

REPORTING PERIOD: 1 AUGUST 2020 - 31 JULY 2021

1. Director’s Summary

The UWI Seismic Research Centre (SRC) is the regional institution responsible for surveillance of and fundamental research into volcanoes and earthquakes for the English-speaking islands of the Eastern Caribbean. The UWI-SRC has a much broader mission than most research agencies, with responsibilities that include monitoring of geophysical activity, research, warnings and outreach and postgraduate teaching. The SRC provides the governments of its 9 contributing territories¹ with accurate and up-to-date information about earthquake, volcanic and other geologic activity, including 19 live volcanoes, in the Eastern Caribbean. The Centre has been providing these services for over 65 years. Its work has and will continue to have direct impact on vulnerable island communities throughout the Eastern Caribbean. All aspects of the work undertaken by the SRC are of direct and immediate relevance and importance to public safety and sustainable development in the region.

The income received from our contributing territories continue to be inconsistent and provide only sufficient funds for routine monitoring (i.e. operation of a minimal seismic network). We continued to lobby vigorously during the year for payment of outstanding debts. All other work, including most research, major developments in the network and outreach, were undertaken through grant funding mainly from external sources or from applications to the SRC Departmental Consultancy Fund (DCF).

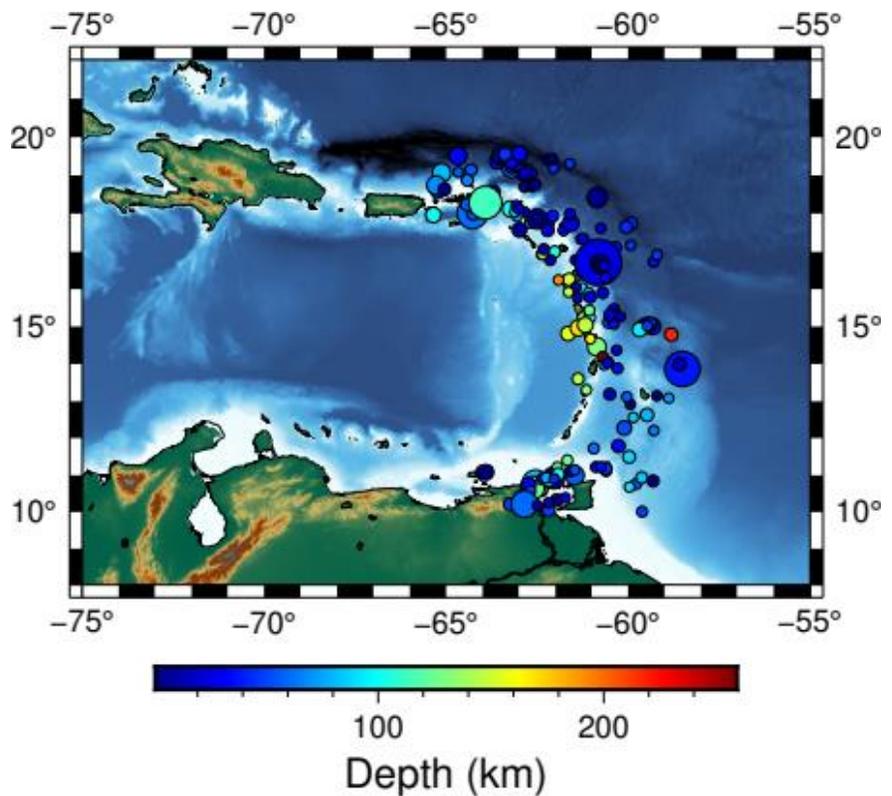
Seismicity in the Eastern Caribbean linked to volcanic and subduction processes persisted with more than 23,000 events recorded during the reporting period. Almost 75% of this seismicity was related to the La Soufrière volcano, St. Vincent eruption during the period January and April 2021. Around 6,000 events were related to the subduction process, which is in close agreement with the events recorded in previous years. There were 201 earthquakes recorded above

¹ St. Kitts & Nevis, Antigua & Barbuda, Montserrat, Dominica, Saint Lucia, St. Vincent & the Grenadines, Barbados, Grenada, Trinidad & Tobago

magnitude 3.8, with the largest magnitude 6.0 off the coast of Antigua/Barbuda on 26 March 2021.

