

ISSUE 16

TSUNAMI SPECIAL ISSUE

MEDIA & WEB UPDATE

The BHRC media profile reached unprecedented levels in late December and into the New Year. Largely on the back of the tsunami disaster, Centre staff gave over 60 interviews to the press and broadcasting media. In addition, Bill McGuire featured in three tsunami 'specials', most notably Channel 4's *The Wave that Shook the World*. Bill was also one of the key characters in the Channel 4 'docudrama' *Krakatoa*, broadcast at the end of January, and series consultant and contributor to the BBC *Supervolcano* film and accompanying documentary about a future super-eruption at Wyoming's Yellowstone Park. The film itself, broadcast in two parts, attracted a combined audience of 14.3 million, with the two-part documentary picking up 7.6 million.

During January, the huge interest in natural hazards triggered by the tsunami resulted in close to half a million hits on the BHRC website, and more than a quarter of a million in February.

BHRC TSUNAMI WEB RESOURCES

Check out the new tsunami web pages at www.benfieldhrc.org. Included are a discussion of the implications of the Indian Ocean event for preparedness and contingency planning, environmental impact assessment reports from Sri Lanka and Indonesia, and a Powerpoint presentation of damage and effects. Related pages address Atlantic tsunami and mega-tsunami potential, and link to the BHRC co-authored online atlas on global tsunami risk.



alert

The Newsletter of Benfield Hazard Research Centre



EDITORIAL

Since publication of the last ALERT, our perceptions of natural hazards and the mayhem they have the potential to cause have been transformed. The Boxing Day, 2004 tsunami demonstrated with utter callousness that geophysical events neither respect national boundaries, nor differentiate between local and visitor. Most importantly, it showed that such events can be large enough to affect the entire planet or a substantial portion thereof. No longer are low-frequency, high-magnitude hazards such as climate-modifying volcanic eruptions, asteroid impacts or ocean-wide mega-tsunami regarded as teetering on the edge of science fiction, and moves are now afoot to take such threats more seriously. In the US, NOAA quickly put forward a proposal for an Atlantic Tsunami Warning System, at least in part to help counteract the threat of the unstable Cumbre Vieja volcano on the Canary Island of La Palma. In the UK, the government moved rapidly to establish a Natural Hazard Working Group, charged with making recommendations about how the international community might tackle global and para-global hazards. The negative side of the Asian tsunami catastrophe balance sheet shows a third of a million dead, half a million injured, 400,000 homes destroyed and citizens of forty countries wiped out. The positive side is a new perspective on the geophysical events that face our planet and our race, which, in the long term, may save countless lives. In this tsunami special issue, we include disaster scene findings from two BHRC staff, together with other tsunami-related news and features.

[Image: Phi Phi Island, Thailand. Courtesy Tiziana Rossetto, BHRC]

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INDIAN OCEAN TSUNAMI - LATEST TOLL

Three months on to the day, the toll of the Boxing Day tsunami continues to climb. The total number of dead and missing is now put at around 305,276, with more than 220,000 of these in Indonesia's Aceh Province. The number of injured is currently at more than half a million, with the destruction of around 410,000 homes leading to the internal displacement of more than 1.7 million people. Two million people in the affected region are estimated to have lost their jobs and about twice this number are expected to fall into poverty as a consequence of the tsunami. Total economic losses may be as high as US\$13.4 billion (Euro10 billion), with insured losses estimated at between US\$2.5 and US\$4 billion (Euro1.9 – 3 billion). The cost of recovery and reconstruction in Indonesia is expected to be the equivalent of 2 percent of the country's GDP and in Sri Lanka, around 4.4 percent of GDP.

BHRC DIRECTOR ACCEPTS GOVERNMENT ADVISORY ROLE

BHRC Director, Bill McGuire, has accepted an invitation to join the Office of Science & Technology supported Natural Hazard Working Group (NHWG). This ad hoc advisory group, established in the aftermath of the Asian tsunami disaster has the role of advising the Prime Minister on the mechanisms that could and should be established for the detection and early warning of natural hazards. The group has a brief to focus primarily upon global and para-global geophysical events, and on more localised scenarios with the potential for far-reaching economic and social impacts. In particular, it is addressing the feasibility and practicality of establishing an international panel to assess the risks associated with low-frequency, high-magnitude events. The NHWG is expected to present its results within the next few months. Further information can be found on the group website at:

