United Nations A/AC.105/1250

General Assembly

Distr.: General
1 December 2021

Original: English

Committee on the Peaceful Uses of Outer Space

Report on activities carried out in 2021 in the framework of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response

I. Introduction

1. In its resolution 61/110, the General Assembly decided to establish a programme within the United Nations to provide universal access to 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 by being a gateway to space information for disaster management support, serving as a bridge to connect the disaster management and space communities and being a facilitator of capacity-building and institutional strengthening, in particular for developing countries.

2. At its fiftieth session, the Committee on the Peaceful Uses of Outer Space agreed that progress reports on the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) and its future workplans should be considered by the Scientific and Technical Subcommittee under a regular agenda item on space-system-based disaster management support.

3. As part of the responsibility of the Office for Outer Space Affairs of the Secretariat for promoting international cooperation in the peaceful uses of outer space, UN-SPIDER fosters knowledge management, builds bridges between providers of space-based information and users of services in the disaster risk management and emergency response communities, and provides technical advisory support to Member States.

4. The 26 regional support offices[1] of UN-SPIDER are hosted by national and regional organizations with relevant expertise. The regional support offices provide regional coverage of UN-SPIDER activities from institutions specialized in Earth observation, disaster management, disaster risk reduction and emergency response.

5. The regional support offices also contribute to UN-SPIDER international conferences, capacity-building programmes and technical advisory and institutional strengthening missions. They also provide content to the UN-SPIDER knowledge portal.

[1] In 2021, one new regional support office was added to the network. Further information is available at www.un-spider.org/network/regional-support-offices.

6. The present report contains a summary of activities carried out under the UN-SPIDER programme in 2021.

II. Activities carried out in 2021

7. The work carried out by UN-SPIDER in 2021 was implemented with the resources allocated through the regular budget of the United Nations and with voluntary and in-kind contributions from Member States and collaborating entities. Most activities were carried out in a virtual format owing to the continued manifestation of the coronavirus disease (COVID-19) pandemic.

8. A virtual meeting of the UN-SPIDER regional support offices was held on 12 and 13 October 2021. The meeting served as an opportunity to introduce a new regional support office, to provide updates on ongoing and upcoming activities and to discuss thematic issues.

9. As part of its technical advisory support activities (see sect. A below), UN-SPIDER provided virtual support to several countries in Africa, Asia and Latin America. The programme also provided short-term consultancy resources to carry out activities at the national level in Mongolia and Sri Lanka.

10. The outreach activities carried out by UN-SPIDER (see sect. B below) included virtual workshops, conferences, regional expert meetings, webinars, training courses, and side events. UN-SPIDER also contributed to various outreach activities conducted by its partners.

11. The programme supported emergency response efforts in several countries and promoted the universal access initiative of the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters (also referred to as the “International Charter on Space and Major Disasters”).

12. The programme supported the activation of the International Charter on Space and Major Disasters following floods triggered by Cyclone Burevi in Sri Lanka and tropical storm Shaheen in Oman. The Charter was also activated after an earthquake in Indonesia.

13. In addition, UN-SPIDER generated tailor-made space-based information for national disaster management agencies in countries that experienced floods (Malawi and Namibia), and droughts (Malawi, Namibia and Paraguay). Information on those activities is presented in section D.

A. Technical advisory support

14. Owing to the continued COVID-19 pandemic, technical advisory support was provided in virtual fashion to several countries, including Guatemala, Malawi, Mexico, Mozambique, Namibia, Nigeria and Oman. Advisory support was also provided through the use of local consultants in the case of Mongolia and Sri Lanka.

15. UN-SPIDER provided virtual advisory support during March and April to the National Coordinating Agency for Disaster Risk Reduction of Guatemala following the eruption of the Pacaya volcano. As part of that support, the National Space Commission of Argentina, in its role as a UN-SPIDER regional support office, donated satellite imagery from its SAOCOM 1 satellite to contribute to tracking the active lava flows.

16. In the period from January to May, UN-SPIDER held several virtual teleconferences with staff of the National Space Research and Development Agency and the National Emergency Management Agency of Nigeria and the Nigerian Hydrological Services Agency to continue discussions on ways to address the challenges posed by floods. As part of those discussions, it was agreed that a national

expert meeting would be organized with those institutions. The meeting was held from 13 to 15 April 2021. More information on the meeting is presented in section B.

