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Report on the United Nations International Conference on Space-based Technologies for Disaster Management: A Consolidating Role in the Implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 (Beijing, 14-16 September 2015)

I. Introduction

1. In its resolution 61/110 the General Assembly decided to establish the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) as a programme within the United Nations to provide universal access for all countries and all relevant international and regional organizations to all types of space-based information and services relevant to disaster management to support the full disaster management cycle.

2. The United Nations International Conference on Space-based Technologies for Disaster Management is the annual event of the UN-SPIDER programme. It has been held in Beijing since the establishment of the UN-SPIDER Beijing Office in 2011.

3. The conferences have covered various themes based on the current issues and needs identified in the course of UN-SPIDER technical advisory activities. Those activities are aimed at enabling national Governments to make effective use of space-based information in disaster risk reduction and emergency responses and form the UN-SPIDER contribution to the activities of the Office for Outer Space Affairs of the Secretariat. They are one concrete element in the development of stronger space governance and supporting structures in the run-up to the fiftieth anniversary of the United Nations Conference on the Exploration and Peaceful Uses of Outer Space ("UNISPACE+50"), which must lead to an improved delivery of its programme in the context of the 2030 Agenda for Sustainable Development.

4. Previous conferences covered best practices for risk reduction and rapid response mapping (2011), risk assessment in the context of global climate change (2012), disaster risk identification, assessment and monitoring (2013), and

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multi-hazard disaster risk assessment (2014). The theme in 2015 was a consolidating role in the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030.

5. The Conference marked another step in the long-term effort of the Office for Outer Space Affairs and UN-SPIDER to build on the commitments of the Sendai Framework and of the 2030 Agenda for Sustainable Development. One of the unique features of the Conference was that it strove to integrate Earth observation and space-based technologies into applications for disaster risk reduction. A series of events to address challenges faced by humanity in achieving sustainable development, protecting the space environment and securing the long-term sustainability of outer space activities, will be held in the run-up to the 2018 “UNISPACE+50” thematic cycle.

6. The Conference brought together national organizations involved in disaster management and generating geospatial information in the countries where UN-SPIDER technical advisory support had been provided or was offered. The Conference was also attended by representatives of the UN-SPIDER regional support offices, various regional and international organizations, and experts from centres of excellence from different part of the world.

II. Background and objectives

7. The main aim of the Conference was to contribute to the process of producing guidelines to help Member States to integrate Earth observation and geospatial technologies into the implementation of the Sendai Framework. The Conference built on the outcomes of the Third United Nations World Conference for Disaster Risk Reduction, held in Sendai, Japan, from 14 to 18 March 2015, and on the related commitments undertaken by the Office for Outer Space Affairs. Those included the commitment to facilitate the coordination of stakeholders in Earth observation technology as proposed in a white paper circulated among a group of stakeholders on a global partnership for Earth observation to support nations in their disaster risk reduction efforts, and to continue to raise awareness of how Earth observation technology can contribute to sustainable development prior to the United Nations summit for the adoption of the post-2015 development agenda held in New York from 25 to 27 September 2015 and the twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, to be held in Paris from 30 November to 11 December 2015.

8. The Conference was co-organized by the UN-SPIDER programme and the Ministry of Civil Affairs of China in collaboration with the Ministry of Foreign Affairs, the National Disaster Reduction Centre of China, the China National Space Administration, the Asia-Pacific Space Cooperation Organization, the Regional Centre for Space Science and Technology Education in Asia and the Pacific (China), and received support from DigitalGlobe, a private company.

9. The Conference brought together 104 participants. The attendees represented different types of organizations, such as civil protection agencies, disaster management agencies, space agencies, research institutions, science and technology agencies and other governmental and non-governmental agencies.

10. A total of 79 organizations from the following 32 countries were represented at the conference: Algeria, Armenia, Austria, Bangladesh, Belgium, Bhutan, Brazil, Cambodia, Canada, China, Ethiopia, India, Indonesia, Iran (Islamic Republic of), Iraq, Lao People's Democratic Republic, Mongolia, Mozambique, Myanmar, Nepal, Oman, Pakistan, Peru, Saudi Arabia, Singapore, Sudan, Switzerland, Thailand, Turkey, United States of America, Venezuela (Bolivarian Republic of) and Viet Nam.