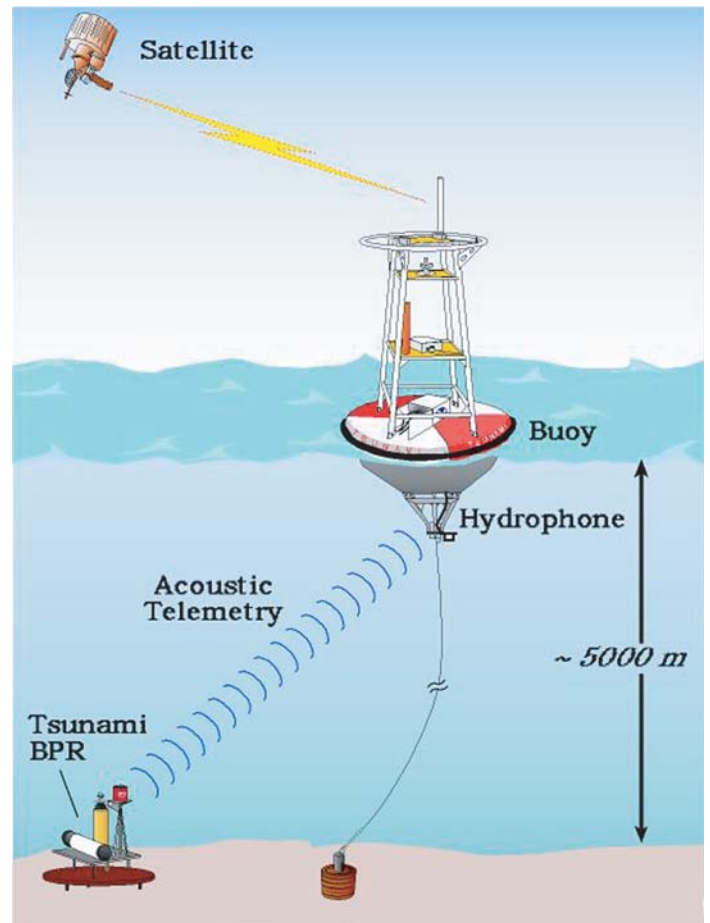
www.ost.gov.uk/policy/bodies/nhwg/

US LAUNCHES ATLANTIC TSUNAMI WARNING SYSTEM

In response to concerns over the generation of catastrophic tsunami in the Atlantic Basin, the Bush Administration has unveiled plans to spend US\$37.5 million on upgrading the Pacific Tsunami Warning System and building a new system in the Atlantic Basin. The US National Oceanic & Atmospheric Administration (NOAA) has announced its intention to establish an Atlantic tsunami early warning system as early as the year after next. The agency plans to have seven DART (Deep-ocean Assessment and Reporting of Tsunamis) buoys in place by mid-2007 - five in the Atlantic and a further two in the Caribbean. The buoys are linked to sea-bed pressure sensors that are capable of detecting and measuring tsunami with amplitudes as small as 1cm. Once a possible tsunami is detected, an acoustic signal is sent from the sensor to the buoy and onwards via radio to the GOES satellite. From here the data are sent via satellite ground stations to tsunami warning centres, which NOAA currently operates in Hawaii and Alaska.

Although the Atlantic has hosted just 2 percent of all recorded tsunami, a real risk still exists. Tsunami generated by the 1755 Lisbon earthquake killed many thousands in Portugal and sent waves as high as 7 m across to the Caribbean, where they caused damage and reported loss of life. Earthquake-generated tsunami in the English Channel are reported to have killed hundreds in Dover in 1580, while an earthquake and submarine landslide off Newfoundland took 30 lives in 1929. The Caribbean is particularly tsunami-prone, and large earthquakes here took lives in 1842, 1876, 1918 and 1946. On scales of many thousands of years, collapsing volcanic islands and gigantic sediment slides off the continental margins are also capable of generating 'mega-tsunami', with wave heights at the coast of many tens of metres having the potential to affect the entire North Atlantic Basin.

[Image: How a DART buoy works. Courtesy NOAA. BPR=Bottom Pressure Recorder]



ANOTHER LIVELY HURRICANE SEASON IN 2005

Following on from last year's exceptionally active hurricane season, it looks as if this year could also be pretty dynamic. Based upon current and projected climate signals the Tropical Storm Risk consortium, led by UCL's Benfield Hazard Research Centre, forecasts that Atlantic Basin and US landfalling tropical cyclone activity will be 160 percent of average in 2005. In its March Forecast Update, TSR forecasts 14.0 (\pm 3.2) tropical storms, of which 7.9 (\pm 2.3) are predicted to be hurricanes. 3.6 (\pm 1.6) of these are forecast to be intense hurricanes in the category 3 - 5 range. The consortium forecasts that 4.3 (\pm 2.1) tropical storms will make landfall in the US, with 2.0 (\pm 1.6) of these having hurricane status.

