

## EARTHQUAKE UNIT



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### INTRODUCTION

The Earthquake Unit (EQU) is a research unit in the Department of Geography and Geology 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 budget is supported by the Government of Jamaica with allocations through the Ministry of Science Technology Energy and Mining (MSTEM). The EQU acts as a Data Centre for the Comprehensive Test Ban Treaty Organization (CTBTO) and contributes data to the upcoming Caribbean Tsunami Warning Network in conjunction with the United States Geological Survey (USGS).

### WORK OF THE UNIT

The Earthquake Unit (EQU) at the University of the West Indies continues to operate the Jamaica Seismograph Network (JSN), Jamaica

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Strong Motion Accelerograph Network (JSMAN) and GPS Network along with the USGS-GSN MTDJ broadband digital station at Mount Denham in Manchester. The EQU also operates the Jamaica National Data Center (NDC\_JM) for the Preparatory Commission for Nuclear Test Ban Treaty Organisation (CTBTO) where we operate equipment at the Earthquake Unit's Central Recording Station to access Seismic data, Hydro-acoustic data, Infrasound data and Radionuclide data from over 321 stations around the world.

From January to June 2016 the Department and the Earthquake Unit hosted Fulbright CORE scholar, Dr Katherine Ellins from The University of Texas at Austin. Dr Ellins collaborated with the Department, the EQU and IRIS (Incorporated Research Institutions for Seismology), Washington, D.C., on setting up JAESN (Jamaica Educational Seismic Network). The network will initially comprise about seven educational (AS-1) seismometers installed at selected high schools (and colleges) across the country allowing students to record earthquakes. IRIS is providing the analytical software, JAMASEIS, free of charge to participating school and teachers. Schools/ colleges have pay for their instrument (about US \$650 plus shipping) and supply a dedicated computer with Internet access to allow them to upload their data to the global network, as well as download data from other stations in the network, with assistance from the Earthquake Unit. Students and educators will have opportunities to assist the UWI and international researchers with local research in seismology and related geohazards, and to promote awareness, preparation and response in their community through, for example, service learning projects. The Department of Geography and Geology hosted two immersive 3-day educator workshops in April and May, 2016 for teachers interested in hosting a JAESN station. The purpose was to train participating schools' geography, physics and mathematics teachers on JAESN. JAESN has been supported by the ODPEM and the Network was launched at Ardenne High School on the 23rd June 2016.

A total of 9 schools visited the EQU during the 2015–2016 reporting period, with totals of 388 students and 23 teachers. The Seismic Analyst and Education Officer provided presentations to the visitors detailing

the operation of the Earthquake Unit and also information on Jamaica's seismic activity and earthquake awareness.

### **THE JAMAICA SEISMOGRAPH NETWORK (JSN)**

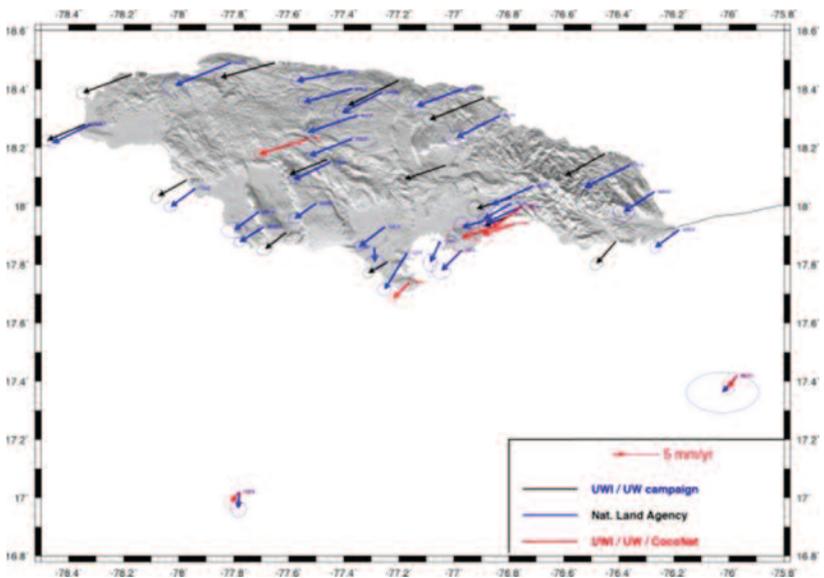
For the academic year August 1, 2015 to July 31, 2016 the JSN operated with twelve (12) short period seismograph stations and three upgraded digital broadband seismograph stations. Two (2) of the upgraded digital stations went down due to damage from lightning strikes in September and there was a long delay in repairing and restoring service to these stations as we had to send back the damaged equipment to the factory for repairs. Unfortunately we did not have the necessary spare equipment needed for the newly upgraded digital broadband stations which resulted in these stations remaining down for extended time. Also two of the short period stations remained down for longer than was acceptable as we waited on the equipment ordered to arrive to complete repairs on them. The delay was as a result of problems encountered in the UWI Bursary processing payments for supplies and with some suppliers not accepting UWI's purchase order for supplies.