III. Programme

11. A total of five plenary sessions were held. In addition, three working groups met to discuss technical subjects relevant to the themes of the Conference. The plenary sessions addressed the following topics: Earth observation and understanding disaster risk (relating to priority 1 of the Sendai Framework); Earth observation and enhancing preparedness for effective responses (relating to priority 4 of the Sendai Framework); fostering public-private partnerships; empowering communities so that they can prepare for disasters; and engaging with the Office for Outer Space Affairs and UN-SPIDER in streamlining the use of Earth observation technology in decision-making about disaster risk reduction and sustainable development.

12. Three working groups focused on the following topics: issues to be addressed to improve drought monitoring using space-based information; lessons learned from the 2015 Nepal earthquake from the perspective of Earth observation; and capacity-building and emerging technologies.

13. The last day of the Conference included institutional visits to the satellite Earth station in Yungang, China, and the National Disaster Reduction Centre of China.

14. From 17 to 22 September 2015, back-to-back with the conference, a training event on Earth observation technology for earthquake damage assessment was held for 25 Conference participants.

IV. Observations and recommendations

A. Earth observation and understanding disaster risk

15. The topic of Earth observation and understanding disaster risk was addressed at the first plenary session. The objectives of the session were to demonstrate operational programmes, systems and tools that use Earth observation technology to understand disaster risk; outline the policy and coordination issues affecting the collection, management, analysis and use of advanced Earth observation data in understanding disaster risk; and address the main issues that limit the use of Earth observation technology in understanding disaster risk.

16. Participants discussed various means, especially those based on Earth observation technology, that could be adopted by Member States to support international and regional organizations in their efforts to understand disaster risk. Those means included tools, technologies and peripheral issues such as data sharing,

spatial data infrastructure and institutional coordination. Panellists and participants shared recommended practices and experiences.

17. There was an urgent need to understand risk on the basis of evidence such as provided by satellite images and other Earth observation data. The targets of the Sendai Framework consisted of a substantial reduction of disaster risk and losses, the prevention of new risks and the reduction of existing risks. In order to reach those targets, it was necessary to understand the level of risk and measure it continuously over a long period.

18. The Sendai Framework targets agreed by countries required a mechanism that continuously evaluated risks and losses due to disasters. According to the Sendai Framework, "policies and practices for disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment".

19. According to the Sendai Framework, key actions at the national and local levels included:

(a) To promote the collection, analysis, management and use of relevant data and practical information;

(b) To encourage the use of and strengthening of baselines and periodically assess disaster risks;

(c) To develop, periodically update and disseminate, as appropriate, location-based disaster risk information, including risk maps and information obtained from geographic information systems;

(d) To systematically evaluate, record, share and publicly account for disaster losses and understand the economic, social, health, education, environmental and cultural heritage impacts;

(e) To promote real-time access to reliable data, and make use of space and in situ information, including geographic information systems.

20. Also according to the Sendai Framework, at the global and regional levels it was important:

(a) To enhance the development and dissemination of science-based methodologies and tools to record and share disaster losses, and to strengthen disaster risk modelling, assessment, mapping, monitoring and multi-hazard early warning systems;

(b) To promote the conduct of comprehensive surveys on multi-hazard disaster risks and the development of regional disaster risk assessments and maps, including climate change scenarios;

(c) To promote and enhance access to and the sharing and use of non-sensitive data and information, as appropriate, communications and geospatial and space-based technologies and related services; and maintain and strengthen in situ and remotely-sensed Earth and climate observations.

21. The major issues identified in the first plenary session were: (a) the understanding of how space-based information and capacity could be applied to reduce disaster risks at the local and national levels continued to be limited;

(b) access to and availability of high-quality Earth observation data (in the form of high-resolution and microwave data) in non-emergency situations still remained a key constraint; (c) the sharing of digital data among ministries and departments within a given country, and among countries within a given region, remained a gap area that limited the use of Earth observation technology and geospatial information in disaster management; and (d) the lack of national spatial data infrastructure.

