ISSUE 22

alert

The Newsletter of Benfield UCL Hazard Research Centre

DISASTER UPDATE

March to August 2007

Extreme precipitation events dominated the period across the world. In the UK, record levels of rainfall and widespread flooding damaged over 60,000 properties and triggered losses totalling an estimated US$6 billion, most of which are insured. Elsewhere, Pakistan suffered major floods in June, while in late July and early August, the South West Monsoon brought the worst floods for more than 30 years to northern India, Bangladesh, Nepal, Bhutan and Myanmar - in total affecting an estimated 50 million people. China experienced its worst flooding since 1998, with over 450,000 homes destroyed, 200 million people affected, and losses as high as US$7 billion. Other significant flood events occurred in Afghanistan, Argentina, Colombia, Haiti, Indonesia, the Maldives and Sri Lanka. Contrastingly, southern and south-eastern Europe sweltered in record temperatures, triggering wildfires that raged across Greece, Bulgaria, Croatia, Cyprus, the Canary Islands, and elsewhere, leading to July 2007 being the worst month for wildfires ever recorded in Europe. While Atlantic storm activity was low, the Indian Ocean spawned Super Cyclone Gonu, the first tropical cyclone to enter the Gulf of Oman, which caused damage estimated at US$4 billion and insured losses in the hundreds of millions (US$). Geologically, the period was reasonably quiet. Most notable was a magnitude 6.6 earthquake close to the Japanese city of Niigata, which damaged a nuclear power plant and generated economic losses of around US$12.5 billion.

A version of this report is published in the September edition of Catastrophe Risk Management.

EDITORIAL

If you think the Summer 2007 UK floods were a freak event - think again. New research suggests that what are now regarded as extreme floods will become far more common in the future. To a large degree, this is a reflection of accelerating climate change. A recent paper in the journal Science reveals that levels of precipitation worldwide are increasing more rapidly than expected, while another in Nature provides evidence for human activities making a significant contribution towards observed 20th century hikes in rainfall, particularly at northern hemisphere mid-latitudes. More worryingly, a new report from the UK Met Office's Hadley Centre forecasts that UK river levels will climb higher than anticipated due to the fact that many current models do not sufficiently take into consideration the impact of climate change on plant life. The problem is that in a hotter world less water will be taken up by vegetation, leaving more available to drain into the catchment basins of the Severn, Thames and other major UK rivers. The findings of the report, also published in Nature, point to a 13 percent rise in European river flow over the next three centuries, if greenhouse gas emissions are not curbed. While a resulting sharp rise in flood events can be expected, this is likely to be the least of our worries. A recent study by Tim Lenton of the University of East Anglia suggests that collapse of the Greenland Ice Sheet could occur in as little as 300 years, rather than the thousand years or more proposed in the 2007 IPCC report. The resulting 7 m sea level rise would permanently inundate large areas of coastal UK, together with low-lying land currently far from the sea. Pitched against such a devastating scenario, the predicted rises in river flooding seem very small beer indeed. Image: The Severn floodplain at Gloucester. Photograph shows Walham substation at the centre of picture, with Alney island in the background. July 2007. Reproduced by permission of the British Geological Survey. © NERC 2007. All rights reserved. IPR/92-22C.

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BENFIELD UCL Hazard Research Centre

10 Year Anniversary

GLOBAL WARNING FROM THE SOUTH PACIFIC

Stephen Edwards (BUHRC) writes

It is not a new story, but the gradual submergence of the small island nation of Tuvalu in the South Pacific is back in the news. In July 2007, The Independent drew attention to the precarious situation facing this group of nine coral islands and atolls lying far to the north of Fiji. Tide gauges indicate sea level is currently rising at twice the average global rate predicted by the Intergovernmental Panel on Climate Change, but immediate threats to land, infrastructure and livelihoods come from other events: increasingly frequent and devastating storms and invasive tides, rising water tables, and contamination of soil and crops by salt water. It is likely that these events will render the islands uninhabitable long before rising sea level. A lesson is to be learned from this example, as the same sequence of events and consequences will be experienced in many more low-lying coastal areas around the world as the planet continues to warm.

