



THE EARTHQUAKE UNIT

Dr. Donovan Campbell Head of Unit

OVERVIEW

The Earthquake/Seismic Unit (EQU) is a research organization 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 Unit was established to understand seismic processes in Jamaica and the region as well as to advise the society about earthquake hazards, encourage community awareness and promote mitigation strategies for development. The EQU is responsible for operating and managing the Jamaica Seismograph Network (JSN), Jamaica Strong Motion Accelerograph Network (JSMAN), Jamaica Educational Seismic Network (JAESN), USGS Global Seismograph Network/ Caribbean Tsunami Warning MTDJ station, local GPS stations for the UNAVCO Continuously Operating Caribbean GPS Observational Network (COCONet) and also acts as the National Data Centre for the Comprehensive Nuclear Test Ban Treaty Organisation (CTBTO). In addition to serving as the hub for earthquake monitoring and seismic research, the EQU is affiliated with other Caribbean and regional networks, maintains an earthquake database, informs the public about earthquakes felt, collect information seismic data, conduct research and host visits from schools or community groups.

Work of the Unit

For the period August 2021 to July 2022, the EQU maintained a full operational status as an essential service to the country. The Unit was successful in its bid to secure additional funding and a new field vehicle, allowing for significant improvements to its operations and overall capacity. Key achievements for the period included improvements to the seismic network and national monitoring program, research arm, administration,

public education and community service arms. A notable change to staffing was the official retirement of Ms. Verdine Stephenson (Administrative Secretary) in December 2021, who was previously on pre-retirement leave.

In addition to the regular annual contributions to various state agencies, the Unit remained active with project collaborations and initiatives, fulfilled multiple data requests, provided information on seismic activity, provided consultations to various stakeholders, hosted a tour and visit by the Minister and P.S, conducted major repairs to seismic network links, participated in multiple workshops, meetings, seminars and training programs. Throughout the academic year, the Unit also played an active role on the relevant disaster risk management committees, contributed to the work of the new FST Lab Managers and Policy Development sub-committees, supported the ODPEM in various initiatives as well as provided support to PIOJ in its annual Economic and Social Survey for Jamaica (ESSJ). To compliment these activities, the Unit also contributed in developing COVID 19 protocols for the EQU and DOGG, completed hazard assessments for the Unit, reviewed and updated public education information, launched a new website, launched an interactive earthquake map, launched the revised report an earthquake form and contributed to the development of new virtual products with ODPEM.

Seismic Activity

The EQU recorded and processed 516 events from August 2021 to the end of July 2022. This included 176 local earthquakes, 215 near region events, 71 regional events, 35 distant events and 19 blasts (Table 1). During this period nine (9) earthquakes were reported as felt, the largest local event being a magnitude 3.5 earthquake with an epicentre in Manchester. This event occurred along the Rio Minho-Crawle River Fault Zone and was reported as felt in various communities. The near region magnitude 7.3 Haiti Earthquake in August 2021 was also reported as felt across the island. The most active sub area for the period was the Blue Mountain Block, followed by the Port Antonio subarea then the Yallahs-Plantain Garden Fault Zone (Figure 1). Figure 2 shows a map with the locations of earthquakes across the island for the period.

Table 1: Events recorded by the Central Recording Station from August 2021 to July 2022

Year	Month	Recorded Events					Total Recorded	Felt Events
		Local	Near	Regional	Distant	Blasts		
2021	Aug.	12	59	6	9	2	88	2
2021	Sept.	23	33	14	2	5	77	0
2021	Oct.	11	13	5	5	2	36	0
2021	Nov.	11	14	3	0	1	29	0
2021	Dec.	19	11	5	5	2	42	2
2022	Jan.	26	39	3	3	1	72	1
2022	Feb.	15	3	5	0	0	23	0
2022	March	12	11	9	2	3	37	1
2022	April	14	4	3	3	0	24	1
2022	May	10	8	4	5	2	29	1
2022	June	13	12	7	0	0	32	1
2022	July	10	8	7	1	1	27	0
All	Total	176	215	71	35	19	516	9

