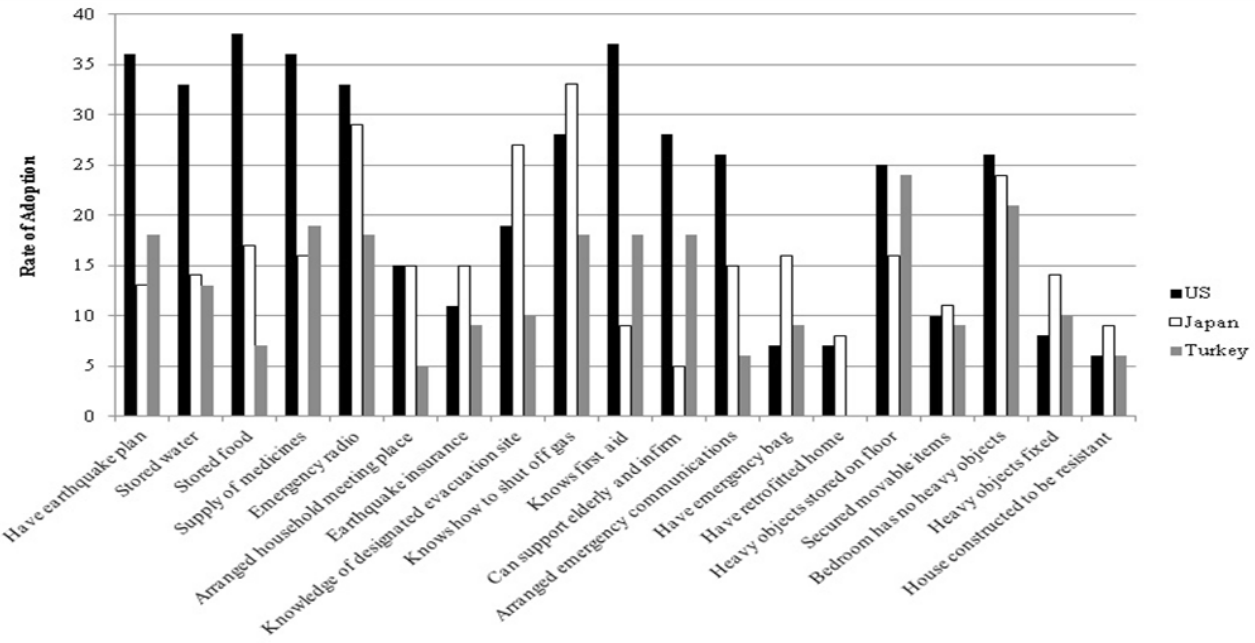

Figure 1: Number of people in each city reporting to have taken different seismic adjustments (out of 48 people in each city).

data, on the other hand, drew on a religious framing of earthquakes as acts of divine power, as well as an emphasis on vulnerability caused by institutional corruption.

The data suggest that emotional and socio-cultural variables exert an appreciable influence on people's risk behaviour. The intense emotions experienced by the Turkish and Japanese participants, in combination with cultural currents that represented earthquakes as insurmountable forces, seem to have overwhelmed people and paralysed them from action. The US participants displayed a more muted emotional response to earthquakes and also reported the greatest levels of protective action. A more moderate level of concern, rather than high anxiety, may be more facilitative of earthquake-protective behaviour. Nevertheless, even the US participants performed less than half of the recommended practices. Action is undermined by cultural representations of earthquake threat as impervious to human action, by the long return period of earthquakes and by them being rare but potentially catastrophic risks.

Relevance to Disaster Risk Reduction

This research demonstrates that barriers to the adoption of seismic mitigation measures are not purely financial, with there being a low general uptake of seismic adjustments in general in all three cities. In addition, the barriers do not fit within the traditional cognitive biases, like the optimistic bias, which are touted as reasons for people failing to prepare for rare, high magnitude risks. Indeed the city where least preparation is found – Izmir – is also the one where people have the most pessimistic outlook concerning the deadly effects of earthquakes. Thus Turkish inaction is more likely to be related to distrust of authorities, fatalism and anxiety than to cognitive bias. Emotion rather than cognition should be foregrounded when endeavouring to understand people's risk-related behaviour. These findings are in line with major shifts in the psychology of risk field, away from pure reliance on cognitive processing to emotive reaction, from biases in the 'perception of risk' to the consequences of the 'feeling of risk'.

