Economic Commission for Latin America and the Caribbean

ECLAC SUBREGIONAL HEADQUARTERS FOR THE CARIBBEAN

Report of the workshop II on technical issues towards effective applications of geospatial technologies and data in support of disaster risk management in the Caribbean

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The Caribbean Catastrophe Risk Insurance Facility

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Economic Commission for Latin America and the Caribbean
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Workshop II on technical issues towards effective applications of geospatial technologies and data in support of disaster risk management in the Caribbean

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REPORT OF THE WORKSHOP II ON TECHNICAL ISSUES TOWARDS EFFECTIVE APPLICATIONS OF GEOSPATIAL TECHNOLOGIES AND DATA IN SUPPORT OF DISASTER RISK MANAGEMENT IN THE CARIBBEAN

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A. INTRODUCTION

1. The training workshop "Towards effective applications of geospatial technologies and data in support of disaster risk management (DRM) in the Caribbean" was convened from 6 to 8 September 2021. It was one of two training workshops jointly organized by ECLAC subregional headquarters for the Caribbean and the Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company (CCRIF SPC). The first workshop "Policy issues towards effective applications of geospatial technologies and data (GST/D)" was held on 30 August 2021.

2. These training workshops were delivered under a memorandum of understanding (MOU) established between ECLAC and the CCRIF SPC. The objectives of these workshops were to support the Caribbean Region in building national and regional capacities in the applications of GST/D in DRM, (see annex IV: concept note and annex V: programme). Workshop II was designed for technical officers responsible for GIS and application developers supporting DRM. The objectives of this workshop were:

- Applications of geospatial technologies and data in DRM.
- Identify and address data and data management requirements in DRM.
- Examine the current state of geospatial technologies available to support DRM.
- Identify human capacity needs to enhance mainstreaming of geospatial technologies and data (GST/D) in DRM.
- Identify areas of regional technical cooperation supporting GST/D with applications in DRM.

B. BACKGROUND

3. The Caribbean Region is highly vulnerable to several natural hazards including flooding, hurricanes, storms, earthquakes, volcanic eruptions, tsunamis, landslides, droughts, sea-level rise, coastal erosion etc. To significantly reduce the negative impacts caused by these hazards, the region needs to develop a holistic DRM strategy which include mitigation, preparedness, response, and recovery plans.

- GST/D can be considered as one of the tools necessary for effective DRM. These technologies can be applied to capture images, information, and data at all stages of the DRM cycle. The application of GST/D in DRM provides for informed decision-making, facilitates and encourages a more systematic and integrated approach to data collection, data storage and data retrieval capabilities.
- Results in the reduction of the overall costs of data collection and management by facilitating data accessibility and sharing to a wide range of decision-makers across agencies and other stakeholders.
- Improves the integration of diverse data sets for holistic spatial analysis.
- Encourages the spatial analysis of the impacts of disasters.

4. GST/D comprises of the followings components: computer hardware, data collection hardware, computer software, data and databases, personnel, and applications. GST/D provides the platform that enables spatial analyses particular to DRM. These include for example:

- Temporal analysis of natural hazard parameters
- Trend analysis of the occurrence of disasters
- Spatial analysis of the impact of disaster over a geographic region
- Three-dimensional analysis of the effect of natural hazards
- Multivariate disaster risk analysis

- Natural hazard prediction and modelling
- Simulation of response rate to vulnerable communities
- Analysis of impact zones or anticipated degree of severity
- Storm runoff impacts predictions within watersheds
- Site suitability screening for hazardous waste facilities

5. GST/D applications are necessary tools for disaster management within the Caribbean Region. Geospatial technology applications such as remote sensors, drones, weather channels, and Global Navigation Satellite System (GNSS) provide precise information and location of potential and ongoing natural hazard events. This can facilitate immediate access to required data and information in detecting vulnerable areas prior to a disaster or the extent of the devastation caused by a disaster as these technologies capture images and information pre, during and post disaster. These technologies also allow for information to be uploaded and shared to all agencies and stakeholders involved in DRM.

6. The benefits of the use of GST/D in DRM include the following:

- Provide integrated data storage and data retrieval capabilities
- Encourage a more systematic approach to data collection
- Lead to reduction in the overall costs of data collection and management by facilitating data sharing
- Increase comparability and compatibility of diverse data sets
- Make data accessible to a wider range of decision-makers and the public
- Encourage the spatial analysis of the impacts of natural disaster

7. To effectively manage the devastation caused by natural disasters, the region needs to develop strategies of mitigation, preparedness, response, and recovery. Additionally, there must be updated national databases including information on hospitals, infrastructure, hazards, population, buildings, transportation, and utilities. This information is essential to support decision making at all stages of disaster management including for evacuation planning.

C. GENERAL INFORMATION

1. Place and date of the training course

8. The workshop on technical issues towards effective applications of geospatial technologies and data in support of disaster risk management in the Caribbean was convened from 6 to 8 September 2021, via the online platform Webex. The workshop documents including presentations are available on the ECLAC website via https://bit.ly/3EEOJNi.

2. Attendance

9. In total, 77 participants attended the workshop. These included DRM representatives and geospatial technology specialists as follows:

- ECLAC member States: Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Jamaica, Saint Kitts and Nevis, Saint Lucia, Trinidad and Tobago, as well as associate member British Virgin Islands.
- Representatives of DRM institutions and development partners such as: Caribbean Disaster Emergency Management Agency (CDEMA), Caribbean Development Bank (CDB), University of the West Indies (UWI): Earthquake Unit, Mona Campus, Seismic Research Centre, St. Augustine

Campus; and the Association of Caribbean States (ACS), Food and Agriculture Organization (FAO), United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP) and United Nations Office for Disaster Risk Reduction (UNDRR). The full list of participants is provided in annex I.

3. Objectives and structure of the workshop

10. The objectives of this technical level workshop were to:

- Provide information on the myriad of applications for which GST/D may be used to support DRM.
- Examine current state of geospatial technologies available to support DRM.
- Identify human capacity needs to enhance mainstreaming of GST/D in DRM.
- Identify and address data and data management issues that should be considered for effective DRM.
- Identify regional technical cooperation supporting the applications of GST/D in DRM.

11. Feedback was collected from participants using online (Microsoft form) post-workshop survey, see link at: https://forms.office.com/r/37nDqn7J98.

D. SUMMARY OF KEY OUTCOMES OF THE WORKSHOP

Day 1
Session 2: Key outcomes of the draft study on applications of GST/D in support of DRM in the Caribbean Region

12. Under the MOU established between ECLAC and CCRIF SPC, a study was conducted titled "The applications of GST/D in support of DRM in the Caribbean Region". This study seeks to determine the extent of, and main challenges in the use of GST/D in DRM in the subregion. The ECLAC DRM consultant (and lead facilitator) presented the key outcomes of this draft study.

13. Approach of study: The data collection for the study involved the administration of a field survey in sixteen Caribbean countries. The field survey was intended to obtain national data and information in the following thematic areas:

- National institutional approaches and systems
- Geospatial technologies
- Application of and assess to GST/D
- Strength, weaknesses, opportunities, and threats (SWOT) analysis
- Human resource capacity
- Policy and standards.

14. Status of field survey: The ECLAC DRM consultant informed the workshop that to date, nine countries responded to the questionnaire, with responses pending from the others. The responding countries were the Bahamas, Barbados, Grenada, Guyana, Jamaica, Saint Kitts and Nevis, Saint Lucia, Suriname, Trinidad and Tobago, and Turks and Caicos Islands. The countries from which responses were pending included: Antigua and Barbuda, Belize, Dominica, Saint Vincent and the Grenadines, and Sint Maarten.

15. The consultant gave a summary of the preliminary findings in the preparation for the study. It was the deduced that the extent of institutional integration of DRM Systems National Agencies such as those with responsibility for physical and environmental planning were fully integrated into the DRM process, while others such as public works, utilities and social development agencies were less so.

16. He added that less than 56 per cent of the countries surveyed have data policies and standards in support of GST/D: metadata, data access, backup, maintenance and sharing, and cartographic standards and mapping policies.

17. The ECLAC DRM consultant also shared the findings on the technological requirements for effective and sustained application of GST/D in support of DRM, based on the survey:

- Investment in geospatial technologies is a major financial outlay. Caribbean countries are unable to finance this requirement from regular national budget. Only 25 per cent of the countries surveyed so far have a budget for GST and support. The average annual budget for the acquisition of hardware and software is US$ 6,000.
- Access to Geospatial Technologists for technical support is mostly on an informal or on a project basis. Many member countries rely on regional or international projects to augment their aging technologies.
- The segregated institutional environment and the protection of department owned technologies have closed the doors to the notion of community use of available technologies. Geospatial technologies like GNSS and drones are protected from shared use and access.
- With the exception of the Bahamas, Barbados, Jamaica, and Trinidad and Tobago most DRM Agencies do not have dedicated geospatial technologies of their own but rely on the goodwill of other agencies to develop geospatial products and services.
- Access to software is generally not a problem, it is the lack of funding for upgrades that poses a challenge. The use of open-source software is gaining ground.

18. He also presented the challenges relating to GST/D human resource development:

- Only 31 per cent of the 59 respondents to the pre-workshop assessment survey reported knowledge in the efficient use of GIS. There were significant deficiencies with respect to human resource capacity in the use of key geospatial tools such as satellite remote sensing, spatial analysis tools, and knowledge of global navigation satellite systems. In these cases, countries reported less than 20 per cent human resource capacity relative to their needs.
- Of the 59 respondents to the pre-workshop skill assessment, only six have the knowledge at level of “good” and “very good” to support geospatial technology use across all thematic areas evaluated.
- The high cost of staff training, high level of staff mobility and inadequate pre-requisite qualifications were among the main factors which hindered GST/D training of Caribbean nationals.

19. The National Disaster Agencies, Lands and Surveys Departments and Town and Country Planning Departments were among the principal users of GST/D identified. These agencies typically applied GST in risk and vulnerability assessments and the preparation of hazard maps.

20. The consultant added that a wide range of strengths (e.g. motivated staff); weaknesses (e.g. lack of inter-agency collaboration); opportunities (e.g. application of new tools such as Computer tablets and drones, use of different displays to show geospatial data) and threats (e.g. budgetary constraints), were also reported in the overall assessment of the use of GST/D in the Caribbean.

21. He gave a few recommendations to improve the application of GST/D in the Caribbean:

- To negotiate memoranda of understanding between agencies and having the purpose of promotion of greater inter-agency collaboration relative to data sharing and improve the national and regional databases. This can also support the establishment of National Spatial Data Infrastructure (NSDI) Framework
- Institution: To conduct strengths, weaknesses, opportunities, and threats assessment to determine the best suited agencies for addressing the application of GST/D in DRM.
- There is the requirement to have a national organisational structure to ensure a more comprehensive integration, development and implementation of a Geospatial policies supporting data maintenance, and data sharing
- Increased government expenditures for funding for GST/D. This should include additional funding for GST/D. Budgets are also required for upgrading of computer systems. One common recommendation and across all countries is that Ministry of Finance should be a member of the DRM systems.

22. The ECLAC DRM consultant also gave recommendations on the training and skills development that would be needed. Directors, senior managers, and staff should be trained in the value, purpose, use and benefits of GST/D. This should also include increased staffing having responsible for GST/D in DRM

23. He added that there is the need to develop capacity building programmes at universities and technical institutions to obtain a critical mass of trained personnel.