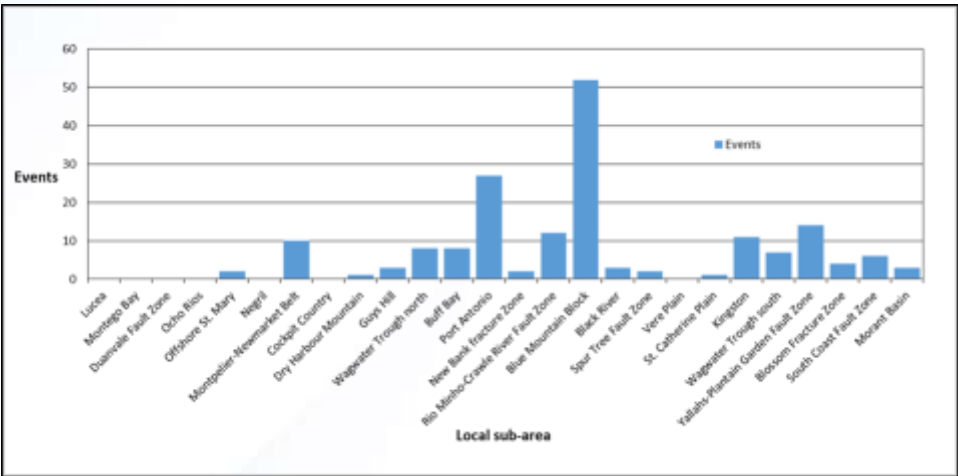


Figure 1: Seismicity by local sub-area for the period August 2021 to July 2022



Figure 2: Seismic activity recorded for the period August 2021 to July 2022

Network Operations

- i. **Central Recording Station (CRS):** The CRS comprises of a combination of data acquisition and processing equipment in an integrated and dedicated IT infrastructure. General maintenance to the solar power system was conducted along with some upgrades to the IT and processing equipment. There were several instances where the network went offline temporarily due to IT equipment or power issues, these incidents were reported and logged.
- ii. **Jamaica Seismograph Network (JSN):** The Jamaica Seismograph Network (JSN) includes 13 seismic stations with installations across the island comprising of 12 short period analogue sensors and 13 broadband sensors (Figure 3). At the end of July 2022, all 13 broadband stations were in operation, with 10 of the stations having an operational uptime of over 90% despite some of the stations not streaming in real time. The short period acquisition links continue to remain offline and awaiting new radio equipment to restore service to the analogue. Throughout the period, field visits to the stations were conducted for maintenance, data collection, research and major repair works with

significant improvements to various links. Some of the issues included the long wait period for payments to suppliers, vandalism and theft, lightning, power issues, pests/vermin and the site accessibility due to weather conditions. A significant number of trips were conducted as a result of power issues at the sites, communication gaps and defective equipment. The Montego Bay station was vandalised and equipment stolen from the vault, this site was subsequently repaired.

- iii. **Jamaica Strong Motion Accelerograph Network (JSMAN):** The Jamaica Strong Motion Accelerograph Network include a combination of building and free field sensor installations. At the end of the reporting period, there were 42 accelerographs installed island wide, with 35 sites operational and 7 requiring repairs. Work is ongoing with completing the communication links and upgrading the power for the sites. Some of the issues encountered for the period included the long wait period for payments to suppliers, vandalism and theft (stolen batteries, solar panels and cables), weather conditions, defective equipment and incomplete links due to lack of equipment. The solar panel and cables were stolen from the Falmouth Hospital site which is located in the compound of the hospital.
- iv. **Jamaica Educational Seismic Network (JAESN):** The JAESN include five AS-1 educational seismometers installed at 5 sites including 4 secondary schools and 1 at DOGG, UWI. For the period, work was completed with OS updates and basic maintenance. At the end of July, 3 of 5 seismographs were collecting data and work was ongoing to restore service to the other 2. Challenges included site access and delays with the contact persons.
- v. **USGS Global Seismograph Network/Caribbean Tsunami Warning (MTDJ/PIKE):** The Earthquake Unit maintains the USGS station at Mount Denham and accesses the earthquake data from the USGS Global Seismograph Network (GSN). For the period general site visits and maintenance work was completed with the station operating.
- vi. **UNAVCO Continuously Operating Caribbean GPS Observational Network (COCONet):** The network include 3 permanent GPS units installed at the Pedro Cays, Morant Cays and at UWI. Currently, the station at UWI Mona is the only operational site transmitting data for Jamaica; the stations at Pedro Cays and Morant Cays are offline. Visits to these sites have been delayed as the support contractors had to reschedule the trip due to COVID 19 and weather conditions.
- vii. **Comprehensive Nuclear Test Ban Treaty Organisation (CTBTO) National Data Centre:** The EQU continues to operate the National Data

