

THE EARTHQUAKE UNIT

Mr Kevin Tankoo – Research Fellow and Head of Unit

INTRODUCTION

The Earthquake/Seismic Unit (EQU) is a research unit of the Department of Geography & 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 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 2022 to July 2023, the EQU maintained a full operational status as an essential service to the country. The Unit was once again successful in its bid to secure additional funding for significant improvements to its operations and overall capacity. Following the restructuring of several GOJ ministries, the EQU was moved from the Ministry of Transport & Mining to the new Ministry of Agriculture, Fisheries & Mining in May 2023. Key achievements for the reporting period included: JMD 100 million in funding for training and equipment from the World Bank, significant improvements to the seismic network, active research

and project involvement, strengthened administrative arm, increased public education initiatives and increased visibility through community service and public engagements.

Changes with staffing included the appointment of Kevin Tankoo to the role of Research Fellow/Seismologist on contract, appointment of Camille Bryant as the Administrative Secretary and the appointment of Donique Blake as the Administrative Assistant on temporary contract. Additionally, Kevel Daley resigned from the GIS Officer post in November 2022, Walter Williams subsequently joined the Unit as the GIS Officer in May 2023 on contract and resigned at the end of June 2023.

Apart from 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, delivered multiple presentations and lectures, hosted tours, conducted radio and public interviews, completed major repairs to seismic sites and links, participated in several workshops, meetings, seminars and training programs. Throughout the academic year, the Unit also played an active role on the relevant disaster risk management committees, supported the ODPEM in various initiatives as well as provided support to PIOJ in its annual Economic and Social Survey for Jamaica. To compliment these activities, the Unit also hosted two (2) interns from the Department of Geography & Geology for a six (6) weeks through the inaugural internship course, completed hazard assessments and also reviewed/updated public education information. Another highlight for the period was the acknowledgement and commendation from the Prime Minister and several Ministers for the work that the Unit was doing as well as the new developments at the EQU.

SEISMIC ACTIVITY SUMMARY

The EQU recorded 407 events from August 2022 to the end of July 2023. This included 164 local earthquakes, 91 near region events, 80 regional events, 48 distant events and 24 blasts (Table 1). During this period eight (8) earthquakes were reported as felt, the largest local event being a magnitude 4.9 earthquake with an epicentre in St. Thomas. This event occurred within the Yallahs-Plantain Garden Fault Zone sub-area and was reported as felt throughout several parishes. The most active sub area for the period was the Blue Mountain Block, followed by the Yallahs-Plantain Garden Fault Zone then the Rio Minho-Crawle River 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 2022 to July 2023

Year	Month	Recorded Events					Total Recorded	Felt Events
		Local	Near	Regional	Distant	Blasts		
2022	Aug.	13	7	1	3	2	26	1
2022	Sept.	11	7	13	5	3	39	0
2022	Oct.	19	7	5	7	0	38	2
2022	Nov.	18	9	4	8	0	39	0
2022	Dec.	12	7	7	1	1	28	0
2023	Jan.	19	8	7	3	0	37	1
2023	Feb.	10	6	7	8	1	32	0
2023	March	9	16	9	4	6	44	0
2023	April	22	9	7	4	4	46	2
2023	May	16	4	8	2	3	33	2
2023	June	7	4	3	1	2	17	0
2023	July	8	7	9	2	2	28	0
All	Total	164	91	80	48	24	407	8