24. He also underscored the need for disaster vulnerability assessments. Each country should have updated hazards maps as standard inputs in decision making for example in land use planning and approvals. In this regard also the work of CDEMA in this field was recognized.

25. Following this presentation of the study, a few interventions were made by participants:

- The CDEMA GIS Specialist underscored the value of accessing open sources and the need for having local context and variations. Local variations can be for example: buildings, other infrastructure and the need to assign financial value to these. These variations are to be included as part of national disaster preparedness plans. The representative of the Barbados Lands and Surveys Department agreed on this intervention of GIS Specialist.
- The Representative from the CCRIF Technical Assistance and Corporate Communications Teams made a clarification on the national exposure data versus parametric data that while the exposure databases have the attribution for each type of asset, she stated that the parametric insurance is not looking at the exact losses for each type of structure, this exposure data is included in the parametric models that determine the amount of loss based on the entire exposure due to the hazard level. She expounded that CCRIF parametric insurance models do not determine losses asset by asset and the attributes of each type of asset but rather generate a total loss calculated by the underlying models based on the entire set of assets on the ground.

Session 3: United Nations Global Geospatial Information Management Working Group on Geospatial Information and Services for Disasters

26. This session was delivered by the Senior GIS Manager/Trainer, Coordinator, Jamaica's National Emergency Response GIS Team, Task Groups Lead, United Nations Global Geospatial Information Management (UN-GGIM) Working Group on Geospatial Information and Services for Disasters, National Spatial Data Management Branch, Ministry of Housing, Urban Renewal, Environment and Climate Change. She gave an overview of the work of the UN-GGIM Working Group on Disasters and how it is aligned to the Sendai Framework.[1]

27. She gave an introduction to the UN-GGIM Strategic Framework on Geospatial Information and Services for Disasters.[2] Participants were informed that this strategic framework is based on the following five priorities: (i) governance and policies, (ii) awareness building and capacity building; (iii) common infrastructure, (iv) services and (v) resource mobilization. That the objectives of the framework include having available and accessibility quality geospatial information and services within and across all sectors, before, during and after disaster events.

28. She informed participants that the 2020 UN-GGIM Strategic Framework on Geospatial Information and Services for Disasters Assessment Survey is available online: https://bit.ly/2TxLF0t. Caribbean countries were encouraged to complete this survey.

Discussions

29. The representative from National Emergency Response GIS Team of Jamacia (NERGIST) representative highlighted the importance of having business continuity plans for DRM. The NERGIST representative further inquired on the public private partnership engagement and the role of the private sector in assisting and supporting geospatial technology.

30. In response, the Senior GIS Manager/Trainer, Coordinator, Jamaica's National Emergency Response GIS Team, explained that the private sector has the resources to generate geospatial information and that this data could have application for disaster responses and therefore support DRM and disaster risk reduction (DRR) efforts at the national level. In which case, the private sector should be involved in the national disaster response system

31. The representative from the Association of Caribbean States (ACS) inquired if UN-GGIM could propose plans or strategies to bridge the disconnect between national geospatial and DRM organizations.

32. In response to the question of the ACS Representative, she acknowledged that UN-GGIM in 2020 held two strategy sessions to address this deficiency and that this subject will continue to be on the agenda of this United Nations body. However, at the national level, countries will need to work on this requirement for supporting DRM coherencies across institutions and stakeholders

33. The GIS Analyst, Bahamas National Geographical Information System Centre, sought advice on ways her agency could encourage the private sector to share their geospatial information given the private sector's data policies and protocols.

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[1] Sendai Framework for Disaster Risk Reduction see link at: https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030, cited October 9, 2021. UN-GGIM: Working Group on Geospatial Information and Services for Disasters - Work Plan 2020 – 2023, see link at: https://ggim.un.org/meetings/GGIM-committee/11th Session/documents/WG_Disasters_Work_Plan_draft_2021-08-4_final.pdf, cited October 10, 2021. Tenth session of the Committee of Experts on Global Geospatial Information Management 26 and 27 August and 4 September 2020, see link at: https://ggim.un.org/meetings/GGIM-committee/10th-Session/documents/UN-GGIM_Tenth_Session_Informal_Paper_containing_draft_decisions_4Sept2020.pdf.

[2] UN-GGIM Strategic Framework on Geospatial Information and Services for Disasters: https://ggim.un.org/unggim-wg5/.

34. In response to the question posed by the GIS analyst she recommended open dialogue, identification of common ground and exploring ways in which the services of government agencies could support and benefit private entities. She gave the Jamaican experience as an example where; a long-standing relationship was developed between government agencies and the private sector which makes it easier for these entities to access data sets and databases. This has also fostered buy-in with respect to disaster management from the private sector. She identified strong partnerships as the key strategy for sustained public-private partnership.

35. The Chairman of the Ministry of Local Government, Jamaica believed that partnerships can be garnered through a MOU.

36. The Senior GIS Manager/Trainer, Coordinator, Jamaica's National Emergency Response GIS Team, agreed and proposed other possibilities such as a partnership agreement or a gentleman's agreement. The private sector would buy into the disaster response strategies once they could see the benefits. However, she cautioned that clear terms should be outlined including the terms under which the data will be used.

37. The GIS Specialist of CDEMA shared that private sector involvement could also be sourced from outside the country as the roles Maxar[3] and Open Street[4] maps have demonstrated.

Session 4: Building applications with geospatial technologies and data (GST/D) in support of disaster risk management

38. The objectives of this session were to introduce participants to the GIS development process, familiarize them with GIS Needs assessment steps needed to develop GIS applications and to introduce participants to GIS platforms and technologies used in application development. The ECLAC DRM consultant delivered a presentation on building applications with geospatial technologies and data in support of disaster risk management.

39. The ECLAC DRM consultant listed of the major areas of applications of GST/D in DRM which include: Temporal analysis of natural hazard parameters; in trend analysis of the occurrence of disasters; spatial analysis of the impact of disaster over a geographic region, three-dimensional analysis of the effect of natural hazards; multivariable disaster risk analysis; natural hazard prediction and modelling; simulation of response rate to vulnerable communities; cause-effect analysis and analysis of impact zones or anticipated degree of severity.

40. He listed each step for deciding on GIS applications development processes and to support on decision making for GIS use and database maintenance.

41. Step 1- needs assessments: this step serves as a learning tool where potential users in each participating department learn about GIS and how it can serve the office having this responsibility. The results of the needs assessment – provides the information needed to plan the development of a GIS System. Including the possible DRM applications to be developed, the GIS functions required, data needed in the GIS database and the data maintenance procedures. With respect to the DRM applications the decisions can be made based on the anticipated purpose either for assessment or analysis.

[3] See link at: https://www.maxar.com.
[4] See link at: https://www.openstreetmap.org.

42. Step 2- Design stage: in the design stage the GIS developer will have to consider the following factors: What are the objectives and the decisions required regarding the utilization of this application? What are the criteria for the decisions? What information is needed to evaluate the criteria? What data must be acquired to generate the information? And what GIS functions will turn the data into information?

43. Step 3: in the development stages the following must be considered by the Head of Unit and in consultation with the GIS technical officer: What are the objectives and the decisions to be made regarding the utilization of this application? What are the criteria for the decisions? What information is needed to evaluate the criteria? What data must be acquired to generate the information? What GIS functions will turn the data into information?

44. A case study was used to demonstrate the processing of building geospatial tools and applications. Towards landslide and flood Hazard mitigation planning and management in Trinidad and Tobago: a GIS landslide and flood susceptibility mapping and risk mapping using a weigh factor modelling. In this example, the GIS building components considered were:

- To develop a model of areas susceptible to landslide and flood hazard in Trinidad and Tobago. The model will be based on the spatial analysis of biogeophysical factors that contribute to the occurrence of landslides and flooding in Trinidad using GIS, satellite imagery and field observation to validate the model.
- To develop a risk model of buildings and populations at risk due to landslide and flood susceptibilities in Trinidad and Tobago. The model was based on the spatial correlation of landslide and flooding susceptibility with population and buildings at risk. The model evaluates and ranks the exposure to landslides and floods of resident population and the physical assets in Trinidad and Tobago.

45. The case study included a methodology for susceptibility mapping:

- Landslide susceptibility, and five factor weight analysis and landside occurrences with weight scenario modelling.
- Flood susceptibility, flood factors, flood factor rankings and scenario modelling.
- Landslide risk mapping and risk mapping considering population and building density. Also presented was the conceptual design (Risk = susceptibility + vulnerability (population, building).
- With the three input layers, the modelling scenarios of landslide occurrences over population density; building density; building vulnerability levels were presented and with the determination of risk levels.
- The results of the landslide risk-maps included: single-risk (population) map, single risk (building) map and multi-risk (building and population) map.
- Flood risk mapping: the conceptual design considered that risk = susceptibility + vulnerability (populations, building). The results of the flood risk maps included: single-risk (population) map, single risk (building) map and multi-risk (building and population) map.

46. This modelling exercise concluded in demonstrating the results of a multi-risk assessment of flood for the island of Trinidad. The use of this modelling approach and from the data generated can serve for development control and planning, disaster mitigation planning disaster management, policy formulation, law reforms, site analysis and review of insurance premium. The users can be for example Physical Planning Offices, non-governmental organizations, environmental agencies, Works Departments, utility companies, insurance agencies, National Disaster Offices, security and protective services, lending agencies,

Meteorology and Hydrology Departments, educational institutions, land developers, the general public and foreign investors.

47. In conclusion for this segment, the ECLAC DRM consultant provided information on the limitation of the methodology and data - including for example- size of drains, maintenance, extreme rainfall. The following recommendations were provided:

- The need to keep official records of the location and the extent of communities affected by flooding and landslides events as well as the rainfall regime that trigger these events on how these limitations can be addressed.
- The need to clear all drains, culverts, and bridges of all debris during the dry seasons in order provide adequate capacity for storm runoffs during the raining seasons.
- The need to have volunteers in each community who provide the necessary alerts to first responders.

48. Following on the presentation the following comments and questions were received from participants:

- Addressing the roles of the private sector, recommendation was made to explore the partnerships with private insurance companies.
- That proper modelling requires historical and just in time data. In the case of rainfall this series should over 30 years. Data on flooding should be obtained at the time/duration of the flooding and not after the event.
- The development model has to map all drainage systems, noting that many of the islands have underground freshwater systems.

Day 2
Session 5: database design and development

49. In this session the ECLAC DRM Consultant provided an overview and key aspects related to database design and development. He introduced that it is necessary for all data sets and databases to be properly designed and ready for application. This will facilitate smooth workflow and quick analysis. Participants were informed the word Information "I" in GIS refers to two components – geographic content and the attributes. The attribute table was very important as it provided detailed information about the object which could be expanded as more information becomes available. Therefore, a clear understanding of this is required during the design stages of the database. One of the most important take-aways was the ability for different departments to manage their individual data sets, with properly linked databases, agencies could perform powerful analysis without interrupting the integrity of their respective databases.

50. He began this session by presenting on geospatial database design concepts. That the spatial information and the attribute information are the two main components to be considered in GIS. Examples of use and applications of these components were provided.

51. Participants were encouraged that before designing a data management system, a needs assessment should be conducted. This assessment should include elements of objectives, decisions, criteria, information, data, GIS functions and a risk analysis.

52. With respect to the Attribute information- in GIS this information is typically entered, analysed, and presented using a database management system (DBMS). The DBMS is a specialized computer program for data organization and manipulation and incorporates a special set of software tools to manage the GIS non-spatial tabular data including Efficient data storage, data retrieval, data indexing, data reporting

53. DBMS often provides data independence and is valuable while working with large data sets. It allows for multiple user views, centralized control, and maintenance of important data.