In order to promote the uptake of mitigation measures, the barriers identified need to be counteracted. Once it is recognised that barriers are largely emotive and also socio-culturally variable, campaigns can be tailored accordingly. For example, mitigation messages can be fed through "trusted" sources of information, and messages should not focus on eliciting extreme fear, but should focus on injecting an "I can" attitude. Such tailoring can only be achieved once the dynamics of each group's complex representation of a particular danger are understood. Finally, since damaging earthquakes have such a long return period, making them feel distant in time, it may be better to bundle earthquake adjustments with adjustments for hazards that have shorter return periods.

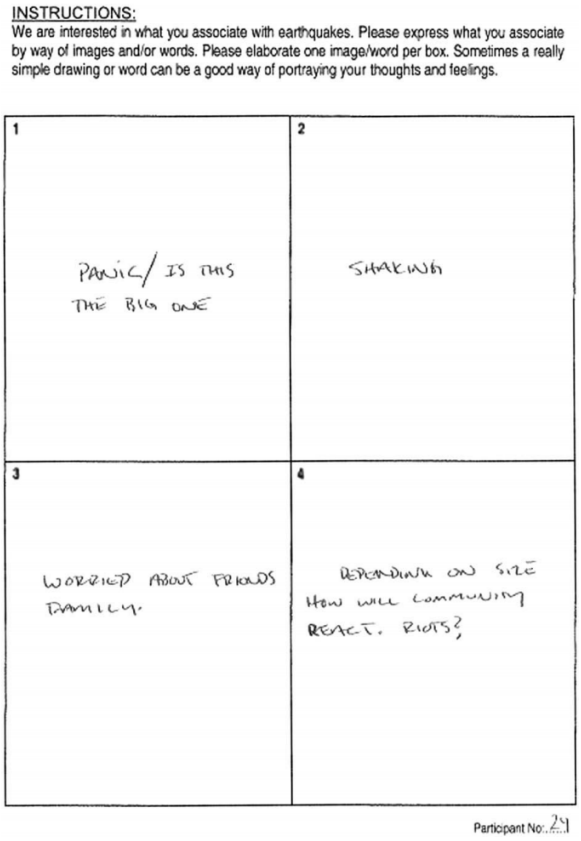

Figure 2: Example of the free association form used as part of the interview process, showing the response of one US respondent.

On 28th November 2013, a workshop was held at the Joint Research Centre, Ispra, Italy, between representatives of the Seismic Hazard Harmonization in Europe (SHARE) research programme, the CEN technical sub-committee on Eurocode 8, and a new EAEE working group established by Edmund Booth, aimed at establishing "Future directions for Eurocode 8". Helen Crowley, Scientific Coordinator of the Global Earthquake Model, kindly shared her summary of some of the main discussion points that arose, which we felt would be of interest to SECED members. The presentations given at the meeting are available from: https://www.dropbox.com/sh/u19x2q15qwurhqc/iUd_EoJ8ub.

Discussion Points from SHARE-EC8 Workshop

Comparison of SHARE results and national hazard results

Following the presentation of the engineering outputs from SHARE (Graeme Weatherill, EUCENTRE), the impact of the Ground-Motion Prediction Equations (GMPEs) on the results of the SHARE model was discussed. GMPEs have changed considerably over the past 20 years, and it was reiterated by Domenico Giardini (ETH-Zurich) this should be taken into consideration when evaluating the results of SHARE. Although the peak ground acceleration (PGA) has been seen to increase in some areas of Europe, the spectral ordinates have also been observed to be lower than those given by the EC8 spectral shapes. For this reason, some EC8 members noted that a map of PGA might give the wrong impression in terms of the impact of SHARE on hazard estimates in Europe. All countries in Europe are thus encouraged to carry out an evaluation of the impact of the SHARE modelling assumptions on the full spectrum of hazard results, for example by comparing the SHARE results with those based on national source models with the SHARE GMPE logic tree.