High level seismic activity is observed near UK/US Virgin Islands, off the SE coast of Antigua/Barbuda, off the NE coast of Barbados and West of Trinidad, in the Gulf of Paria. Besides the magnitude 6.0 event registered, we recorded six events in the range 5.0 – 5.9 and 96 events in the range 4.0-4.9. Whilst it is not possible to say definitively when the next great earthquake would occur in the region, the time since the last one is now more than 170 years ago. It should be noted that regional seismic and volcanic activity has been elevated for several years. For this reason, monitoring programmes continue to be enhanced, promoting the legislation of building codes continues and maintaining critical education and outreach to ensure adequate detection and seismic hazard and risk capability, and better-informed population.

Figure 1:
Seismicity recorded during August 2020 - July 2021. Size of the circles represent magnitude and the colour depth.



On 27 December 2020, the La Soufrière volcano, St. Vincent began a dome building eruption. This required the rapid deployment of staff to St. Vincent to augment the volcano monitoring network and establish on-island monitoring at the Belmont Observatory. Staff rotations to

support on island monitoring were carried out during the period January to November 2021. After 10,165 volcanic events, the volcano moved to explosive activity over the period 9 - 22 April 2021, there were 32 explosions recorded. At least 16,150 volcanic events were recorded during the explosive period. The volcano is currently at Alert Level Yellow and monitoring is ongoing.

The Dominica and Saint Lucia volcanic complexes recorded above background seismicity. Other volcanic systems in the Lesser Antilles arc remained at background levels, including Soufriere Hills volcano, which is constantly monitored by the Montserrat Volcano Observatory (MVO). All systems are continuously monitored to identify any escalation of activity that may arise.

2. Report

A. STAFF

Appointments

- Dr. Rodrigo Contreras-Arratia – Research Fellow (Seismologist) assumed duty on April 1, 2021.
- Dr. Joan Latchman – Honorary Senior Research Fellow appointed on June 1, 2021.

B. STUDENTS

Postgraduate Programme

During the reporting period the SRC's Postgraduate programme included a total of six (6) postgraduate students employed as Research Assistants working on projects that contribute to our key areas of research and monitoring. Of these, three (3) were registered for postgraduate degrees in Seismology and two (2) for postgraduate degrees in Volcanology. One (1) other postgraduate student was part of a joint project in collaboration with the Department of Geography.

C. RESEARCH & INNOVATION

Volcanology

- Development of the myHAZ citizen science system.** This project was supported by the British Geological Survey NC-ODA grant NE/R000069/1: Geoscience for Sustainable Futures, with input from the following BGS Challenge Areas: Multihazards and Resilience, Digital and Global. It involves stakeholder awareness and participation in the development of the prototype citizen

science ‘myHAZ’ platform, which consists of three components: (1) a citizen science smartphone app for gathering multihazard observations and providing users with a ‘quick glance’ of ongoing hazards, environmental change and impacts; (2) a management dashboard to manage and respond to incoming observations in-country, and; (3) a web portal for exploring, visualising and downloading data collected by the app. Budget: £15,000.00 [March 2017 – March 2022].

- ii) **Volcano-Ready Communities in St. Vincent.** (Project leader Prof. R. Robertson) This project is being done in St. Vincent in collaboration with the National Emergency Management Organization of St. Vincent and the Grenadines. It involves the provision of scientific information and its downscaling to support community level volcano contingency planning, community-led multi-hazard mapping and capacity building for disaster risk reduction. This project played a significant role in our response to the La Soufrière eruption in providing financial and monitoring equipment resources to SRC. (Funding: Caribbean Development Bank; US\$618K; 2018 - 2021).

- iii) **UK Global Challenges Research Fund (GCRF). Caribbean Resilience and Recovery Knowledge Network.** Funding: £144,963.00 (Project partner: Dr. Erouscilla Joseph) The SRC will contribute to the GCRF Caribbean Resilience and Recovery Knowledge Network in collaboration with Dr. Emily Wilkinson (Overseas Development Institute) and Dr. Donovan Campbell (UWI, Mona). The overall aim of the Caribbean Knowledge Network is to create a new culture for responding to and preparing for hazardous events; one that promotes sustainable and equitable recovery and resilient development pathways in Caribbean islands. Three key activities will all happen in the region: a forensic workshop, scenario roadshows and an interdisciplinary webinar series. New knowledge will be co-produced between the research, practitioner and policymaker communities. This will take the form of policy briefs, scenario exercises, new (bespoke) principles and strategies for disaster recovery and new research manifestos and proposals.

