EARTHQUAKE UNIT

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WORK OF THE UNIT

The 2008 – 2009 academic year was a very challenging one for the Unit with the departure of two (2) members of staff, the Seismologist/Head of Department and the Information Technologist, with the Unit operating for most of this period with four (4) full-time members of staff. The Unit, as most persons might be aware, is Government funded and based on the certain economic climate, the Budgeted amount for Capital Expenditure was not received for the past four (4) years. This resulted in the non-implementation of upgrade to our Network and Earthquake Monitoring Systems. The Unit had intended as part of its Operational Plan, to establish on a phased basis, an automated system to reduce the processing time after felt earthquakes and thus improve emergency response time.

Notwithstanding, we had a successful year in meeting certain important targets and have seen improvements in the seismic station performance. This is attributed to the efforts of members of staff.

Earthquakes Recorded

The Jamaica Seismograph Network (JSN) recorded and processed over two hundred and sixty-four (264) earthquakes during this period. Of this number there were one hundred and thirteen (113) local events, one hundred and fourteen (114) regional, twenty-seven (27) distant or teleseismic and ten (10) attributed to blasting. One hundred and thirty-nine (139) events were located of which one hundred and nine (109) were local (earthquakes occurring within Jamaica) and thirty (30) near Jamaica (events occurring within 400 km of Jamaica).

The most active sub-area was the Blue Mountain Block with thirty-six (36) earthquakes followed by Kingston with fifteen (15) and the Montpelier-Newmarket Belt with nine (9). There were nine (9) felt earthquakes with the largest magnitude being 4.8 that occurred 6:48 pm on October 28, 2008 in the Cayman Ridge area. It was reportedly felt in Negril, Westmoreland. Also of significance were two (2) felt events with the same epicentre near Westphalia in St. Andrew. They occurred 7:23 am and 7:46 am on February 25, 2009 with magnitudes of 3.8 and 3.3, respectively. Both of these were felt in areas Kingston, St. Andrew, Portland and St. Thomas with a maximum intensity of (v) on the European Macroseismic Scale (EMS).

Table 1: Felt Earthquake for August 1, 2008 to July 31, 2009

Date	Time	Magnitude	Lat.	Long.	Block	Reportedly felt
October 20	7:33pm	3.6	18.07	-75.5	Port Antonio	Eastern St. Andrew (II)
October 28	6:48pm	4.8	19.27	-78.5	Cayman Ridge	Negril, Westmoreland
November 1	9:13am	4.0	18.17	-77.8	Mountpelier - Newmarket belt	Savanah-La-Mar, Westmoreland
January 10	11:41pm	3.5	18.2	-77	near Cheesefield, St. Catherine	St. Catherine
January 24	5:31pm	3.5	18.04	-76.6	Wagwater Trough	St. Andrew
February 25	7:23am	3.8	18.07	-76.6	Near Westphalia	St. Andrew, Half-Way-Tree (II), Mavis Bank (V), Dallas (IV), Bull Bay (III), Port Royal (I)
February 25	7:46am	3.3	18.07	-76.6	Near Westphalia	St. Andrew, Portland, St. Thomas
March 23	10:42pm	3.6	18.28	-77.2	Near Albion, St. Ann	Reportedly felt in St. Ann, Bamboo, Alexandria Priory, Frankfield
June 25	10:11pm	3.6	18.00	87.01	Near Whitehouse	

Jamaica Seismograph Network (JSN)

The main function of the Earthquake Unit is to operate the Jamaica seismograph Network (JSN). The JSN continues to operate with twelve (12) short-period seismic stations comprising of ten (10) single component vertical stations and two (2) 3-component stations. The 3-component stations are Montego Bay (MBJ) and Stony Hill (STH). Horizontal component seismometers which were previously installed at Portland Cottage (PCJ) and Munro College (MCJ) were removed and return to the factory for recalibration, hence these two (2) stations operated with a single component for this period. All the seismometers will be recalibrated over time in a phased basis.

