

EARTHQUAKE UNIT

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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 research in seismic hazards in Jamaica. The EQU continues to focus on improving the seismic network across Jamaica by increasing the number of broadband seismographs. With budgetary constraint, the



EQU focuses on requesting the essential allocations. The support of 30.1 million dollars received this financial year puts the unit in a position to acquire a third broadband seismograph to meet the transformation to broadband seismographs as the primary data acquisition source of the Jamaica Seismograph Network. The acquisition of this additional unit will make this number three (3) 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 currently operates the Jamaica Seismograph Network (JSN) which is a network of 12 analog short period seismograph stations installed across the island (see figure 1) and two broadband seismographs. The data from the JSN station is still transmitted to the Central Recording Station (CRS) at UWI-Mona in real time using radio telemetry where the data is recorded on computers running data acquisition and processing software. The EQU is currently negotiating transmission via internet to the EQU in some areas where this is possible at least for the broadband instruments. The EQU has not been able to add any new instruments to the Jamaica Strong Motion Network and as such this still remains at eight (8) accelerographs which are installed across the island to record ground shaking for larger earthquakes and structural response as is the case of the

two instruments located at the Portmore Toll Bridge and Toll Booth plus the other two located at the Norman Manley International Airport. 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.

The addition of three (3) permanent location of GPS stations at Pedro Cays, Morant Cays and on the Physics building on the UWI campus has improved the network (now including five (5) permanent continuous stations) of the thirty-six (36) GPS points across the island. Monitoring of these points will assess fault movement or strain accumulation over time. Over the past year at least eight (8) GPS points were monitored in the University of Wisconsin collaboration with the EQU.

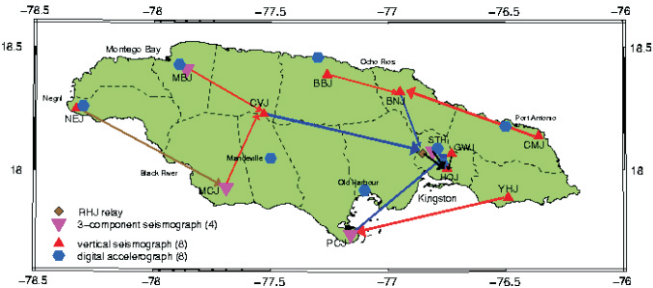


Figure 1: Location of instruments forming the Jamaica Seismograph Network used to capture and transmit ground motion in and around Jamaica to the Central Recording Station at the Earthquake Unit at UWI, Mona.

EARTHQUAKES RECORDED

The JSN recorded and processed two hundred (234) events, seventeen of which were determined to be blasting events, of the remaining two hundred and seventeen (217) earthquakes during this period (August 2010 – July 2011), see table 1, only seventy-seven (77) were local events.

Table 1: Events recorded by the Central Recording Station at the EQU, of these only 77 were local events with only 9 of these recorded events being felt.

Year	Month	Recorded Events					Total Recorded	Felt Events
		Local	Near	Regional	Distant	Blasts		
2011	Aug	4	7	5	0	2	18	1
2011	Sept	6	6	9	1	0	22	1
2011	Oct	12	5	1	1	3	22	2
2011	Nov	2	6	5	2	1	16	1
2011	Dec	7	1	2	0	0	10	0
2012	Jan	5	1	9	0	1	16	0
2012	Feb	14	5	12	1	0	32	2
2012	Mar	3	4	7	1	3	18	2
2012	Apr	9	3	9	0	1	22	0
2012	May	9	8	7	0	1	25	0
2012	Jun	4	3	8	0	2	17	0
2012	Jul	2	3	8	0	3	16	0
ALL	Totals	77	52	82	6	17	234	9

The most active sub-area (as seen in Figure 3) was the Blue Mountain Block (labelled 16 in Figure 4) followed by Rio Minho-Crawle River Fault (labelled 15 in Figure 4) and the Wagwater Trough, South (labelled 22 in Figure 4). There were nine (9) felt earthquakes during this period with the largest local event with a magnitude 3.7 with an epicentre in Manchester along the western extension of the Rio Minho-Crawle River Fault. This event was felt mostly in Manchester St. Ann, Clarendon, and St. Catherine; however, there were no reports of damages associated with this event. Figure 5 shows the location of earthquake events across the island.