- iv) **Quantitative methods for hazard assessment at the Soufriere Hills Volcano, Montserrat.** Dr. Victoria Miller (Principal Investigator) is leading a research project to employ quantitative methods for hazard assessment at the Soufriere Hills Volcano, Montserrat. A new hazard map will be developed in collaboration with researchers at The University of Edinburgh, scientists at

UWI-SRC and the Government of Montserrat, with a focus on pyroclastic flows and lahars, to differentiate hazard levels within the existing Zone V (exclusion zone). The micro-zonation of Zone V will provide input to risk assessment for the volcano and an evidence base for decision-making regarding access management and long-term development planning on the island of Montserrat.

Geophysics

- i) The UWI SRC Geophysics team continues this year to work on the **Trinidad & Tobago Microzonation project (TTMP)**, funded by the Ministry of Planning & Development. The TTMP has reached the 10th year, with field work commencing in the areas of Barataria and San Juan. The technical report for this area is to be submitted to Ministry of Planning and Development in the next year. This year the TTMP Steering committee accepted as final the Amended First Technical Report: Port of Spain, while the Second Technical Report: San Fernando has also been submitted and awaiting final approval. (Project leader Dr. I. Papadopoulos).
- ii) The **PREPARE TT** project has ended in 30th of November 2021. The geophysics team assisted in collecting building stock information that was reviewed by civil engineers, to calculate the exposure in Port of Spain. The results of the TTMP: PoS were also used from Miyamoto International to calculate the seismic hazard in the same area. Dr. Ilias Papadopoulos led the presentation of the results to various stakeholders. (Project leader Dr. I. Papadopoulos).
- iii) **Dominica Geothermal Project in Roseau Valley:** In April 2021 Dr. Ilias Papadopoulos and Mr. Arvid Ramdeane installed a small seismic network comprising of 4 broadband sensors in Trafalgar, Dominica. The purpose of the network is to monitor any induced seismicity that can be caused by the drilling operations during Phase II of the geothermal project.

D. OUTREACH

The Education and Outreach section of the Centre aims to bridge the gap between the science of the geological hazards monitored by the UWI-SRC and public understanding and knowledge of these phenomena in the region. The section focuses on student outreach, stakeholder sessions, special projects, and collaborations throughout the islands along with social media posts with the

aim of raising awareness of the geological hazards and helping to reduce the risk via preparedness and mitigation messages. The end of 2020 and 2021 saw the continuing COVID-19 pandemic impact the work of the Centre. The section had to take further steps to engage our audience via our various online platforms. The year also brought the challenge of dealing with the La Soufriere eruption and the response of the section is detailed below.

Student Outreach

We conducted our first virtual student session with Geography students of San Fernando Central Secondary, Trinidad and Speyside Secondary School, Tobago. The discussion involved earthquake science and safety and allowed us to trial techniques for future online sessions.

Science and Safety Sessions

Science and safety presentations on either earthquakes, volcanoes, tsunamis or all three hazards are given to private firms, government offices and other entities in Trinidad and Tobago upon request. During this reporting period, Dr Ilias Papadopoulos did an earthquake science and safety session virtually with the Eastern Regional Health Authority, Trinidad. He and Dr Camejo-Harry also conducted sessions with students of the Department of Geology and Geography, Mona Campus on volcanic processes, hazard, and risk. Other sessions requested focused on the La Soufrière eruption in St. Vincent and the Grenadines and are addressed separately.

Teachable Moments

We reinvented our ‘Teachable Moments’ calendar for the various social media platforms. These moments highlight significant occurrences of the geological hazards we monitor. The table below details the events shared.