Centre for the CTBTO (NDC_JM), work has been ongoing with the IDC for configuration work and technical support.



Figure 3: The Jamaica Seismograph Network and Strong Motion Accelerograph Stations

Research Work & Project Involvement

- Forensic Investigation of Disasters Project- ongoing collaboration project with external agencies and organizations including ODPEM.
- Caribe Wave 2021/2022 Simulation Project- organized by the Pacific Tsunami Warning Centre and included a tsunami simulation exercise with other local agencies.
- GPS Campaign Project- ongoing collaboration with University of Wisconsin. Additional GPS data was provided by the National Land Agency (NLA) from their 13 GPS networks.
- Geospatial Database & Building Project- geospatial project outputs produced from this project include interactive seismic map, GIS outputs, new maps, building data for parishes, etc.
- Earthquake Database & Catalogue Project- ongoing research investigating seismic parameters for the region through the integration of back end database and seismic cataloguing methods.

- Seismic Processing & Analysis- in house project utilizing the seismic data from 2010 to 2021.
- Seismic Network Project- ongoing research on the seismic network and site assessments.
- Moment Tensor & Fault Research- ongoing research using seismic data and geological data for the island and near region, collaboration project on tectonics and geotechnical studies with UWI STA research group.
- 2021 Haiti Earthquake Research- technical study on the seismicity of the region with data recorded from the magnitude 7.3 earthquake and aftershocks, ODPEM.
- JSN Communications Network Project- ongoing in-house project focusing on the communications technology and network for upgrades and collaborations.
- IT Infrastructure Project- Upgrade project targeting improvements through migrating to new server and acquisition platform.
- Earthquake Intensity Project- ongoing project utilizing historical records, revised methods and GIS applications to develop new catalogue and data for felt events in Jamaica.
- Building Assessment Project- collaboration and consultation project with TAJ for earthquake building assessments.

Community Service & Public Education

- Participated in tsunami interview, facilitated by ODPEM (September 2021).
- Developed material and delivered lectures for earthquakes and tsunamis modules in new undergraduate Natural Hazards & Society course at DOGG, UWI (September - October 2021).
- Provided consultation and feedback on revised indicators for JDVRP/JSIF (November 2021).
- Earthquake Awareness 2022- collaborated with ODPEM to produce professional public education videos for students and the general population (November 2021 - January 2022).
- Hosted first ever visit and tour for the Minister, Permanent Secretary and ministry team to the EQU and CRS facility (December 20th 2021).
- Participated in the Braeton Parkway Sovereign Village earthquake and fire drill, provided sensitization talk, evaluated drill plan, presented on response, conducted TVJ interview (December 21st 2021).

- Participated in a Smile Jamaica TVJ Interview (January 10th 2022).
- Contributed to island wide multi hazard seismic simulation and conducted scenario review (February - March 2022).
- Contributed to the earthquake scenario planning for the ODPEM-CDE-MA exercise (March 29th 2022).
- Conducted tour/field trip with Ministry of Transport & Mining PFO representative (April 29th 2022).
- Participated in the Ministry of Transport and Mining Jamaica 60th Expo (July 29th 2022).
- Provided consultations on earthquakes and seismic activity for ODPEM (August 2021 - July 2022).
- Contributed to the work of the FST Laboratory Managers sub-committee and safety planning initiatives for the faculty (September 2021 - May 2022).
- Made contributions and provided reviews for PIOJ ESSJ 2021 Report (February - May 2022).
- Facilitated consultations and data requests: ODPEM (August 2021 - July 2022), IH Cantabria (September 2021), CL Environmental Ltd. (September 2021), PIOJ (February 2022), NEPA (May 2022), other agencies, researchers and students (August 2021 - July 2022).
- Additional Presentations/Talks: FST Science in Action series (August 26th 2021), MCGES/UNESCO Workshop Series (September 16th 2021), DOGG geology course (November 12th 2021), DOGG Department Meeting (January 20th 2021), General Assembly to Portmore Community College (January 21st 2022), Heart Trust- NTA Earthquake Awareness (January 27th 2022), DOGG DRM course (March 9th 2022), Disaster Workshop- Department of Community Health & Psychiatry (April 4th 2022).