54. It was noted that there can be data systems providing for different users and to address the requirements of confidentiality. For example, data requirements for government and data for the citizens

55. Participants were introduced to examples of database software, typical database attribute or item and formulating a database design procedure from conceptual design to having an operational system.

56. He gave examples of Geospatial data: examples of geological, geomorphological, geochemical, geophysical, were used to demonstrate various types of geospatial data.

57. He also expanded on attribute data definition: Attribute data facilitates interpretation and analysis of the data set. It is the descriptive information on features, can be classified and stored as data items in tables.

- Attribute characteristics include name, date, time, magnitude, value, nature, condition, number, ownership…
- Domains are the set of values an attribute may have and including types, length, and size of data.
- Business rules- specify constraints on the data that can appear in tables and the operations that can be performed on data in tables. For example, a customer cannot be deleted if they have an existing (open) account.

58. Relational database management systems (RDBMS). Almost all tabular data in a GIS are stored in relational database tables. RDBMS models are more flexible than the other similar database models. Table structure is simple to understand and does not restrict any kind of query.

- Outside of a GIS, tabular data also are commonly held and manipulated in relational databases. These are for example: dBASE, rBase, ACCESS, Oracle, SQLServer, INFORMIX, DB2, Rational, Rose.
- The object-oriented relational database: management system includes primary and foreign keys.
- Primary key is the unique identifier for each record. It may consist of one or more attributes (columns). Each table should have a primary key to facilitate indexing and including:
  - A foreign key is an attribute (item) which is included in a table and is a primary key in another table. The process is referred to as the posting of the key into the table they facilitate the relating (linking) of tables. It is the basis upon which referential integrity is enforced.
  - Preferred key characteristics should be short length, numeric and non-volatile.
  - Examples of RDBMS were provided in demonstrated and for different applications for example forest-recreational trails, integrated water resources management and in pest management.

59. Attribute tables: database in ArcGIS was demonstrated using examples of field attributes and records. Participants were guided on the structure and data inputs of attribute table and including linking and relating of tables. Example of table record includes cardinality: one-to-one, one-to-many, many-to-many cardinalities.

60. He also expanded on the characteristics of geodatabases:

- Hosted inside of a relational database management system, storage for features classes, feature data sets, non-spatial tables, relationships (spatial, non-spatial).
- Features and feature classes: collections of features (spatial objects) with the same type of geometry and the same attributes.
- File geodatabase: characteristics: stores data sets in a folder of files, each dataset a file up to 1 TB in size, can be used across platforms, can be compressed, and encrypted for read only, secure use ESRI's recommended choice. Using the ArcGIS model (ESRI) was presented as an example to participants.
- Other example of Geodatabases:
  - Personal geodatabase- stores data sets in a Microsoft Access .mdb file, storage sizes between 250 and 500 MB, limited to 2GB only supported on Windows.
  - ArcSDE geodatabase- stores data sets in several optional DBMSs (IBM DB2, IBM Informix, Microsoft SQL Server, Oracle, or PostgreSQL), unlimited size and users.

61. Requirements for supporting the use and applications of geospatial technologies includes technology (currency): data (currency, resolution, accuracy), policy (relevance, monitoring), human resources (skills and benefits), funding (driven by applications and results) and political support (motivation for success).

Discussion

62. The following includes interventions received from participants upon completion of the presentation on database design and development:

- Emphasis on the need for accessible historical and just-in-time records. For example, that all landslides, landslides mapping should be recorded. This data then provides for and risk and vulnerability assessment modelling.
- Data must be continually updated for example to now include the impact of climate change and climate variability. With respect to rainfall data —to have proper data models— 30 years of data is normally needed.
- The public needs to have access to data and information.
- That there is a role for the Private sector- users (share with the insurance company, foreign investors, for example of the use of land for housing, agriculture).

63. Chairman of the Ministry of Local Government GIS Committee, Jamaica, inquired on the most appropriate type of database management system for use and following on this case example used. The ECLAC DRM consultant responded that these were all open-source database management software, but he recommended any available database software which had a relational attribute data may be used.

64. In addressing database design, both the CDEMA - GIS Specialist and ECLAC DRM consultant encouraged the participants to first draft their database design using paper and pencil as it is the responsibility of the GIS professional. This is mainly because the computer could only process what is fed into the system. Ultimately, professionals must be well versed and equipped to monitor the system's processing. The Senior GIS Manager/Trainer, Coordinator, Jamaica's National Emergency Response GIS Team, expanded on this point, proposing sketching possible database designs options altering as needed, as it is a dynamic system that will evolve over time.

65. The representative of ACS inquired on the limitations were when converting data from different database formats. The ECLAC DRM consultant offered that these limitations could manifest in two ways, functionality, and size of the database.

66. The GIS Specialist/NERGIST, Jamaica enquired whether GIS courses in the Caribbean should focus on database design, especially Oracle, Postgres and whether there was need for capacity building in this regard. The Director, Sustainable Development /NERGIST Certified Professional, Jamaica and ECLAC both agreed that regional GIS experts should keep abreast of the advances made in database design.

Session 6: characteristics of geospatial data

67. For this section the ECLAC DRM consultant, presented on the GIS data models. He informed that these models are abstractions of the real world placed into a computer interface. This is accomplished through the application of the layer concept. GIS professionals should be able to ascertain the appropriate situations when a raster or vector model should be applied. Delving further into the vector and raster models, their application, advantages, and disadvantages, he furnished the participants with a deeper appreciation of the subject matter as follows:

- Key characteristics of geospatial data, and the critical decision-making requirements necessary to develop an efficient, reliable and sustainable database for use in geospatial modelling in the Caribbean. In this very comprehensive discussion, workshop participants were exposed to thematic areas such as the nature of GIS data models and approaches towards implementation; types of Geospatial Data; types of GIS models (Vector and Raster), and the data modelling process.

- Participants were informed that GIS data models facilitate the digital representation of geographic features in the real world, so that they can be stored in a database. Such a model also allows for representation in map form and can be manipulated to address a problem. That this data is organized by layers or themes which are integrated using explicit location on the earth's surface. This data organization is supported by a spatial reference system which is critical for ensuring accurate overlaying of layers.

- With respect to types of data, two broad categories were presented. These being:
  - Cartographic/spatial - observations on spatially distributed features (points, lines, areas (polygons)).
  - Non-cartographic/attribute - descriptive information about the cartographic features (such as attributes and attribute values).

68. Participants were provided with explanations on the elements of a good database design and organization, including the specification of data keys, approaches to elaborating data attributes and issues relating to the scale of models.

69. The fundamental concept of a vector GIS as being able to represent all geospatial features in the real world was also presented and including:

- Points (nodes): trees, poles, fire plugs, airports, cities
- Lines (arcs): streams, streets, sewers
- Polygons (areas): land parcels, cities, counties, forest, rock type
- That Vector models were also shown to be best when used to represent features with discrete boundaries (roads, buildings, lakes, rivers, administrative boundaries). Hence, this model tells "where everything occurs", i.e. it gives location to every object.

- This was compared to the Raster Model for which the modelled area is covered by grid with (usually) equal-sized, square cells organized in rows (horizontal) and columns (vertical). This type of model also tells "what occurs everywhere" (space filling), i.e. everywhere has a value (even if that value is no data). This type of model was also shown to be good for representing indistinct boundaries, such as for instance thematic information on soil types, soil moisture, vegetation, ground temperatures. The consultant also noted that image data is a special case of raster data in which the attribute is a reflectance value from the electromagnetic spectrum.
- The importance of metadata and standards in database design was also emphasized, who noted that metadata should accompany the transfer of a data set. Such metadata will aid the organization receiving the data to process and interpret data, incorporate data into its holdings, and update internal catalogues describing its data holdings.

Discussions

70. The following includes interventions received from participants upon completion of the presentation on the characteristics of geospatial data.

71. Several workshop participants questioned and commented on the importance of developing human talent in the Caribbean in database design and development. The ECLAC DRM consultant endorsed the observation and shared that this is a critical constraint, as this field of expertise was found to be very limited in the Caribbean Region.

72. The CDEMA - GIS Specialist, advised participants to explore PostgreSQL/PostGIS using a Docker/Virtual machine and Linux server software as open-source systems until financing could be sourced. The ECLAC DRM consultant agreed with this strategy and further cautioned against spending money unnecessarily on an unsuitable database software. Participant were also guided to the option of using an evaluation copy from Microsoft Server that runs for 30–60 days that can be used on a virtual machine, with the consideration that the design is conceptualized prior to beginning this virtual license.

Session 7a: supporting application of geospatial applications in the Caribbean Region - accessing global and regional dataset

73. This presentation was delivered by ECLAC Regional Geospatial Advisor of the Statistics Division. It provided an introduction on the Use of United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER).[5] It was noted that the main goals of UN-SPIDER are to "ensure that all countries, international and reginal organization have access to an develop the capacity to use all types of space-based information to support the full disaster management cycle" and that the delivery of this service is aligned to priorities 1 and 4 of the Sendai Framework on DRR. The presentation also provided details on the workflow of the International Charter Space and Major Disasters, describing the request for activation; the process itself including the role of the project manager; the product/information to be released (maps of affected areas) and identifying the authorized users: national disaster management authorities, United Nations organizations via United Nations Office for Outer Space Affairs (UNOOSA) or United Nations Institute for Training and Research (UNITAR) / Operational Satellite Applications Programme (UNOSAT), and Sentinel Asia users. Participants were also informed that the International Charter Space and major Disasters[6] is a worldwide collaboration among space agencies through which satellite derived information and products are made available to support disaster response

[5] United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER): https://un-spider.org.

[6] International Charter Space and Major Disasters: https://disasterscharter.org and for example the recent- Haiti's Disaster activation page at: https://disasterscharter.org/web/guest/activations/-/article/earthquake-in-haiti-activation-729-.

efforts. Following on this presentation the GIS specialist from CDEMA requested on an intergovernmental body as hers can gain access to the platform. The Geospatial Advisor informed that he would conduct the research and refer to her soonest.

Session 7b: supporting geo-enables DRM within the Caribbean Region
Caribbean Geospatial Development Initiative (CARIGEO) and National Emergency Response Geographic Information Systems Team (NERGIST)

74. The Senior GIS Manager/Trainer and NERGIST Coordinator, Ministry of Housing, Urban Renewal, Environment and Climate Change (MHURECC) - National Spatial Data Management Branch (NSDMB) and National Emergency Response GIS Team (NERGIST) presentation contained the components on the work of CARIGEO at the regional level and NERGIST at the national level in Jamaica.

75. CARIGEO initiative[7]: this is an initiative implemented by the Americas Regional Committee of United Nations Committee of United Experts on Global Geospatial Information Management (UN-GGIM). Its main purpose is to improve spatial data infrastructures at both the national and regional levels in the Caribbean. She shared that the initiative has the support of many international agencies such as the National Aeronautics and Space Administration (NASA), the National Oceanic Atmospheric Administration (NOAA), Esri. Participants were encouraged to join the CARIGEO Initiative- Caribbean Geoportal and explore its various tools such as web map, story map, live feeds and data on storms, hurricanes, earthquakes, most recently in Haiti, the volcanic eruptions in Saint Vincent and the Grenadines.