17. In recent years, Southern Africa has been experiencing more frequent and intense droughts that impact rural communities. In order to raise awareness regarding the use of UN-SPIDER recommended practices, more than 490 maps of the standard vegetation index were created for Namibia, covering the period from April 2000 to June 2021. The maps were created by the Centre for Remote Sensing of Land Surfaces (ZFL) of the University of Bonn in its role as a UN-SPIDER regional support office in the period from June to August. In addition, a map of areas flooded in Namibia in April 2020 was developed. The maps were presented to the Acting Director of the National Directorate of Disaster Risk Management of Namibia.

18. In Malawi, in order to raise awareness regarding the use of UN-SPIDER recommended practices, more than 490 maps of the standard vegetation index were created in July, covering the period from April 2000 to June 2021. Those maps were also created by ZFL. In addition, a map of areas flooded in March 2019 was developed. The maps were presented to the Department of Disaster Management Affairs of Malawi and to the Office of the United Nations Resident Coordinator in Malawi.

19. In 2021 Paraguay has been experiencing severe agricultural and hydrological droughts, which have contributed to severe forest fires. At the request of the Paraguayan Space Agency, in October ZFL prepared more than 490 maps of the standard vegetation index covering the period from April 2000 to June 2021. These maps were provided to the Agency for subsequent use.

20. UN-SPIDER has been a supporting Mongolia since it undertook a technical advisory mission in 2014. Following the emergence of the COVID-19 pandemic, UN-SPIDER offered the National Emergency Management Agency the services of a national consultant in order to facilitate the use of space-based information in disaster management. Such support was offered for five months in 2020 and for four months in 2021.

21. During the period, three capacity-building programmes were carried out with officials from various stakeholder agencies and provincial offices of the National Emergency Management Agency. The national consultant supported the strengthening of the Platform for Real-time Impact and Situation Monitoring, which was developed by the World Food Programme and the Agency. The consultant also assisted the Agency in undertaking the training programme that was a prerequisite for becoming an authorized user of the International Charter on Space and Major Disasters.

22. UN-SPIDER has been supporting Sri Lanka since its technical advisory mission in 2011. In 2020, UN-SPIDER offered the Disaster Management Centre of Sri Lanka the services of a national consultant for five months, and those services were continued in 2021, from September to December. The consultant organized the data collected from various stakeholders to demonstrate its utility in the monitoring of targets under the Sendai Framework for Disaster Risk Reduction 2015–2030.

23. Support was also offered to establish approaches for monitoring forest fires and burn severity mapping and drought monitoring. The systems were developed using open-source satellite images and software tools.

24. UN-SPIDER facilitated the nomination of two officers from the Disaster Management Centre of Sri Lanka to undertake a nine-month postgraduate diploma course in remote sensing and geographic information systems at the Centre for Space, Science and Technology Education in Asia and the Pacific.

25. An introductory meeting to support Afghanistan was carried out on 26 January 2021 under the auspices of the Office of the State Ministry for Disaster Management and Humanitarian Affairs. The meeting focused on understanding policy, institutional coordination, current capacity and supportive legislation related to the use of geospatial information for disaster preparedness, early warning, response and

recovery. The information captured during the meeting was used for identifying priorities that resulted in offering advocacy on drought monitoring in Afghanistan in the period from January to May.

26. On 21 May 2021, the Office of the State Ministry for Disaster Management and Humanitarian Affairs and UN-SPIDER conducted a virtual thematic meeting with key stakeholder agencies on the theme "Assessing drought and water resource conservation using Earth observation". The meeting was conducted in collaboration with two regional support offices of UN-SPIDER, namely, Delta State University and the Intentional Water Management Institute.

27. An introductory meeting was carried out on 29 September 2021 with the Philippine Space Agency to provide a briefing on services offered by the UN-SPIDER programme. The meeting was useful in establishing a coordination mechanism with the Agency and discussing the possibility of conducting a technical advisory mission in 2022 and hosting a few online meetings prior to the technical advisory mission.

28. A virtual meeting was held in August 2021 with representatives of Azercosmos to explain the support and services offered by UN-SPIDER and discuss the possibility of conducting a UN-SPIDER technical advisory mission in 2022.

29. An online training course on space technology for building disaster resilience to water scarcity, organized jointly with the Asia Pacific Space Cooperation Organisation, was held from 11 to 15 October. It was attended by more than 60 participants from 11 countries, namely, Bangladesh, Indonesia, Iran (Islamic Republic of), Iraq, Jordan, Mexico, Mongolia, Pakistan, the Sudan, Thailand and Turkey. The course was repeated from 18 to 22 October to suit the time zones in Latin America. Experts from the Office for Outer Space Affairs, the National Disaster Reduction Centre of China and three regional support offices of UN-SPIDER (the International Water Management Institute, Ben Gurion University of the Negev and Delta State University) delivered the technical sessions.

