EARTHQUAKE UNIT

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WORK OF THE DEPARTMENT

Targets met/New Horizons

Paleoseismology

In January M. Grandison participated in pioneering paleoseismic investigations along the Plantain Garden and South Coast faults with Drs. P. Mann (U. Texas), C. Prentice (USGS) and C. DeMets (U. Wisconsin) and in a Gravity Survey in south-central Jamaica conducted by Bryn Benford, a Ph D student at U. Wisconsin. JDF facilitated a fly-over by helicopter of the St. Thomas locality, which was instrumental in helping to choose where to dig.

Jamaica Mantle Study (JaMS)

A decision was taken to install 4 broad-band seismographs (owned by U. Wisconsin) on the island for one year to obtain high quality teleseismic data for imaging the lower crust and mantle beneath Jamaica. In February, Neal Lord from U. Win and EQU staff installed 2 CMG-ESP instruments at STH and MCJ, respectively. In March EQU staff installed the third broad-band instrument at BNJ. The fourth instrument is to be installed at MBJ pending the completion of the vault there.

Caribbean Tsunami Warning System/ Station MTDJ

P. Williams, Network Engineer and M. Grandison coordinated the project to build and commission an USGS/Global Seismograph Network Station MTDJ at Mount Denham, Manchester. The JDF's engineering and construction team completed building the infrastructure in October. Don Anderson and Ted Kromer from the USGS' Albuquerque Seismological Laboratories installed and commissioned

the station during December 10 to 13. MTDJ is one of nine VSAT linked stations that form the core of the first Caribbean Tsunami Warning System. All stations can be viewed live at http://www.liss.org. The EQU has responsibility for maintaining MTDJ although all associated costs will be borne by the USGS. EQU technical staff members were trained last year to maintain this station.

L. Choy, IT/Electronics Technologist installed Earthworm software (for automated data processing, analysis and reporting) on the PC donated by the USGS. Data from one accelerograph at Mona is being streamed live to the software for testing and further implementation.

Global Positioning System (GPS) Network

Hurricane Dean damaged the continuous GPS stations at Portland Cottage in Clarendon, and Mount Denham/Pike in Manchester. The Ashtech receiver at the former site was repaired by the Unit's engineering staff and reinstalled on October 25. It was felt that the receiver's power requirement was compromising that of the seismograph station at the same location therefore a separate power supply was used. A new Trimble NetRS station was sent from the University of Wisconsin and installed at Mount Denham on February 19. The NetRS feature reduces significantly the amount of time spent downloading the data.

Seven sites were occupied with the portable Trimble this year - BRAE, MANC, KEMP, UWIN and 3 existing Jamaican geodetic monuments at Nutfield, St. Mary; Palmyra, St. James; and Malvern, St. Elizabeth. The 3 new sites were measured in 1999 using GPS by Mr. Glendon Newsome, a commissioned land surveyor and lecturer at the University of Technology. Mr. Newsome arranged for us to borrow from UTECH an adapter that allowed the Trimble to be attached to the monuments, and provided his data which together with this year's measurements will yield a nine-year time series for each of these points.

Jamaica National Data Centre (CTBTO)

The VSAT equipment at Jam-NDC was upgraded as the CTBTO swapped supplier HUGHS for PSI. P. Williams assisted William Molini of PSI in installing the new equipment in early May. This global geophysical data link remains largely an untapped resource due largely to the unwillingness of the available staff to pursue it.

Jamaica Seismograph Network

Maintenance

Hurricane Dean (Category 4-5) on August 19 skirted Jamaica's south coast and devastated the Jamaica Seismograph Network as did Hurricane Ivan in 2004. Of the twelve stations, ten were working before the hurricane and only three stations remained working afterwards - Mona (HOJ), Montego Bay (MBJ) and Stony Hill (STH). As expected the south coast stations Munro (MCJ), Portland Cottage (PCJ) and Yallahs Hill (YHJ) were worst affected. The Central Recording Station (CRS) at Mona which is powered by the Unit's alternate-energy solar system remained intact and operational during the onslaught. North-coast stations at Castle Mountain (CMJ) and Bamboo (BBJ) were also found to be in working condition but the relay point, Bonny Gate (BNJ) went down. By the end of November all stations were returned to working order, a significant feat as the Unit has only one field vehicle and one Electronics Engineer.

Seven seismometers including four horizontal ones from MCJ and PCJ were sent to the factory for repairs and recalibration at a cost of nearly US$3,000.00, excluding shipping.

Infrastructure

The drive to properly house all stations was advanced this year with the construction of a seismometer vault at Bonny Gate in March, which brings the number of stations with vaults or piers to 7. Another was excavated at MBJ in July. The roof of the station house at Bamboo (BBJ), which was overdue for attention, was repaired in June. New large format, 130- and 140-Watt solar panels were installed at MCJ and STH, respectively, the mounts for these were manufactured by the Mechanical Engineering Workshop (MEW) on campus. MEW also manufactured an antenna mast for YHJ which is awaiting transportation to the site. Telecommunications Sales and Services was contracted to install lightning protection equipment at STH which was completed in July and that station was finally fenced around by UWI, a security issue that was pending for some years.

