EARTHQUAKE UNIT

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EARTHQUAKE UNIT'S MISSION STATEMENT

Through operating the Jamaica Seismograph Network and affiliation with other Caribbean and regional networks, the Earthquake Unit seeks to understand earthquake processes in and around Jamaica and advise the society about earthquake hazards, thereby encouraging earthquake awareness and the application of mitigative strategies to development.

THE EARTHQUAKE UNIT

The Earthquake Unit (EQU) is a research unit of the university that is funded directly by the Government of Jamaica (GOJ) as the sole agency responsible for the monitoring of earthquakes and researching seismic hazards in Jamaica. The EQU is challenged annually to make the necessary upgrades because of shortfall in the budgetary allocations from the Govt. of Jamaica. However, this year saw an increase in the allocations of 29.4 million dollars despite a shortfall of 5 million of the budgetary request to the Government of Jamaica. This increased allocation will allow the EQU to purchase an additional broadband seismograph unit as the Unit moves towards a digital network. The acquisition of this additional unit will make this unit the second of the minimum four (4) broadband seismograph network required by the EQU. This additional equipment will contribute to improving the data quality that can improve the seismic codes being used in the proposed national building code.

The EQU operates The Jamaica Seismograph Network (JSN) which is a network of 12 analog short period seismograph stations installed across the island (see figure 1). The data from the JSN station is transmitted to the Central Recording Station (CRS) at UWI-Mona in real time using radio equipment where the data is recorded on computers running data acquisition and processing software. The EQU also operates the Jamaica Strong Motion Network which is a network of 8 accelerographs installed across the island to record ground shaking for larger earthquakes. These instruments operate in a standby mode and start recording when triggered by an earthquake. They provide very important data that are used in seismic hazard assessment, studying the response of sites to ground shaking and provide parameters to be used in constructing or retrofitting important structures.

Another area of operation is the GPS network which has over 36 points across the island to monitor fault movement or strain accumulation over time. Over the past year at least 12 GPS points were monitored in this University of Wisconsin collaboration with the EQU. The EQU has acquired one broadband seismograph unit, now installed in the Stony Hill Station, where additional components to this station were installed including solar panels, and a new tower, new batteries and lightning protection system.

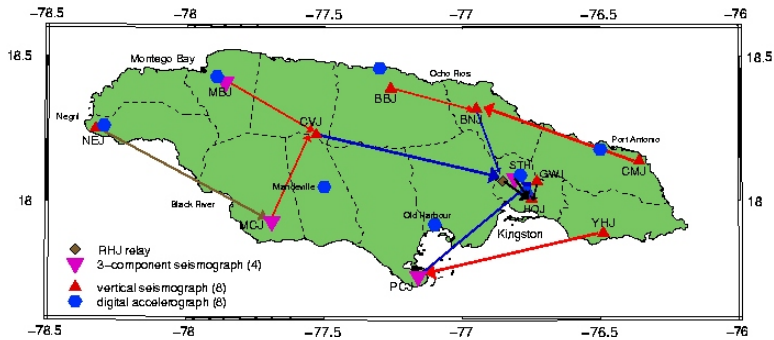

Figure 1: Location of instruments forming the Jamaica Seismograph Network that is used to capture and transmit ground motion in and around Jamaica to the Central Recording Station at the Earthquake Unit at UWI, Mona.

The Unit was also able to replace the 24 deep cycle batteries that were in use for 6 six years, well past their working life.

In January 2011 Globe Insurance Co. Ltd. donated two Dell PowerEdge 2650 servers they had in use to the EQU. This has enabled the EQU to collect and archive more data from all 12 stations and also for the installation of Earthworm software.

EARTHQUAKES RECORDED

The JSN recorded and processed two hundred (200) earthquakes during this period (August 2010 – July 2011), see Figure 2. Of these events only ninety (90) were local events.

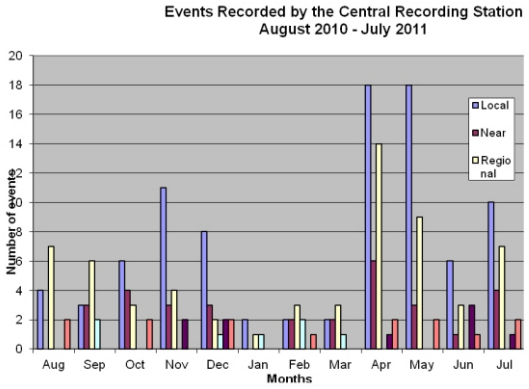

Figure 2: Events recorded by the Central Recording Station at the EQU, of these only 90 were local events.

