EARTHQUAKE UNIT

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WORK OF THE DEPARTMENT

Caribbean Tsunami Warning System

Arising from the devastating Boxing Day 2004 Indian Ocean tsunami, the US Government mandated the US Geological Survey and the National Oceanic and Atmospheric Administra- tion to establish a Tsunami Warning System (TWS) in the Caribbean. To this end the Caribbean is to receive nine Very Broad-Band six-component seis- mograph stations of the highest quality and five Deep Ocean Assessment and Reporting of Tsunamis (DART) II buoys each having ication links with the USGS National Earthquake Information Centre or NOAA. In December two members of the United States Geological Survey (USGS) team visited Jamaica to discuss with the GOJ the establishment of one of the seismograph stations in Jamaica. The project would be financed entirely by the US Government including training of locals in maintaining the station and delivering the data to the EQU, who would operate as the first local contact. Dr. Wiggins-Grandison took the visitors to three sites that satisfied their requirements, NEJ, BBJ and CVJ that were also existing stations of the Jamaica Seismograph Network. CVJ was selected with BBJ as the runner-up. An MOU outlining the terms of the bilateral cooperation was presented to the GOJ. On Earthquake Awareness Day in January 2006 the then Ministry of Land and Environment held a press conference in which an intention to sign the MOU was signed by her Excellency US Ambassador Johnson and the Honourable Minister Dean Peart. At the time of writing the MOU is still a work in progress.

Spectral Seismic Hazard Maps for Jamaica

In March two spectral seismic hazard maps representing long and short period ground accelerations with a two percent probability of exceedence were handed over to the National Building Code Committee. The maps were the result of an extensive study by M. Wiggins-Grandison. They conform to the guidelines of the International Building Code which is being promulgated into law for Jamaica. A brochure on the maps has also been prepared. A more detailed paper for publication will follow.

Microzonation of Kingston

M. Wiggins-Grandison attended a second workshop of the UNESCO-IUGS-IGCP Project 487, "Microzonation of Latin American Cities". This time it was held at the Engineering Department, University of San Jose in Costa Rica, October 18-26, 2005

Other

As usual staff were involved in the ODPEM's Earthquake Awareness Week and Disaster Preparedness Month activities, UWI's Research Day and Jamaica National Heritage Trust's commemoration of the Port Royal earthquake. Over 550 students and teachers visited the Unit and the Unit participated in Savanna-la-Mar Primary's Disaster Preparedness exhibitions in June.

About eighty-three (83) trips were made to maintain the three networks of recording instruments.

Jamaica Seismograph Network (JSN)

Finally, the last two stations damaged from Hurricane Ivan were dealt with. The Jamaica Constabulary erected a new antenna tower at CMJ in August-September 2005 enabling that station to be rebuilt. The Harbour Master's Department re-roofed the building at PCJ during May to July 2006 enabling both the seismograph and the continuous Global Positioning System (GPS) receiver to be reinstated in a dry, secure environment. Since September 2004 those equipment had been operating under a tarpaulin which contributed to the downtime of PCJ as well as YHJ which is relayed through PCJ.

For northern and western stations much of the down time is attributable to lightning damage at Cooper's Hill which is the relay point for these stations, this despite the use of lightning protection cells. This year, Cooper's Hill was placed on solar energy which has decreased the impact of the damage. A number of options about how to eliminate/minimize

this problem were examined including the possibility of shifting the relay point to Stony Hill, where there has been historically lower incidence of lightning strikes. However, a higher tower will be required there to achieve line-of-sight with the outlying stations.

Figure 1. Station Performance in terms of percentage of earthquakes recorded.

Most stations rebounded since Hurricane Ivan. Exceptions are: (1) MCJ that experienced a period of noisy signals caused by weather-worn cables and weak batteries, which had to be replaced; (2) NEJ that continued to operate in an electronically noisy environment from which it must be removed; (3) YHJ that was inaccessible for much of 2005 due to unsafe

road conditions brought on by the excessive rainfall. Stations exhibiting significant gains over the period include BBJ, CMJ, GWJ, HOJ and MBJ. [Background is the undeveloped site of NEJ at Mount Airy, Westmoreland.]

Figure 2. JSN Performance.

For 2005-6, the number of earthquakes recorded by 9-12 stations increased three-fold when compared to the previous two years.

Concrete plans were drafted to build adequate infrastructure and use solar

energy at stations giving priority to those that need it most, NEJ, YHJ and BBJ. Estimates were included in the budget for 2006-7. A significant amount of investigation concerning the choice of equipment for upgrading stations from analogue to digital has taken place and will continue into next year. Investigations also focussed on a new communication system for staff and digital instruments alike using the flat rate Oceanic Digital/MiPhone CDMA wireless service.