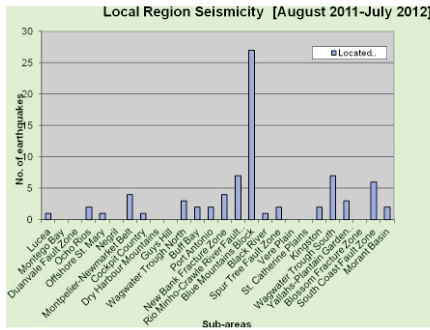


Figure 3: Seismic activities in the Jamaica local sub-areas for August 2011 - July 2012.

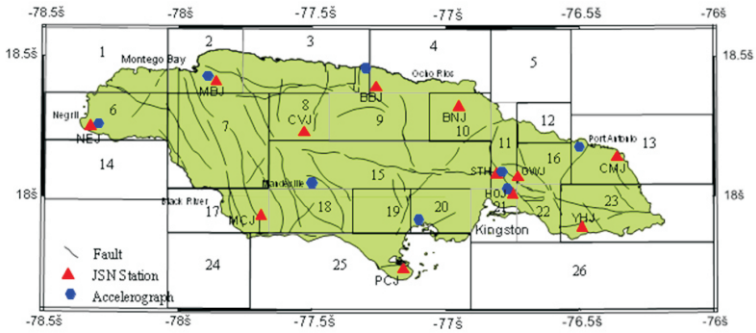


Figure 4: The Jamaica Seismograph Network local region sub areas and the major fault lines across the island.

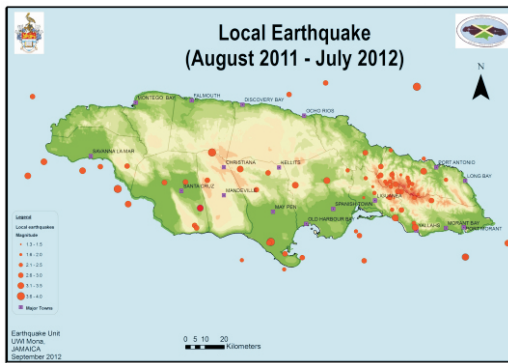


Figure 5: Seismic activity within the local region sub-areas of Jamaica for the period of August 2011-July 2012.

WORK OF THE DEPARTMENT

Fifteen primary and high schools visited the EQU, a total of 719 students and 47 teachers form part of these groups. There were other visits from students here at the UWI and other tertiary institutions. Members of staff of the EQU also visit a number of community organizations, colleges and expos to educate the public in an effort to fulfill its mandate towards educating the society about seismic occurrence and vulnerability. 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 earthquake and development.

Through presentations to the Jamaica Institution of Engineers and other major public fora the EQU continues to implore these institutions to acquire accelerographs to install at large sized structures / facilities (government and private) to monitor the performance of these structures to large earthquakes that can be used to determine the integrity of structures after an earthquake, and also that can guide engineers further in the retrofitting after a major event. This collaboration can also contribute to the EQU database of strong ground motion data that will be important in improving the seismic codes of Jamaica.

Efforts continue to organize the collection of the EQU library; the library holds journals, magazines, newsletter bulletins maps, all related to geophysics and seismology in particular. The EQU Library now has a list of its collection in a database online so that the wider university community can have information on the holdings of the EQU and can visit the unit to use any of this collection. The focus is the development of a collection that can attract students and the wider community to utilize the resources of the EQU.

Mrs Stephanie Williams-Grizzle joined the EQU as permanent staff in September 2011; she fills the role as GIS Officer/Geophysical Research Assistant and also served as a liaison officer between the EQU and the Land Information Council of Jamaica (LICJ).

The new IT Officer: Mr. Paul Coleman joined the unit in March 2012; a replacement for Mr. Laurel Choy who is no longer with the EQU.

Personal Development/Training

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 in Austria May, 2012.

DRRC Software Training Exercise, Caribbean Disaster Risk Atlas, Trinidad & Tobago, February & May 2012.

Paul Williams (Network Manager/Engineer): Puerto Rico (Training Exercise in Seismic Network Operations) November 2011.

Laurel Choy: (IT Officer) International Data Centre Comprehensive test Ban Treaty Organization (CTBTO): Wave-form Analysis Training in Mexico, January 2011.