The SHARE results, including the uniform hazard spectra at a number of return periods, can be obtained from the SHARE portal:
http://www.efehr.org:8080/jetspeed/portal/hazard.psml

Risk-targeted ground motions

Vitor Silva (EUCENTRE) presented some initial risk-targeted maps for Europe, which show that the "risk coefficient" (which provides the ratio between the spectral acceleration at a given design return period, and the spectral acceleration value that leads to a specified probability of collapse) in some areas of Europe could actually lower the design actions that would be needed to achieve a uniform probability of collapse. The need for different maps for different building typologies and site conditions was discussed, as well as the need for each country to identify the limits of acceptable risk (in terms of probability of collapse). It was stated by Peter Fajfar that some studies have shown that engineers would expect a maximum probability of collapse of around 1 in 1000 in 50 years (which is lower than the values assumed in the United States). A list of necessary future developments was presented which includes the need to investigate more accurate collapse limit state fragility functions, the possibility of including various branches on the logic tree in the calculations, and the consideration of damage limitation rather than just the collapse limit state.

Site amplification factors

The analysis undertaken by Pitilakis et al. utilise the most extensive database of European strong motion records to derive new coefficients to modify the Eurocode 8 spectral shape to different site classes. These analyses can serve as a basis for short-term modification to the site amplification, particularly for the EC8 Type C soil class, to reflect improvements in knowledge of the soil response. Furthermore EC8 site coefficients are derived using a new site classification scheme designed to reflect the state-of-the-art in geotechnical engineering knowledge. Using the same database, Akkar et al. demonstrate the impact of soil nonlinearity in the amplification factors, deriving an alternative model of site amplification factors based on VS30 site categorisation.

The difference in the findings of the importance of nonlinearity by Pitilakis et al. and Akkar et al. could potentially call for more investigations to be carried out on site amplification, before modifications are included in Eurocode 8. Should the spectral shapes be modified in Eurocode 8 (as recommended by SHARE – see presentation by Helen Crowley, EUCENTRE), then the results of Pitilakis et al. would need to be re-elaborated.

Requests from EC8 members for further investigations in hazard

The Eurocode 8 members requested more input from hazard experts on the following issues:

- Displacement spectral shapes;
- Duration;
- Influence of minimum magnitude on hazard (which could potentially be different depending on the application, e.g. "damage limitation" as opposed to "no collapse");
- Spatial variability of ground motion for long structures (e.g. bridges).

Domenico Giardini noted that input such as this is very welcome, and that although some of these tasks are being undertaken in other projects (e.g. spatial variability

is covered in NERA) others will require new specific studies (e.g. displacement spectra).

EAEE EC8 Working Group

Edmund Booth (Consulting Engineer, Chair of EAEE Working Group 1) introduced the terms of reference of the new EAEE working group on Eurocode 8:

"Preparatory work for drafting the forthcoming major revisions to Eurocode 8 began some time ago and the formal establishment of CEN Project Teams tasked to prepare new drafts is expected by the summer of 2014. It will take at least six years before an agreed version of the revised standard is ready to be ratified; however, the broad outlines and scope of the work are already defined in the proposals that CEN has submitted to the European Commission. Moreover, recognising the need and desire by practising engineers for stability in code provisions, there is a general desire by CEN to limit the extent of revisions to the Eurocode suite at this time. However, EC8 is in many ways a special case among the Eurocodes, because the underlying practice of earthquake engineering is evolving much more rapidly and radically than is the case for practice applying to the other Eurocodes, where the technology is much more mature. Consequently, it is considered that more radical changes to EC8 will be needed in future.

It is therefore likely that the adopted version of EC8 which results from the evolution process in around 2020 will fall some way short of both the state-of-the-art and state-of-practice in earthquake engineering at that time. There is a need to look beyond the forthcoming evolution process in a review which proposes a direction for EC8 to a longer timescale than the current enquiry period, and which is therefore not limited by the current CEN proposals. A similar review was carried out by Californian earthquake engineers in 1995, to produce the Vision 2000 report (SEAOC, 1995) which so successfully set out a path for radical revisions to the US seismic codes of the 21st century.

The Executive Committee of the EAEE (European Association for Earthquake Engineering) has approved the formation of a Working Group (designated WG1 by the EAEE) to carry out this review. WG1 comprises a small group of academic engineers and design practitioners, drawn from both high and low seismicity regions of Europe. The task of WG1 is to set out the broad characteristics of EC8, to be achieved by the year 2025; redrafting of specific clauses or any other detailed redrafting work is specifically excluded."