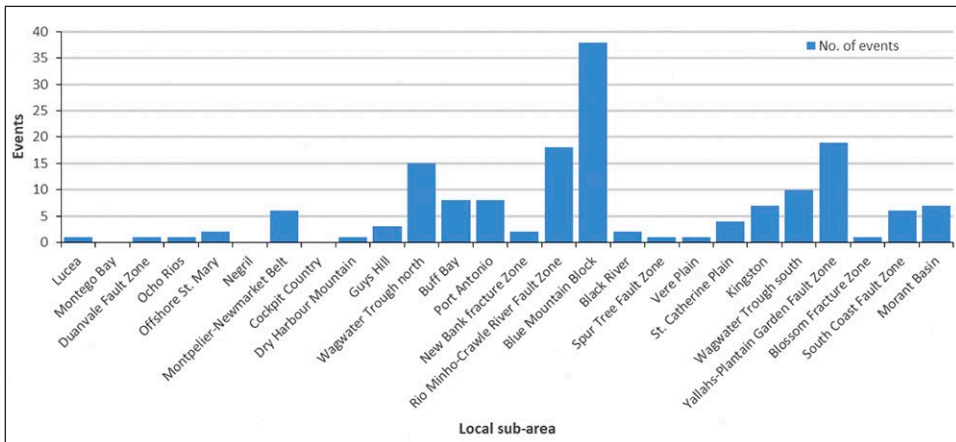


Figure 1: Seismicity by local sub-area for the period August 2022 to July 2023

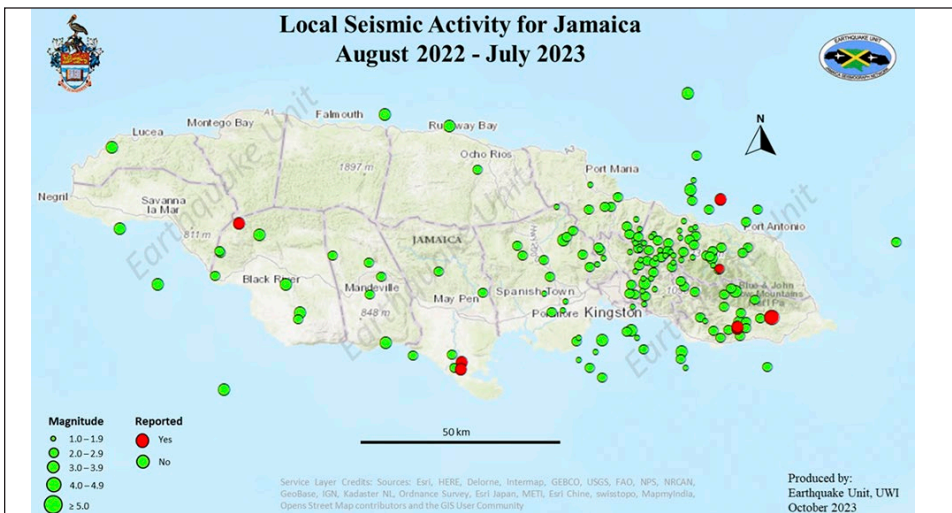


Figure 2: Seismic activity recorded for the period August 2022 to July 2023

NETWORK OPERATIONS

Central Recording Station (CRS):

The CRS comprises of a combination of data acquisition and processing equipment in an integrated and dedicated ICT infrastructure. Internet connectivity issues along with several power cuts and electrical issues resulted in data loss and down time for the period. There were also several instances where the network went offline temporarily due to IT equipment or server issues, these incidents were reported and logged. The solar bank was also replaced as a result of its age and several non-functioning batteries.

Jamaica Seismograph Network (JSN):

The Jamaica Seismograph Network (JSN) now includes 14 seismic stations with installations across the island comprising of 12 short period analogue sensors and 14 broadband sensors (Figure 3). At the end of July 2023, 12 broadband stations were in operation, with 9 of the stations having an operational uptime of over 85% despite some of the stations not streaming in real time. A new station was installed at Paradise in Montego Bay, St. James in December 2022 and testing was completed over 6 months. The short period network continue to remain offline as critical repairs and work to the broadband network was prioritized. 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, damaged communication links and defective equipment. Communication equipment was stolen from the Shafton site and this was replaced after consultation with the host and several visits. The Unit also removed its equipment from the Shotover site in Portland due to the new arrangements by the owner.

Jamaica Strong Motion Accelerograph Network (JSMAN):

The Jamaica Strong Motion Accelerograph Network include a combination of building and free field installations. At the end of the reporting period, there were 40 accelerographs installed island wide, with 34 sites operational and 6 requiring critical repairs. Work was completed with upgrading the power at a few of the sites. Some of the issues encountered for the period included the long wait period for payments to suppliers from UWI, vandalism and theft (stolen batteries, solar panels, cables and radios), poor weather conditions, defective equipment and incomplete links due to a lack of equipment.

RESEARCH WORK & PROJECT INVOLVEMENT

- NCST-MSET/ UNESCO'S Go Spin Project
- Earthquake Intensity Project
- National Earthquake Implementation Programme
- National Risk Information Platform Project
- Network Surge & Power Assessment Project
- Network Expansion & Station Siting Programme
- NEPA Development Order Project
- Jamaica-Cuba Technical Working Group Project
- Focal Mechanism Project
- Seismic Analysis & Database Project
- JSIF-World Bank Jamaica Disaster Vulnerability Reduction Project
- Seismic Data Digitizing Project
- Network Catalogue Project

COMMITTEES & MEMBERSHIP

- National Disaster Risk Management Council (NDRMC): Prevention and Mitigation Committee, Preparedness and Emergency Operations Committee, Recovery Planning Committee, Public Education and Information Committee.
- Member of the International Seismological Centre.
- 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 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.