Karleen Black (Scientific Officer): Completed a Master degree in Disaster Management with a focus on Seismology in Japan through a scholarship funded by the Japan International Corporation Agency (JICA) returned to the EQU in October 2011.

International Data Centre Comprehensive test Ban Treaty Organization (CTBTO): Wave-form Analysis Training in Mexico, January 2011.

PROJECTS

■ DRRC Seismic Micro-zonation Project

The EQU unit has been actively participating with our international partners in an effort to increase the quality research with added expertise and equipment that the unit lacks. A major research project is the seismic microzonation of Kingston a Disaster Risk Reduction Centre (DRRC) Disaster Risk Atlas being led by the Seismic Research Centre in St. Augustine. The project started with major data collection in November and ended in the filling of data gaps in July. Analysis of this ambient seismic data produced a site effect map indicating iso-period values across the urban KMA with a classification of rock/soil ground motion across the city. Publication and conference proceeding from this project resulted in the DRRC launch of Disaster Risk Atlas in Ocho Rios in July 2012.

- Global Positioning System (GPS) Network Continuously Operating Caribbean GPS Observational Network (COCONet) and the network of GPS Fault delineation project in collaboration with the University of Wisconsin at Madison

The EQU continues to work with the University Consortium (UNAVCO) in the COCONet Project to examine Caribbean Plate motion and activity along major faults in the region. Three (3) 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 Electronics Lab, (see Figure 6). In addition to the GPS unit a Meteorological pack with weather instrument is also included in the installation that can be used for climate change studies. Replacement of the meteorological packet on all 3 permanent GPS sites at Pedro Cay, Morant Cay and UWI was done after installation as those initially installed were found to be defective.

The installation of these instruments will further boost local climate change studies and also improve assessment of fault motion. These instruments are now fully operational and data can be accessed at <http://pbo.unavco.org/data/gps/realtime>.

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

The EQU continues to operate the National Data Centre (NDC) at the Central Recording Station (CRS), Mona. The Earthquake Unit is linked to the International Data Centre (IDC) in Vienna and has access to the data from the CTBTO's International Monitoring System. THE EQU received a donation of equipment in June from the CTBTO, a value of twenty four and a half thousand euros (24,500) to strengthen the capacity of the EQU as the National Data Centre

PRESENTATIONS

- **Brown, L.;** “Jamaica’s Earthquake Threat - latest research findings from previously unidentified faults near Kingston” Public Lecture, UWI, Disaster Risk Reduction Centre, Oral presentation.

- **Salazar, W.**, Brown L., Higgins M., La Barrie C., Juman A., St. Bernard J., Latchman J., Robertson R., Lynch L., “Development of Caribbean risk atlas for earthquake hazards risk atlas project” Training workshop and symposium on the use of GIS and Risk Estimation in Disaster Risk Reduction for the Caribbean, Ocho Rios, Jamaica, June 27-28, Oral presentation.
- **Brown, L.** Blake, S., Murray. D.; “Seismic vulnerability of critical facilities in Jamaica; Rapid Visual Screening of Fire Station in Kingston & St. Andrew” Jamaica Institution of Engineers Conference, Kingston, September 2012, 10 p.
- **Brown, L.**, Salazar, W., Mannette, G., “Surface soil effects using microtremors Observations in Kingston Jamaica” Jamaica Institution of Engineers Conference, Kingston 2012, Oral presentation.

PUBLICATIONS

Referred Journal

- * **B. Benford**, C. DeMets, B. Tikoff, P. Williams, L. Brown and M. Wiggins-Grandison. “Seismic hazard along the southern boundary of the Gonave microplate: block modelling of GPS velocities from Jamaica and nearby islands, northern Caribbean”. *Geophys. J. Int.* (2012) 190, 59-74

Technical Report

- * **L. Brown**, S. Williams-Grizzle, R. Grant, K. Henry, “Seismic vulnerability of Annotto Bay using the RVS methodology and the H/V (Nakamura Method)” July 2012 : ODPEM project.

INCOME GENERATION

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

- TransJamaican Highway monitoring acceleragraph on Tolls Bridge and Plaza: J\$202,950.00
- ODPEM: Seismic Assessment of Annotto Bay: \$153,900

COMMUNITY SERVICE

The Earthquake Unit works in close collaboration with ODPEM and the Jamaica Institution of Engineers in disseminating the findings of research and provides advice to both institutions that is of national significance.