SC8 Task Groups for Second Generation of Eurocode 8

Eduardo Carvalho (Chairman of the CEN technical sub-committee on Eurocode 8, SC8) introduced the aforementioned CEN Project Teams that will be tasked to produce new drafts of the Eurocodes by 2020, to be ratified by Eurocode 8 member countries. He noted that although Nationally Determined Parameters (NDPs) will still exist, one of the main objectives of the evolution process will be to reduce their number and improve harmonisation across Europe. Another key objective of the revision will be to enhance ease of use of the Eurocodes.

Artur Pinto (JRC) outlined the project currently being undertaken at the JRC to study the NDPs that are used within Europe, to understand how many differ from the recommended values. He requested that all EC8 members pass on the message that these parameters need to be uploaded to the JRC database.

For what concerns the sub-task related to "European Seismic Zonation and Definition of the Seismic Action", Eduardo Carvalho presented the text of the associated project proposal (provided below). He noted that the Project Teams for this (and other) sub-tasks will be assembled following an open call in Spring 2014.

Brief description, background and reasons for the work

In the present version of EN1998 the seismic zonation and the definition of the spectral shape of the seismic action for design are Nationally Determined Parameters (NDPs) to be defined in the National Annexes to EN 1998-1. Although those in EN 1998-1 corresponded to an advancement in terms of harmonisation (by establishing a "standard shape" of the design spectra and by establishing the anchoring variable for the definition of the national seismic zonation maps) it is clear that there is a need to pursue further such harmonisation in the future revision of EN 1998. Seismic zonation and the definition of the seismic action are key elements for all parts of EN 1998. Its updating fundamentally influences EN 1998 and so this activity should have priority with regard to other changes.

Key benefits

The main benefit of this action is to update the way in which the seismic zonation is presented, taking profit of the more recent research in this field and aligning EN1998 with the way in which seismic zonation is presented in other national and international seismic codes. To this effect profit shall be taken from recent European research projects, namely the project SHARE, which provided consistent methodologies and tools to support the establishment of a European seismic zonation.

Output

Redrafting of Section 3 (Ground conditions and Seismic action) of EN 1998-1. The redrafting shall provide the advancement towards a harmonised seismic zonation but still enabling the Member States, if required, to establish its own safety levels at different performance levels and for different types of structures (importance classes).

Justification for funding

Although it is expected to take profit of the results of recent European Research projects in this field, (namely Project SHARE that has been developed in contact with SC8), this is a crucial aspect that shall require some additional work to transform pure research results into a codified text modifying a key aspect (with significant economic and safety consequences) of EN 1998-1. For this sort of matter no industrial support may be envisaged and the work should be carried out by independent experts under close scrutiny by the member countries through SC8.

The SECED Young Engineers' Conference 2013

Sean Wilkinson
Conference Organiser

The SECED Young Engineers' Conference 2013 was held at Newcastle University on the 4th of July. The event was well attended with over 30 delegates from both industry and academia. The conference consisted of 13 presentations and six posters, with delegates from universities from all over the UK and from as far away as the National University of Cordoba and industry delegates from companies like Mott MacDonald, Atkins and Arup.

The conference started with a keynote address from Dr Tiziana Rossetto entitled "The Role of Reconnaissance in Understanding Earthquakes: Lessons from the Field". It was a great presentation in which her vast experience at visiting areas affected by earthquakes was presented in a very clear and thought-provoking manner. With many of the audience wanting to continue work in academia, Tiziana's talk was a great inspiration.

After the first keynote address, the first sessions started with presentations on performance of structures, while the second session concentrated on some of the newer techniques such as rocking structures, tuned mass dampers and self-centring systems. The morning sessions were both very interesting with great presentations and many insightful questions being asked at the end of every presentation.

During lunch, there was a poster session where research on a diverse range of topics was on display. Posters on liquefaction, lifelines, concrete and dams, to name a few topics, were discussed at length while everyone tucked into the conference lunch. This was a particularly useful lunchtime session and a great deal of networking took place. It was good to see the industry delegates discussing how some of the research presented at the conference was relevant to the jobs that they were working on and hopefully some of the students now have some contacts for when they complete their PhDs.