30. To continue strengthening the capacity of the General Directorate for Civil Protection of the Niger to use space-based information to respond to floods in the country, and at the request of the Director of the National Civil Protection Directorate of the Niger, UN-SPIDER carried out a second online training course on flood mapping with Sentinel-1 radar imagery in Google Earth Engine. A total of 36 participants from the Directorate, the National Civil Protection Academy and other government agencies, as well as from the Office of the United Nations Resident Coordinator, took part in the training course, which was held on 11 and 12 August.

31. Training participants were introduced to the basic principles of radar remote sensing, learned to use the relevant recommended practices, explored the process with selected case studies and presented the results in geographic information systems as flood maps.

32. Phase II of the massive open online course "Geospatial applications for disaster risk management" took place from 1 June to 30 November, in collaboration with the Centre for Space Science and Technology Education in Asia and the Pacific, based in India. The course provided free and flexible online training to enhance capabilities related to the use of geospatial and Earth observation technologies in disaster risk management.

33. Phase II is an enhanced version of Phase I, which was launched in 2020 and offered a much-needed learning tool during the challenging times of the COVID-19 outbreak. It received an overwhelming response from 29,727 participants from 104 countries. Phase II saw the participation of 6,328 persons from 122 countries.

34. From 30 November to 2 December 2021, UN-SPIDER joined forces with the Central American Coordination Centre for Natural Disaster Prevention and with the International Charter on Space and Major Disasters to carry out a training course on the procedures employed by project managers in case of activation of the International Charter.

35. The training course, carried out in Guatemala City, allowed participants to understand the procedures that the International Charter employs during activation and the rules that project managers and value-adding providers must follow when carrying out their tasks. In addition, participants were trained on the use of the UN-SPIDER recommended practice for rapid flood mapping using Sentinel 1 radar imagery. The training course was also used to establish a regional remote sensing team that will support the Centre and national disaster management agencies in the countries of the region in mapping efforts in case of disasters.

36. The Centre mobilized 17 participants from Central American countries and the Dominican Republic. UN-SPIDER mobilized trainers from the National Space Research Institute of Brazil and the National Space Commission of Argentina as members of the International Charter, an expert from the Federal University of Santa Maria, Brazil, in its role as a UN-SPIDER Regional Support Office, and two professionals from the National Disaster Prevention Centre of Mexico.

B. Outreach and networking activities

37. The present section covers: (a) events organized or co-organized under the UN-SPIDER programme; and (b) contributions to events organized by various partner organizations.

1. Events organized or co-organized under the UN-SPIDER programme

Regional workshop: “Enhancing preparedness for climate-related disasters using space-based technologies”, 17 February 2021

38. The workshop was carried out jointly by UN-SPIDER and the South Asian Association for Regional Cooperation (SAARC) Disaster Management Centre (Interim Unit) in collaboration with the International Water Management Institute of Sri Lanka and the Centre for Space Science and Technology Education in Asia and the Pacific. It was attended by about 50 experts from SAARC member States.

39. The workshop included training and simulation exercises to support the efforts of the countries of the region to make effective utilization of space-based information for providing early warning and risk information, which also contributes to achieving the targets of the Sendai Framework. This joint effort allowed the participants to identify risk areas, access flood- and cyclone-related early warning information, use emergency response mechanisms, such as the International Charter on Space and Major Disasters and Sentinel Asia, and prepare the products needed for supporting emergencies.

National virtual expert meeting: “Space-based solutions for disaster risk management and emergency response in Nigeria”, 13 to 15 April 2021

40. UN-SPIDER, ZFL, the National Space Research and Development Agency and the National Emergency Management Agency of Nigeria and the Nigerian Hydrological Services Agency co-organized a national expert meeting on space-based solutions for disaster risk management and emergency response in Nigeria. The expert meeting was held virtually from 13 to 15 April 2021 and contributed to the efforts carried out by UN-SPIDER and the National Space Research and Development Agency.

41. Nearly 120 people from institutions in Nigeria, elsewhere in Africa and Europe registered for the meeting, representing government agencies, private companies, universities and regional and international organizations. More than 80 of those attended the meeting, which was structured in three sessions that included presentations by different institutions and discussions that allowed the audience to identify challenges and recommendations that need to be addressed regarding flood management in Nigeria.