22. There was a fundamental disconnect between suppliers of spaced-based information, such as space research organizations or remote sensing centres, and users of that information, such as national and local disaster and risk management organizations. This was considered one of the most important issues hampering the successful employment of space-based technologies under the Sendai Framework.

23. At the technical level, important suggestions were made in connection with documenting and understanding risk:

(a) At the national level there was a need to establish uniform standards for specifying risk grades;

(b) Because they included a certain element of uncertainty, risk assessments should be fine-tuned based on information from early warning systems wherever possible.

24. Some of the key recommendations from the session were:

(a) To build and enhance the capacity for using Earth observation data at all levels;

(b) To promote a culture of continuous risk assessment at the national and local levels;

(c) To promote a culture of sharing non-sensitive data at all levels;

(d) To raise awareness among politicians of the usefulness of Earth observation data in disaster risk reduction;

(e) To enhance the political will of Governments at the highest level to carry out risk assessments and promote the effective use of Earth observation data;

(f) Government agencies should include Earth observation technology in their disaster management strategies, plans and policies, as those are further transformed into implementable actions.

B. Earth observation and enhancing preparedness for effective responses

25. The topic of Earth observation and enhancing preparedness for effective responses was addressed at the second plenary session. The objectives of the session were to enhance preparedness for planning effective emergency responses by identifying gaps, capacity-building needs, database needs, financial needs, mapping procedures, institutional coordination, and other issues; to prepare to respond to major disasters by taking advantage of international mechanisms that provide space-based information during emergencies; and to outline the framework for

preparing countries to use Earth observation technology to respond to disasters on a routine basis.

26. At the session, guidance was provided on how to prepare efficient responses by making effective use of Earth observation technology by addressing issues such as prerequisite data, data access, skills and capacity, emergency mapping products and product dissemination. Participants also discussed methods and presented case studies demonstrating the use of space-based information for disaster damage and loss assessment. They further discussed ways to standardize the role of Earth observation technology beyond emergency mapping, so as to provide valuable information for damage and loss assessments.

27. To ensure that countries prepared to handle the challenges posed by the increasing frequency of disasters, it was of critical importance to assess the current status and needs for an effective use of Earth observation and geospatial information in planning emergency responses. A first step in addressing those challenges was to review the current capacity to produce maps needed for emergency responses on one hand, and the availability of baseline and operational geospatial data, data sharing policies, and institutional coordination on the other.

28. At the national level, geospatial information in the form of in situ data or other non-satellite-based data, which during emergencies was often needed in conjunction with Earth observation information, was rarely well organized. This issue needed to be addressed in cooperation with the nations that have established best practices, international agencies and centres of excellence.

29. Earth observation and geospatial information needed to be integrated with ground-based information, such as from weather radars and water level sensors. That integration would result in the information products needed to enhance preparedness and would enhance the ability of civil defence organizations and rescue teams to conduct their operations.

30. Disaster response agencies needed an institutional framework for utilizing space-based information during emergencies, to enable them to improve the capabilities of their emergency response teams. A country-level needs assessment on the availability of Earth observation data for decision-making was therefore needed to enhance information preparedness.

31. It often happened during a disaster that end user needs were unclear. This posed challenges in the coordination of mapping efforts. The key major mapping agency in each member State needed to set out common standards for disaster impact assessment, so as to avoid a duplication of mapping efforts. At the same time, data should be served through a single portal to avoid miscommunication and confusion.

32. The technical capacity of disaster management authorities needed to be enhanced through sustainable long-term activities. At the national level, emergency operation centres should have standard operating procedures for accessing and utilizing Earth observation data in a timely manner and should disseminate information products through emergency data communication systems.

33. A key concern was that collaboration between various agencies involved in emergency responses had not improved since the Haiti earthquake of 2010, as seen again during the earthquake in Nepal of 25 April 2015. Organizations providing

mapping products needed agencies to work together efficiently during the early stages of an emergency so that they could make sense of enormous flows of information by filtering out what was irrelevant or incorrect (sometimes termed “information debris”).

34. Crowdsourced information should be used more widely in disaster management, especially while responding to an emergency. There were many online platforms that leveraged the power of the crowd, such as MicroMappers, Tomnod, OpenStreetMap and GeoTag-X. The key issue was to ensure that political organizations from various countries built trust in crowdsourcing technology and that crowdsourcing became an integral part of the emergency response methodology in the coming years.