76. The second part of her presentation was based on the Jamaican National Emergency Response GIS Team (NERGIST) experience. As a case example, participants were informed that NERGIST success is to be credited through a coordinated effort and buy-in at senior management levels in the respective participating agencies. Jamaica will be happy to share with the Caribbean countries this NERGIST experience and work in DRM. In her presentation, she gave recognition to the legacy champions and with special mention that Jacqueline DaCosta and Cecille Blake were largely responsible for pushing the GIS agenda in Jamaica.

Session 8: use of geospatial technologies and data in support of disaster risk financing
Case study: CCRIF SPC

77. In this session, the representative from the CCRIF SPC Technical Assistance and Corporate Communications teams, delivered presentation on the use of geospatial technologies and data in support of disaster risk financing.

78. She gave a description of how GST/D is applied in the context of disaster risk financing. The presentation elaborated the organization's loss modelling framework to show that such data are critical to the model through their use in the following modules: Hazard, Vulnerability and Exposure.

79. That in each of these modules, GST/D help the CCRIF SPC to be able to quickly estimate the likely loss caused by an event as it draws on spatial data to determine the intensity and location of the hazard; the attributes of the assets at the locations impacted and the determinants of the likely damage from the event. Such estimates are subsequently entered into a Loss Module for deriving the modelled ground-up loss, which is then input into the Insurance Module which compares the modelled loss to the policy conditions and ultimately determines if a payout is due and the value of that payout.

[7] CARIGEO, see link at: https://www.caribbeangeoportal.com/pages/about-us, cited October 10, 2021.

80. Significantly, she noted that GST/D give CCRIF the capacity to be flexible, and adaptable in updating its models with new data that reflects changing circumstances on the ground. One aspect of GST/D flexibility was reflected in the fact that the CCRIF was able to develop hazard-specific models which gave it the additional speed and agility in its roll out of new insurance products. CCRIF current models were presented as:

- Tropical cyclone (for tropical cyclone and electric utilities policies)
- Excess rainfall (for excess rainfall policies)
- Earthquake (for earthquake policies)
- Fisheries (for COAST[8] policies)

81. Benefits of CCRIF policies were demonstrated recently with the Haiti earthquake for which CCRIF made its largest single payout to date of US$ 40 Million to Haiti.

Discussion

82. The following includes interventions received from participants upon completion of the presentation on the use of geospatial technologies and data in support of disaster risk financing.

83. The ACS representative inquired why some countries may not be enhancing their spatial data infrastructure, whether this gap could be attributed to lack of knowledge and what can be done to encourage the use of Geoportal.

84. The Senior GIS Manager/Trainer and NERGIST Coordinator, Ministry of Housing, Urban Renewal, Environment & Climate Change (MHURECC) - National Spatial Data Management Branch (NSDMB) and National Emergency Response GIS Team (NERGIST) shared that a strategic framework, governance, policies, champions, and knowledge sharing were all critical to push the national and regional GST/D agenda. In the case of Jamaica, even though there were improvements there is still a long way to go.

85. The Coastal Information Systems Manager, Coastal Zone Management Unit, of Barbados asked about the frequency with which CCRIF updated the exposure/asset database. The CCRIF representative indicated this was done every few years when the models were updated and that the next updates were scheduled for 2022.

86. The Senior Director Mitigation Planning and Research, Office of Disaster Preparedness and Emergency Management (ODPEM), Jamaica asked whether the model information was available for use or planning by accessing the data and CCRIF products. In response, the CCRIF representative explained that as the frequency of events increased, so do the impacts, notably the vulnerability functions were always based on previous data. Nonetheless, CCRIF SPC ensured that these models were frequently updated with the most current technology and data sets. However, it was noted that there is often a discrepancy between the results generated by the models with respect to the actual losses. At the country level considerations should made to integrate disaster mitigation and climate adaptation strategies to address the increased risks of natural hazards that climate change imposes. In responding to this intervention, CCRIF SPC representative informed that it shares the country risk profiles with their members and further recommends the sharing of these profiles, but this remains the country's prerogative. However, CCRIF SPC publishes the country risk profiles that have been cleared by countries, by placing them on its website. For unpublished profiles, bilateral arrangements could be made to access country data directly.

[8] Caribbean Ocean and Aquaculture Sustainability Facility.

87. The GIS Specialist of CDEMA asked whether CCRIF planned to expand the hazard coverage, specifically for volcanic eruptions, considering the recent eruptions in Saint Vincent and the Grenadines and activity in Dominica. In responding to CDEMA, the CCRIF SPC representative stated although they were not actively working on covering volcanic eruptions, they have been exploring policies that respond to business or economic disruption, for example, considering the impact on the tourism sector in Saint Vincent and the Grenadines because of the eruptions or the economic disruption caused by the pandemic. In both cases there would be a policy trigger based on the losses to the sector and not the hazard itself.

88. The ECLAC DRM consultant asked whether the payouts were compared with actual losses to determine the level of correlation. CCRIF SPC informed that it is not appropriate to compare payouts with losses on the ground, as the payouts value depends on the conditions of the country's policy. CCRIF periodically compares the modelled losses for a hazard event to 'on the ground' losses to determine the correlation and the results of the comparisons can be used to revise the models.

89. Several questions were raised relating to the modelling frameworks and the way GST/D were being used. Among these was whether CCRIF SPC used any kind of climate models as part of its overall modelling process. In responding it was explained that while the CCRIF SPC models did not use CC modelling directly, they were frequently updated by using the results of CC models.

90. CCRIF SPC was asked if it conducts any ex-post evaluations of payouts to determine the accuracy of their modelling framework. In response the CCRIF SPC representative indicated that this was done on a periodic basis using independent assessments of disaster impacts such as the Damage and Loss Assessments done by ECLAC.

Day 3

Session 9: global guidelines supporting risk management using geospatial technologies and data

91. In this session the Geospatial Advisor gave a presentation on the global guidelines supporting risk management using geospatial technologies and data.

92. He introduced the initiatives of the United Nations for Global Geospatial Information Management and including:

- The UN-GGIM takes joint decisions and establishes guidelines on the production and use of geospatial information within national and global regulatory frameworks.
- It promotes common principles, policies, methods, mechanisms, and standards for the interoperability of geospatial data and services.
- Provides a platform for the development of effective strategies on how to build and strengthen national geospatial information capacity, especially in developing countries.

93. Participants were in informed on the UN-GGIM Regional Committees and including that of the Latin America and the Caribbean and in which ECLAC plays the role of Technical Secretariat. That the objectives of the UN-GGIM Strategic framework are in alignment with the 2030 Agenda for Sustainable Development. This strategic framework includes the international agendas of the Sendai Framework for Disaster Risk Reduction (2015–2030), SAMOA Pathway, Addis Ababa Action Agenda, Paris Agreement on Climate Change, and the Habitat III and the New Urban Agenda.

94. He added that the main requirements of the UN-GGIM Strategic Framework are on having a global policy framework, geospatial challenges and drivers, direct national benefits and efficiencies and operating principles. The working activities are expected to deliver on:

- Geospatial information for sustainable development
- Integrated Geospatial Information Framework (IGIF)[9]
- Geospatial geodetic reference frame
- Determination of global fundamental data themes
- Marine geospatial information
- Land administration and management
- Legal and policy frameworks
- National institutional arrangements
- Implementation an adoption of standards for the global geospatial information community

95. With respect to the IGIF, the following details were provided:

- IGIF- vision, mission, strategic drivers, principles and underlying objectives.
- The three components of the IGIF being: an overarching strategic framework, implementation guide and an action plan.
- IGIF- nine strategic pathways including governance and institution; policy and legislation technology; financial; data; innovation; standards; partnerships; capacity and education; and communication and engagement.

96. Referring to the UN-GGIM, ECLAC Geospatial Advisor informed participants that there is a committee of experts at the global level. Amongst the work agenda of this Committee are topics and resources such as: the development of a Global Geodetic Reference Frame (GGRF), the Integrated Geospatial Information Framework (IGIF) and its implementation guide; a Strategic Framework on Geospatial Information and Services for Disasters; geospatial information in support of the 2030 Agenda for Sustainable Development (geospatial lens), standards adoption and implementation by the global geospatial information community, integration of statistical and geospatial information (Global Statistical Geospatial Framework), determination of fundamental geospatial data sets (proposal worldwide), a Framework on Geospatial Information for Land Administration and Marine Geospatial Information.

97. With respect to the integration of statistical and geospatial information, participants were informed on the following benefits this is providing and including:

- New, better and more integrated information for analysis and decision-making processes. This includes providing support to local, sub-national, national, regional, and global decision-making processes.
- More information on small geographic areas, new insights and data relationships that would not have been possible through analysis of social, economic or environmental data in isolation from each other.
- Support for the measurement and monitoring of the objective and global indicator framework such as the 2030 Agenda.

98. For the Global Statistical Geospatial Framework, it was presented that this framework opens a space for both joint and collaborative work amongst the communities of practice and at both regional and national levels. That this framework is composed of five principles, these being:

- Use of fundamental geospatial infrastructure and geocoding

[9] The IGIF is a guideline document endorsed by the UN and generated in collaboration with the World Bank. The IGIF aims to provide a foundation and guidance for countries in developing and strengthening their national and subnational institutional arrangements in the management of geospatial information and related infrastructures.

- Geocoded unit record data in a data management environment
- Common geographies for dissemination of statistics
- Statistical and geospatial interoperability
- Accessibility and usability

99. In presenting on the contributions for the geospatial and statistical communities to the implementation of a geostatistical framework the following were listed: Administrative units, Georeferenced postal addresses, Property division, Building identifiers, Transport networks, Topographic maps, elevation and depth data, Satellite image data, Geocoding standards, Metadata standards, Geodetic Reference Frames, Open Geospatial Consortium (OGC) interoperability protocols and Technological tools for geospatial data management (GIS, Map services). Examples of the products of these contributions are: Census geographies; Social, economic, agricultural, environmental Statistics, Demographic and census data, Administrative records, Statistical business process models, National and international privacy protocols, Procedures of registration data for statistical and administrative units and their storage and management, metadata standards Interoperability standards (SDMX, ESS methodological work (GEOSTAT)) and Technological tools for statistical data management.

100. The fundamentals of Geospatial Data were also demonstrated through such examples as: Global geodetic reference frame, addresses, building and settlements, elevation and depth, functions areas, geographical names, geology and soils, land cover and land use, land parcels, physical infrastructure, population distribution, orthoimagery, transport networks, water.

101. With respect to geospatial information and services for disasters the priorities for Action were presented and including – Governance and Policies, Awareness Raising and Capacity building, Data management, common infrastructure and services, and resource mobilization.

102. With respect to ECLAC support at the regional and national levels and specifically related to geospatial technologies, participants were informed in the following as ECLAC services:

- Support the implementation of the global agenda at the national level.
- Provide technical assistance for the implementation of national geospatial frameworks and spatial data infrastructures (SDI).
- Support the process of integration of statistical and geospatial information in countries of Latin America and the Caribbean.
- Promote the use of geospatial information in the implementation of the 2030 Agenda for Sustainable Development.
- Facilitate the coordination of ECLAC with the global agencies of the United Nations and other global and regional organizations in the management of geospatial information.
- Apply the diagnosis and monitor regional progress related to the management of geospatial information.

Discussion

103. The following includes interventions received from participants upon completion of the presentation on the global guidelines supporting risk management using geospatial technologies and data.

104. The Association of Caribbean States (ACS) emphasized on the value of working together. That workshop such as this event provides an excellent medium to interact, receive knowledge, excellent opportunity. These forums can also support in identification of gaps and areas for addressing such

105. The CDEMA GIS Analyst inquired on the role intergovernmental organizations play in setting up the UN-GGIM processes versus the national government. In response to this query the Geospatial Advisor of the ECLAC Statistics Division informed that this request to have to be investigated and will provide update as the information is available.