42. The virtual expert meeting also included a technical segment at which staff from UN-SPIDER presented information on step-by-step procedures that have been developed by UN-SPIDER to process satellite imagery to generate relevant space-based information for flood management. Presentations, recordings and additional information on this virtual expert meeting are available at: https://un-spider.org/news-and-events/events/un-spider-expert-meeting-space-based-solutions-Nigeria.

Online workshop: "Drought monitoring and management using Earth observation and weather forecast data", 7 July 2021

43. Since droughts occur frequently in South Asia, the workshop on drought monitoring and management using Earth observation and weather forecast data was carried out jointly by UN-SPIDER and the SAARC Disaster Management Centre (Interim Unit) in collaboration with the International Water Management Institute of Sri Lanka. More than 50 senior officials from SAARC member States attended the workshop.

44. The workshop discussed advances in Earth observation and weather forecast data and approaches and tools to help to achieve drought resilience in the SAARC member States. The event highlighted various global and regional platforms and related tools for drought monitoring and early warning to guide policymakers in planning timely drought management measures.

UN-SPIDER virtual regional expert meeting: "Space-based solutions for risk and disaster management in Southern Africa", 13 to 15 July 2021

45. UN-SPIDER and ZFL co-organized a virtual regional expert meeting with a focus on Southern African countries. The meeting addressed the role of satellite technologies and novel applications developed by the space community to respond to challenges posed by natural hazards.

46. Nearly 120 people from many institutions registered for the conference, representing national disaster management agencies, space agencies, other government agencies, universities, private companies and regional and international organizations. Participants from the following countries attended the meeting: Algeria, Brazil, Eswatini, Germany, Greece, Israel, Italy, Kenya, Malawi, Mexico, Mozambique, Namibia, Nigeria, Romania, Rwanda, South Africa, Uganda, the United States of America and Zimbabwe. Experts from several UN-SPIDER regional support offices also participated (Algeria, Brazil, Germany, Greece, Israel, Kenya, Nigeria and Romania).

47. The virtual expert meeting comprised three sessions. The first session allowed UN-SPIDER and ZFL to set the scene, and national disaster management agencies of Southern African countries, the Regional Centre for Mapping of Resources for Development, UN-SPIDER and ZFL provided information to the participants about their activities. The second session was used by other institutions of Southern African countries to present information on their activities, and included a presentation on the Copernicus Emergency Mapping Service and a presentation by the German Aerospace Centre. The third session allowed institutions from the space community to present information on services, tools and products developed by the space community to support disaster management efforts. The International Charter on Space and Major Disasters was also invited to make a presentation at the session. The virtual expert meeting also included technical sessions in the afternoons at which experts from the Copernicus programme made presentations on the Copernicus Global Flood Awareness System, the Wildfire Information System and the Global Drought Observatory. Experts from the UN-SPIDER regional support offices also presented several UN-SPIDER recommended practices.

United Nations/Islamic Republic of Iran workshop on space technology applications for drought, flood and water resource management, 9–11 August 2021

48. The workshop, hosted by the Iranian Space Agency, was conducted as an online event. Earth observation technologies are crucial to managing and monitoring water resources and water-related disasters such as floods and droughts, which increasingly affect agricultural production and food security.

49. In this regard, the workshop focused on drought, floods and water resource management, key areas that benefit significantly from space-related technology and contributed to the most recent and significant initiative of the Secretary-General of United Nations, the Food Systems Summit, and the decade of action to deliver the Sustainable Development Goals.

50. A total of 378 participants, including 112 women, from 64 countries registered for the workshop. Of those registered, some may have attended the workshop in part. The report of the conference is available in all of the official languages of the United Nations at the following link: http://unoosa.org/oosa/oosadoc/data/documents/2021/aac.105/aac.1051253_0.html.

Seventh Planetary Defense Conference, 26 to 30 April 2021

51. The seventh Planetary Defense Conference, conducted by the International Academy of Astronautics and hosted by the Office for Outer Space Affairs in cooperation with the European Space Agency, included a scenario exercise of a hypothetical near-Earth object impact event, allowing practitioners across the field of planetary defence to discuss what it would take to respond.

52. UN-SPIDER brought together disaster response and management professionals to participate in a series of panels to provide critical feedback and perspective on the unfolding crisis scenario. The exercise used a hypothetical but realistic asteroid threat scenario to illustrate how such a short-warning threat might evolve over the span of the four-day conference.