We continued work during this year in putting things together and in working out details and technical specifications plus getting estimates for the upgrading of all the seismograph stations at the JSN and also on establishing a new seismograph station at Font Hill in St. Elizabeth. These objectives should be materialized in the next academic year through funding from the World Bank. In June we started submitting requested documentation to the Jamaica Social Investment Fund (JSIF) for the above Network upgrade.

For the Jamaica Strong Motion Accelerograph Network (JSMAN), there were seventeen (17) accelerographs operating at twelve locations across the island this year with most of these functioning at the desired level. We also continued working on making arrangements for the expansion of JSMAN by securing all the necessary documentations and permission from owners of the selected sites. There will be a total of forty (40) accelerographs that will be added to JSMAN at twenty-four (24) locations across the island to be funded by the World Bank.

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For this year, we started data collection from the GPS campaign sites to continue measurements for the deformation research work of the Earthquake Unit in collaboration with the University of Wisconsin. In addition to the 36 GPS campaign sites on the island of Jamaica and on the Cays south of Jamaica (Goat Island, Pedro Cays and Morant Cays), we were also able to access data from the National Land Agency GPS Network for their 15 continuous GPS (cGPS) stations and from the UNAVCO three continuously recording stations at UWI, Pedro Bank and Morant Cays. We have one continuous GPS station in our JSN network at Pike in Manchester which was added to the database. For this year we occupied and did measurement at twenty-two (22) GPS campaign sites. The GPS motion measured in Jamaica is shown in Figure 1.



*Figure 1. GPS motions recorded from sites around Jamaica showing stress build up from NE to SW across the island.*

The Earthquake Unit continues to operate the Jamaica National Data Center (NDC-JM) for the Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO) with equipment installed at the Earthquake Unit's Central Recording Station to provide secure access to the

International Data Center's database. Staff members at the Earthquake Unit received training on how to access data from the International Data Center (IDC) and also how to access the products of the International Monitoring System. We therefore have access to high quality seismic data from 170 Seismograph stations, 11 Hydroacoustic stations, 60 Infrasond stations and 80 Radionuclide Stations which covers the globe. During this year we carried out repairs on the power supply for the CTBTO communication equipment and replaced some defective part. This system maintained above 99 percent uptime as there are duplicates of equipment to ensure there is very minimal down time.

There were the usual challenges at the JSN of operating without the requisite spares in addition to the delays of acquiring equipment. This meant that more time was spent doing repairs in the laboratory and making multiple visits to stations to carry out repairs. Equipment that were repaired and tuned included UHF and VHF transmitters, UHF and VHF receivers, discriminators, seismic amplifier and voltage control oscillators, radio frequency amplifiers and power supplies. Every effort was made to ensure that seismic stations that malfunctioned were repaired in reasonable time. The solar system at the Central Recording Station required more attention during this year as it is in need of being upgraded, after operating continuously for over twenty-two (22) years. Work was done to work out the specification and to secure estimates on upgrading the solar power system.

There was more damage to the network this year compared to last year from lightning strikes. Stations affected were Pike in Manchester, Kempshot in Montego Bay, Cooper's Hill repeater station in St. Andrew, Stony Hill in St. Andrew, Bonny Gate in St. Mary and Bamboo in St. Ann. We continued work at these stations to improve on the grounding and protection. Major work was done at Kempshot in Montego Bay by AEROTEL to install a new tower, thereby removing the old tower, hence, our seismograph was taken down for an extended time. We also started discussion with AEROTEL on relocating the seismometer vault as it is too close to the new tower. The uptime for stations is shown in Figure 2.



Events recorded by the Central Recording Station at the EQU from August 2015 to July 2016; of the 79 local events recorded, six were felt. Table 1.