Trainings, Workshops & Seminars

- NDRMC/PEO Committee Meeting, ODPEM, attended by Karleen Black (August 12th 2021).
- UN ECLAC & CCRIF SPC workshop: Policy Issues towards effective Applications of Geospatial Technologies and Data in support of Disaster Risk Management (DRM) in the Caribbean, attended by Kevin Tankoo & Kevel Daley (August 30th 2021).
- Building Disaster Resilience in Jamaica's Culture Sector Workshop: MCGES/UNESCO Cluster Office and Jamaica National Commission, attended by Karleen Black (September 4th - 16th 2021).

- UN ECLAC & CCRIF SPC training workshop: Technical Issues towards effective Applications of Geospatial Technologies and Data in support of Disaster Risk Management in the Caribbean, attended by Kevin Tankoo (September 6th - 8th 2021).
- National Tsunami Response and SOPs Workshop, ICG/CARIBE-EWS, UNESCO/IOC, attended by Karleen Black, Raymond Stewart and Kevin Tankoo (September 13th 2021).
- Spatial Innovation, Geodatabase Fundamentals Seminar, attended by Kevel Daley (September 2021)
- National Tsunami Board (NTRB) UNESCO/IOC EWS programme board meeting, ODPEM, attended by Kevin Tankoo (September 16th 2021).
- UN GGIM: Americas & CARIGEO Geoportal seminar on data publishing and best practices on data sharing, attended by Kevin Tankoo & Kevel Daley (September 21st 2021)
- Caribbean Community Climate Change Centre (CCCCC) & Caribbean Development Bank (CDB) End User and LiDAR Training, completed by Kevin Tankoo (August 30th - September 10th 2021).
- Blue Line meeting: National Tsunami Response, ODPEM, attended by K. Black (September 2021).
- NDRMC: Preparedness and Emergency Operations Meeting on National Tsunami Response Plan and SOPs, attended by Karleen Black & Kevin Tankoo (October 2021).
- ISA workshop: Deep-sea scientific research with National Marine Institute of Korea and the Ministry of Oceans and Fisheries, completed by Kevin Tankoo (October 14th 2021).
- Spatial Innovation Webinar, "ArcGIS Technology in Logistics & Transportation", attended by Kevel Daley (October 27th 2021).
- ISA Workshop: Expert Scoping Meeting on Advancing Technology to support Sustainable Mining of Mineral Resources in the Area, completed by Kevin Tankoo (November 2nd - 4th 2021).
- JSIF Evaluation of Understanding Risk Meeting and Exercise, attended by Kevin Tankoo & Karleen Black (November 9th 2021).
- Spatial Innovation Webinar: 11th GIS Business Executive Forum, attended by Kevel Daley (November 9th 2021).
- World Bank Mission JDVRP Meeting, attended by Kevin Tankoo (November 22nd - 24th 2021)
- REF TEK Systems Incorporation training session, completed by Paul Coleman (December 2021).
- Fire Safety and Prevention Seminar: JFB/FST, attended by Kevin Tankoo Paul Coleman, Kevel Daley & Camille Wint (December 3rd 2021).