GRANT SUCCESS

Gerald Roberts (BUHRC) writes

Patience Cowie (University of Edinburgh), Gerald Roberts (UCL-Birkbeck) and Ken McCaffrey (University of Durham) have been awarded £560,000 by the Natural Environment Research Council (NERC) for a project to test theoretical models for earthquake clustering using chlorine-36 cosmogenic exposure dating of active normal faults in central Italy. Chlorine-36 in rocks exposed at Earth's surface is produced almost entirely by cosmic ray induced reactions. Therefore, when a fault slips and rock is exposed along the fault surface, chlorine-36 will form for as long as the rock is exposed. Dating the duration of this exposure provides a means of dating fault movement and associated seismic activity.

The researchers intend to constrain the natural variability in earthquake recurrence intervals on normal faults with varied geometries. This variability is a key input for probabilistic seismic hazard calculations and hence hazard mapping. The work will be concentrated in Lazio/Abruzzo, an area that has suffered destructive earthquakes; for example, the 1915 A.D. Avezzano earthquake of magnitude 6.9 that caused 33,000 deaths. Such earthquakes are known to cause damage in the Italian capital city, Rome. The work will test the hypothesis that natural variability in the seismic cycle is controlled by the geometry and motion of the faulting, by conducting numerical modelling of the earthquake cycle on simulated fault systems, calibrating the physics of the system with data from the cosmogenic dating. A post-doctoral researcher will be employed for three years.

MAKING WAVES

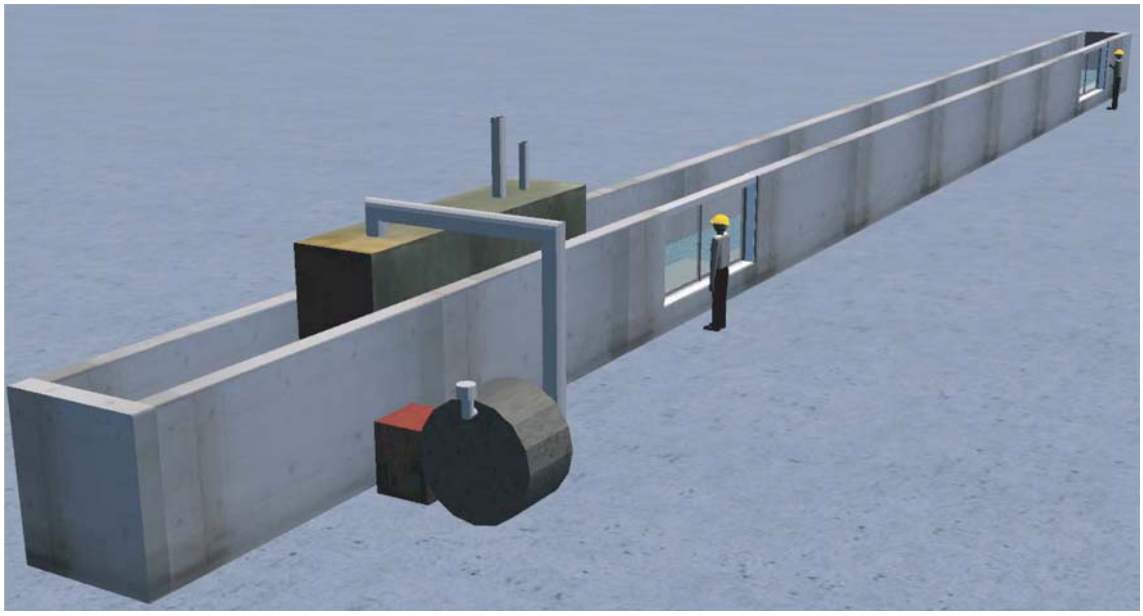

Image: Artist's impression of the proposed new tsunami generator. Courtesy HR Wallingford

Tiziana Rossetto (BUHRC) writes

Tsunamis are water waves generated by earthquakes, underwater landslides, volcanic eruptions or major debris slides. Tsunami waves travel across oceans with quite small vertical displacements, but shoal up dramatically in coastal and nearshore environments. Generation and transformation of tsunami waves from source to nearshore can be simulated by various numerical models.