After lunch, Dr Damian Grant from Arup gave the second keynote address "The Role of Analysis in Earthquake Engineering Practice". This was another excellent keynote. The main theme of this talk was showing when you might want to "push" designs a little further and what techniques you could use to achieve this. He demonstrated that there are "rewards" to be had by looking outside conventional design, if you know how to perform the correct sort of analysis. It is clear that he has worked on some very interesting jobs and has a wealth of experience in analysis and design. Hopefully some of the younger engineers got a sense of what positions they may find themselves in in a few years' time and what sorts of projects they may be working on.

Post-lunch, it was the turn of the geotechnical engineers to present the latest directions in earthquake engineering research. Papers on fibre-reinforced sand and liquefaction were presented along with a presentation on structural health monitoring.

The final session of the day was back to structural engineering with some sophisticated analysis techniques on display and a great demonstration of a buckling restrained brace that Hector Gurrero had built out of a rule and a piece of plastic. I have to say that while I have known the principle behind a buckling restrained brace, there is nothing like holding one in your hand and trying to make it buckle to really convince you that this is a very clever concept.

Finally, the conference organising committee and the keynote speakers met to decide upon the prizes for best presentation and best paper. This was a very difficult decision as there had been so many excellent presentations, not only in terms of the research that was being conducted, but also the engaging way that it was presented. After a constructive deliberation the award for best presentation was given to Sinan Acikgoz from the University of Cambridge with his paper entitled Analytical and Experimental Observations on Vibration Modes of Flexible Rocking" (co-authored by M. J. DeJong). The best paper award was given to Ke Wang from the University of Dundee for his paper on "Dynamic Response Of Saturated Fibre-Reinforced Sand" (co-author A. J. Brennan). The conference finished with the conference chair Sean Wilkinson thanking everyone for attending and closing the conference and the delegates making their way home after a rewarding day.

The organisers would like to thank Arup and EEFIT for their sponsorship of a very successful conference.

Notable Earthquakes January 2013 – February 2013

Reported by British Geological Survey

Issued by: Davie Galloway, British Geological Survey, July 2013.
Non British Earthquake Data supplied by The United States Geological Survey.

Year	Day	Mon	Time UTC	Lat	Lon	Dep km	Magnitude ML	Mb	Mw	Location
2013	05	JAN	08:58	55.39N	134.65W	10			7.5	SOUTHEASTERN ALASKA
2013	05	JAN	23:15	53.02N	4.41E	5	2.7			SOUTHERN NORTH SEA
2013	12	JAN	03:59	53.20N	1.02W	2	1.4			NEW OLLERTON, NOTTS
Felt New Ollerton (3 EMS).										
2013	14	JAN	10:09	53.19N	1.03W	2	1.8			NEW OLLERTON, NOTTS
Felt New Ollerton (3 EMS).										
2013	14	JAN	13:51	49.96N	1.19W	5	1.9			ENGLISH CHANNEL
2013	18	JAN	05:20	52.80N	1.25W	13	2.9			LOUGHBOROUGH, LEICS
Felt Leicestershire, Derbyshire and Nottinghamshire (4 EMS).										
2013	21	JAN	11:40	52.80N	1.26W	11	1.4			LOUGHBOROUGH, LEICS
Felt Loughborough (2 EMS).										
2013	21	JAN	22:22	4.93N	95.91E	12			6.1	NORTHERN SUMATRA
One person killed, fifteen injured and over 70 buildings damaged in Aceh.										
2013	30	JAN	20:15	28.09S	70.65W	45			6.8	ATACAMA, CHILE
2013	31	JAN	04:16	58.47N	4.75W	2	2.4			DURNESS, HIGHLAND
Felt Loch Eriboll (3 EMS).										
2013	31	JAN	09:38	53.23N	1.69W	12	1.6			BAKEWELL, DERBYSHIRE
2013	02	FEB	14:17	42.77N	143.09E	107			6.9	HOKKAIDO, JAPAN
Felt throughout Hokkaido and NE Japan.										
2013	04	FEB	10:51	52.75N	1.04W	3	1.6			LOUGHBOROUGH, LEICS
2013	04	FEB	10:51	52.75N	1.04W	3	2.4			LOUGHBOROUGH, LEICS
Felt Loughborough (2 EMS).										
2013	06	FEB	01:12	10.80S	165.11E	24			8.0	SANTA CRUZ ISLANDS
Ten people killed, seventeen injured, five still missing presumed dead and over 700 houses destroyed or damaged in several villages on Nendo and Tomotu Noi. All casualties and most of the damage were caused by a strong localised tsunami which penetrated some 500 metres inland. The dock at at Lata Wharf was damaged by the tsunami and then further damaged by subsequent aftershocks (noted below).										
2013	06	FEB	01:23	11.18S	164.88E	10			7.1	SANTA CRUZ ISLANDS
2013	06	FEB	01:54	10.50S	165.59E	9			7.0	SANTA CRUZ ISLANDS
2013	07	FEB	18:59	11.00S	165.66E	11			6.7	SANTA CRUZ ISLANDS
2013	07	FEB	22:41	53.06N	4.37W	17	2.3			CAERNARFON BAY, GWYNEDD
Felt throughout the epicentral area particularly from the towns of Caernarfon, Bangor and surrounding hamlets (3 EMS).										
2013	07	FEB	22:44	53.05N	4.37W	14	1.9			CAERNARFON BAY, GWYNEDD
Felt throughout the epicentral area particularly from the towns of Caernarfon, Bangor and surrounding hamlets (3 EMS).										
2013	08	FEB	11:12	10.84S	165.97E	12			6.8	SANTA CRUZ ISLANDS
2013	08	FEB	15:26	10.93S	166.02E	21			7.1	SANTA CRUZ ISLANDS