MEETINGS & SEMINARS

- JSIF Project Meeting, JSIF-EQU, attended by Kevin Tankoo (August 2nd)
- Introduction to ArcGIS Utility Networks Webinar, hosted by Spatial Innovation, attended by Kevel Daley (Sept 9th).
- DVRP Steering Committee Meeting, hosted by PIOJ, attended by Kevin Tankoo (November 3rd).

- IT Review & Evaluation, JSIF, Kevin Tankoo & Paul Williams, (November 14th–18th).
- Faculty Administrative Meeting, FST, UWI Mona, attended by Camille Bryant and Donique Blake (monthly meetings).
- Technical Review & Evaluation, JSIF, Kevin Tankoo & Paul Williams, (December 12th–15th, 21st).
- Seismic vulnerability and preparedness, meeting with ODPEM, Kevin Tankoo (January 9th).
- Marketing and outreach initiatives meeting with the EQU and FST Dean's Office representative Mrs. Collins-Fray (January 18th).
- Review & evaluation meetings/discussions, JSIF project management and procurement teams, Kevin Tankoo (multiple meetings in January).
- JDVRP review meeting and discussion, JSIF, attended by Kevin Tankoo, (February 9th).
- CCRI-GCF meeting on geospatial analysis platform for infrastructure risk assessment and resilient investment prioritisation in Jamaica, attended by Kevin Tankoo, (February 10th).
- Jamaica Data Protection Act seminar, hosted by the Office of the Information Officer & UWI Data Protection Office, attended by Kevin Tankoo, (February 16th).
- Communications network meeting with ODPEM representative, attended by Paul Williams & Kevin Tankoo, (February 17th).
- Data Privacy Session, UWI Mona, attended by Camille Bryant & Donique Blake, (February 24th).
- Ministry of Transport & Mining Performance Management Meeting, Jamaica Business Development Corporation, represented by Kevin Tankoo & Donique Blake (March 2nd).
- Hazard and safety for technical operations, meetings and discussions with 3M specialists, attended by Kevin Tankoo (March 13th–15th).
- National Works Agency meeting/facility visit, attended by Paul Williams & Camille Bryant (March 16th).
- Science Fair and public education review and internal meeting, attended by all staff (April 4th).
- EQU meeting with SMADA Consultants Ltd., Kevin Tankoo & Paul Williams (April 12th).
- JSIF electrical and survey review/meeting, attended by Kevin Tankoo & Paul Williams (April 18th).

- Event response and technical review internal meeting, attended by all staff (April 18th).
- Global Security Perspective Network Symposium, UWI, attended by Camille Bryant (April 19th).
- National Early Warning systems and sector initiatives, meeting with ODPEM and Entity Heads, attended by Kevin Tankoo (April 21st).
- Annual Administrative Professionals Day Seminar, UWI, attended by Donique Blake (April 26th).
- Ministry of Transport & Mining Meeting, Ministry Headquarters, attended by Kevin Tankoo (April 27th).
- Evaluations and several discussions, JSIF, completed by Kevin Tankoo & Paul Williams (May 2nd–31st).
- Tender Committee Meeting, UWI Mona, attended by Camille Bryant & Donique Blake (May 4th).
- FST Tender Committee Meeting, UWI Mona, attended by Camille Bryant (May 17th).
- Steering Committee Meeting for the Jamaica Disaster Vulnerability Reduction Project, attended by Kevin Tankoo (May 25th).
- Meeting with the Minister and Permanent Secretary in the Ministry of Agriculture, Fisheries and Mining, MAFM, attended by Kevin Tankoo (May 25th).
- Ministry of Agriculture, Fisheries & Mining 4th Quarterly and Annual Review Performance Management Meeting, attended by Kevin Tankoo (May 31st).
- National Disaster Risk Management Council 2023 Annual Meeting, Spanish Court, New Kingston, attended by Kevin Tankoo & Karleen Black (June 1st).
- Several discussions and contract reviews with Jamaica Social Investment Fund, completed by Kevin Tankoo (June 2nd–29th).
- Evaluation Meeting with JSIF, completed by Kevin Tankoo & Paul Williams (June 5th).
- Ministry of Agriculture, Fisheries and Mining Meeting with Minister and portfolio agencies, attended by Kevin Tankoo (June 7th).
- NERGIST High Level Action Meeting, Terra Nova, Kingston, attended by Kevin Tankoo & Walter Williams (June 12th).
- Ministry of Agriculture, Fisheries and Mining Meeting with Minister & Permanent Secretary, attended by Kevin Tankoo (June 13th).
- Ministry of Agriculture, Fisheries and Mining Finance Meeting, attended by Kevin Tankoo & Camille Bryant (June 14th).