The main gap in knowledge involves the propagation of the tsunami wave in the nearshore region, across the shoreline, and then running inland. These flow processes cannot be simplified, and are made significantly more complex by interactions with beaches, sediment, coastal defences, and then around buildings.

These processes can be simulated in hydraulic models, but accurate generation of the tsunami wave is essential including, where required, the characteristic, preceding draw-down wave. Conventional wave generators however simply do not have the capability to reproduce the required wavelength, which often approach the total length of the experimental water tank.

The EPICENTRE research initiative on earthquake interactions with people, supported by the Engineering and Physical Sciences Research Council (EPSRC), is intended to solve this problem through a collaboration between University College London and HR Wallingford. Within the EPICENTRE project HR Wallingford will construct an innovative new tsunami generator that removes the constraints of limited stroke mechanical paddles by using the principles of HR Wallingford's pneumatic tide generators, to generate multiple waves (viz. the 3-4 peaks in the Boxing Day Tsunami), and ensure realistic wavelengths. The Tsunami Generator will be mounted within a conventional wave flume tank equipped to measure coastal processes, inundation and wave forces. It will generate tsunami waves that have been previously transformed from deeper water (approx. -200m) to shallow water (approx. -20 to -50m) using a suitable numerical model. Bathymetry in the wave flume will further shoal the tsunami waves over a representative coastal slope though the shoreline and inland, covering a suitable inland inundation area.

Within the EPICENTRE research, measurements of tsunami wave transformations through the nearshore region will test or validate existing numerical models. UCL and HR Wallingford researchers will then examine interactions of the tsunami with representative coastal seawalls, and test effects of tsunami waves (particularly retreating and repeated waves) with seawall and beach. These tests will then be expanded to measure wave / flow forces on representative buildings and to quantify scour potential around those buildings.

The 2-3 year programme for development, testing, validation and application of the Tsunami Generator within the EPICENTRE project will be refined during July - September 2007. Current plans envisage that construction of the device will be completed in summer 2008 with proving trials in the autumn 2008. The UCL researchers then expect to run tests at Wallingford during spring 2009, so the facility may be available for international teams to use during autumn of the following year.

For further information on the EPICENTRE project, please contact: Tiziana Rossetto, BUHRC, t.rossetto@ucl.ac.uk.

THE HULL FLOODS OF JUNE 2007 - SOME INSURANCE INDUSTRY IMPLICATIONS

David Crichton (BUHRC) writes

The rainstorm of 25th June affected many parts of Northern England and Wales, but the flooding in Hull was perhaps the most significant with 15,900 houses in 240 streets affected. Hull is a low lying city already vulnerable to river and coastal flood but on that Monday there was a record downpour of 96mm in two hours, causing flooding of approximately one in five properties in the city. Estimates give the return period as ranging from 150 years to 200 years. The flooding was widespread as can be seen from aerial photographs taken the following day. (see http://www.bgs.ac.uk/news/FloodsJune07.html) General pictures of the flood can be accessed at http://www.thisiseastriding.co.uk

The properties in the flooded area were almost entirely two storey, modest, semi detached or terraced houses. Date of construction is not known, but many of the houses appear on the 1924 Ordnance Survey map. The houses are brick built with small front gardens and dwarf garden walls. Many gardens are now covered with impermeable surfaces for car parking, mainly concrete and monoblock. In most cases the monoblock was grouted making it impermeable.

Pavements are tree lined with mown grass verges. External flood depth was only around 300mm so internal flood depth would range from zero to 200mm, still deep enough to cause a lot of damage. The National Flood Insurance Claims Database is the biggest flood damages database in the world and was used recently by the National Audit Office in their analysis of the Environment Agency's work on flood defences . This database is funded by different insurance companies in turn. The current sponsor is Direct Line Insurance, and it was previously sponsored by Halifax General Insurance. It shows for example the expected losses for an average domestic property will depend on the sums insured and internal depth of flood as follows:

Table: extract from Halifax Dundee tables.