There are also four (4) broadband stations in operation in the JSN network which are installed at Stony Hill (STH), Munro College (MCJ), Montego Bay (MBJ) and Bonny Gate (BNJ) as part of a research project to study Jamaica Mantle which is in collaboration with University of Wisconsin. The University of Wisconsin supplied the equipment for this project which will be in our possession for the duration of the project. The equipment used in this project are Guralp CMG-ESPD seismometer and Storage and Acquisition Modules (SAM). Continuous recording is done and data are downloaded periodically from the SAM unit.

At the Central Recording Station (CRS) we have started using the software, Seislog for data acquisition and Seisan for epicentre determination and analysis as the main CRS programs. The software PC Seismic Data Processing (PC-SDP) for data acquisition and Seismic Data Processing (PC-SDP) for data processing which we have been using since 1997 as the main program is still used as a backup to Seislog and Seisan.

We are still embarking on our mission to use clean alternative power, to power our equipment and thus seven of our 12 stations are powered by solar energy. These stations are Negril (NEJ), Munro College (MCJ), Stony Hill (STH), Coopers Hill (COJ, Greenwich (GWJ), Yallahs (YHJ) and Mona (HOJ). The solar panel at Portland Cottage (PCJ) which was damaged in the last hurricane (Dean) has not been replaced and we are currently receiving power from the Port Authority. This Solar panel at this station will be replaced when funds become available. The CRS, Mona is fully powered by solar energy.

Station Infrastructure

In keeping with our objective to improve the quality of the data recorded a seismometer vault was constructed at Kempshot (MBJ) in October 2008.

The Mechanical Engineering Workshop at UWI fabricated and installed an antenna pole and grounding system at the Yallahs Hill (YHJ) Seismograph Station. This has significantly improved the performance of this station (YHJ) which resulted in the performance of this station moving from 35% to 80%. We received the seven short period seismometers from the factory which were sent back for recalibration. As funds become available we will recalibrate the other seismometers.

Guralp Systems Limited, a manufacturer of seismic equipment lent the Unit two CMG-6TD digital seismometers with the option to purchase; this is in addition to the CMG-5T accelerograph that was on loan to the Unit last year.

There was a setback with the seismic station at Negril (NEJ) which was vandalised in July 2009.

Station Performance

For this period there was an overall increase in performance of the stations of the Jamaica Seismograph Network over the corresponding period last year. We had all twelve seismic stations working for most of the year with greater than 60% uptime. Three stations had 100% uptime, four had over 92 %, three over 80 % and two over 60 %. The most improved station was Yallahs (YHJ) which had a significant change from 35 % to 80 %.

Jamaica Strong Motion Network (JSMN)

The drive to improve the JSMN by the construction of vaults and housing for the accelerograph has been put on hold due to budgetary constraint. We are presently looking at specifications and requirements to implement a shake map using information from the JSMN. This will provide very important and timely information to assist government agencies such as the Office of Disaster and Emergency Management (ODPEM) in their planning after an earthquake.

Discussions continues with SMADA consultants Limited regarding building an outside vault to house the accelerograph presently installed at the SMADA office in Half-Way Tree. We are also continuing talks with the manager of the Errol Flynn Marina in Port Antonio. (There projects are on hold attributed to the current recession).

We are in negotiation with Transjamaican Highway Ltd (Highway 2000) to manage the ETNA accelerograph installed at the Hunt's Bay Bridge, Portmore (formerly Causeway Bridge) and at the Toll Plaza, where data from these units will be added to the EQU database.

Field Trips/Site Visits

The EQU has over forty-five (45) sites across the island between the three (3) networks that are in operation - (JSN, JSMN and GPS). Scheduled field trips/site visits are made to these sites to download data and carry out site maintenance throughout the year. In addition trips are made after felt earthquakes to collect data and for other research activities. In total, approximately fifty (50) field trips were made to install equipment, repair and service seismic stations, download data and collect intensity report after felt earthquakes. During this period fewer than required trips were made as Paul Williams, the Network Manager/Engineer had the added responsibility of Head of Unit and addressing Information Technology matters.