53. This scenario utilized at the Conference was a cautionary tale. It indicated that there is a need to prepare now for what might come in the future, because even with advance notice, time to prepare may be limited. The scenario showed that planetary defence is, indeed, a global endeavour. The constant engagement of the planetary defence community and the disaster preparedness and response community is essential in order to keep the world safe from potential disasters due to a near-Earth impact. The outcome of the exercise will be published in the form of a paper in a research journal.

UN-SPIDER/ZFL Bonn International Conference: “Space-based solutions for disaster management in Africa: networks and information technologies in times of crisis”, 16 to 18 November 2021

54. UN-SPIDER and ZFL held the Bonn International Conference on the theme “Space-based solutions for disaster management in Africa: networks and information technologies in times of crisis” from 16 to 18 November 2021. The conference, which was held virtually, included 30 presentations and one panel discussion. It addressed the use of space technologies to address the challenges posed by floods, droughts and forest fires. The conference also included a dedicated session on innovative tools developed by the academic community, the private sector and UN-SPIDER.

55. A total of 225 people registered for the conference: 70 were women, 154 were men and one preferred not to say. Participants represented 81 institutions from Afghanistan, Algeria, Austria, Bangladesh, Bolivia (Plurinational State of), Brazil, Chile, Ethiopia, France, Germany, Ghana, the Gambia, Greece, India, Italy, Kenya, Malawi, Malaysia, Mozambique, the Niger, Nigeria, Rwanda, South Africa, Tunisia, the United Kingdom of Great Britain and Northern Ireland, the United States, Venezuela (Bolivarian Republic of), Zimbabwe and the United Nations. The

conference benefited from the participation of experts from the United Nations Convention to Combat Desertification, the Food and Agriculture Organization of the United Nations (FAO), the United Nations University Institute for Environment and Human Security, the African Union Commission and other regional and international organizations. UN-SPIDER regional support offices from Algeria, Germany, Greece and Sri Lanka contributed to the conference, making presentations on various topics.

56. Participants reiterated the need to continue awareness-raising efforts regarding novel technologies and tools developed by the space community, capacity-building efforts, including in the format of training the trainers, and the organization of simulations for disaster management agencies to identify how to use such innovative technologies and tools.

UN-SPIDER virtual regional expert meeting for Latin America and the Caribbean on the theme “Space-based solutions for disaster risk reduction and emergency response in Latin America”, 23 to 25 November 2021

57. UN-SPIDER, the Central American Coordination Centre for Natural Disaster Prevention, four regional support offices (Argentina, Brazil, Colombia and Mexico) and the National Aeronautics and Space Administration of the United States co-organized a virtual regional expert meeting to address how satellite technologies and novel applications developed by the space community contribute to confronting the challenges posed by natural hazards in Latin America and the Caribbean. A total of 196 people registered to participate in the event, 69 women and 127 men. They represented nearly 100 disaster management agencies, space agencies, other government agencies, non-governmental organizations, universities, private companies, United Nations entities and experts from the Regional Centre for Space Science and Technology Education for Latin America and the Caribbean.

58. The meeting was attended by participants from Argentina, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Italy, Mexico, Paraguay, Peru and the United States. It benefited from the participation of experts from FAO, the United Nations Development Programme and the United Nations Human Settlements Programme (UN-HABITAT).

59. Participants agreed on the need to continue taking note of advances made by Latin American institutions in the use of space technologies and in the establishment of a regional technical group of professionals to contribute to disaster response efforts. They suggested organizing quarterly virtual meetings to continue awareness-raising efforts, to exchange lessons learned on the use of space technologies and to continue facilitating synergies between the space and the disaster management communities.

Three global meetings of UN-SPIDER regional support offices

60. Following the recommendation of the tenth annual regional support office meeting in November 2020, UN-SPIDER organized more frequent meetings between the offices. In 2021, three virtual meetings were held. On 28 January, 14 regional support offices discussed the coordination of UN-SPIDER workplans and collaborative activities. The results were presented through a survey on the capacities of the offices to identify possible cooperative activities and knowledge gaps. In March 2021, a thematic meeting was held at which seven RSOs discussed the use of Earth observation techniques to monitor locust infestation. The annual meeting, held on 12 and 13 October 2021, was attended by 15 regional support offices. One new regional support office was introduced, and updates were given on ongoing and upcoming activities. Discussions were held about new ways to conduct capacity-building activities, including eLearning, and the activities for the rest of 2021 and for 2022.