<u>Month</u>	<u>Teachable Moment</u>
August	Dominican Republic earthquake and tsunami, Trinidad Mag 6.9 earthquake
October	Disaster Risk Reduction Day, 1766 Paria Peninsula Earthquake
November	Lisbon earthquake and tele tsunami, Tsunami Day, 2007 Martinique earthquake
December	Tobago earthquake
January	Haiti earthquake
February	1843 Antigua earthquake, International Women’s Day
March	Japan earthquake and tsunami, CaibEWave (regional tsunami) exercise
April	Tobago 1997 earthquake
June	Jamaica Port Royal earthquake and tsunami
July	Kick’-em-Jenny eruption anniversary, Barbados 2015 earthquake sequence, Soufriere Hills Montserrat anniversary

Collaborations/Special Events

Earth Science Week 2020 - Dominica

Since October 1998, the American Geological Institute has organized this international event to help the public gain a better understanding and appreciation for the application and relevance of Earth Science to our daily lives and to encourage stewardship of the Earth. The UWI-SRC proposed a collaboration with the Office of the Disaster Management (ODM), Dominica. This virtual campaign focused on the seismic and volcanic hazard that can impact the island. SRC's primary objective for ESW 2020 was to sensitize the public to the island's vulnerability to these hazards as well as to increase awareness of the potential impact of these phenomena. This enhanced awareness is expected to motivate the public to adopt relevant preparedness measures to preserve life and property. The week of activities included student outreach, public stakeholder meeting and ended with a virtual tour of the Valley of Desolation and the Boiling Lake.

Hairouna Film Festival, St. Vincent and the Grenadines

'Beyond the Ashes' – a short film produced under the Volcano Ready Project (VRCP) was selected and screened during the film festival in 2021. It showcased the work done by the Centre during its annual Volcano Awareness Week of activities in collaboration with the National Emergency Management Organization (NEMO) to commemorate the 1979 eruption of La Soufrière.

TV and YouTube interviews

Dr Ilias Papadopoulos appeared on two programmes hosted by Dr Shirin Haque: 'Full S.T.E.A.M Ahead' a TV programme and 'Wormholes' a YouTube information series. In both programmes, the work done by the Microzonation Project team at the Banwari Trace, Trinidad was highlighted, and the findings discussed.

St. Kitts Volcano Hazard Graphics

A suite of graphics was created for St. Kitts based on the volcano, Mt Liamuiga after erroneous reports on increased activity. The National Emergency Management Agency (NEMA) contacted the Centre and requested info to be shared on various platforms regarding the volcano and its current alert level (Green).

Q&A Facebook Chat Live

With the La Soufriere eruption and earthquake activity being noted by the public, a Live Q&A session was conducted to address any concerns regarding earthquake and volcanic activity in the region. The public was invited to ask any questions, and which were answered by a scientist from the Centre in a 1-hour period.

La Soufrière Eruption 2020-2021

As mentioned previously, the La Soufrière St. Vincent and the Grenadines eruption began in December 2020. In collaboration with NEMO, the section disseminated information to the public in the subsequent months. The section used an array of media to share information on various platforms. The following objectives were identified to guide the risk communication strategy:

1. Reinforce the capacity of local authorities to communicate effectively with the public.
2. Be recognized as one of two primary sources of credible, accessible, and reliable information about volcanic activity.
3. Facilitate public understanding of science related to ongoing volcano monitoring techniques, volcanic activity, potential hazards, and mitigation measures.

The table below provides a sample of the products shared that were either created during the eruption or executed under a project that relates to the volcanic hazard and risk mitigation.

Products/Items	Description
VRCP Multimedia Suite	Volcanic hazard graphics, hazard zones map, emergency kit poster, volcano monitoring poster, volcano safety poster, FAQ graphics, alert level graphics, Videos, Dome infographic, Dome tracker graphic, community evacuation maps, volcano animation series.
Graphics	volcano FAQs, ash, lahars, pyroclastic deposits, volcano glossary, La Soufriere specific FAQs, earthquake types, volcanic explosivity index, scientific update, eruption timeline, thank you and appreciation.
Videos	VolFilm hazard educational series, La Soufriere Today (talk show style), seismology, ground deformation, eruption breakdown (educational), eruption timeline.
Special	Written scientific update, audio update, virtual regional press conference, community meetings on island, blog, website updates, media fact sheet, cabinet briefings, presentations to various private and public entities on St. Vincent and the diaspora, intra campus conferences, mini conference.
Other	Photos (field work, team at work, Observatory life) and slideshows of dome and summit
Media	Local, regional and international interviews were conducted either by the Team Lead on St. Vincent, The Director Dr Joseph or then Senior Seismologist Dr Latchman. Requests were facilitated through emails or the WhatsApp messenger platform.