- ESTAC Industrial representatives meeting and assessment, attended by Paul Williams, Kevin Tankoo, Donique Blake & Camille Bryant (June 16th).
- Ministry of Agriculture, Fisheries and Mining, Strategic Planning, Performance and Risk Management Sessions, attended by Kevin Tankoo (July 3rd–5th).
- Project discussions and contract support with JSIF, completed by Kevin Tankoo (July 10th & 27th).
- Meeting and EQU Operations Tour with the University of Technology and National Land Agency project team, completed by Kevin Tankoo and Paul Williams (July 19th).
- Ministry of Agriculture, Fisheries and Mining, 1st Quarter Performance Review Meeting, attended by Kevin Tankoo (July 26th).

TRAININGS, WORKSHOPS & CONFERENCES

- US Forest Service / ODPEM – NEOC Webinar Series, completed by Kevin Tankoo, Raymond Stewart & Karleen Black (August 3rd).
- CTBTO Online Training, completed by Kevin Tankoo (August 8th–15th).
- World Bank Implementation Support Mission, JDVRP, attended by Kevin Tankoo (November 7th–11th).
- Emergency First-aid & Safety Training, Mona Ageing & Wellness Centre, FST Laboratory Managers and Policy Development committees, completed by Kevin Tankoo (November 8th). First Aid & CPR Certificate of Achievement, awarded to Kevin Tankoo (February 13th).
- CTBTO NDC Capacity Building Training Course, completed by Kevin Tankoo (Nov. 28th–Dec. 2nd).
- UNESCO Global Observatory of Science, Technology & Innovation Policy Instruments, National Commission on Science and Technology Sensitization Workshops, Karleen Black (January 5th–6th).
- IAEA Nuclear Law, U.W.I Mona, Faculty of Law, Kevin Tankoo (January 16th–18th). Nuclear Law Course, International Atomic Energy Agency & UWI Faculty of Law, certificate received.
- Cloud Computing: Disaster Preparedness and Response Workshop, hosted by the Inter-American Institute for Global Change Research, NASA Earth Science Applied Sciences Disasters and Amazon Web Services, completed by Kevin Tankoo, (February 1st).
- EQU staff training series on intensity data collection, presenter Raymond Stewart, completed by all staff members at the Unit, (February 7th).
- Science Communication Workshop, GlobalSCAPE Project, University of Leiden, completed by Karleen Black, (February 20th).

- Customer Service Training (Part A) Session, UWI Mona, completed by Donique Blake, (February 28th).
- EQU Staff Training Series (Session II), NAS and network troubleshooting, presenter Paul Coleman, completed by all staff, (March 8th).
- National Commission on Science & Technology, Ministry of Science Energy & Technology, and the Scientific Research Council: STEM Workshop, PCJ building, panellist: Kevin Tankoo (March 9th).
- Procure-to Pay Process Training Session: Office Managers and Administrative Assistants, completed by Camille Bryant & Donique Blake (March 9th).
- Results-based Risk, Crisis and Business Continuity Management Training Program, Office of the Cabinet, field trip co-lead: Kevin Tankoo (March 16th).
- TMA Maintenance Training, UWI-EMD, completed by Camille Bryant & Donique Blake (April 5th).
- Earthquake Intensity and Felt Event Reporting Workshop for Parish Disaster Coordinators, hosted virtually by Earthquake Unit (April 20th).
- EQU Operations Workshop & Field Visit, attended by all staff members (April 28th).
- National Earthquake Programme & Implementation Plan Technical Working Group Workshop, ODPEM, completed by Kevin Tankoo (May 3rd).
- Working Session of the National Disaster Risk Management Council, attended by Kevin Tankoo & Karleen Black (May 25th).
- National Earthquake Programme and Implementation Strategies Workshop, ODPEM, completed by Kevin Tankoo (June 5th).
- Jamaica Educational Seismic Network Training Workshop for Teachers, hosted by the EQU, delivered by Paul Coleman and Karleen Black (July 19th).
- UWI Banner 9 Training Session, attended by Donique Blake (July 27th).
- Public Education, Events & Conferences
- GIS Day Expo 20th Anniversary, NSDDB/LICJ Event, UWI Mona Campus, booth display (November 16th).
- Jamaica's Vulnerability to seismic hazards radio interview and Earthquake Awareness Week launch, Cliff Hughes Show and ODPEM, Kevin Tankoo (January 9th).
- Portmore Gospel Assembly Preparatory School visit, 27 students, (February 16th).
- Edge FM Home Run Radio Interview – Deon Mattis, Karleen Black represented the Unit, (February 23rd).
- Riddim FM OnSpot Interview – Vernon Derby, Karleen Black represented the Unit, (February 27th).