In March two new personal computers for data acquisition were received and a new data acquisition system employing an economical 32-channel SARA digitizer and SEISLOG freeware from University of Bergen was installed and tested. The Central Recording Station (CRS) was rehabilitated and tidied by replacing and ducting weather-worn antenna cables and internal wiring. In addition renovation and upgrading to the solar power system at the CRS began with the aim of improving its efficiency.

Following a series of major repairs, the Unit's vehicle, a 1998 Subaru Forrester broke down on July 11 and was declared irreparable. Station maintenance therefore was hampered until the end of the month when the GOJ loaned the Unit a vehicle. It is anticipated that enough money to purchase a new 4-wheel drive vehicle will be provided in the 2006-7 budget.

The Jamaica Strong Motion Network

This year Kinemetrics Inc. repaired and returned to us FOC an ETNA digital accelerometer that had been damaged since two years ago. Successive budgets of the EQU could not support the repair cost of US$3,600.00. In August 2005 yet another Etna was damaged and repairs have been assessed at US$2,000.00. Engineers from Oceanic Digital worked with EQU engineering staff testing wireless CDMA communications with the ETNA digital instrument. Aspects of the tests were positive and supportive of continued testing.

GPS network

A first manuscript that integrated the findings of the initial five years of GPS measurements in Jamaica with Jamaican seismicity was drafted and submitted for publication by C. DeMets (U. Wisconsin) and M. Wiggins-Grandison.

In April the two Ashtech GPS receivers and data-bridges were redeployed at Pike and at Portland Cottage lighthouse. During May to July six new sites were selected for GPS measurements: Manchioneal, Kempshot, Munro College, Braeton and Manatee Bay both in the Hellshire Hills, and **Big Goat Island**. A short talk on GPS and its use in Jamaica was well received by Munro College fourth form geography students and teacher, many of whom had not heard the term before.

Earthquakes Recorded

105 local earthquakes were recorded with magnitudes between 1.1 and 4.3. The largest was offshore Black River. Six minor/light earthquakes were felt, none causing any damage. Another thirty-nine events (39) were attributed to man-made explosions.

Seismicity for 2005-6 was dominated by earthquakes occurring in the Blue Mountains, followed by the central Rio Minho-Crawle River fault zone, the Wagwater Trough South, Wagwater Trough North, Buff Bay and Montpelier-Newmarket Belt, in that order, all traditional zones of higher activity.

Forty-five (45) earthquakes were located in the near-Jamaica region. Most were situated in the Oriente Fracture Zone/Cayman Trough that lies between Jamaica and south-eastern Cuba. In addition 45 regional and 32 distant earthquakes were recorded bringing the total number of events this year to 267.

PAPERS PRESENTED

- M.D. Wiggins-Grandison, "Towards IBC Seismic Hazard Maps for Jamaica", 50th Anniversary of the Geological Society of Jamaica Conference, Mona Visitor's Lodge, December 1 - 4, 2005 (oral)
- M.D. Wiggins-Grandison, "Jamaican Seismology with reference to other islands in the Greater Antilles", Caribbean Division of Structural Engineers 2-day conference on Earthquake Engineering, Mount Irvine Bay Hotel, Tobago, December 5 - 6, 2005 (oral, invited)
- M. D. Wiggins-Grandison, "The Preparation of IBC Seismic Hazard Maps for Jamaica", Jamaica Institution of Engineers & Institution of Structural Engineers – Caribbean Division Joint Technical Session: Selection of Seismic Design Values for Use in Jamaica, University of Technology, June 8, 2006 (oral).

INCOME GENERATION

The EQU delivered three small consultations which earned just over $40,000.00. Work progressed satisfactorily on a seismic risk assessment for NEM Insurance Company Ltd. The project valued at over $2 million, involved two weeks of site response measurements in Kingston and employed one Scientific Officer for one year.

PUBLIC SERVICE

- Member, National Data Centre, Comprehensive (Nuclear) Test-Ban Treaty Organization (CTBTO)
- Member, Federation of Digital Seismograph Networks (FDSN)
- Member, International Seismological Centre (ISC)
- Member, Middle America Digital Seismograph Con- sortium (MIDAS)
- Member, National Committee on Science and Technology (NCST)
- Member, National Disaster Committee (NDC)

- Member, US Caribbean Seismic Station Network (USCaribNet)
- Member, West Indies Group of University Teachers Executive (WIGUT)
- Member, Senior Common Room (SCR) Management Committee