C. Fostering public-private partnerships

35. Public-private partnerships were addressed at the third plenary session. The overall objective was to give participants insights into ways to promote cooperation between the public and private sectors so as to reduce disaster risk and prepare disaster responses and recovery efforts. The specific objectives were to provide participants and potential stakeholders with an assessment of advanced Earth observation satellites and online platforms giving access to satellite data archives and near-real-time data; to address major issues in connection with the investments needed to work with private companies and gain access to satellite images during emergencies; to discuss ways to develop public-private partnerships; and to outline the role of public-private partnerships in ensuring the near-real-time availability of Earth observation images, interoperability across communities, ease of data post-processing and interpretation, data delivery, and related matters.

36. The participants discussed opportunities offered by public-private partnerships and provided insights about advanced Earth observation satellites, online platforms giving access to satellite data archives and near-real-time data, investments needed to work with private companies to improve access to satellite images during emergencies, and ways to develop partnerships.

37. There was an increased awareness among citizens and the private sector of the role they could play by volunteering, which was definitely a big step forward in enhancing public-private partnerships in disaster risk reduction. It was important to establish collaborative governance to make public-private partnerships work. There was a need to raise political awareness of the role public-private partnerships could play in disaster risk reduction and to increase the capacity of the providers of disaster risk reduction information (including private players) and users of the information.

38. Academia and civil society had a valuable role to play in making public-private partnerships for disaster management successful. A three-pronged strategy to promote public-private partnerships was proposed. First, a Government should set up support centres for volunteers and non-governmental organizations in disaster prone areas; second, civil society should be in a strategic alliance with that Government to better understand the needs and improve capacity; and third, the private sector should contribute according to its resources and strength. Such a three-pronged strategy should lead to collaborative governance of disaster risk

management and emergency responses. For collaborative governance to be effective, it was important to consider three factors: the culture of the region or nation concerned, the relevant policy framework and the legal system.

39. Public and private players were investing in advanced Earth observation systems. Both had an important role to play in providing high-quality and timely Earth observation data, both before a disaster (by providing satellite image archives) and after (by providing near-real-time satellite images), in order to plan successful responses. National disaster management agencies had to develop forms of bilateral and multilateral cooperation with public and private players, so that advanced Earth observation technologies would be used for disaster risk management and emergency responses.

40. Public-private partnerships also needed to address one of the key issues, the ways and means to transmit satellite images to end users. Transmitting terabytes of satellite images using the conventional file transfer protocol (ftp) was not efficient during disasters. There was a need to provide a wide range of end-users with access to images using cloud-based, state-of-the-art technologies. Such technologies, devised by a number of public-private partnerships, made the transmission of Earth observation images and their interpretation practicable even for Internet users with low bandwidth.

41. Crowdsourcing was the way to put public-private partnerships into practice. Besides making available valuable data, crowdsourcing made volunteers aware of the real nature and scope of a disaster. Since platforms such as Tomnod or Google Earth reached the wider community, crowdsourcing prompted large numbers of users to learn more about analysing remote-sensing data by seeking formal training. Such tools integrated geospatial content with Earth observation images and ensured sustainability in the use of Earth observation images, which was one of the significant contributions of public-private partnerships.

42. The leaders and decision-makers of countries that had recently started considering the use of Earth observation images and geospatial data in disaster management needed to be made aware how public-private partnerships could share responsibility for disaster-risk-reduction. An appropriate legal framework was necessary to back up the engagement of public-private partnerships in efforts to generate the geospatial information needed for decision-making.

43. The experience of successful bilateral or multilateral projects involving early warning systems demonstrated the importance of having strong working partnerships between specialized private companies, government authorities, and universities and research institutions, as such partnerships were the backbone of efficient project management.

44. Public-private partnerships were also important in gathering best practices and proven methodologies and transferring those as tools from one region to another.

45. Although international mechanisms were in place to back up emergency responses, such as the International Charter on Space and Major Disasters, Sentinel Asia and Copernicus, access to Earth observation images for disaster risk management purposes in non-emergency situations was often inadequate. This situation limited the effective use of Earth observation images at all stages of disaster management.