There was no progress with installing the 80-ft tower at Long Mountain: permission is still being sought from the National Water Commission who own the targeted property. Having a high site at Long Mountain would allow the Unit to stop using Cooper's Hill as a relay point. Cooper's Hill is prone to lightning strikes which create havoc at the JSN

during the rainy season by way of the amount of down time of the stations. Too much money and time are being allocated each year for repairing transmitters and receivers damaged at Cooper's Hill between May and November.

Earthquakes

Two hundred and sixty (260) earthquakes were recorded and processed, of which 60 were distant events, 37 regional, 45 in the near-Jamaica region, 85 local, and 33 attributed to man-made explosions. The 130 local and near events contributed 1,798 records to the existing database, with averages of 14 records per event and 5 stations per earthquake, the same as last year. Seven events were very well recorded by = 9 stations enabling 4 fault plane solutions to be determined. The maximum number of stations recording any one earthquake was 10 and 3 earthquakes held this distinction.

Seven (7) earthquakes were reported felt. Most notable was one of magnitude 3.9 that occurred at 8:07 pm July 13 near Norbrook, St. Andrew. This event was widely felt throughout Kingston, St. Andrew and Portmore with EMS intensity IV. An isolated case of EMS intensity V was reported by in the immediate vicinity of the epicentre.

JSN data up to May 2007 was revised and sent to the International Seismological Centre in the UK for inclusion in their global bulletins.

Station Performance

Station performance declined slightly this year compared to last year and this was directly due to Hurricane Dean. Three stations (STH, GWJ, HOJ) recorded $\geq$ 70% of local and near events; 2 (MCJ, PCJ) >50%; one (CMJ) >30 %. Six stations (BBJ, BNJ, CVJ, MBJ, NEJ, YHJ) recorded <30%. The big movers this year were GWJ, up 35% and NEJ which improved from 1% to 14%, both of which were moved out of noisy buildings into self-contained station enclosures late last year.

Network Performance

Despite the setbacks there were increases in the number of earthquakes recorded by $\geq$ 7 stations over last year (19% to 27%) and decreases in the number recorded by $\leq$ 6 stations (80% to 73%).

Ground acceleration data was collected at HOJ for the earthquakes of January 12 and July 13, 2008.

The accelerograph station at Old Harbour was all but demolished by the hurricane. The Jamaica Public Service who built the station in 2001-2 kindly rebuilt it but the building had to be subsequently treated for termites and wasps. Following this an Etna accelerograph was re-installed there. An Etna was also re-installed at Stony Hill.

Guralp loaned one CMG-5T digital accelerograph to the Unit for one year with an option to purchase. This instrument was installed at Mona.

The Manager of the Erroll Flynn Marina in Port Antonio has given permission for one Strong Motion instrument to be placed there and for a vault/pier to be built. Mr. Earl Richards, President of the Airports Authority of Jamaica has requested the Unit to provide two accelerographs to monitor strong ground motion on the Palisadoes at their expense. This is a very welcome gesture, one that should be emulated by more Jamaican companies.

Over 80 trips were made to carry out the Unit's work, excluding research projects. The unit's field vehicle was out of use from July through September 2007, the second prolonged period since its acquisition in November 2006. The electrical harness, which usually lasts a vehicle's lifetime, caught fire and a new one had to be manufactured by Nissan of Japan. The dealers said it was a freak occurrence and replaced it under warranty. This loss of use restricted field activity. Thanks to Laurel Choy for using his all-wheel drive vehicle to carry out maintenance at those sites with better roads.

Staff

Laurel Choy, IT/Electronics Technologist left the EQU at the end of July for the Faculty of Medical Sciences. During his short stay he was an asset to the Unit solving many of our long-standing IT problems, assisting with station maintenance, pioneering office safety standards and contributing significantly to the life of the Unit. Choy played a dual role at the Unit but in retrospect it is felt that there is enough work to merit employing in the future both a junior Electronics Technologist as the work of maintaining the stations is very demanding, and an IT/Systems Technologist.

Other

On October 3 the Unit's new web-page was finally launched thanks to Stephanie Williams, temporary employee to August 2007, and Akilah Myrie of MITS. The page includes a scrolling text bar with information on recent felt earthquakes that can be updated by EQU staff. One of the highlights of the page is the interactive Felt Earthquake Reporting Form and a version that can be downloaded, both of which attracted some respondents following the July 13 felt earthquake. However, it was not the first time that such a form was on the Unit's webpage. In 1996 the first home page that was launched on the Unit's own server by then analyst, Earnest Parkes had a similar form. Later with the help of a Computer Science student the capability for automatic processing in MSAccess to output a list of intensities by town/village was added. That form was ahead of its time since the penetration of computers let alone web-access in Jamaica was much less than it is now.