106. He also informed that the coordination and integration of the geospatial and statistical data is required and that any approach that will vary by country to country.

Session 10: GST/D implementation issues in the Caribbean

107. This session addressed the GST/D implementation challenges for the Caribbean Region. The ECLAC consultant provided on the main factors contributing to delays in implementation and including:

- That there was a disconnect between the GIS professionals and the disaster management community.
- These is an absence of national policy mandates to develop DRM application.
- There is need for having proper data management plans. Countries must ensure that accurate and current data is used.
- Human resources- there is the need to keeping trained staff motivated.
- There is also the need for users of GST/D to champion and drive the process. Using the applications and reaping the benefits will push the region towards advancing the implementation process.

Discussion

108. The following includes interventions received from participants upon completion of the presentation on the GST/D Implementation issues in the Caribbean.

109. There were several interventions seeking to encourage CCRIF SPC to include the country's technocrats in the decision-making processes with the Ministries of Finance. This could also include participating in joint training and capacity building initiatives, especially as these offices are the ones capable of vetting and reviewing CCRIF SPC models and profiles.

110. The representative of Barbados, Lands and Surveys Department, shared on the national challenges and specifically about limited human resources to continually update such data as road networks, land use et al. Furthermore, interagency sharing was not forthcoming, as many agencies also limited in the required resources data management. He also identified the lack of classification as a limiting factor in their analysis capabilities.

111. The CDB representative praised the CDEMA comprehensive disaster strategy and highlighting that this has provided a good basis for advancing this work in the Caribbean Region. It was noted however that the updating data was the remit of Member Countries, and that budget allocations were often not assigned for this task.

112. The Bahamas GIS Analyst stated that there is a requirement of data custodians to update and maintain data, however, in many cases this was not done.

113. The Integrated Water Recourses Management consultant from Jamaica, raised a concern regarding the lack of engagement with the private sector and which is heavily involved in generating useful GIS data.

He asked whether there was a proposed mechanism or strategy that could address the integration of the private sector GIS data into the national database.

114. In responding to the interventions made by participants, the ECLAC consultant provided the following:

- That the best way to engage the private sector was to create incentives. For example, if the CCRIF SPC models were made available to investors, it would improve their awareness of the usefulness of these instruments, thereby encouraging them to invest in improvements. The private sector may also see an opportunity to sell insurance, as in the case in Trinidad and Tobago most recently where 100 roofs were blown off due to high winds. The private sector armed with the relevant data - the type of roof, whether it could within stand high winds may think it prudent to enter insurance to extend these services to families
- He has advocated for an open data sharing platform where all the agencies can house their data. In this way, the private sector would be encouraged to share and cooperate as the national data would be advantageous to them.
- Responding to the representative from the Barbados, Lands and Surveys Department, it was suggested that this department create a survey that would generate a list of users and the purposes for GIS application every month. This could provide valuable data and demonstrate the value of this department to the national landscape, that is, going beyond the benefit of cash revenue. Jamaica's representative provided an example of the Planning Institute of Jamacia (PIOJ) where its Land Information Council was engaged the private sector and that data was integrated into the national framework, however at this time arrangement was no longer in existence.

Session 11: Towards a regional technical cooperation to harness the full benefits of GST/D

115. In this session, the ECLAC DRM consultant addressed issues to be considered in engendering regional technical cooperation for harnessing the maximum benefits from the use of GST/D.

116. He outlined broad strategic elements related to the benefits of regional cooperation, requirements for a regional approach, opportunities and challenges. He also offered recommendations for strengthening regional cooperation in this area. By way of preamble, however he cautioned that it was not necessary to reinvent the wheel, but instead the adoption/adaptation of well-known or used regional policies, law, standards, and regulations could suffice. He also called for the establishment of a regional working group to work with the CARIGEO Initiative; the establishment of a regional educational portal for the delivery of online short courses; and for efforts to secure regional scholarships for at least two persons in each member State as an avenue to form cohorts of personnel with this particular GST/D skill set.

117. With respect to regional cooperation, the urgency for establishing a dedicated Caribbean GST/D forum for the negotiation, evaluation, acquisition, and application of remote sensing imageries from extra regional sources was tabled. That it is imperative that a coordinated and strategic approach be developed at regional level as opposed to local level to take full advantage of opportunities provided by space-based geoinformation. Listed amongst the benefits to be achieved in having a dedicated Caribbean forum were:

- Have focused attention addressing the limited human and capital capacity, and the rapidly changing information communication technology environment.
- Address and priorities Caribbean- GST/D resource management challenges and including cost savings, building regional cooperation.

- Regional intergovernmental bodies such as the CARICOM/Caribbean Disaster Emergency Response Agency could use its regional status, strategic advantages and negotiating machinery to obtain imageries at little or no-cost and as services to participating States. A regional programme in database management was critical. Since without this, the high investment in data collection may go to waste, if there is no consistent data management programme. Moreover, a regional data management plan would include data sharing and data dissemination protocols and cost recovery strategies among member States.
- Facilitate accessibility through a regular and sustained data acquisition programme in support of DRM.

118. He also added that the proposed Caribbean body can also function as:

- A regional institute for the training of Caribbean nationals on the use and processing of satellite imageries and noting that:
  - Many State institutions are not able to take advantage of space-based imageries and products due to such factors as the lack of knowledge, technical capability, financial resources.
  - Limited capacity or expertise to select, acquire, analyse, or integrate remote sensing data.
  - There is a lack of ground stations for live link.
  - Lack of current and high-resolution maps of the natural and physical resources.
  - Aerial photography remains the primary source of information at local and regional level.
  - Practitioners rely mainly on visual analysis techniques.
- One-single one-stop processing centre for Caribbean remote sensing products.
- A regional approach would facilitate the development of regional standards for the acquisition, processing, integration, classification, and use of remote sensing imageries.
- Reduce the tradition of data access restrictions and encourage the sharing of best practices in the use of space-based imageries and their application for disaster risk management.

119. Amongst the other opportunities identified for a Caribbean regional approach were:

- Increased awareness and with a wider audience on the impacts of disastrous events in the region and the use of Geographic Information Systems.
- Build on existing regional initiatives through such bodies as CDEMA, the Caribbean Institute for Meteorology and Hydrology (CIMH), Caribbean Meteorological Organization, Caribbean Environmental Health Institute (CEHI).
- Improvement in the social, economic and environment conditions.
- Support the objectives and purpose of the International Charter Space and Major Disasters,[10] and Group on Earth Observations (GEO).[11]

120. In closing this session, the ECLAC Regional Geospatial Advisor endorsed the proposal for a Caribbean regional approach and towards supporting greater collaborative efforts to fully exploit the benefits of GST/D for the subregion and including supporting DRM.

[10] https://disasterscharter.org/web/guest/how-the-charter-works.
[11] Group of Earth's Observations see link at: https://earthobservations.org.

Session 12: participants' interventions
How do you deal with the following challenges in mainstreaming geospatial technologies and use of data in DRM in your country?

121. In this session, country representatives and regional agencies were invited to share their experiences under the following themes: policy and legislation, access to high resolution data and data management, political support, access to trained personnel and access to international and regional technical support.[12] Participants did not report under policy and legislation nor political support. The following contributions made are expanded in this session.

Access to high resolution data and data management

122. The GIS Analyst from Office of Disaster Planning and Management (ODPM) Trinidad and Tobago informed that his country is an authorized user to the International Charter. However, it has not been activated and that this country may consider doing so in the future. With respect to the collection of data the representative explained that the agency relies on stream flow and river rain gauges from the Water Resources Agency. Other advances being made include a direct uplink to the goals and live satellite imagery through the M-WIN system and ongoing work with national Regional Corporations. The delegate from Trinidad and Tobago concluded that funding and training fieldworkers in equipment use were two pressing challenges.

123. The GIS Manager/Trainer and NERGIST Coordinator, Jamaica gave an overview on activating fieldworkers during a hazard. The process is initially activated through a notification sent to all teams. These teams are briefed depending on the type of hazards approaching and are furnished with the necessary equipment, type of data to be collected and specifics related to the terms of mapping and related attributes. This contribution was endorsed by a representative of Jamacia- Office of Disaster Preparedness and Emergency Management (ODPEM) and informing that the teams when deployed do collect data which is then relayed to the ODPEM for processing.

Access to trained personnel

124. The representative from the Barbados- Lands and Surveys Department, provided a summary of his department competencies which were variable and spanning from those who are formally training to those with a wealth of on the job-practical experience. Nonetheless, his government have challenges related to train personnel in GIS. The office, however due to their staff's quality experience have been able to provide geospatial services and assistance to several ministries and departments. The representative of Coastal Zone Management Unit Barbados confirmed Lands and Surveys, Barbados provides great GIS support to other agencies.

Access to international and regional technical support

125. The ACS representative outlined the areas of GIS services that her organization is pursuing with the intention of improving corporation and providing support to the region. Emphasizing the high risk, the Caribbean Region faces with respect to hazards, the ACS informed that it has established strategies addressing public awareness, preservation, and conservation to reduce the impact on the Nations of the Caribbean Sea. She called for an urgent recalibration of the region's resilience.

126. The Caribbean Development Bank (CDB) representative informed that DRM is an integral part of the CDB corporate strategy. The CDB acknowledged the significant role climate change plays in the amplification of hazards and works alongside their borrowing member countries in reinforcing their

[12] To note that participants did not provide comments under policy and legislation nor political support.

preparedness and mitigation efforts. Further, much work has gone into the integration of DRM and climate change into the borrowing member countries national development plans through the Ministry of Finance and the National Disaster Management agencies. The CDB also provides additional grants and concessional funding to its members. Some of their partners include CDEMA, the Caribbean Institute for Meteorology and Hydrology (CIMH) and the Caribbean Community Climate Change Centre (CCCCC).

127. The GIS Manager/Trainer and NERGIST Coordinator of Jamaica provided the Jamaican context, informing the participants a background into the technical geospatial support the National Spatial Data Management Branch (NSDMB) offers to government agencies capacity development, coordination of national GIS initiatives, standards, policies, GIS needs assessments, GIS Implementation, GIS administrative services. The Jamacia- NSDMB coordinates the NERGIST Team in providing geospatial support to ODPEM and the Ministry of Health and Wellness, specifically for disaster response and disaster related projects and disaster response to Jamaica sub-regional focal point areas. The NSDMB in collaboration with ODPEM provides leadership of the Working Group on Geospatial Information and Services for Disasters and provides support on the CARIGEO Steering Committee for support in the Caribbean Region.

Closure of workshop II

128. The ECLAC DRM consultant expressed hope that participants would actively incorporate the elements of the workshop within their countries to advance GIS and GST/D. He extended his thanks to CCRIF SPC for the explanation of their models, the CDB representative for his intervention, the ACS. He particularly thanked ECLAC for the organization and delivery of this workshop. and ECLAC colleagues.

129. On behalf of the Director of ECLAC subregional headquarters for the Caribbean, the Coordinator of the Sustainable Development and Disaster Unit thanked all participants for their attendance and active participation during this three-day workshop. Participants were reminded to complete the application of GST/D as well as the online workshop evaluation surveys. The workshop concluded at 12.10 p.m. on Wednesday 8 September 2021.