The most active sub-area (as seen in Figure 3) was the Blue Mountain Block (labelled 16 in Figure 4) followed by Morant Basin (labelled 26 in Figure 4) and the Montpelier-Newmarket Belt (labelled 7 in Figure 4). There were fourteen (14) felt earthquakes during this period with the largest local event having a magnitude 5.0 with an epicentre off the coast of St. Elizabeth in the Blossom Fracture Zone. This event was felt island-wide; however, there were no reports of damages. The epicentre of local events are shown on land and the waters around Jamaica on Figure 5.

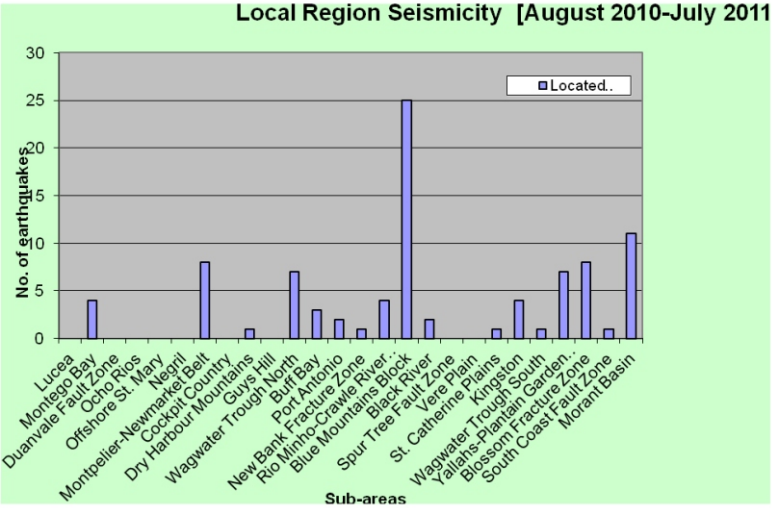

Figure 3: Seismic activities according to different Sub-Area for August 2010-July 2011.

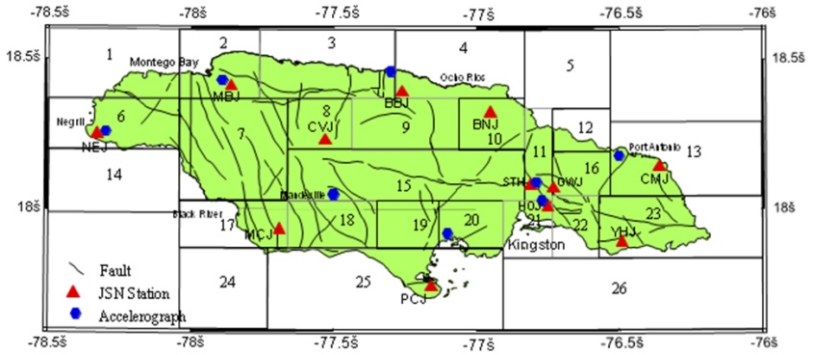

Figure 4: The Jamaica Seismograph Network local region sub areas and the major fault lines across the island.

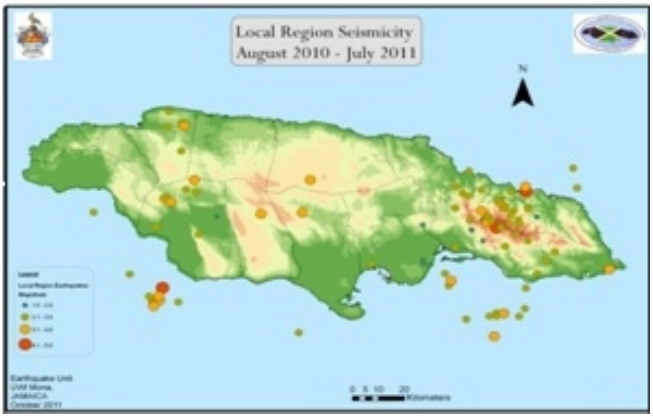

Figure 5: Seismic activity within the local region sub-areas of Jamaica for the period of August 2010 – July 2011.