	Sum insured	0mm depth	200mm depth
Buildings(Table 3)	£150,000	£11,043	£23,155
Contents (Table 8)	£35,000	£ 7,108	£10,059
Alt. Accommodation (table 11)	Where buildings sum insured is £150,000	£ 2,617	£ 4,078
Total		£20,768	£37,292

Source Halifax Dundee Tables 2005

According to the Chartered Institute of Loss Adjusters, by 12th July, 9,000 household insurance claims had been made for flood damage in Hull and it was estimated that 2,000 families had no insurance. Assuming an average claims cost of £30,000 this produces a total household insurance cost of £270 m for drainage floods just for Hull. In other words this summer the annual average figure for the whole of the UK was incurred in just two hours in one city.

Local councils offered special assistance to the elderly, disabled or people with children under five whether insured or not. Assistance included removal of damaged possessions, accommodation, assistance with clothing, furniture etc. and government agreed to pay compensation for individual flood survivors; the first time this has happened in the UK. The council estimate that about 800 tonnes of flood damaged possessions had been removed within two weeks of the flood.

Drain covers in the affected areas of Hull are much smaller than current designs and may date back to the time the houses were originally constructed, that is sometime prior to 1924. It is normal practice in the UK to have bottle traps under the drains to prevent odours and these need to be cleaned out annually to remove sludge. In Hull it appears that such cleaning may not have happened for a long time. Many of the pavements were tree lined with grass verges which had been recently mowed. Leaves and grass cuttings were blocking a number of drains. It was perhaps not surprising that the storm drains could not cope.

There is no doubt that with climate change increasing the incidence of severe downpours and prolonged rainfall, such flooding events are likely to become a regular occurrence in any urban setting where the storm drainage is inadequate.

At a meeting with the ABI on 10th July, Government agreed to take urgent steps to address the problem of drainage maintenance. (It should be noted that this is not a problem in Scotland where a different legal position applies.)

Insurers may wish to take into account the design and maintenance of storm drains in their underwriting, and where these are inadequate, make household cover conditional on the fitting and timely deployment of approved demountable flood defences and premium rates and excesses which reflect the risk.

Insurance companies in Norway were recently able to obtain damages from a drainage undertaker following flooding from drains in a 100 year return period event .

In the longer term, it may well be that climate change will make many of our cities uninhabitable due to sea level rise . One of the first of these is likely to be Hull.

For more information please contact: David Crichton, BUHRC, david@crichton.sol.co.uk

David Crichton wishes to to acknowledge the assistance of Direct Line insurance in connection with this report.

THE SUMMER FLOODS OF 2007

In 2007, England and Wales had their wettest summer since records began in 1766. Even before July was over, by 25th July the Met Office said that 387.6mm of rain had already fallen since the beginning of May. 120.8mm of rain fell in a single day in Worcestershire. The Jetstream was further south than normal and this led to unusually severe rainfall especially on 25th June and 20th to 22nd July.

The record downpour in June flooded 27,000 homes and 5,000 businesses in the Midlands, Yorkshire and Northern Ireland. Sheffield, Doncaster and Hull were particularly affected, because drainage systems could not cope, costing insurers an estimated £1.5bn. Hull suffered most (see left). Unfortunately many people in Hull were uninsured against flood as was the City Council itself.

The rain in July resulted in rivers overflowing and flooding 10,000 homes in Gloucestershire, Oxfordshire, Warwickshire, Worcestershire and Bedfordshire. It is estimated that this event alone could have cost insurers more than £2bn.

Although the cause of each event was the position of the Jetstream, they were separated by more than the 168 hours specified in reinsurance covers and were therefore treated as two separate events for reinsurance purposes. This meant that while some insurers faced claims of as much as £200m for each event, this was within their retentions and reinsurance recoveries were not possible.