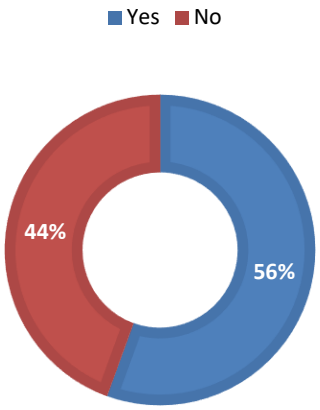
E. SUMMARY OF EVALUATIONS

130. An evaluation form was provided to participants to obtain feedback on the workshop. This section of the report outlines the summaries of their responses.

131. In total, 77 participants attended the workshop. 18 participants completed the post-training survey, of which 11 are females (61 per cent), 6 are males (33 per cent) with 1 applicant (6 per cent) chose not to disclose gender. Regarding professional affiliation, 78 per cent work for the public (government offices) sectors, 6 per cent represented the private sectors, another 6 per cent were in academia. Eleven per cent were representatives from “other”- comprising of UN partners and other region intergovernmental agencies.

132. To begin, the participants were asked of their previous training in geospatial technologies and data in support of disaster risk management to which 56 per cent affirmed that they have received prior training and 44 per cent indicated that they have not.

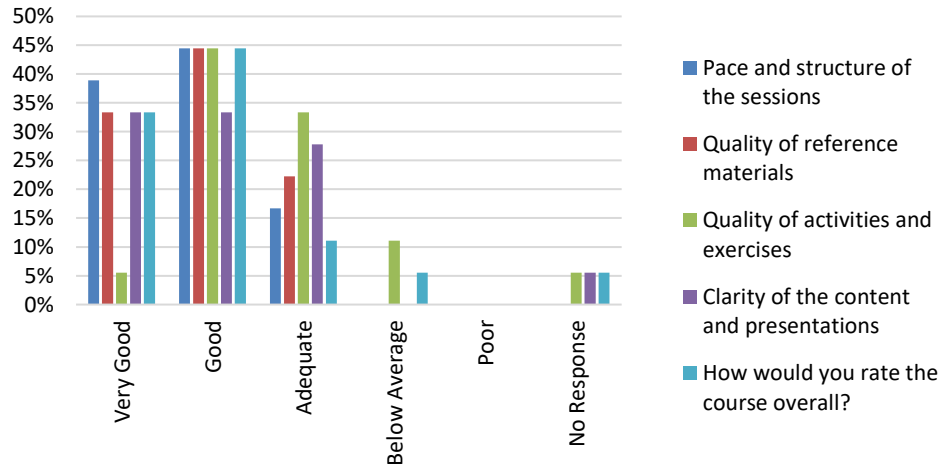
FIGURE 1
PARTICIPANTS' FEEDBACK ON PREVIOUS KNOWLEDGE IN SUPPORT OF DISASTER RISK MANAGEMENT



1. Content, delivery and organization

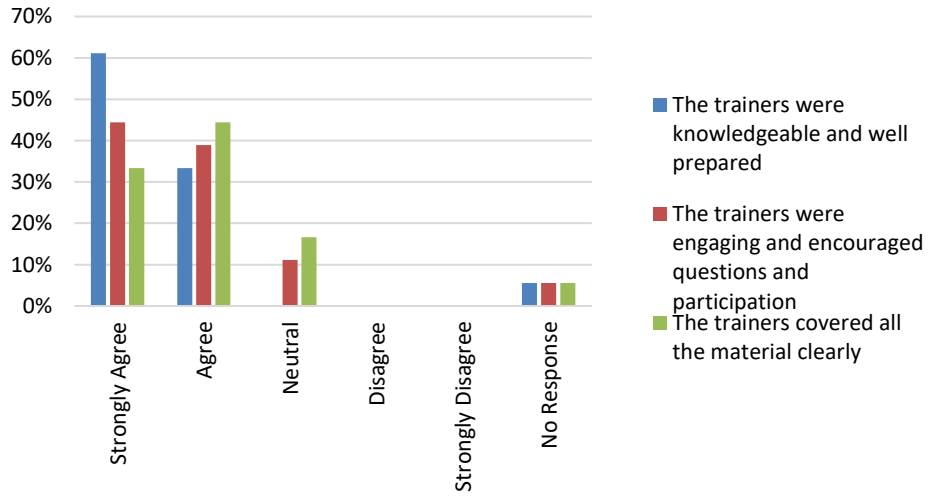
133. On a 5-point Likert scale ranging from very good to poor, 39 per cent of respondents found the space and structure of the workshop very good, 44 per cent found it good, and 17 per cent found it to be adequate. Regarding the quality of reference material relating to the workshop, 33 per cent found it to be very good, 44 per cent found it good, and 22 per cent thought it was adequate. Respondents identified the quality of activities and exercises, 6 per cent thought they were very good, 44 per cent thought they were good, 33 per cent found them to be adequate,11 per cent indicated they were below average, and 6 per cent did not respond. Referencing the clarity of the content and presentations, 33 per cent of the respondents found them to be very good, 33 per cent thought they were good, 28 per cent found them to be just adequate while 6 per cent did not respond. Overall, 33 per cent of the participants rated the course as very good, 44 per cent thought it was good,11 per cent found it to be adequate, 6 per cent rated it as below average and another 6 per cent did not respond.

FIGURE 2
PARTICIPANTS' FEEDBACK ON CONTENT, DELIVERY AND ORGANIZATION



134. Respondents rated the facilitators' capacity, engagement, and preparedness. With regards to the trainers being knowledgeable and well prepared 61 per cent of respondents strongly agreed, 33 per cent agreed and 6 per cent did not respond. For the second evaluation of the trainers, which examined engagement and whether questions and participation were encouraged 44 per cent strongly agreed, 39 per cent agreed, 11 per cent felt neutral and 6 per cent did not respond. Lastly for the evaluation of the trainers, 33 per cent strongly agreed when asked if trainers covered all the material clearly, 44 per cent agreed, 17 per cent felt neutral and 6 percent did not respond to the notion of materials clearly being covered.

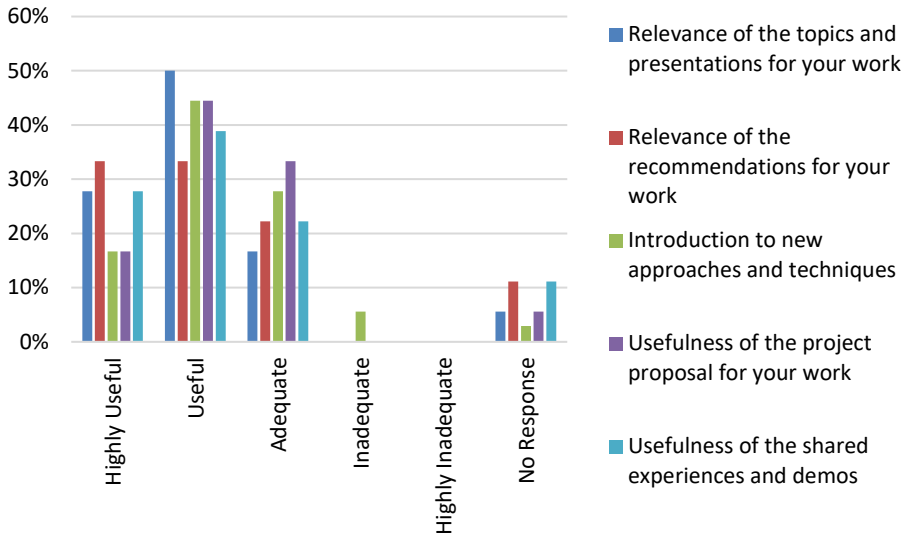
FIGURE 3
PARTICIPANTS' FEEDBACK ON THE FACILITATORS' CAPACITY, PREPAREDNESS AND OVERALL ENGAGEMENT.



135. Participants were asked about the impact of the workshop while focusing on five classifications. For the first classification "relevance of the topics and presentations for your work." 28 per cent found the workshop highly useful, 50 per cent found it useful, 17 per cent found it to be adequate and 6 per cent did not respond. For the second classification "relevance of the recommendations for your work" 33 per cent thought the recommendations would be highly useful, 33 per cent thought they would useful, 22 per cent thought they would be adequate and 11 per cent did not respond.

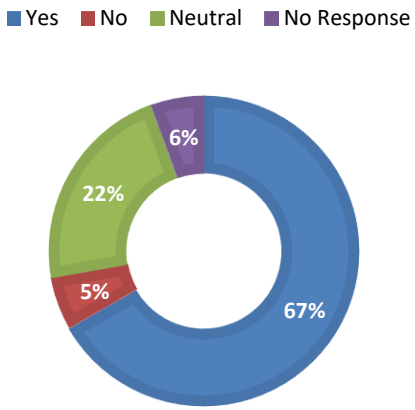
136. With regards to "introduction of new approaches and techniques" 17 per cent believed the workshop would be highly useful in impacting their ability to apply new approaches and techniques, 44 per cent believed it would be useful, 28 per cent believed it would be adequate, 6 per cent thought it would be inadequate and 3 per cent did not respond. Referencing the "usefulness of the project proposal for your work" 17 per cent stated that this was highly useful, 44 per cent found it to be useful, 33 per cent thought it was adequate and 5 per cent did not respond. For the final classification, "usefulness of the shared experiences and demo" 28 per cent thought this was highly useful, 39 per cent found it to be useful, 22 per cent thought it was adequate and 11 per cent did not respond.

FIGURE 4
PARTICIPANTS' FEEDBACK ON THE IMPACT AND RELEVANCE OF THE WORKSHOP



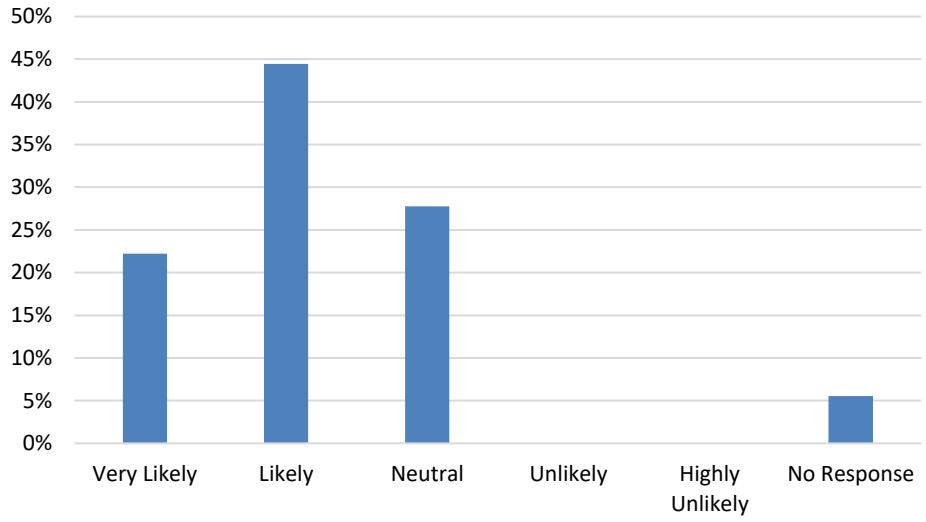
137. The participants were asked if the training met their expectations 67 per cent said yes, 5 per cent said no, 22 per cent remained neutral and 6 per cent did not provide a response.

FIGURE 5
PARTICIPANTS' FEEDBACK ON THE WORKSHOP'S ABILITY TO MEET THEIR NEEDS



138. Respondents were asked about the likelihood of them applying what they have learned at the workshop within their respective organizations 22 per cent expressed that this was very likely of happening, 44 per cent revealed that it was likely, 28 per cent remained neutral and 6 per cent provided no response to this question.