Year	Month	Located Events		Total located	Recorded Events					Total recorded	Felt Events
		Local	Near		Local	Near	Regional	Distant	Blasts		
2015	Aug	2	4	6	2	4	1	0	2	9	0
2015	Sep	9	2	11	9	2	11	0	2	24	0
2015	Oct	7	6	13	7	6	3	0	2	18	0
2015	Nov	7	3	10	7	3	11	0	3	24	1
2015	Dec	6	8	14	6	8	11	0	2	27	0
2016	Jan	8	31	39	8	31	5	0	1	45	0
2016	Feb	9	3	12	9	3	3	0	1	16	0
2016	Mar	6	4	10	6	4	5	0	5	20	2
2016	April	2	5	7	2	5	11	0	2	20	0
2016	May	7	1	8	7	1	8	0	6	22	0
2016	Jun	7	5	12	7	5	7	0	2	21	2
2016	Jul	9	1	10	9	1	7	0	7	24	1
<b>ALL</b>	<b>Totals</b>	<b>79</b>	<b>73</b>	<b>152</b>	<b>79</b>	<b>73</b>	<b>83</b>	<b>0</b>	<b>35</b>	<b>270</b>	<b>6</b>

The largest ‘cluster’ of earthquakes was located to the north-east of Kingston in the south-western Blue Mountains Block/Wagwater Belt, which is the main subarea for earthquakes in Jamaica. Scattered earthquakes also occurred elsewhere but there were no other clusters (Figures 3 & 4).

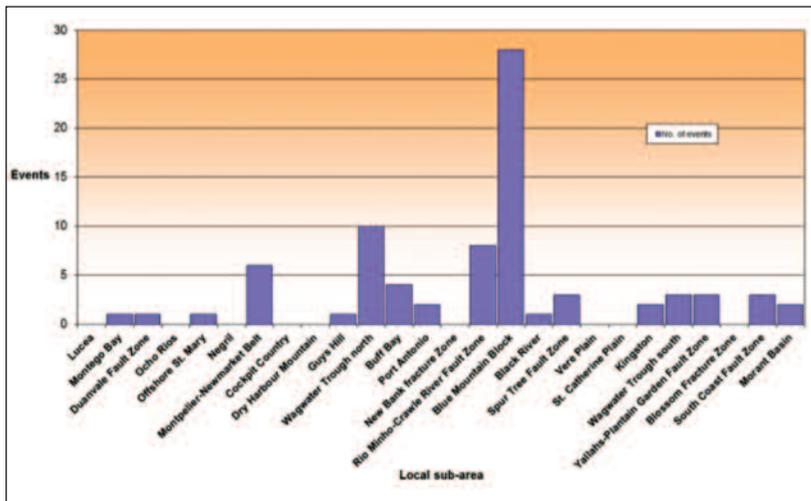


Figure 3. Breakdown of earthquakes by sub-region for the period from August 2015–July 2016.

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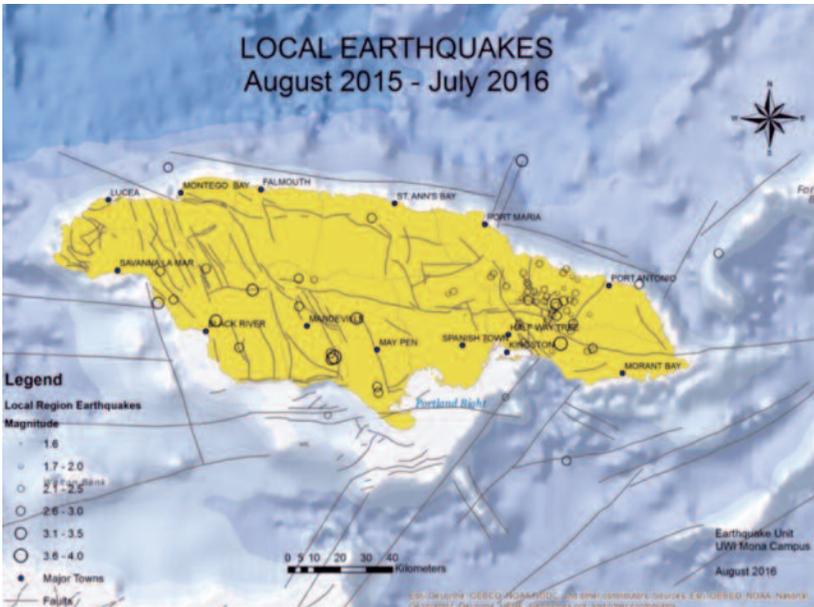


Figure 4. Earthquakes in Jamaica from August 2015 to July 2016; felt earthquake shown in red.

The total number of event processed by the Jamaica Seismic Network was 270, which included: 79 local events, 73 near events, 83 regional events, and 35 blasts (Table 1).

### COMMUNITY SERVICE

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