The TSR February forecast spans the period from June 1st to November 30th, 2005, and employs data through to the end of February 2005. The consortium's two predictors are the forecast July-September 2005 trade wind speed over the Caribbean and tropical North Atlantic, and the forecast August-September 2005 sea-surface temperature in the tropical North Atlantic. The first of these influences cyclonic vorticity - how easy it is for rotating storm systems to develop - in the main hurricane track region, while the second provides moisture and heat to power incipient storms in the main track region.

Monthly Forecast Updates will be issued through to August 2005 and can be accessed at: www.benfieldhrc.org/

HOW TSUNAMI-PRONE IS THE UK?

Notwithstanding the tsunami menace to the southern coastline posed by a future catastrophic collapse of the Canary Island of La Palma's Cumbre Vieja volcano, it seems that the UK is exposed to a range of local and remote tsunami sources. The tsunami with run-up heights in excess of 3 - 4 m that inundated parts of NE Scotland following a giant submarine landslide off the coast of Norway around 8,000 years ago is now well documented. Others, however, are only now attracting more serious attention. Two historical earthquakes in the English Channel are reported to have generated tsunami, the second - a Magnitude 5.9 quake in 1580 - being charged with sinking 20 ships and drowning hundreds in the coastal cities of Dover, Calais and Boulogne. More recently, in the Summer of 1929, the [Brighton Argus](#) newspaper reported one death and a number of injuries arising from a giant wave that appeared from nowhere on a warm, summer's day. In 2002, Simon Haslett of Bath Spa University College in the UK and antipodean tsunami expert, Ted Bryant from Australia's University of Wollongong presented evidence for a major, lethal tsunami striking the Bristol Channel and Severn Estuary on 30th January 1607. The event, which is commemorated on plaques in churches in the region, and in numerous contemporary documents, is held responsible for taking more than 2,000 lives and devastating some 570 km of the North Devon, Severn Estuary and South Wales coasts. Haslett and Bryant estimate maximum deep-water wave heights of a little under 4m in the channel, with run-up heights on the adjacent coasts reaching 7.5m. In places, the wave or waves appear to have penetrated several kilometres inland, purportedly reaching the foot of Somerset's Glastonbury Tor, more than 20km from the coast. Confirmation of a tsunami cause for the event remains to be categorically determined and no geological source has yet been identified. Perhaps the best candidate is an - as yet - unrecognised local submarine landslide.

Reference: Bryant, E. A. & Haslett, S. K. 2002 Was the AD1607 coastal flooding event in the Severn Estuary and Bristol Channel (UK) due to a tsunami? [Archaeology in the Severn Estuary](#) **13**, 163-167.

TSUNAMI DAMAGE ASSESSED IN SRI LANKA AND THAILAND

Tiziana Rossetto, BHRC associate and UCL specialist in earthquake engineering, recently participated in the Earthquake Engineering Field Investigation Team (EEFIT) tsunami field mission. The team spent 2 weeks making tsunami run-up measurements and surveying the damage to buildings and lifelines along the south western coast of Sri Lanka, and Phuket Island, the area of Khao Lak and Phi Phi Island in Thailand. A large variation in the degree of damage (from total devastation where over 70% of the buildings collapsed, to light damage where only windows and shutters were damaged) and water levels (from 2 to 11m run-up) along the coasts was observed and is attributed to local variations in shoreline topography, bathymetry and the presence of offshore coral reefs. Generally, poorly built one-storey masonry houses fared worst during the tsunami. These form the majority of the building stock in Sri Lanka and where the water level exceeded 2m most were seen to have collapsed. Villages composed of these houses were often totally wiped out. Low-rise reinforced concrete frame buildings performed better. Most suffered damage to their infill walls and windows and a few suffered partial failure, however the latter could typically be attributed to the presence of poor joint detailing, poor quality concrete or smooth reinforcing bars with inadequate bond. The structural performance of medium-rise well engineered and constructed reinforced concrete buildings (e.g. most hotel structures in Thailand and public buildings in Sri Lanka) was generally satisfactory, with only non-structural damage and contents damage being observed even in the presence of large wave heights.