- Spatial Innovation Seminar: Modern Cadastral Field Operations, attended by Kevel Daley (December 9th 2021).
- ODPEM Mitigation Planning and Research department meeting for review on earthquake damage scenarios for Kingston and Montego Bay, attended by Karleen Black (January 2022).
- JSIF technical proposal review and evaluation meeting, attended by Kevin Tankoo & Karleen Black (January 24th 2022).
- Coastal Scenarios and Land Use Planning Training, Stanford University, attended by Karleen Black (February 2022).
- CETL-CANVA workshop, attended by Karleen Black (February 2022).
- Caribe Wave tsunami simulation exercise, attended by Karleen Black, Raymond Stewart & Kevin Tankoo (March 10th 2022).
- Earthquake scenario for ODPEM-CDEMA exercise, attended by Karleen Black (March 29th 2022)
- NDRMC/ODPEM: Disaster Risk Management State of Readiness Workshop 2021-2022, attended by Karleen Black (April 2022).
- Volterra Fietta, Deep sea research on mining and sustainability for the green energy transition, attended by Kevin Tankoo (April 21st 2022).
- ODPEM Technical Working Group Meeting for Forensic Investigations of Disasters Conceptual Framework, attended by Karleen Black (May 13th 2022)
- UWI FST lab managers and policy development team meetings, attended by Kevin Tankoo (September 2021- May 2022).
- ISA-UN: Decade of Ocean Science for Sustainable Development, World Ocean Day event, attended by Kevin Tankoo (June 8th 2022).
- World Bank/JSIF: JDVRP Implementation Support Mission, attended by Kevin Tankoo (June 13th - 17th 2022).
- NDRMC Council Meeting: NDRMC Secretariat, ODPEM, attended by Karleen Black (June 2022).
- National Earthquake Programme and Implementation Plan - TWG, ODPEM, attended by Karleen Black (June - July 2022).
- National Emergency Operations Centre Planning Seminars, attended by Kevin Tankoo, Karleen Black & Raymond Stewart (July 20th and 27th 2022).

Committees & Membership

- National Disaster Risk Management Council (NDRMC): Prevention and Mitigation Committee, Preparedness and Emergency Operations Committee, Recovery Planning Committee, Public Education and Informa-

tion Committee.

- Member of United Nations CTBTO Preparatory Commission.
- Member of ACP-EU-CDB Project Steering Committee: Strengthening the Disaster Risk Management of the Portmore Municipal Council.
- Member of the International Seismological Centre.
- Member of the International Federation of Digital Seismograph Networks.
- Member of the National Tsunami Board (NTRB) for the UNESCO/IOC EWS programme.
- Co-chair and focal point for NEP-TWG along with the ODPEM.
- Member on FST Laboratory Managers and Policy Development sub-committees.

Reports & Publications

- Tankoo, K.R & Stewart, R. (2022) "Moment Tensor technical reports for 2021-2022", in-house publication for Earthquake Unit, Faculty of Science & Technology, UWI Mona.
- Tankoo, K.R & Williams, P (2022) "JSN broadband network coverage analysis and preliminary report", in-house publication, Earthquake Unit, FST, UWI Mona.
- Tankoo, K.R (2022) "Earthquake Unit Preparedness and emergency operations plan, revised", in-house publication for Earthquake Unit, Faculty of Science & Technology, UWI Mona.
- Black, K (2022) "2021 summary of earthquakes", report for ODPEM and St. Thomas Municipal Council.
- Tankoo, K.R (2022) "Summary of EQU activities and operations", report for MTM Minister Sectoral Debate, GOJ.
- Tankoo, K.R (2022) "Standard operating procedures and protocols manual for Earthquake Unit", in-house publication, Earthquake Unit, Faculty of Science & Technology, UWI Mona.
- Tankoo, K.R (2022) "Earthquake Unit's half yearly performance review report", report for MTM GOJ.
- Tankoo, K.R (2021) "EQU budget, risk rating, corporate and operational plans", MTM GOJ annual reports.
- Tankoo, K.R (2021) "MTM Earthquake Unit risk assessment report", MTM report, GOJ.
- Tankoo, K.R (2021) "Earthquake Unit Annual Report", Earthquake Unit, Faculty of Science & Technology Annual Report, UWI Mona.
- Tankoo, K.R (2021) "Magnitude 7.3 Haiti 2021 earthquake technical

report and supplementary maps”, ODPEM report.

- Tankoo, K.R. & Stewart, R. (2021) “Revised earthquake catalogue for 2010 to 2020 felt events”, in-house publication, Earthquake Unit, Faculty of Science & Technology, UWI Mona.