The human costs and suffering cannot be measured, but were huge. The July 2007 flooding in central and western England left at least 350,000 homes without running water and 50,000 without power. There were fears that a further 250.000 would lose power and water if Gloucester's Walham sub station was lost and emergency crews with help from the army worked overnight to keep the floods out. Questions were subsequently raised over the wisdom of locating electrical sub stations and water treatment plants in the flood plain.

ATLANTIC HURRICANES AUGUST FORECAST

In their most recent update, Mark Saunders and Adam Lea, of the BUHRC's Weather and Climate Extremes Group, continue to envisage a lively Atlantic hurricane season, although with a slight reduction in their forecast for US landfalling hurricane activity. In their August forecast update for Tropical Storm Risk, Saunders and Lea predict an active season in which Atlantic Basin tropical cyclone activity is expected to be around 35 percent above the 1950 to 2006 norm, with US landfalling tropical cyclone activity about 20 percent above the norm. There is also a high (~ 60 - 70 percent) chance that activity will be in the top one-third of years historically. The forecast is for 14.7 (± 2.9) tropical storms, of which 7.8 (± 1.7) are predicted to be hurricanes, with 3.5 (± 1.3) achieving intense (category 3 and above) status. The US coast is expected to be struck by 3.9 (± 1.7) tropical storms, of which 1.7 (± 1.2) are predicted to be of hurricane strength. At the time of writing (early September), there have been six named storms, two of which achieved hurricane status. Both of these - Dean and Felix - were category five storms that battered Mexico and Central America in late August and early September.

All updates and forecasts can be downloaded at:
http://tsr.mssl.ucl.ac.uk/

PUBLICATIONS BY CENTRE MEMBERS

David Crichton, BUHRC, has produced a paper on climate change resilience which has been accepted for publication by the Royal Society.

Crichton, D, 2007 What can cities do to increase resilience? Phil. Trans. R. Soc 10. 1098 pp1 – 11. Royal Society, London 2007.

Available from
www.journals.royalsoc.ac.uk/content/?Author=David+Crichton

The paper highlights the importance of adapting our buildings and cities to be more resilient to the impacts of climate change.

David is the co-author of the best selling text book, Adapting buildings and cities for climate change, the only text book in the world on this subject for architects.

Other selected papers by David are available from www.benfieldhrc.org/flood/

STORM FORECASTS TO TAKE A BLOW

Stephen Edwards (BUHRC) writes

In mid-July 2007 typhoon Man-yi hit southern Japan, killing three people, injuring about 70, and causing widespread flooding and damage. Man-yi was the strongest typhoon on record to hit Japan in July and illustrates the need to monitor and respond to such extreme weather events. Satellites and their on-board instruments are essential for collecting data that assist weather forecasters detect such storms, thus providing early warning and better understanding of how weather works. One such satellite launched in 1999, NASAs Quick Scatterometer (QuikScat), not only measures near-surface wind speed and direction under all weather conditions over Earth's oceans, but also the extent of sea ice cover. Consequently, it provides essential data for monitoring weather and climate, and for understanding atmospheric processes and change. At a time when there has never been a greater need for weather and climate data, it is somewhat ironic that when QuikScat falls silent in a few years it will not be replaced because of federal budget cuts in the US.

Fortunately the loss of QuikScat will not compromise the ability of the US National Hurricane Center to accurately forecast hurricane landfall in the Atlantic and the Caribbean, because radar and reconnaissance planes are used as hurricanes approach land. However, it is in the tracking of storms far offshore in the Atlantic and Pacific Oceans where the loss will be realised, because these are regions not routinely monitored by aircraft.

The great advantage of QuikScat is that it scans 90% of Earth's surface at high resolution every 24 hours, making it an essential instrument for short-term forecasting and determining levels of threat posed by storms. Weather forecasters already use other instruments to provide data that complement those collected by QuikScat, but these are not as accurate and provide less coverage. When QuikScat ceases to operate there will be a significant gap to fill in global monitoring and understanding of weather and climate, and in storm tracking.