- JIS ‘Think Tank’ interview on disaster readiness, represented by Karleen Black (March 14th).
- UWI Faculty of Science and Technology, Science Festival, EQU hosted a booth with support from all staff members (March 31st–April 1st).
- Nationwide this Morning radio interview on seismic vulnerability and earthquakes in Jamaica, represented by Kevin Tankoo (April 17th).
- Get the Facts JIS interview session with EQU and JFB, aired on the Jamaica Magazine TV programme, represented by Karleen Black (April 17th).
- PriceSmart Earthquake Sensitization Sessions, Red Hills and Portmore locations, represented by Raymond Stewart & Karleen Black (May 2nd & May 4th).
- Portmore Municipal Council – Outta Road Campaign, invited by ODPEM, represented by Karleen Black, Portmore Mall (May 11th).
- Earthquake Symposium: Turkey, Who’s Next – Jamaica’s Resilience, School of Engineering in the Faculty of Engineering & Computing, University of Technology, panellist – Kevin Tankoo (May 18th).
- Ministry of Finance & Public Service public consultancy on National Natural Disaster Risk Financing Policy, Earthquake Unit participated in the outside broadcast and information session, Mandela Park, Half Way Tree (May 26th).
- JIS Information Service & Nationwide News Network live streaming of NDRMC, EQU represented by Kevin Tankoo (June 1st).
- Nationwide News Network Interview on the Haiti earthquake and earthquakes in Jamaica, completed by Kevin Tankoo (June 6th).
- CTBTO Science & Technology 2023 Conference, Vienna, Austria, virtual/online participation, completed by Kevin Tankoo (June 18th–23rd).
- Data Requests, Tours & Presentations
- Several data requests were received and processed along with input for consultations by the Unit throughout the academic year.
- Guest lecture for Geophysics course, DOGG UWI (September 15th).
- Unit tour and lab presentation for Geophysics course, DOGG UWI (September 19th).
- Guest lecture for first year Geology course (September 23rd).
- Unit tour for Charlemont High School group (October 27th).
- Earthquake Unit’s Presentation, MTM-GOJ meeting, presented by Kevin Tankoo (March 2nd).
- STEM Workshop Presentation, hosted by NCST, MSET & SRC, presented by Kevin Tankoo (March 9th).
- Presentation on earthquake & tsunami vulnerability & preparedness, UWI

Department of Community Health & Psychiatry, presented by Raymond Stewart (April 17th).

- Presentation on the Earthquake Unit Operations & Research, Ministry of Transport & Mining, GOJ, presented by Kevin Tankoo (April 27th).
- Presentation on the seismicity in Jamaica & the work of the Earthquake Unit for the National Disaster Risk Management Council's Working Session, Spanish Court, presented by Kevin Tankoo (May 25th).
- Presentation on programme areas and priority actions for the National Earthquake Programme & Implementation Plan Technical Working Group, ODPEM, EQU-JIE-NWA collaboration, presented by Kevin Tankoo and JIE/NWA collaborators (May 3rd).
- Presentation on Seismic Risk in Jamaica and State of Readiness for the National Disaster Risk Management Council Annual Meeting, GOJ, presented by Kevin Tankoo (June 1st).
- Presentation on the Earthquake/Seismic Unit to the Minister & MOAFM Executive Team, presented by Kevin Tankoo (June 7th).
- Earthquake Unit tour & talk for UWI FST Interns (July 13th).
- Applications of the Upgraded Jamaica Seismic Network for Monitoring and Research in the Caribbean, CTBTO SnT2023 Conference e-poster and lighting talk presentations, Vienna, Austria, presented virtually by Kevin Tankoo (June 23rd).