In March 2009, Paul Williams spent two (2) weeks in the field with Professor Basil Tickoff and PhD student Bryn Benford of the University of Wisconsin examining faults and collecting samples from the South Coast fault zone, Spur Tree fault, Duanvale fault and the Crawle River-Rio Minho fault, and collect samples at different elevations up the Blue Mountains.

STAFF

Dr Margaret Wiggins-Grandison, Head and Seismologist/Research Fellow has been on leave since October 2008. Mr. Paul Williams is currently acting as the Head of Department.

Mrs. Verdine Stephenson, Administrative Secretary, is on one (1) year study leave since June 2009 and Miss Nadine Davis is currently acting in the position.

Staff Training and Development

- **Karleen Black** attended a GIS training course at the Land Information Council (LICJ), February 2009.
- **Paul Williams** attended a training course on Guralp Instruments at the Seismic Research Unit in Trinidad, August 2008.

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 collected and the data downloaded and processed. There are two (2) continuous GPS stations, one at Portland Cottage in Clarendon and the other at Mount Denham/Pike in Manchester where trips are made periodically to download data for analysis. The EQU was assisted by Life Sciences in August and September, 2008, with the use of their boat in transporting staff to Manatee Bay and Goat Island to install the GPS equipment for periods of more than one (1) week at each location. Also, arrangements were made with the Jamaica Defence Force (JDF) Coast Guards to transport EQU staff and equipment to Pedro Banks and Morant Cays.

Global Seismograph Network/Caribbean Tsunami Warning System

The Global Seismograph Network (GSN) station at Mount Denham/Pike MTDJ is operational and can be viewed at http://www.liss.org. In January 2009, however, problems occurred in which Paul Williams of the EQU along with Engineers from the United States Geological Survey (USGS) worked assiduously to resolve.

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

The EQU continue 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 (IMS). The IMS consists of a global network monitoring seismic activities, hydroacoustics, infrasound and radionuclide. We have started to explore the possibility of using the data from these networks for research and scientific applications.

PRESENTATIONS

Raymond Stewart

- "Earthquake Awareness" Savanna-la-mar Primary, Westmoreland, to Grade 5 Students, June 17, 2009.
- "Understanding Earthquakes – Safety & Precautions", HEART/NTA – Boys Town Training Centre, February 2009.

INCOME GENERATION

The University of Wisconsin provided US$4,000.00 for the period October 1 to May 1 for costs associated with the GPS and JaMS projects.

Specific request for earthquake data search generated income of approximately JA$15,000.00.

PUBLIC SERVICE

Paul Williams

- Member, National Data Centre, Comprehensive Nuclear Test Ban Treaty Organisation
- Member and Advisor, Passion and Purity
- Member, Portmore New Testament Church of God, Music Team
- Member, Portmore Vision Gospel Choir

Table 2: Educational Visits to Earthquake Unit by schools

Date	School	Students	Teachers
October 29, 2008	Dunrobin Primary	200	1
November 6, 2008	St. George's Girls Preparatory	36	1
November 13, 2008	Harrison Memorial High	60	1
November 14, 2008	May Pen Primary	60	6
November 19, 2008	Mona Preparatory	79	4
November 20, 2008	Mona Preparatory	96	2
November 27, 2008	Gimme-Me-Bit Primary	40	2
November 11, 2008	McNy Primary	24	1
February 24, 2009	Cascade Primary	59	2
March 11, 2009	Victor Dixon High	79	2
March 17, 2009	Holland High	23	2
June 4, 2009	Mile Gully Primary	30	2
	Total	**786**	**26**

INFORMATION ON STUDENTS

Postgraduate: One student from the Department of Geography & Geology enrolled for a Master of Philosophy in Geology specializing in Seismology.