ACTIVITIES AT THE UNIT

The EQU has been actively participating with our international partners in an effort to increase the quality research and access to equipment and expertise that the unit lacks. Two of the most beneficial are the sonar mapping of Kingston Harbour with Matt Hornbach from University of Texas, Institute of Geophysics. This work is in an effort to understand tsunamigenic occurrences, and fault lineation and activity in the Kingston Harbour. From this research escarpments were identified that suggest that there is a fault that runs in the Kingston Harbour with bifurcations towards Long Mountain and the Caymans area. The trend of this fault has not previously been mapped. The research should continue in January 2012 when coring in the location and dating of the samples will be done to determine activity of this fault and the age of tsunami deposits.

The EQU has been working with the University Consortium (UNAVCO) in the COCONet Project to examine Caribbean Plate motion and activity along major faults in the region. Three permanent GPS units were installed in Jamaica; one at Morant Cay, another at Pedro Cay and the third on the Mona Campus on the Physics Dept. Electronics Lab. In addition to the GPS unit a weather instrument is also included in the installation at each location that can be used for meteorological and climate change studies.

The EQU hosts visits from schools and the public each year in an effort to fulfill its mandate towards educating the society about seismic occurrences and vulnerability. For this period the Unit hosted 27 schools with 940 students and 60 teachers. These students came from the Primary school to University, including the Department of Geography & Geology and a number of Teachers Colleges and the University of Technology, Construction Engineering and Architectural programmes. In addition, several presentations were made to organizations where staff members visited on invitation. There were also several media interviews and fora to discuss matters relating to earthquakes and development.

The EQU continue to implore the Jamaica Institute of Engineers (JIE) and the institutions to acquire accelerographs to install at large sized structures/facilities (government and private) to monitor the performance of these structures to large earthquakes. This data can be used to determine the integrity of structures after an earthquake, to assist in retrofitting designs, and also that can contribute to the EQU database of strong ground motion data that will be important in improving the seismic codes of Jamaica.

The Norman Manley International Airport (NMIA) acquired two accelerographs and these were installed on the Control Tower and in open ground (free-field) at the NMIA. We hope that this step will continue as these instruments are installed when new structures are built and more institutions will acquire these instruments for existing structures. The EQU also continues to maintain and operate a Kinemetrics accelerograph purchased by SMADA Consultants which is installed in Half Way Tree and also the TransJamaican Limited has two accelerographs one at the Hunts Bay Bridge and one at the Toll plaza in Portmore.

The EQU Administrative Assistant/Librarian, Mrs. Stephenson has started to reorganize the collection of the EQU library. The library holds journals, magazines, newsletter bulletins and maps, all related to geophysics. She is trying to acquire all collections to fill the gaps of our holdings in seismology. The focus is the development of a collection that can attract students and the wider community to utilize the resources of the EQU. We hope that we can complete the database of the collections

to facilitate the sharing of our resources by linking to the UWI Mona network- UWIMINET.

PROJECTS

Global Positioning System (GPS) Network (In collaboration with The University of Wisconsin at Madison)

In monitoring deformation and movements across faults in Jamaica, the EQU continues to install equipment to collect data at thirty-six (36) GPS sites across the island with four of these points being offshore at Morant Cay, Pedro Banks, Goat Island and Manatee Bay. Sites are occupied for a minimum period of seven (7) days after which the equipment are collected and the data downloaded and processed. Also, arrangements were made with the Jamaica Defence Force (JDF) Coast Guards to transport EQU staff and equipment to Pedro Banks and Morant Cays. Additionally, the two (2) continuous GPS stations, one at Portland Cottage in Clarendon and the other at Mount Denham/Pike in Manchester are periodically monitored and data downloaded for analysis. Additional GPS data is provided by the National Land Agency (NLA) from their 13 GPS networks this data is also analysed by the University of Wisconsin. The EQU is preparing to install the necessary hardware with software and develop the necessary expertise to process this data as well.

Global Seismograph Network/Caribbean Tsunami Warning System

The Earthquake Unit accesses the earthquake data from the Global Seismograph Network (GSN) station at Mount Denham/Pike MTDJ, this data is also used with the local network data to provide immediate solutions of earthquake data using the open source Earthworm software.

CTBTO (Comprehensive Nuclear Test Ban Treaty Organisation) National Data Centre (NDC) activities.

The EQU continues to operate the National Data Center (NDC) at the Central Recording Station (CRS), Mona. The Earthquake Unit is linked to the International Data Center (IDC) in Vienna and has access to the data from the CTBTO's International Monitoring System.