FIGURE 6
LIKELIHOOD OF THE APPLICATION OF KNOWLEDGE



2. Responses and comments to open-ended questions

139. Participants found the content useful. However, participants had very differing answers as to which part they found the most useful, which indicates that different respondents benefited most from differing sections of the workshop.

140. What were the most important outcomes / recommendations of the workshop?

- The most important recommendation is the need to integrate geospatial data systems across the region and source funding towards this end.
- Collaboration between Caribbean countries and need for capacity building among geospatial professionals.
- Highlighting the importance of shared experience and research across the region. Recommendations: additional technical regional working groups with country specialists.
- How to go about collecting data. How data is organized.
- Need for communication of objectives and projects
- Need for further capacity building in region to share lessons learned and strengthen technical knowledge
- The discussion will be able to help participants understand the information for their country.
- The most important outcome/recommendation of the workshop for me was the realization that it takes 'all hands-on deck', both public and private sector companies and organizations, shared knowledge on a regional level and the coming together of each one to make our region stronger and more resilient to the impact of natural disasters when they come.
- The recommendation about utilization of a common system between CDEMA and the other host countries.
- There are models that already exist for some of the projects we are working on.
- Very informative. Everyone gets to know what the other countries are doing as it relates to GIS

141. How do you intend/expect to apply the knowledge acquired in this training workshop?
- Apply good practices and collaboration for data management.
- As a NERGIST member in Jamaica it helps me to network with other countries
- At the ACS we will work towards regional cooperation as it relates to the creation, use and exchange of geospatial data.
- By incorporating the lessons learnt into projects/ proposals and through knowledge transfer to others.
- Having sessions with coworkers to enlighten them about all the information gathered here.
- I intend to follow up on Dr. Opadeyi's hazard modeling to see how I can apply it to my work.
- I intend to incorporate it in my training plan and make it mandatory area within the organization.
- In support of Jamaica's National Emergency Response GIS Team (NERGIST) efforts in Jamaica and the northwestern Caribbean.
- Integrate insights gained to enrich my organization data.
- Knowledge acquired here could be applied at my level, to hydrant mapping, mapping of flood or landslide prone areas and bypass routes, shelter locations, development of database to accommodate the aforementioned data, and the development of a data management system.
- The knowledge acquired in this training workshop will be used to improve preparedness, response, recovery, prevention, and mitigation activities in the event of an emergency.
- Use the different ideas in my projects to increase the efficiency of decision making and give more accurate information to the general public.

142. What are the Strengths of the training workshop?
- The information presented was the main strength.
- The platform itself, which enabled the meeting and interaction of persons across the region.
- The facilitators/hosts, presenters, and anyone else involved in making the training possible.
- A lot of new ideas and models were presented.
- Knowledge base
- Knowledgeable about Geospatial technologies.
- Knowledgeable facilitators and enlightening discussions
- Potential for regional collaboration, shared experiences.
- Presenters were prepared and knowledgeable.
- The examples and experiences shared.
- The instructors were very knowledgeable
- The interaction with the participants was positive.
- The presenters were very knowledgeable, and I loved the interaction between participants.
- The speakers are very knowledgeable about the topics presented. The presentations provided an overview of where we are in the Caribbean re geospatial technologies and disaster management, increased awareness re achievements and gaps, best practices, and areas where we can gather and offer support. Overall, an excellent 3 days.
- The workshop provided a forum for discussion and the exchange of information with professionals across the region. Participants also highlighted key issues and challenges which are useful to note and address.

143. What areas of improvement would you recommend?
- Possibly a short training component given the technical nature of geospatial applications.
- Actionable items for collaboration between countries could be included or proposed.
- Additional technical discussions, introduction of new technologies and applications
- Continuity with this workshop as an annual event
- Extend the length of time for the workshops and have one or 2 less presentations for the day. Also start a little later, probably like an hour.
- I would like to recommend that the participant get some materials before the course so they could be better prepared

- It was great
- More involvement from participants
- Practical exercises/sample guide sheets for the participants.
- Presentations submitted to participants.
- Sessions should be shorter and interactive
- The quality of the connectivity of some, needs improvement
- The workshop was well planned and executed; perhaps a shorter agenda may be helpful, given the limits of the virtual environment.
- There should have been a practical component with live demos of databases and various geospatial data, tools and apps that can be used to support DRM. Demonstrations of how to build models and run them, after setting the parameters would have also been very useful to aid participants in better understanding. The presentations were very useful but having demos and practical sessions would have been more beneficial. This could have been facilitated in a virtual environment. Highly recommend this approach in the future.
- Would like to follow up with hands on training.

F. CONCLUSIONS

144. The following are the main conclusions from this workshop:

- Establishment of national organizational structure to ensure a more comprehensive integration, development and implementation of geospatial policies supporting data maintenance, and data sharing. This structure and the technological requirements are to be adequately budgeted and financed.
- Negotiation of a MOU between agencies and having the purpose of promoting inter-agency collaboration on data management including data access and sharing. Platforms for data sharing should also provide access to the public.
- Data must be continually updated for example to now include the impact of climate change and climate variability. Historical data is also necessary to have proper data models. For example, with respect to rainfall data a duration of 30 years of data is normally needed.
- That there is the need for disaster vulnerability assessments. Each country should have updated hazards maps as standard inputs in decision making for example in land use planning and approvals. There is the need to develop capacity building programmes at universities and technical institutions to obtain a critical mass of trained personnel. Capacity building for the practicing GIS experts should keep abreast of the advances made in database design.
- To have a dedicated Caribbean GST/D regional entity for the negotiation, evaluation, acquisition, and application of remote sensing imageries from extra regional sources. That it is imperative that a coordinated and strategic approach be developed at regional level and to take full advantage of opportunities provided by space-based geo-information. This entity can also support in the integration of geospatial data systems, capacity building among geospatial professionals and the sharing of best practices. Under this item a recommendation was made for exploring establishment of a common data system between CDEMA and the member countries.
- Incentives are to be created to engage the private sectors in the national disaster response system. Private sectors can have the resources to generate geospatial information and that this data could have application for disaster responses and therefore support DRM and DRR efforts at the national level.

Annex I

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Annex II

PRE-WORKSHOP TRAINING ASSESSMENT

A training pre-assessment evaluation form was provided to participants to obtain feedback on the workshop. As a component of the pre-assessment questionnaire, participants were asked to indicate on previous training in GST/D in support of DRM. Based on information received from 92 responses, 58 per cent affirmed that they have received prior training and 42 per cent indicated that they have not. Table 1 provides a summary on the knowledge of the use of various GST tools in DRM and based on information obtained from the pre-workshop questionnaire.

Table 1: Training Pre- Needs Assessment Report (N=92)

How do you rate your knowledge of the use of the following tools for disaster risk management?	Below Average	Average	Fair	Good	Very Good
Knowledge of geographic information systems (GIS)	12%	12%	14%	35%	26%
Knowledge of spatial analysis tools	14%	17%	22%	29%	16%
Knowledge of satellite remote sensing	22%	21%	32%	20%	5%
Knowledge of global navigation satellite systems (GNSS or GPS)	17%	17%	25%	26%	12%
Unmanned aerial vehicle (Drone technology)	40%	20%	23%	11%	4%
Processing of satellite imageries	33%	23%	25%	11%	8%
Database design and management	23%	25%	21%	20%	11%

Number of Entries: N=92

Annex III

WORKSHOP EVALUATION FORM

Workshop on Effective Applications of Geospatial Technologies and Data in support of Disaster Risk Management in the Caribbean

Link to Online survey form:
https://forms.office.com/r/37nDqn7J98

TRAINING EVALUATION
In an effort to assess the effectiveness and impact of this workshop, kindly complete the following evaluation form. Your responses will be invaluable in providing feedback on the overall training, identifying areas of weakness and help improve the organization of future courses.

Sex	Age		Sector	
☐ Female	☐	30 or under	☐	Public
☐ Male	☐	31 – 40	☐	Private
	☐	41 – 50	☐	Academia
	☐	51 or over	☐	Other (NGO, social organization, etc.)

Country of origin: _____**Country you represent:** _____

Institution(s) you represent: _____

Title/Position: _____

1. Have you previously received training in Geospatial Technologies and Data in support of Disaster Risk Management? Yes ☐ No ☐

2. How would you rate the following?

a. Content, Delivery & Organization	**Very Good**	**Good**	**Adequate**	**Below Average**	**Poor**
Pace and structure of the sessions	[ ]	[ ]	[ ]	[ ]	[ ]
Quality of reference materials	[ ]	[ ]	[ ]	[ ]	[ ]
Quality of activities and exercises	[ ]	[ ]	[ ]	[ ]	[ ]
Clarity of the content and presentations	[ ]	[ ]	[ ]	[ ]	[ ]
How would you rate the course overall?	[ ]	[ ]	[ ]	[ ]	[ ]

b. Facilitator	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
The trainers were knowledgeable and well prepared	[ ]	[ ]	[ ]	[ ]	[ ]
The trainers were engaging and encouraged questions and participation	[ ]	[ ]	[ ]	[ ]	[ ]
The trainers covered all the material clearly	[ ]	[ ]	[ ]	[ ]	[ ]
c. Impact	**Highly Useful**	**Useful**	**Adequate**	**Inadequate**	**Highly Inadequate**
Relevance of the topics and presentations for your work	[ ]	[ ]	[ ]	[ ]	[ ]
Relevance of the recommendations for your work	[ ]	[ ]	[ ]	[ ]	[ ]
Introduction to new approaches and techniques	[ ]	[ ]	[ ]	[ ]	[ ]
Strengthening of knowledge about universal and comprehensive social protection systems and its components	[ ]	[ ]	[ ]	[ ]	[ ]
Usefulness of the project proposal for your work	[ ]	[ ]	[ ]	[ ]	[ ]
Usefulness of the shared experiences and demos	[ ]	[ ]	[ ]	[ ]	[ ]

3. Did the training meet your expectations? Yes ☐ No ☐

4. What is the likelihood of using what you learned in this training?

Very Likely	Likely	Neutral	Unlikely	Highly Unlikely
[ ]	[ ]	[ ]	[ ]	[ ]

5. What were the most important outcomes / recommendations of the workshop?

_____

_____

6. How do you intend/expect to apply the knowledge acquired in this training workshop?

_____

_____

7. What are the Strengths of the training workshop?

8. What areas of improvement would you recommend?

Annex IV

CONCEPT NOTE

UNITED NATIONS

ECLAC

CCRIF SPC
The Caribbean Catastrophe Risk Insurance Facility

CONCEPT NOTE

Training Workshops on Policy and Applications of Geospatial Technologies and Data in support of Disaster Risk Management (DRM) in the Caribbean- Online

Workshops titles, venue, date and time

- Workshop #1: Policy Issues towards effective Applications of Geospatial Technologies and Data in DRM: Venue and Date - Online via WebEx on August 30, 2021.
- Workshop #2: Technical Issues towards effective Applications of Geospatial Technologies and Data in DRM: Venue and Date - Online via WebEx on September 6-8, 2021.

Introduction: Caribbean Small Island Developing States (SIDS) are considered to be particularly vulnerable to external shocks that stem from climate change impacts and in particular the increase in frequency and magnitude of natural disasters (ECLAC, 2011).[13] To significantly reduce the devastation caused by these disasters, the region needs to develop strategies of mitigation, preparedness, response, and recovery. In support of these requirements, a national database is required to provide accessible and up-to-date information containing such data as hospitals, infrastructure, logistics, hazard type and zones, population, building, transportation, hydrology, utilities etc. Decision makers can obtain precise information at all DRM stages by applying geospatial technologies (and data) such as remote sensors, drones, weather channels, Global Navigation Satellite Systems (GNNS).