Table 1: Products created or shared, and events conducted during the La Soufriere 2020-21 eruption.

The eruption was followed globally and the Centre’s social media platforms including the website were often in focus. At the start of the explosive phase, 24-hour monitoring was done by members of the section and a communications guide was continuously updated to ensure information for various parties were being met. The change in alert level in May led to a slight change in communications with public scientific updates being shared on a fortnightly and then monthly basis. As a result of the eruption, a communications assessment was conducted on island and the

results will generate a new communications strategy for volcanic unrest situations that can be applied to islands we monitor.

E. STRATEGY REVIEW

Please see Appendix I.

Appendix I: Biennial Estimates 2020/2021-2021/2022

In addition to routine monitoring operations, the key projects with which the Centre were engaged during the period are summarized below, with an indication of their alignment with the University's 2017-2022 Strategic Objectives provided in the footnotes. *All of these projects are ongoing and will continue during the 2021/2022 period.*

1. **Management of the Montserrat Volcano Observatory².** Successful execution of the new contract signed in 2016 for the management of the Montserrat Volcano Observatory continued. The contract is for a **fixed sum of EC\$17.9 million** and largely supports the employment of 8 members of staff (7 based at MVO and 1 at SRC).
2. **Seismic Microzonation Studies in Trinidad and Tobago³** – This Ministry of Planning and Sustainable Development, Government of Trinidad and Tobago funded project continued with the collection of data moving to the San Juan/Barataria area. It caters for microzonation of ten major population centres in Trinidad and Tobago and has a total budget of **US\$2.1M**.
3. The **PREPARE TT⁴** project has ended in 30th of November 2021. The geophysics team assisted in collecting building stock information that was reviewed by civil engineers, to calculate the exposure in Port of Spain. The results of the TTMP: PoS were also used from Miyamoto International to calculate the seismic hazard in the same area. Budget **US\$55K**
4. **Dominica Geothermal Project in Roseau Valley⁵:** In April 2021 a small seismic network comprising of 4 broadband sensors was installed in Trafalgar, Dominica. The purpose of the network is to monitor any induced seismicity that can be caused by the drilling operations during Phase II of the geothermal project.
5. **Volcano-Ready Communities in St. Vincent⁶.** This is a project funded by a grant of **US\$618,700** from the Community Disaster Risk Reduction Fund administered by the Caribbean Development Bank that is being done in St. Vincent in collaboration with the National Emergency Management Organisation of St. Vincent and the Grenadines. It involves the provision of scientific information and its downscaling to support community level volcano contingency planning, community-led multi-hazard mapping and capacity building for disaster risk reduction.
6. **Revised web site for the SRC & more effective use of social media and developing video products⁷.** Work on our revised website is now nearly completed and is expected to be launched

² Aligned to AC3 through expansion of CORE internship to MVO & AG2 through consultancy funding received.

³ Aligned to AC4

⁴ Aligned to AC4 & AG2

⁵ Aligned to AC2, AC4 & AG2

⁶ Aligned to AC4, AL3 & AG2

⁷ Aligned to AL1 & AC3 as is all of the Education & Outreach work undertaken by the SRC.

during the 2020-2021 period. Attention will continue to be focused on enhancing the education and outreach work of the Centre to vulnerable island communities using social media but also developing short videos.