UNAVCO (UNIVERSITY CONSORTIUM) COCONet (Continuously Operating Caribbean GPS Observational Network) Project

Three permanent GPS units were installed at the Pedro Cays and Morant Cays with permission from the JDF Coast Guard, the third unit was installed on the roof of the Electronics Lab. The Coast Guard has offered assistance to the EQU to visit the sites at Morant Cay and Pedro Cay whenever there is need for maintenance. The GPS units are expected to be fully in operation by November 2011.

Seismic Research Centre (St. Augustine) and the EQU will be working together to conduct the seismic microzonation study of Jamaica, a World Bank Funded project through the Disaster Risk Reduction Centre DRRC (Mona).

FUNDING/CONSULTATION

The Earthquake Unit has undertaken a number of consultations during this year, among these are:

- TransJamaican Highway monitoring accelerograph on Tolls Bridge and Plaza –**J233,750.00**
- Smaller consultation from Insurance companies on specific seismic events – **J$45,000.00**
- Airport Authorities of Jamaica monitoring accelerograph on Tolls Bridge and Plaza – **US$1,780.00**
- UNAVCO - COCONET Project – **US$45,000.00**

PRESENTATIONS

In addition to hosting students and other visitors to the EQU, the unit made presentations to the following:

- Jamaica Institute of Engineers
- Institute of Jamaica
- Boys Town Community

- Savanna la Mar Primary School
- LIME

STAFF/ PERSONAL DEVELOPMENT

Lyndon Brown (Research Fellow/Head): completed the 2nd Training Cycle as part of the Surrogate Inspector Training programme in the Comprehensive Test Ban Treaty Organization, Onsite Inspection (OSI). Training exercise took place for 3 weeks in Austria and Hungary with simulation of an actual OSI in Hungary during June-July, 2011

Global Earthquake Model: Participated in conference on Global Earthquake Model(GEM): A member of two (2) working groups towards the establishment of uniform and open standards for calculating and communicating earthquake risks worldwide.

Paul Williams (Network Manager/Engineer)

Chile: IRIS (Incorporated Research Institution for Seismology) workshop/training

Laurel Choy: (IT Officer) currently pursuing the Cisco Certified Network Associate (CCNA) course.

Karlene Black (Scientific Officer): Currently pursuing a Master's degree in Seismology in Japan through a scholarship funded by the Japan International Corporation Agency (JICA), expected to complete and return to EQU in September 2011.

PAPERS PRESENTED

- Brown, Lyndon, 2011; Earthquake induced landslides; An assessment of 19th Caribbean Geological Conference, Le Gosier, Guadeloupe.
- Brown, Lyndon, 2010: Earthquake Induced Landslides; 5th Caribbean Conference on Comprehensive Disaster Management, Montego Bay

- Robertson, R. W. Salazar, M. Higgins, C. La Barrie, J. Latchman, O. Graham, M. Johnson & L.Brown, 2010: Development of a Caribbean Risk Atlas for Earthquake Hazard, 5th Caribbean Conference on Comprehensive Disaster Management, Montego Bay

- Tankoo, K & Lyndon Brown, 2010; Seismic Screening of Critical Medical Facilities in Kingston, Jamaica using Rapid Visual Screening (RVS) Procedure; 5th Caribbean Conference on Comprehensive Disaster Management, Montego Bay

- Brown, Lyndon, 2010: Earthquake induced landslides: An assessment of the landslides of Ness Castle, Arntully, St. Thomas: 5th Caribbean Conference on Comprehensive Disaster Management, Montego Bay

- Brown, Lyndon, 2010: Unravelling the past, implications for the future: understanding earthquake history in Jamaica: 5th Caribbean Conference on Comprehensive Disaster Management, Montego Bay

- Delbecq, K, M. Hornbach, P.Mann, & L. Brown. 2010: Geohazards of seismically triggered submarine slides in Kingston, Jamaican initial report. American Geophysical Union, Annual Conference, San Francisco.

- Hornbach, M., P. Mann, K. Delbecq, L. Brown, C. DeMets, & B. Benford, 2010: Assessing tectonics and geohazards near Kingston Jamaica; an initial report. American Geophysical Union, Annual Conference, San Francisco.

PUBLICATION

* Hornbach, M. L. Brown, P. Mann, C. Frohlich, & K.Ellins, 2011: Assessing geohazards near Kingston, Jamaica; Initial results from chirp profiling. Special Section: Geoscientist without borders, *Leading Edge, pg. 410-413*