46. Public-private partnerships had the capacity to facilitate new initiatives, such as making available Earth observation satellite resources to give Member States access to satellite images at all stages of disaster management, as is the mandate of UN-SPIDER. Such initiatives would leverage the capabilities of scientists, engineers and space explorers to foster innovation and entrepreneurship through low-cost pooling of resources to resolve major challenges faced by countries that do not own or have a stake in Earth observation satellites.

47. To sum up, public-private partnerships would be able to address technical, policy, governance and financial issues, and help to fulfil commitments undertaken under the Sendai Framework.

D. Empowering communities so that they can prepare for disasters using Earth observation technology

48. The topic of enabling communities so that they can prepare for disasters using Earth observation technology was addressed at the fourth plenary session. The objectives of the session were to present participants and stakeholders with successful cases where the power of communities was leveraged through crowdsourced mapping; to address major issues in making community-based tools more effective; and to provide guidelines on involving communities to identify risks during normal situations, provide early warning and help in building resilience.

49. Speakers showed how various platforms, tools and technologies leveraged the power of communities and provided valuable input with which to build programmes that enhanced community involvement and used Earth observation data to build resilience. Participants also discussed the role of children and women, who are often the weakest members of the community and the first victims in a disaster.

50. The ultimate goal was to involve communities and the general public by equipping them with the required knowledge and enabling them to use Earth observation and other technologies to manage disaster risks. Doing so was critical for the safety and resilience of communities. Map products were not meaningful until they were widely used by communities to contribute to risk reduction, preparedness, early warning and — during major disasters — relief efforts.

51. Thanks to their increasing awareness of computer-based maps and their wide use of smartphones, communities had developed great potential to contribute to building resilience by identifying risks in normal situations, providing early warning prior to disasters and assessing damage and losses during and after disasters.

52. It was also recognized that communities needed individuals and organizations championing the use of Earth observation technology to familiarize them with the technology, and that they needed practical examples showing how the technology had been used elsewhere. Universities and the education sector in general could serve as a good bridge between the technology and communities. For communities, small day-to-day disasters could have as big an impact as one major disaster. Small disasters were much more present in the minds of community members and the general public than one major disaster. Communication and dissemination of information were as important as the disaster risk reduction measures themselves. Information could be communicated and disseminated by conventional means such

as leaflets or television and radio broadcasts, or by non-conventional means such as role play, folklore and songs that integrated technology awareness into the message.

53. Capacity-building in communities was a two-way mechanism. While communities needed to know more about Earth observation technology and how it could help them, providers of Earth observation services needed to learn about community concerns related to disaster risk reduction to be able to tailor the technology to community needs. A culture of voluntarism, as already existed in several countries, could be a powerful tool in building the capacity of communities to use Earth observation technology to reduce the risk of disaster. At the same time, children could be agents of change who bring the technology to their communities. Risk assessment and comprehensive school safety programmes centred around children could be planned using simple maps and Earth observation images from sources such as Google Maps.

54. Numerous initiatives were leveraging the power of communities to reduce the risk of disaster and prepare emergency responses. Platforms such as Ushahidi, OpenStreetMap and Google were providing collaborative and crowdsourced social mapping tools. In addition, the Tomnod platform gave communities access to high-resolution images to assess damage during a disaster.

55. The United Nations Children’s Fund had taken several initiatives to educate children in Asia and prepare them for disasters. The future use of Earth observation technology needed to be considered as part of those initiatives. Several non-governmental organizations, schools and colleges were making efforts to empower mothers and children in developing countries and increase their awareness in matters of disaster preparedness. Those initiatives needed to use simple maps and Earth observation data in order to improve communities’ understanding of the risks that faced them.

56. The experience gained with crowdsourcing during the Nepal earthquake of 2015 demonstrated how geospatial information could be used successfully as part of a disaster response. After the earthquake had struck, the non-governmental organization Kathmandu Living Labs, which operated the OpenStreetMap platform, received over 1,000 reports from different parts of Nepal. The OpenStreetMap team mobilized numerous volunteers to help with mapping areas affected by the earthquake and providing input to search and rescue missions.