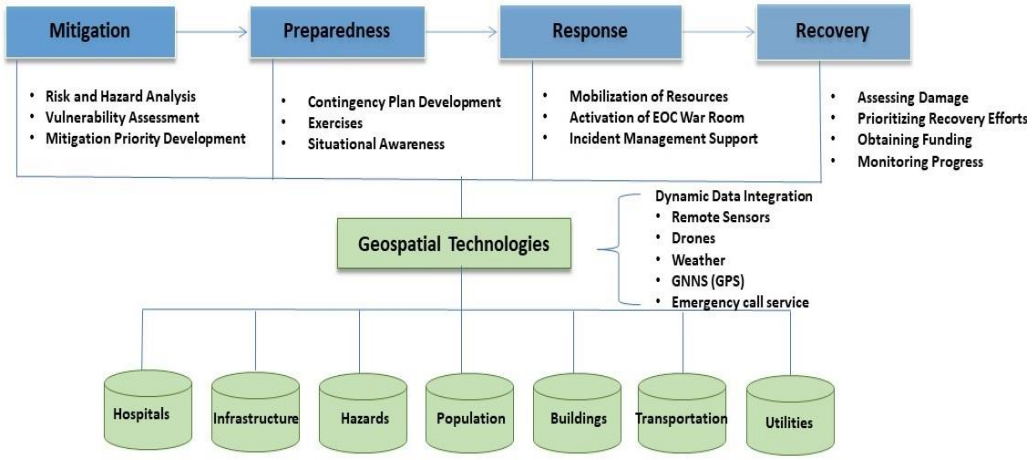
Geospatial technologies and data: Geospatial technologies comprise of the following components: computer hardware, data collection hardware, computer software, data and databases, personnel, and applications. These components work together to generate data to inform decision-makers and other stakeholders. These technologies also allow for information to be uploaded and shared globally to all agencies involved in disaster risk management. Geospatial technologies and data provide the platform for undertaking the following spatial analyses peculiar to DRM. This is illustrated in Figure 1. The following are examples of geospatial technologies and data:

- Temporal analysis of natural hazard parameters.
- Trend analysis of the occurrence of disasters.
- Spatial analysis of the impacts of disaster and over a geographic region.
- Three-dimensional analysis of the effects of natural hazards.

[13] Reference: Economic Commission for Latin America and the Caribbean (ECLAC), Study on the vulnerability and resilience of Caribbean Small Island Developing, States (SIDS), LC/CAR/L.354 (2011)

- Multivariable disaster risk analysis.
- Natural hazard prediction and modelling.
- Simulation of response rate to vulnerable communities.
- Analysis of impact zones or anticipated degree of severity.
- Storm runoff prediction and early warnings from watersheds.
- Site suitability screening and safe management for hazardous waste facilities.

Figure 7: Geospatial technologies and data in support of DRM



Source: GIS Framework for Disaster, link: https://www.esri.in/~/media/esri-india/files/pdfs/industries/gis-framework-for-disaster-management.pdf?la=en?la=en, cited July 15, 2021.

Caribbean Countries are at varying stages in the adaptation and applications of geospatial technologies and data in DRM. These include establishing policies, legislative procedures, institutional settings, determining technology and data requirements, and addressing capacity requirements. This approach is consistent with emerging global guidelines to provide geospatial support to DRM in all its phases.[14]
The benefits of use and applications of geospatial technologies and data in disaster risk management are:

- Provide integrated data storage, access, and data retrieval capabilities.
- Support a systematic approach to data collection and management.
- The facilitation of data sharing and access can reduce the overall costs of data collection and management.
- Increased comparability and compatibility of diverse data sets.
- It makes data accessible to decision-makers, and other stakeholders and supports informed decision making.
- Provides data and information to support the analysis of the impacts of disasters.

Towards supporting the Caribbean Region in building national and regional capacities in the applications of Geospatial Technologies and Data in DRM, ECLAC, in cooperation with CCRIF SPC, are organizing two (2) workshops as follows:

[14] Under the umbrella of the United Nations initiative on Global Geospatial Information Management (UN-GGIM) a Strategic Framework on Geospatial Information and Services for Disasters deliver references regarding governance, capacity building, data management, common infrastructures, and resource mobilization in these matters.

Workshop I: Policy Issues towards effective Applications of Geospatial Technologies and Data in DRM. To be held online via WebEx on August 30, 2021, at 9am-12noon (3 hours)

Target Audience: Workshop I is designed for senior technical officers having responsibilities in selecting and using technologies to support DRM.

Objectives of Workshop 1: The objectives of this high-level policy workshop are:

1. Provide on the applications of geospatial technologies and data to support decision making in DRM.
2. Identify capacity development issues needed to enhance mainstreaming of geospatial technologies and data in DRM.
3. Examine global guidelines to improve the support to risk management through the use of geospatial technologies and data.
4. Identify policies and governance requirements for geospatial technologies and data management.
5. Identify financial mechanisms and regional technical cooperation required to harness the full benefit of geospatial technology and data.

Workshop II: Technical Issues towards effective Applications of Geospatial Technologies and Data in DRM. This workshop will be held via WebEx on September 6-8, 2021, from 9:00am-12:00pm each day (9 hours).

Target Audience: Workshop II is designed for technical officers responsible for GIS and application developers supporting DRM**.**

Objectives of Workshop II:

1. Applications of Geospatial Technologies and data in DRM.
2. Identify and address data and data management requirements in DRM.
3. Examine the current state of geospatial technologies available to support DRM.
4. Identify human capacity needs to enhance mainstreaming of geospatial technologies and data in DRM.
5. Identify areas of regional technical cooperation supporting geospatial technologies and data with applications in DRM.

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end

Annex V

PROGRAMME

Workshop II: Technical Issues towards effective
Applications of Geospatial Technologies and Data
in support of Disaster Risk Management in the Caribbean
Virtual meeting
September 6-8, 2021
9:00 a.m. – 12:00 p.m. daily (UTC- 4)

PROVISIONAL PROGRAMME

Day 1: 6 September 2021

0900 hrs – 0910 hrs	**Opening of the session** - Welcome remarks by Artie Dubrie, Coordinator for the Sustainable Development and Disaster Unit- ECLAC POS - Welcome remarks Ms. Elizabeth Emanuel, Head of the Technical Assistance and Corporate Communications Teams, CCRIF SPC (formerly the Caribbean Catastrophe Risk Insurance Facility) - Introduction of Facilitators *Moderator: Artie Dubrie – Coordinator for the Sustainable Development and Disaster Unit- ECLAC POS*
0910 hrs – 0950 hrs	**Session 1: Key outcomes of the Study on Applications of Geospatial Technologies and Data in support of Disaster Risk Management** *Facilitator: Jacob Opadeyi, Disaster Risk Management Consultant*
0950 hrs – 0955 hrs	**Coffee break/Cell Phone Break**
0955 hrs – 1025 hrs	**Session 2: UN-Global Geospatial Information Management (UN-GGIM) Working Group on Geospatial information and Services for Disasters** *Facilitator: Simone Michelle Lloyd, GISP MSc.; Senior GIS Manager/Trainer, Coordinator, Jamaica's National Emergency Response GIS Team, Task Groups Lead, UN-GGIM WG Disasters- National Spatial Data Management Branch; Ministry of Housing, Urban Renewal, Environment & Climate Change, Jamaica*
1045 hrs – 1145 hrs	**Session 3 : Building Geospatial Tools and Applications** *Facilitator: Jacob Opadeyi, Disaster Risk Management Consultant*
1145 hrs – 1200 hrs	**Day 1 Wrap – up and closure**

Day 2: 7 September 2021

0900 hrs – 0905 hrs	**Opening of Session 2** *Artie Dubrie – Coordinator for the Sustainable Development and Disaster Unit – ECLAC POS*
0905 hrs – 0910 hrs	**Recap of Day 1** *Facilitator: Jacob Opadeyi, Disaster Risk Management Consultant*
0910 hrs – 0950 hrs	**Session 4 : Database Design and Development** *Facilitator: Jacob Opadeyi, Disaster Risk Management Consultant*
0950 hrs – 1000 hrs	**Coffee Break / Cell Phone Break**
1000 hrs – 1030 hrs	**Session 5: Characteristics of Geospatial data** *Facilitator: Jacob Opadeyi, Disaster Risk Management Consultant*
1030 hrs – 1115 hrs	**Session 6: Supporting application of Geospatial Applications and Data in the Caribbean Region: accessing global and regional data sets** - Use of United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) *Facilitator: Álvaro Monett, Regional Geospatial Advisor-Statistics Division, ECLAC* - **Supporting geo-enabled DRM within the Caribbean Region: Caribbean Geospatial Development Initiative (CARIGEO) and National Emergency Response Geographic Information Systems Team (NERGIST).** *Facilitator: Simone Michelle Lloyd, GISP MSc.; Senior GIS Manager/Trainer, Coordinator, Jamaica's National Emergency Response GIS Team, Task Groups Lead, UN-GGIM WG Disasters- National Spatial Data Management Branch; Ministry of Housing, Urban Renewal, Environment & Climate Change, Jamaica*
1115 hrs – 1155 hrs	**Session 7: Use of Geospatial Technologies and Data in support of Disaster Risk Financing – Case Study:** CCRIF SPC
1155 hrs – 1200 hrs	**Day 2 -Workshop evaluation reminder and closure**

Day 3: 8 September 2021

0900 hrs – 0905 hrs	**Opening of the session 3** *Artie Dubrie – Coordinator for the Sustainable Development and Disaster Unit – ECLAC POS*
0905 hrs – 0910 hrs	**Recap of Day 2** *Facilitator: Jacob Opadeyi, Disaster Risk Management Consultant*
0910 hrs – 0950 hrs	**Session 8: Global guidelines supporting risk management using GST/D** *Facilitator: Álvaro Monett, Regional Geospatial Advisor – Statistics Division, ECLAC*
0950 hrs – 1000 hrs	**Coffee Break / Cell Phone break**
1000 hrs – 1030 hrs	**Session 9: Implementation issues in the Caribbean** *Facilitator: Jacob Opadeyi, Disaster Risk Management Consultant*
1030 hrs – 1115 hrs	**Session 10: Towards a regional technical cooperation to harness the full benefit of GST/D** *Facilitators: Álvaro Monett, Regional Geospatial Advisor – Statistics Division, ECLAC and* *Jacob Opadeyi, Disaster Risk Management Consultant*
1115 hrs – 1155 hrs	**Session 11: Participants' interventions** **How do you deal with the following challenges in mainstreaming Geospatial technologies and use of data in DRM in your country?** a) Policy and Legislation *(Countries TBC)* b) Access to high resolution data and data management *(Countries TBC)* c) Political support (*Countries TBC)* d) Access to trained personnel *(Countries TBC)* e) Access to International and Regional Technical support *(Countries TBC)* *Moderator: Artie Dubrie – Coordinator for the Sustainable Development and Disaster Unit – ECLAC POS*
1155 hrs – 1200 hrs	**Workshop evaluation and closure** *Moderators: Artie Dubrie – Coordinator for the Sustainable Development and Disaster Unit – ECLAC POS and* *Jacob Opadeyi, Disaster Risk Management Consultant*

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