Two in-house publications are being compiled – a book listing all the JSN stations and their parameters, such as location, how to get there, geology, type of equipment start and termination dates; and a manual detailing routine and emergency procedures at the CRS. K. Black is responsible for the initial drafting of these manuals. This year parameters for 5 stations were collected - BNJ, GWJ, MBJ, STH and YHJ.

Targets set

Paleoseismology

This project is set to continue in February/March 2009.

JaMS

The seismograph vault at MBJ is scheduled for early completion next year at which time the fourth and final seismograph of the JaMS project will be installed.

Global Positioning System (GPS) Network

The data collected under phase II of this project, 2005 to present, is sufficient for writing a second paper on these results. Next year stations at Manatee Bay, Goat Island, Pedro and Morant Cays are to be occupied. In addition the GOJ plans to complete its GPRS network of

13 stations which can all contribute to this project, hopefully by remote access.

Jamaica Strong Motion Network

Mr. Adams of SMADA plans to build a vault for his own Etna (maintained by EQU) which is located at Half-Way-Tree. P. Williams will supply the vault design. UWI's Marine Laboratory in Discovery Bay is also being considered for a free-field station. A proposal to supply, install and monitor with Wi-Fi links 2 Ref Tek accelerographs at the Norman Manley International Airport, was submitted to Mr. Earl Richards, President of the AAJ.

JSN

A second batch of seismometers will be sent for repairs and recalibration next year. The database on SEISAN will be revised and updated to July 2008 and sent to ISC in fulfilment of the on-going data exchange accord. The Unit has the goal of revamping the automatic processing of the web-submitted forms and including a searchable database of earthquakes on the website.

Teaching

No teaching of undergraduates.

There are two academic staff members and one per capita publication.

PAPERS PRESENTED

Wiggins-Grandison, M.D.

- "Jamaican Seismology and Seismic Hazard Parameters", Jamaica Building Code Conference 2007, Jamaica Pegasus Hotel, Kingston, September 27-28, 2007
- "The Status of the Jamaica National Data Centre", Comprehensive Test-Ban Treaty Organisation Caribbean Workshop, Nassau Hilton Resort & Casino, Bahamas, November 26-29, 2007
- "IBC-based Jamaica Seismic Hazard Maps", Faculty of Pure and Applied Sciences Ninth Conference, FPAS- UWI, February 26-28, 2008

- "Jamaica: From Seismic Hazard to Seismic Risk", Fifth National Disaster Management Conference, Rose Hall Resort & Country Club, St. James, March 6-7, 2008
- "Active Tectonics and Seismic Hazard in Jamaica", 18th Caribbean Geological Conference, Rennaissance Jaragua Hotel & Casino, Santo Domingo, March 25-28, 2008
- "From Seismic Hazard to Seismic Risk Determination", Foundations and Directions: Celebrating Geography and Geology at the UWI, Department of Geography & Geology, July 7-11, 2008.
- Wiggins-Grandison, M. D. and Paul A. Williams, "The Development and Present Status of Seismic Research in Jamaica, West Indies - 1989 to present", Foundations and Directions: Celebrating Geography and Geology at the UWI, Department of Geography & Geology, July 7-11, 2008.
- Wiggins-Grandison, M. D. and Paul A. Williams, "Use of Alternate Energy at the Earthquake Unit - 1994 to present", Physics Department 60th Anniversary and Homecoming Conference, July 11-12, 2008

PUBLICATIONS

Books & Monographs

* Mann, P., DeMets, C. & Wiggins-Grandison, M, "Toward a better understanding of the Late Neogene strike-slip restraining bend in Jamaica: geodetic, geological and seismic constraints" in Tectonics of Strike-Slip Restraining and Releasing Bends ed. by W.D. Cunningham and P. Mann: Geological Society, London, Special Publications 290, 2007, 239-253.

Non-referred Publications

* Wiggins-Grandison, M.D., "Ancient Prehistoric Earthquakes in Jamaica". Eye on Science, Mona Institute of Applied Sciences, The Daily Gleaner, March 20, 2008.

INCOME-GENERATION

Two local consultations projects worth $163,600.00 were done in 2007.

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

JmD1.5 million was approved under the Principal's New Initiative Grant for a project entitled, "Pilot for an Automated Earthquake Information System for Jamaica".

PUBLIC SERVICE

Margaret Wiggins-Grandison

- Member, National (Jamaica) Data Centre Manager, Comprehensive Test-Ban Treaty Organisation
- Member, Earthquake Engineering Research Institute
- Representative, Federation of Digital Seismograph Networks
- Member, Geological Society of Jamaica
- Representative, International Seismological Centre
- Member, Jamaica Geographical Society
- Representative, National Committee on Science and Technology
- Member, Seismological Society of America