57. Speakers delivered the message that increasing awareness among different sections of communities of disaster preparedness was the key to building disaster-resilient societies. This required initiatives that included strong collaboration between public and private players. One recent example was the use of the DigitalGlobe Tomnod cloud platform, which had enabled about 58,000 people to contribute to the mapping of damage to infrastructure caused by the Nepal earthquake.

58. Providing the right tools and geospatial content to end users, including communities, was very helpful in ensuring the sustained involvement of communities, both in risk reduction prior to any disaster and as part of a disaster response.

E. Improving drought monitoring using space-based information

59. The topic of improving drought monitoring using space-based information was addressed in the first working group.

60. Droughts were major natural disasters that had a serious impact on human societies and the environment, especially in developing countries. Since a drought was a slow process that impacted whole regions, early monitoring and warning arrangements were needed to reduce its impact. Thanks to their ability to make frequent and extensive observations, Earth observation satellites provided critical data needed for drought monitoring. However, access to those data and the capacity to develop monitoring tools that used space technology were major challenges in drought-prone developing countries.

61. There was a need to establish platforms for sharing Earth observation data, since several suppliers and users of such data were involved in drought monitoring. Such platforms should channel medium- and high-resolution remotely-sensed data from suppliers to users in developing countries and offer users timely, regular and free access to space-based data products for use in drought monitoring.

62. Collaboration between the public and private sectors in developing countries was essential to sustain drought monitoring projects. There was a need to develop guidelines and operating procedures to establish effective public-private partnerships.

63. There was a need to produce standard manuals and guidelines for drought risk reduction and drought management. The recommended practices for drought monitoring developed by UN-SPIDER, with the help of its regional support offices, was an example of what was required.

64. Medium-term training programmes on drought monitoring, lasting one to three months, were essential in order to promote a culture of and create the capacity for using Earth observation technology to monitor droughts on a regular basis. Such training programmes should cover methods and models for drought assessment, the suitability of remotely sensed spectral indices for specific regions, and the validation of remote-sensing data products generated for use in drought monitoring.

65. While international scientific and research organizations continued to develop methods and models for drought monitoring, Governments should make an effort to develop national capacity, coordination mechanisms and infrastructure to take advantage of the solutions provided by the international community.

F. Lessons learned from the 2015 Nepal earthquake from the perspective of Earth observation

66. The lessons learned from the 2015 Nepal earthquake from the perspective of Earth observation were addressed in the second working group.

67. The earthquake that struck Nepal on 25 April 2015 measured 7.8 on the Richter scale. The earthquake and the aftershocks that followed it left about 9,000 people dead and 22,300 injured, and affected the lives of 8 million people overall. The economic loss was of the order of $7 billion, according to the

post-disaster needs assessment published by the Government of Nepal. The event affected 31 of the 75 administrative districts, and in 14 of those a crisis was declared. Reaching out to the affected communities with assistance and ensuring their long-term reconstruction was the current priority of the Government. The response given to the Nepal earthquake was in line with the Sendai Framework; it engaged multiple stakeholders from the private and public sectors both within Nepal and abroad.

68. The International Centre for Integrated Mountain Development played an active role in providing Earth observation and geospatial information for use in the response and recovery effort. One of the issues faced by the Centre was making sense of the information flow by filtering out information debris. During major disasters, the demand for information rose exponentially, and as a result a massive amount of information was generated by suppliers and sent to users. The challenge was to integrate such information into the decision-making process. Doing so called for standard operating procedures for data collection and analysis, and supplying the information products needed for decision-making.

69. Among other issues, the need for base maps and common operational data sets for key cities and locations was highlighted. Base maps should be readily available when disaster strikes.

70. The use of crowdsourced Earth observation data was also identified as a promising cutting-edge method for rapidly acquiring the information needed for damage assessment.

71. Defining a mechanism for coordinated information management ahead of time to prepare for disasters was essential. There was a need to define a clear-cut workflow to coordinate multiple stakeholders and generate awareness among all stakeholders involved in providing geospatial information and products.

72. Such a mechanism could be created through mock disaster response exercises based on previous disasters. That approach would ensure that the mechanism created would be appropriate, thereby justifying the time and money invested by information providers to support disaster responses.