2. Organization of or contributions to other initiatives, events and webinars

61. UN-SPIDER made the following contributions to events organized at the initiative of various partner organizations:

(a) International Space University Adelaide Conference 2021, 5 and 6 February 2021;

(b) Meeting of Heads of National Disaster Management Agencies of Members States of the Central American Coordination Centre for Natural Disaster Prevention, Guatemala City, 9 and 10 February 2021;

(c) 2021 Pacific Islands Geographic Information System and Remote Sensing User Intermediate Conference, 23 and 24 February 2021;

(d) Online short course, “Space technology for disaster management”, organized by the Centre for Space, Science and Technology Education in Asia and the Pacific, 19 to 30 April 2021;

(e) Seventh International Academy of Astronautics Planetary Defense Conference, 26 to 30 April 2021;

(f) First National Commission for Aerospace Research and Development webinar on the use of satellite technology for research on disaster risk management, Quito, 29 April 2021;

(g) Training on remote sensing and geospatial technology for reconstruction monitoring, organized by the Asian Institute of Technology for stakeholders in Indonesia, 24 to 28 May 2021;

(h) Committee on Earth Observation Satellites working group on capacity-building (Earth Observation Training, Education and Capacity Development Network Asia-Pacific), coordination meeting to plan the regional meeting, 14 June 2021;

(i) Role of higher education on intervention strategies adopted in mitigation and management of disasters in the context of recent technological developments, organized by the Indian Universities and Institutions Network on Disaster Risk Reduction and National Institute of Disaster Management, 17 August 2021;

(j) Fifth World Congress on Disaster Management, on the theme “Technology, finance, capacity for building resilience to disasters”, with special focus on pandemics”, organized by the Government of India, 24 to 27 November 2021;

(k) Webinar on information and communication technologies for early warning systems for disaster risk reduction, organized by the National Institute of Disaster Management of India on World Meteorological Day, 23 March 2021;

(l) Training programme, “Climate change and disaster management”, Ben Gurion University of the Negev, Israel, 11 May 2021;

(m) Virtual training programme on weather-based agrometeorology advisory services through information and communications technology, organized by the Indian Council of Agricultural Research, 13 August 2021;

(n) Introduction to UN-SPIDER and basic principles and applications of remote sensing at the International Joint Conferences on Artificial Intelligence Organization: talk on how to use and manipulate space data to tackle problems in the community relating to the targeting of young girls, and the use of artificial intelligence and space-based imagery, 23 August 2021;

(o) High-level policy dialogue: “Localizing climate resilience agenda: vision 2050 and 2100”, organized by the National Institute of Disaster Management of India, 3 September 2021;

(p) Fifth global summit of Global Alliance of Disaster Research Institutes, 1 September 2021;

(q) United Nations/Austria Symposium 2021 on the theme “Space applications for food systems”, 7 to 9 September 2021;

(r) Korea Aerospace Research Institute International Space Training, 6 to 10 September 2021;

(s) Virtual Asia-Pacific Economic Cooperation and Emergency Preparedness Working Group workshop, “From new normal to better normal: better risk monitoring and assessment for a risk-informed regional economic integration”, hosted by China, 23 and 24 September 2021;

(t) Webinar on science and Sustainable Development Goals 14 and 15, “Life below water and life on land”, convened by LifeWatch ERIC, 1 October 2021;

(u) Webinar on research and innovation: “The road from UNFSS to COP26”, organized by the International Water Management Institute, 7 October 2021;

(v) GEOINT 2021 (in-person event), organized by the United States Geospatial Intelligence Foundation, 5 to 8 October 2021;

(w) Technical session on the twenty-first anniversary of the Disaster Charter: “History, status and future of this powerful and productive international cooperation”, held as one of the sessions of the seventy-second International Astronautical Congress, Dubai, 25 to 29 October 2021;

(x) “Cosmic sandbox”, Asia-Pacific Oceania Space Association: a side event at the Asia-Pacific Regional Space Agency Forum, 13 November 2021;

(y) Pre-Conference webinar of the fifth World Congress on Disaster Management: “Climate-induced economic inequality and disaster management”, Central University of Tamil Nadu, Thiruvarur, India, and University of Central Lancashire, United Kingdom, 17 November 2021;

(z) Plenary session organized by the Economic and Social Commission for Asia and the Pacific on COVID-19 on lessons for early warning, prevention, preparedness and response (virtual), 25 November 2021;

(aa) A hands-on training session on flood and forest fire monitoring for young aspiring disaster management professionals, co-organized with the Copernicus capacity-strengthening team in cooperation with the Central European University, reaching some 62 participants.