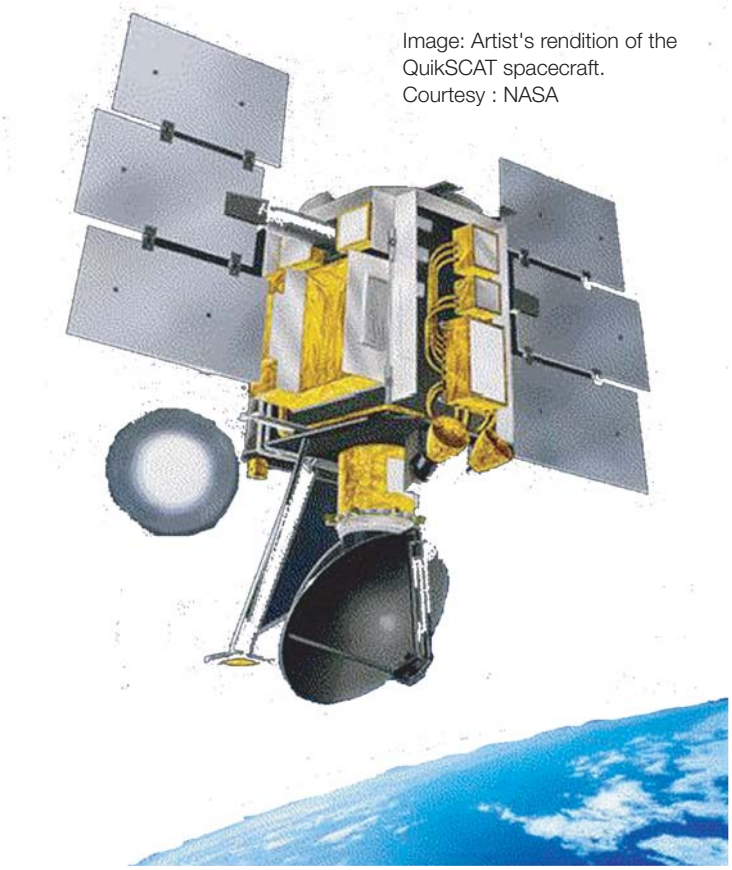

Image: Artist's rendition of the QuikSCAT spacecraft. Courtesy : NASA

MAINSTREAMING DISASTER RISK REDUCTION

Emily Wilkinson, a PhD student within the BUHRC is working on a consultancy project for the United Nations Development Programme (UNDP) Bureau for Crisis Prevention and Recovery Disaster Reduction Team, entitled 'Development of a conceptual framework for mainstreaming disaster risk reduction into development'.

Mainstreaming disaster risk reduction (DRR) is a much used concept in the disaster risk reduction community over the last few years. There is still little clarity, however, about exactly what it entails or how it should be carried out. In order for UNDP and the UN system at large to be a sound advocate to governments for mainstreaming DRR, it is important that it is able, effectively and clearly, to articulate what is meant in practical terms by 'mainstreaming DRR'.

To this end UNDP's Global Mainstreaming Initiative for Disaster Reduction is supporting the development of a practical framework which will seek to outline the major components of a mainstreamed approach. The main objective of the consultancy is to draft a framework for mainstreaming DRR. This will be based on a review of existing literature on mainstreaming DRR and on other frameworks that have been used to mainstream cross-cutting issues such as gender. The draft framework will provide the conceptual basis for UNDP's efforts to promote DRR mainstreaming with their national offices and partner organizations. A final report will soon be posted on the BUHRC website.

Emily Wilkinson has also won an award from the Economic and Social Research Council (ESRC) to permit her to study for a PhD on the subject of 'Disaster Risk Reduction and Local Governance' which explores how local governance structures and practices shape the implementation of DRR policy in Mexico. Emily Wilkinson, BUHRC, emily.wilkinson@ucl.ac.uk

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Comments and suggestions for future newsletter contributions should be sent to the editor:
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