G. Capacity-building and emerging technologies in support of the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030

73. The topic of capacity-building and emerging technologies to support implementation of the Sendai Framework was addressed in the third working group.

74. International cooperation was the key to improving the capacity for risk reduction and emergency responses and successfully implementing the Sendai Framework.

75. The global partnership on Earth observation for disaster risk reduction established by the Office for Outer Space Affairs and UN-SPIDER was playing a critical role in capacity-building by training officials from developing countries in space technology applications for disaster management and emergency responses.

76. The regional centres for space science and technology education, affiliated to the United Nations, were offering postgraduate courses in remote sensing, geographic information systems, satellite meteorology, satellite communication, global navigation satellite systems, space and atmospheric sciences and similar areas. The special themes related to disaster management, climate change and technology such as microwave remote sensing and hyperspectral remote sensing were also covered in short, demand-based courses. The Centre for Space Science and Technology Education in Asia and the Pacific, based in India, had completed 20 years of dedicated service to the States Members of the United Nations. A new regional centre had been launched at Beihang University in Beijing in 2014. Both centres were well equipped to apply space technology in a wide range of areas including disaster management and sustainable development.

77. The network of UN-SPIDER regional support offices worked closely together with other partners to provide valuable support in capacity-building efforts organized by UN-SPIDER.

78. It was imperative for disaster management agencies to prepare national strategies for building sustained capacity in the use of space technology in disaster management. Without such strategies, disaster management efforts would remain ad hoc and unplanned.

79. On-site capacity-building efforts could be more effective, since they involved large numbers of participants from all stakeholder agencies in a given country.

80. The organizers of the training course in applications of space technologies in disaster management and emergency responses given to officials from developing countries should consider using open-source software, since developing countries often did not have large enough budgets to acquire and maintain commercial software.

81. Massive open online courses were a great way to involve large numbers of disaster managers in the process of generating awareness of the usefulness of Earth observation technologies for disaster management. The idea of integrating the experience accumulated by UN-SPIDER through its technical advisory missions into mass open online courses would add a great amount of value to the capacity-building effort. Such massive open online courses should be less academic and more practice-oriented.

82. Massive open online courses, if launched, should be based on the practical needs of the organizations involved in disaster risk reduction and emergency responses. The regional centres and regional support offices could be partners in such an initiative.

83. The Sendai Framework addressed the importance of integrating emerging technologies into existing operational disaster management systems to improve disaster management. Global navigation satellite systems, with their precise time, location and navigation services, could be combined with remote-sensing capabilities, geographic information systems and communication technologies to strengthen the reporting of disaster information, which is then used to direct emergency rescue efforts. Emerging technologies such as location-based services needed to be included in capacity-building efforts to keep pace with the development of science and technology.

84. The BeiDou Navigation Satellite System, constructed and operated by China, will serve customers globally starting in 2020. Currently, BeiDou is fully functional in its main service area, which covers China and most of the countries in Asia and the Pacific. China has already integrated BeiDou into its domestic disaster management platform and is willing to share its experience with other countries in Asia and the Pacific to improve regional capacity in disaster management and emergency responses.

V. Conclusion

85. Based on the feedback received from the participants, the Conference was successful in providing insight into the role of Earth observation technology in implementing the Sendai Framework.

86. The Conference focused on identifying issues related to understanding disaster risk (priority 1 of the Sendai Framework), enhancing disaster preparedness for effective response and to build back better in recovery, rehabilitation and reconstruction (priority 4 of the Framework). It also covered important areas such as public-private partnerships and empowering the communities prominently mentioned in the Sendai Framework.

87. The observations and recommendations formulated at the Conference were valuable inputs for the further consolidation of Earth observation technology in the implementation of the Sendai Framework, for the development of the knowledge base of the UN-SPIDER programme and for the UN-SPIDER contribution to the preparations made by the Office for Outer Space Affairs for its 2018 "UNISPACE+50" thematic cycle. Increasing the impact of the programmes and activities of the Office for Outer Space Affairs could be achieved by, among other means, assisting nations in reaching their goals on disaster risk reduction and sustainable development.