C. Knowledge management

62. Knowledge management is at the core of UN-SPIDER activities. By systematically and continuously compiling the knowledge and available resources held by individuals and institutions, UN-SPIDER aims to transfer lessons learned, highlight innovations and foster collaborative practices. The communities involved in the field of work of UN-SPIDER include many different actors: disaster responders, disaster risk specialists, policymakers, remote sensing experts, space technology providers, academics and researchers.

1. Knowledge portal

63. The UN-SPIDER knowledge portal (www.un-spider.org) is one of the cornerstones of the programme as it hosts information on all activities conducted by the programme as well as by the disaster management, emergency response and space communities. The number of visitors to the portal has continually increased since it was launched. In 2021, the average number of monthly visits to the knowledge portal increased by more than 10 per cent, from 40,000 to approximately 45,000. By the end of 2021, there were more than 9,000 content items.

64. During the first half of the year, efforts were carried out to change the layout of the knowledge portal to adjust it to the guidelines of the Office for Information and

Communications Technologies. The updated version of the portal was launched in July 2021. In addition, the content management system used to host the portal was updated to the newest version (Drupal version 9).

65. The programme developed procedures to enhance the use of services developed by the space community, including a dedicated procedure to use the Global Wildfire Information System (GWIS) to generate data for an ad hoc indicator to present information on the efforts of Member States to reduce the impacts of fires on forests.

66. Efforts were made to incorporate additional content in the Spanish and French versions of the knowledge portal. As a result, the number of visits to the Spanish version site continued to increase substantially compared with previous years.

67. UN-SPIDER has also improved the links on the knowledge portal to the activities of the regional support offices and the hazards they address.

2. Use of cloud-based solutions

68. Given the limited information on technology resources of civil protection agencies, as observed during technical advisory support activities, UN-SPIDER increased the use of cloud-based geographic information system solutions. Examples include the use of online systems such as Google Earth Engine in recommended practices and the promotion of web-based systems during technical advisory support and outreach activities.

69. UN-SPIDER makes regular use of the Copernicus Data and Exploitation Platform developed by the German Aerospace Centre. The platform offers access to remote sensing data and cloud computing resources, which UN-SPIDER has been using to process remote sensing data in order to support Member States during emergencies.

3. Publications

70. UN-SPIDER provided input for the following papers and publications:

(a) “Can space-based technologies help manage and prevent pandemics?”, published in *Nature Medicine*, vol. 27, September 2021 (www.nature.com/naturemedicine). The paper was an outcome of the participation of UN-SPIDER in supporting the space and pandemic project of the International Space University, which focused on how space can help in monitoring and mitigating the COVID-19 pandemic and preparing for and preventing future pandemics;

(b) “Travelling through space and time: remote sensing of natural world heritage sites”, *World Heritage* No. 98, “Monitoring world heritage from space” (UNESCO publication);

(c) “When it strikes, are we ready? Lessons identified in preparing for a near-Earth object impact scenario”, a paper communicated to the *International Journal of Disaster Risk Science.* The paper was an outcome of the seventh Planetary Defense Conference, held by the International Academy of Astronautics, which included a scenario exercise of a hypothetical near-Earth object impact event. The paper argued that the constant engagement of the planetary defence and disaster preparedness and response communities is essential in order to keep the world safe from potential disasters due to such an impact.

71. UN-SPIDER has been contributing, with the United Nations Office for Disaster Risk Reduction, the World Meteorological Organization and several institutions that are members of the International Network on Multi-Hazard Early Warning Systems on the development of a flagship publication *Words into Action: Guide for Multi-Hazard Early Warning Systems*. The publication will be launched on World Disaster Risk Reduction Day in October 2022.

D. Support for emergencies

72. As part of its activities, UN-SPIDER facilitated the activation of the International Charter on Space and Major Disasters as a result of the following:

(a) Floods in Sri Lanka due to Cyclone Burevi;

(b) Earthquake in Indonesia;

(c) Floods in Oman due to tropical storm Shaheen.

Raising awareness of the International Charter on Space and Major Disasters

73. Cooperation between the International Charter and the Office for Outer Space Affairs was highlighted and detailed in statements and presentations at several international events and conferences during the reporting period. Every opportunity was taken by the Office to raise awareness of the opportunities offered by the International Charter, in particular its universal access initiative.

74. UN-SPIDER included specific presentations by the International Charter at the Bonn International Conference on the theme "Space-based solutions for disaster management in Africa: networks and information technologies in times of crisis".