Year	Day	Mon	Time UTC	Lat	Lon	Dep km	Magnitude ML	Mb	Mw	Location
2013	09	FEB	14:16	1.14N	77.39W	145			6.9	COLOMBIA
Fifteen people injured, 100 houses destroyed and over 1,900 damaged in Cauca and Narino, Colombia. Felt in several cities, towns and villages in Colombia, Ecuador, Panama and Venezuela.										
2013	09	FEB	20:13	53.51N	2.44W	12	1.7			LEIGH, GTR MANCHESTER
2013	09	FEB	21:02	10.99S	165.74E	18			6.6	SANTA CRUZ ISLANDS
2013	13	FEB	10:37	53.20N	1.02W	2	1.5			NEW OLLERTON, NOTTS
Felt New Ollerton (2 EMS).										
2013	14	FEB	13:13	67.63N	142.51E	11			6.6	NE SAKHA, RUSSIA
2013	15	FEB	12:35	48.33N	0.76W	5	2.3			NORTHWEST FRANCE
2013	18	FEB	16:03	49.58N	0.22W	5	2.1			ENGLISH CHANNEL
2013	19	FEB	03:52	53.68N	1.11W	2	2.1			HENSALL, N YORKSHIRE
Felt Hensall (3 EMS).										
2013	20	FEB	11:41	48.37N	1.96W	5	2.4			NORTHWEST FRANCE
2013	27	FEB	10:13	55.38N	3.00W	4	1.8			HAWICK, BORDERS
2013	27	FEB	23:57	52.90N	1.04W	8	2.5			COTGRAVE, NOTTS
Felt Nottinghamshire, Leicestershire and Derbyshire (3 EMS).										
2013	28	FEB	14:05	50.95N	157.28E	41			6.9	KURIL ISLANDS

Forthcoming Events

Date	Venue	Title	People
29/1/2014 at 18:00	Institution of Civil Engineers, 1 Great George St, London	*Forensic Seismology*	*Speaker*: **Ross Heyburn** (Atomic Weapons Establishment, AWE) *Organiser*: **Paul Doyle** (Jacobs)
20/2/2014 to 21/2/2014	University College London (Chadwick Building)	*Geotechnical Earthquake Engineering Course*	*Speakers*: **Ziggy Lubkowski, Peter Sammonds, Barnali Ghosh, Ahmed Elgamal** *Organisers*: **Raul Fuentes, Pedro Ferreira, Tiziana Rossetto (UCL)**
26/2/2014 at 18:00	Institution of Civil Engineers, 1 Great George St, London	*Large-Scale Physical and Computational Simulation of Soil-Structure Systems*	*Speaker*: **Ahmed Elgamal** (UCSD) *Organiser*: **Tiziana Rossetto** (UCL)
19/3/2014 at 13:00	Royal Geographical Society	*Nicholas Ambraseys Memorial Symposium*	*Speakers*: **Various** *Organiser*: **Joint symposium of Imperial College, SECED and the British Geotechnical Association**

For up-to-date details of SECED events, visit the website: **www.seced.org.uk**