7. **Development of the myHAZ citizen science system**⁸. This project was supported by the British Geological Survey NC-ODA grant NE/R000069/1: Geoscience for Sustainable Futures, with input from the following BGS Challenge Areas: Multihazards and Resilience, Digital and Global. It involves stakeholder awareness and participation in the development of the prototype citizen science ‘myHAZ’ platform, which consists of three components: (1) a citizen science smartphone app for gathering multihazard observations and providing users with a ‘quick glance’ of ongoing hazards, environmental change and impacts; (2) a management dashboard to manage and respond to incoming observations in-country, and; (3) a web portal for exploring, visualising and downloading data collected by the app. **Budget US\$42K**
8. **Quantitative methods for hazard assessment at the Soufriere Hills Volcano, Montserrat**⁹. A research project to employ quantitative methods for hazard assessment at the Soufriere Hills Volcano, Montserrat. A new hazard map will be developed in collaboration with researchers at The University of Edinburgh, scientists at UWI-SRC and the Government of Montserrat, with a focus on pyroclastic flows and lahars, to differentiate hazard levels within the existing Zone V (exclusion zone). The micro-zonation of Zone V will provide input to risk assessment for the volcano and an evidence base for decision-making regarding access management and long-term development planning on the island of Montserrat.

Appendix II: Main objectives for the current academic year and planned activities for 2022/2024 indicating their alignment with the University’s 2017-2022 Strategic Objectives

The income received from our contributing territories has been inconsistent (TT\$5.5-11.6M during the period 2010 - 2021) and provide only sufficient funds for routine monitoring (i.e. operation of a minimal seismic network). All other work, including most research, major developments in the network and outreach, has to be undertaken through grant funding mainly from external sources or from applications to the SRC Departmental Consultancy Fund (DCF).

- I. **Management of the Montserrat Volcano Observatory**¹⁰. The contract signed in 2016 for the management of the Montserrat Volcano Observatory ended in September 2021. A new 2-year Interim contract, covering the period 1 October 2021 – 30 September 2023, was signed for a **fixed sum of EC\$6.9 million** and largely supports the employment of 8 members of staff (7 based at MVO and 1 at SRC).
- II. **Seismic Microzonation Studies in Trinidad and Tobago**¹¹ – This Ministry of Planning and Sustainable Development, Government of Trinidad and Tobago funded project continued with the collection of data moving to the San Juan/Barataria area. It caters for microzonation of ten major population centres in Trinidad and Tobago and has a total budget of **US\$2.1M**.

⁸ Aligned to AL1 & AC3 as is all of the Education & Outreach work undertaken by the SRC.

⁹ Aligned to AC4, AL3 & AG2.

¹⁰ Aligned to AC3 through expansion of CORE internship to MVO & AG2 through consultancy funding received.

¹¹ Aligned to AC4

- III. **Disaster risk management in the Caribbean, support for the Seismic Research Centre¹².** This project funded by the Government of New Zealand through its Ministry of Foreign Affairs and Trade was extended by one year to allow completion of all activities. It involves GNS Science of New Zealand helping the SRC to build capacity in: a) continuous monitoring of volcano-hydrothermal systems using remote techniques; b) ground deformation monitoring using remote sensing and c) improved alerting systems for volcanic emergencies. Phase II of this project is being finalised to be implemented from 2021 - 2024. Budget **NZ\$730K**
- IV. **CCC - DRiP Dominica¹³.** This initiative will collect, use and integrate a range of existing and new sources of data: physical, climatological, social and economic sources as well as the identification of data gaps. New technologies and advances in data management will be used to develop multi-dimensional hazard and vulnerability mapping to prepare DRM programs and early warning systems. **Budget US\$50K**
- V. **Establish a communications hub co-located with a multi-parametric monitoring station (consisting of 3-component broadband seismic station, accelerometer & continuous GPS station) at Mt. St. Benedict's¹⁴.** This will involve the construction of a vault, erection of a communications tower and installation of seismic monitoring equipment. This work is being entirely funded from the SRC Departmental Consultancy Fund. Budget **TT\$200K**
- VI. **Explore options for developing and expanding work in terms of geothermal consultancy services¹⁵.** This will involve an investigation of the demand for and requirements of providing professional services to geothermal production companies in the Eastern Caribbean.
- VII. **Finalize the outfitting and occupation of the entire new SRC building¹⁶.** This includes a) provision of space for postgraduate students and the Education and Outreach section; b) provision of space for lectures and c) transferral of our existing IT server room to the new building. We anticipate that we can raise sufficient **funds from our SRC DCF** to enable some of these activities, while we will explore the availability of grant funding to contribute towards this
- VIII. **Development and creation of more effective use of social media and developing video products¹⁷.** Attention will continue to be focused on enhancing the education and outreach work of the Centre to vulnerable island communities using social media but also developing short videos and other digital products.
- IX. **Re-location of computer servers to new building and expansion of the SRC IT infrastructure¹⁸.** This work is still outstanding but expected to be completed during the upcoming year. The estimated cost is as follows: servers for data - **US\$32K**, storage for data - **US\$15K**, network infrastructure (racks, switches, UPS) - **US\$50K**. (**TOTAL ~US\$100K from SRC DCF**).