75. UN-SPIDER has been working with relevant institutions in Bangladesh, Honduras, the Gambia, Solomon Islands, Mexico, Mozambique, Nicaragua, the Niger, Viet Nam, Panama and Zimbabwe to support them in becoming authorized users of the International Charter.

76. In 2021, the International Charter incorporated the national disaster management agencies of Armenia, the Gambia, Mexico, Mongolia and South Africa as authorized users.

Raising awareness of the Copernicus Emergency Mapping Service and of other related services

77. The Copernicus Emergency Mapping Service was also highlighted in statements and presentations at international events and missions during the reporting period, including at the UN-SPIDER ZFL regional virtual expert meeting for Southern Africa on the theme "Space-based solutions for disaster risk management and emergency response", held from 13 to 15 July 2021; and during the UN-SPIDER Bonn International Conference on the theme "Space-based solutions for disaster management in Africa: networks and information technologies in times of crisis".

78. Furthermore, UN-SPIDER launched a Flood Guide project with Copernicus, Airbus Defence and Space, ZFL, the national disaster management agencies of Ghana, Guatemala, Nigeria, Peru and South Africa; space agencies from Nigeria, Peru and South Africa; and other institutions from Nigeria and Guatemala. The aim of the project is to use the information generated in the Global Flood Awareness System (GLOFAS) of the Copernicus programme, in combination with in situ historical data on impacts of floods in those five countries to improve flood early warning systems through the incorporation of impact-based forecasts. More information on this project is available at www.un-spider.org/projects/Flood%20GUIDE.

79. In addition, UN-SPIDER developed and launched a procedure to use the Global Wildfire Information System of the Copernicus programme for national focal points of the Sendai Framework Monitor to report on the number of hectares of forests damaged or destroyed by fire in reference to target C of the Sendai Framework.

80. The procedure uses the country data generated by GWIS to calculate a benchmark for the decade between 2005 and 2015 and then compares the number of hectares burned annually from 2015 onwards with respect to that benchmark. The procedure is available at www.un-spider.org/advisory-support/practical-uses/Sendai-Framework-Ad-hoc-indicator-C-2Fo-Intro.

III. Voluntary contributions

81. In its resolution 74/82, the General Assembly encouraged Members States, on a voluntary basis, to provide UN-SPIDER with the additional resources necessary to address the increasing demand for support successfully and in a timely manner. Since its establishment, the programme has benefited from voluntary contributions (cash and in kind) from the following Governments: Austria, China, Croatia, Czechia, Germany, France, Indonesia, Republic of Korea, Switzerland and Turkey.

82. The successful implementation of activities in 2021 benefited from the support and voluntary contributions received from the following Governments and entities:

(a) The Government of China contributed 1,100,000 yuan in 2020, which was utilized to support the activities of the UN-SPIDER office in Beijing in 2021;

(b) The University of Bonn in Germany contributed 101,474 euros towards the conduct of activities by the UN-SPIDER office in Bonn between June 2021 and June 2022. Within the scope of the cooperation agreement between the University of Bonn and the UN-SPIDER office in Bonn, UN-SPIDER will plan and implement international conferences and expert meetings, undertake knowledge management efforts and provide technical advisory support to Member States, with a focus on Africa;

(c) The Government of France sponsored the services of a Junior Professional Officer;

(d) The Government of Germany contributed the services of an Associate Expert on a non-reimbursable loan basis.

83. In-kind contributions made by members of the network of regional support offices have been acknowledged in the present report. Memorandums of understanding were renewed with five regional support offices. One new organization became a regional support office: the National Centre of Space Research and Technology in Kazakhstan.

84. Amid the COVID-19 pandemic, several organizations and partners contributed to virtual events organized by UN-SPIDER.

IV. Conclusions

85. UN-SPIDER is systematically working to achieve its mission by being a gateway to space information for disaster management support, serving as a bridge between the disaster management, risk management and space communities and being a facilitator of capacity-building and institutional strengthening, particularly for developing countries.

86. In 2021, because of the global pandemic, UN-SPIDER carried out all of its activities in a virtual format, delivering technical advisory support, institutional strengthening and capacity-building programmes that included webinars, virtual conferences and a massive open online course that benefited a large number of participants, revealing the power of virtual technologies.

87. Although the travel restrictions imposed as a result of COVID-19 meant that UN-SPIDER was unable to deploy institutional strengthening missions to the countries that it was expected to support, it continued to provide local support to disaster management agencies in a few countries by hiring national experts on a temporary basis with a view to matching the services provided by the short-term institutional strengthening missions carried out in previous years.