One of the main observations made during the field mission was that there are differences in the criteria defining building life-safety performance in earthquake and tsunami scenarios. During an earthquake, life-safety performance is held to have been achieved if the building is structurally intact. However, in the case of the Indian Ocean tsunami, where in some areas water levels reached the third storey of buildings (e.g. Khao Lak, Thailand, see image below), although well-built hotel structures were standing after the tsunami, damage to non-structural components such as windows, doors and infill panels, which allowed water to enter the buildings, determined life safety. The failure of buildings to provide the necessary life protection is reflected in the extremely large death toll associated with the event. Hence, although good engineering practice can reduce economic losses it will not ensure life safety in the case of another large tsunami. It is therefore essential that the risk of life loss be reduced through the implementation of a program of tsunami preparedness, which provides education, methods of warning, disseminating alarm and evacuation and a post-event disaster management plan. [Tiziana Rossetto, BHRC, t.rossetto@ucl.ac.uk](#)

A Powerpoint presentation by Dr Rossetto [Observed damage and effects of the 26th December 2004 Indian Ocean Tsunami](#) can be downloaded from: www.benfieldhrc.org/SiteRoot/activities/publications.htm#obs



[Image: Khao Lak, Thailand. Courtesy Tiziana Rossetto]

CLIMATE CHANGE, EXTREME EVENTS AND COASTAL CITIES

A major conference on the theme of [Climate Change, Extreme Events and Coastal Cities](#), and co-sponsored by UCL, was held in Houston, Texas in February. The event was driven by the fact that more than a third of the world's population lives within 60 miles of a shoreline, while thirteen of the planet's twenty largest cities are located on a coast. Because of their precarious location and unique meteorology, these cities are especially vulnerable to the effects of global warming. Houston and London, prosperous, low-lying estuary metropolises, both rapidly expanding, and at risk from extreme weather events, are two such cities. One of the instigators and organizers of the conference was BHRC Affiliate, Julian Hunt, who concluded the meeting with a call for planners and politicians alike to recognize that climate change was here and happening now, and to act accordingly.

David Crichton of BHRC also attended the conference where he gave a presentation outlining how the insurance industry is finally waking up to the implications of climate change. Together with leading financial institutions they have begun to co-ordinate a major lobbying exercise to highlight the environmental and commercial risks of global warming. Under the auspices of the UN Environment Programme, 200 major banks and insurance companies have made a commitment to the environment and to lobby governments at climate change conferences for ameliorative policies. Under the [Carbon Disclosure Project](#), 95 institutional investment companies with assets of US\$10 trillion are demanding carbon emission information. Currently, some 300 of the top 500 companies in the world now feel obliged to disclose details of their carbon emissions. In addition, the Investor Network on Climate Risk is a consortium of institutional investors putting direct pressure on individual oil companies and other investors.

REA TRAINING OF TRAINERS - EVENTS

12 to 16 April 2005

Chennai, Co-sponsored with RedR India, CARE and BHRC. For info contact info@redrindia.org or prasad@redrindia.org. Web Site: www.redr.org.

25 to 29 April 2005

Washington DC. Co-sponsored with RedR India, CARE and BHRC. For info contact C. Kelly at 72734.2412@compuserve.com.

29 July to 2 August 2005

South Africa. Co-sponsored by CARE and BHRC in collaboration with C 4 L. For info contact C. Kelly at 72734.2412@compuserve.com.

SECOND SUMATRAN QUAKE

A magnitude 8.7 quake on a fault to the south of the Boxing Day rupture occurred on March 28th, spreading fear of a new tsunami and triggering evacuation of coastal communities in Indonesia, Thailand and Sri Lanka. Although the resulting tsunami was generally only a few tens of centimetres high and took no lives, the quake itself is currently estimated to have killed more than 500 people. The event was forecast two weeks earlier by John McCloskey of the University of Ulster and co-workers, in a paper published in *Nature*. They revealed that the massive fault slip that triggered the Boxing Day tsunami had dangerously elevated the stress levels on adjacent faults beneath the submarine Sunda Trench and below the island of Sumatra itself. Such a stress transfer mechanism has been recognised for some time, and is held responsible for earthquakes sometimes occurring in pairs or groups.

Reference: Indonesian earthquake: Earthquake risk from co-seismic stress. *Nature* **434**, 291.



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

Anna McGuire: anna.mcguire@ucl.ac.uk

Benfield Hazard Research Centre
Department of Earth Sciences
University College London
WC1E 6BT, UK

www.benfieldhrc.org

t: +44 (0)20 7679 3637

f: +44 (0)20 7679 2390

MORE BHRC TSUNAMI RESOURCES

To access the online [World Tsunami Atlas](#) developed by a consortium including BHRC, go to: www.nerc-bas.ac.uk/tsunami-risks/

For an assessment of the Atlantic tsunami threat see: BHRC Issues in Risk Science No. 2 [Tsunami Hazards in the Atlantic Ocean](#) at: www.benfieldhrc.com/SiteRoot/activities/issues/issues2.pdf