¹² Aligned to AC4

¹³ Aligned to AC2, AC4 & AG2

¹⁴ Aligned to AC4 & AG5

¹⁵ Aligned to AC2, AC4 & AG2

¹⁶ Aligned to AG4 & AG5

¹⁷ Aligned to AL1 & AC3 as is all of the Education & Outreach work undertaken by the SRC.

¹⁸ Aligned to AG4 & AG5

- X. **Risk at the Margins (RAM): a blueprint for defragmenting disaster risk reduction with populations at risk**¹⁹. The objective is to develop a blueprint for prospective practice that will assist communities in understanding how to monitor, characterise and mitigate extensive hazard. With focus on the perspective of those who experience these changes in producing “visual knowledge” and interpreting images with attention to how photographs and visual storytelling (re)orient discussions about change. Funding is primarily from UKRI NERC.

Appendix III: Conference Presentations and Publications

Journal Manuscripts

- Weber, J., H. Geirsson, P. La Femina, **R. Robertson**, C. Churches, K. Shaw, **J. Latchman**, M Higgins and K. Miller. 2019. Fault creep and strain partitioning in Trinidad-Tobago: Geodetic measurements, models, and origin of creep. *Tectonics* 39: 1: 15pp. Doi: 10.1029/2019TC005530.
- **Papadopoulos, I., K. Reddock, J. Manzano and J.L. Latchman** 2019. The Trinidad and Tobago Microzonation Project: Port of Spain. *Geophysical Journal International* 222: 1936-1951. Doi 10.1093/gji/ggaa275.
- **Papadopoulos, I., Reddock, K., Manzano, J., & Latchman, J. L.** (2020). The Trinidad and Tobago Microzonation Project: Port of Spain. *Geophysical Journal International*, 222(3), 1936-1951.
- Chatzopoulos, G., **Papadopoulos, I.**, Vallianatos, F., Makris, J. P., & Kouli, M. (2021). Strong Ground Motion Sensor Network for Civil Protection Rapid Decision Support Systems. *Sensors*, 21(8), 2833.
- Tucker, M.E., Carey, S.N., Sparks, R.S.J., **Stinton, A.**, Leng, M., Robinson, L., Li, T., Lewis, J., Cotton, L., 2020. Carbonate crusts around volcanic islands: Composition, origin and their significance in slope stability. *Marine Geology* 429, 106320. <https://doi.org/10.1016/j.margeo.2020.106320>
- **Basant, R.A., Ryan, G.A.**, Peacock, J.R., Camacho, A.G., Blake, O.O., Hautmann, S. and Lynne, B.Y. (2021). Multi-geophysical parameter classification of the Montserrat geothermal system. *Geothermics*, 90: 102006.
- Higgins, M., La Femina, P.C., Weber, J.C., Geirsson, H., **Ryan, G.A.** and Wauthier, C., 2021. Strain Partitioning and Interseismic Fault Behavior Along the Caribbean-South American Transform Plate Boundary. *Tectonics*, 40(8): e2021TC006740.
- van Rijnsingen, E.M., Calais, E., Jolivet, R., de Chabalier, J.-B., Jara, J., Symithe, S., **Robertson, R. and Ryan, G.A.** (2021). Inferring Interseismic Coupling Along the Lesser Antilles Arc: A Bayesian Approach. *Journal of Geophysical Research: Solid Earth*, 126(2): e2020JB020677.
- **Smith, P.J.**, Bean, C.J. (November 2020) RETREAT: A REal-Time TREMor Analysis Tool for Seismic Arrays, With Applications for Volcano Monitoring. *Frontiers in Earth Science*. doi:10.3389/feart.2020.586955

¹⁹ Aligned to AC4, AL1 & AL2

- Thompson, Glenn., Power, John A., Braunmiller, Jochen., Lockhart, Andrew B., **Lynch, Lloyd.**, McCausland, Wendy., Rowe, Charlotte A., Shea, Thomas., White, Randall A., Breithaupt, Charles I. (July 2020) Capturing, Preserving, and Digitizing Legacy Seismic Data from the Montserrat Volcano Observatory Analog Seismic Network, July 1995–December 2004. *Seismological Research Letters* 91 (4): 2127–2140. <https://doi.org/10.1785/0220200012>.