REPORTS & PUBLICATIONS

- Tankoo K.R. (2022) Earthquake Unit Annual Report 2021–2022, FST, UWI Mona.
- Tankoo K.R (2023) Earthquake Unit's seismic indicators and targets. Contributions and data published in the JSIF/World Bank report.
- Black K. & Tankoo K.R. (2023) Contributions to PIOJ's 2022 Economic and Social Survey Jamaica, PIOJ.
- Tankoo K.R (2023) Risk Assessment & Risk Rating Survey, Ministry of Transport & Mining, submitted for MTM's annual report.
- Stewart R. & Tankoo K.R (2023) Annual Seismic Summary for Jamaica, 2022, completed and submitted to ODPEM.
- Black K. & Tankoo K.R. (2023) State of Readiness Report to the NDRMC, submitted for the annual report.
- Tankoo K.R (2023) Earthquake Unit's 3rd Quarter Performance Report & Work of the Unit, submitted to the Ministry of Transport & Mining, GOJ, published in Ministry's report.

- Tankoo K.R (2023) Summary of the EQU's Project, submitted project profile to FST Office.
- Tankoo K.R (2023) Report on multi-hazard early warning systems and earthquakes in Jamaica, contributions for the Minister's report (Local Government) at the round table and high level meeting on EWS, New York, USA.
- Tankoo K.R (2023) Briefing Note on the Earthquake Unit, submitted to the Office of the Permanent Secretary, Ministry of Agriculture, Fisheries & Mining, GOJ.
- Tankoo K.R (2023) Seismicity in Jamaica and Work of the Earthquake/Seismic Unit, GOJ-NDRMC, submitted to the 2023 NDRMC Working Session Proceedings and Report.
- Tankoo K.R (2023) Contributions to the National Earthquake Programme & Implementation Plan Final Draft, submitted to ODPEM.
- Tankoo K.R (2023) Earthquake Unit 2022/2023 Annual Performance Report, report submitted to the MOAFM-GOJ.
- Tankoo K.R (2023) Seismic/Earthquake Unit's 2023/2024 1st Quarter Performance Report, submitted to the MOAFM-GOJ.
- Tankoo K.R & Williams P. (2023) Applications of the Upgraded Jamaica Seismic Network for Monitoring and Research in the Caribbean, CTBTO SnT2023, abstract and presentation published in proceedings, Vienna, Austria.
- Tankoo K.R (2023) Seismic/Earthquake Unit's Monthly Report, submitted to the MOAFM-GOJ.

ADDITIONAL INFORMATION & CHALLENGES

- UWI FST 'Unsung Hero' award at Administrative Professional Staff Day ceremony, received by nominee Camille Bryant (April 26th).
- Fixed asset auditing by the UWI Fixed Asset Team (May 18th & 29th).
- An independent power and electrical assessment was completed by REDIS and submitted to the bursar.
- The Prime Minister of Jamaica, the Most Honourable Andrew Holness, publically acknowledged and commended the EQU on its work and the presentation by Kevin Tankoo at the NDRMC Annual Meeting. This event also led to discussions with several GOJ representatives and Council Members who also commended the EQU on its achievements and plans.
- International Seismological Centre Governing Council, Kevin Tankoo officially joined as a member and country representative.
- The EQU received 2 students from the DOGG for a 6 week internship programme. The limited office space is an issue and highlights the need for the Unit to secure a better location for its operations.

- The EQU was successful in securing ArcGIS access through the NSDMB, this is a significant improvement and will now increase the Unit's capacity for geospatial work.
- A working group with the EQU and Cuban counterparts was established.
- Shutdown of the ICT services at UWI Mona impacted data collection and work at the Unit.
- Significant electrical and wiring issues is required at the Unit and CRS, several assessments and consultations have identified low voltage, old wiring and separated electrical components including breaker panels as some of the issues.
- Irregular power cuts from main electrical grid led to issues with the Unit's main server and ICT systems resulting in data loss and damage to the ICT systems.
- Additional parking is requested in Chemistry's parking lot to accommodate staff members.
- The Unit has outgrown its current office space and consideration for a new/renovated building is requested.
- Staff shortages and the high attrition rate for technical staff continue to impact the work of the Unit.