Technical Reports

- **E. Joseph, R. Robertson, R. Stewart** - 2020/12/29 – 2021/07/31 La Soufrière volcano, St. Vincent Scientific Advisories 202011_SVG_04 - 202111_SVG_117.
- IVHHN Briefing note on interpreting volcanic gas measurements. Tamar Elias (US Geological Survey), Claire J. Horwell (Durham University, UK). Reviewed by **Erouscilla Joseph (UWI SRC)**, **Victoria Miller (Montserrat Volcano Observatory)**, Sally Edwards (PAHO), Carol Stewart (Massey University, NZ), and Evgenia Ilyinskaya (University of Leeds, UK). Version 1.5. Last edited 13 May 2021. https://www.ivhhn.org/uploads/IVHHN_briefing_note_interpreting_gas_measurements_FINAL.pdf
- **Joan L. Latchman, Ilias Papadopoulos, Kafele Reddock, Jevan Manzano, Cory George, Jason D. Kanhai, Graham Ryan, Monique Johnson, Lloyd L. Lynch, Richard E.A. Robertson, Stacey Edwards, Clevon Ash, Nisha Nath and Ian Juman** 2018/08/21 Magnitude 6.9 West of Port of Spain Earthquake Report on the 2018/08/21 West of Port of Spain Earthquake. In Preparation for the Government of Trinidad and Tobago 74pp.
- **Papadopoulos, J. L. Latchman, R. Robertson, L. Lynch, K. Reddock, C. Ash, J. Manzano, C. Sobion, J. Seemungal.** Trinidad and Tobago Microzonation Project Monthly Reports August 2019-July 2020
- **Papadopoulos, J. L. Latchman, R. Robertson, L. Lynch, K. Reddock and J. Manzano.** Quarterly Trinidad and Tobago Microzonation Project Progress Reports: 30 - 33
- **James, D., Miller, V.** (2020) Lahar Hazard Assessment for the Soufriere Hills Volcano, Montserrat. Open File Report OFR 20-02

Press Releases and Non-refereed Articles

- Numerous radio, newspaper and television interviews related to the eruption of La Soufrière volcano, St. Vincent.
- UWI Today article: “UWI Seismic Research Centre on the Ground in St. Vincent” published 23rd May 2021.
- UWI Today article: “Be Vigilant, Be Prepared: UWI Seismic Research Centre on La Soufrière” published 31st January 2021.

Conferences, Meetings & Workshops

1. **Erouscilla Joseph and Joan Latchman.** 2021. Institute of International Relations Panel Discussion: Disaster risk reduction and management in the Caribbean region. 3 March 2021(Virtual). <https://sta.uwi.edu/iir/panel-discussion-caricomregional-action-disaster-risk-reduction-and-management>
2. **Erouscilla Joseph.** 2021. ASHRAE CARICOM Chapter, Impact of Volcanic Eruptions on Health and Infrastructure. 19 April, 2021(Virtual)

3. **Erouscilla Joseph, Richard Robertson, Joan L. Latchman, Lloyd Lynch, Stacey Edwards, Thomas Christopher, Roderick Stewart, Graham Ryan, Adam Stinton, Michal Camejo, Karen Pascal, Victoria Miller, Rodrigo Contreras Arratia.**
Management, Monitoring and Impact of the 2020 – 2021 La Soufrière, St. Vincent Eruption.
17 June, 2021. IAVCEI Webinar.
4. **Erouscilla Joseph,** Elizabeth Riley, Michelle Forbes, Rose-Ann Smith. SCIENCE FOR TODAY FORUM: Ash in the Air, Eruption in Effect: La Soufrière, St. Vincent, 2020-2.
Wednesday, June 9, 2021