United Nations A/AC.105/1253

General Assembly

Distr.: General
27 September 2021

Original: English

Committee on the Peaceful Uses of Outer Space

Report on the United Nations/Islamic Republic of Iran Workshop on Space Technology Applications for Drought, Flood and Water Resource Management

(Online, 9 to 11 August 2021)

I. Introduction

1. The Office for Outer Space Affairs of the Secretariat and the Government of the Islamic Republic of Iran, through the Iranian Space Agency, jointly organized the United Nations/Islamic Republic of Iran Workshop on Space Technology Applications for Drought, Flood and Water Resource Management.

2. Owing to the coronavirus disease (COVID-19) pandemic, the Workshop was held online from 9 to 11 August 2021.

3. The present report contains a description of the background, objectives and programme of the Workshop and provides a summary of the observations and recommendations made by the participants.

A. Background and objectives

4. The *Global Assessment Report on Disaster Risk Reduction: Special Report on Drought 2021* explores the systemic nature of drought and its impacts on the achievement of the Sendai Framework for Disaster Risk Reduction, the Sustainable Development Goals and the health and well-being of humans and ecosystems. The report showcases that droughts have deep, widespread and underestimated impacts on societies, ecosystems and economies.

5. On the other hand, heavy rainfalls have triggered devastating floods causing dozens of casualties. Thus, in addition to the increasing impacts of droughts, countries are witnessing an ever-growing risk of floods that cause significant loss of life and damage to property.

6. These risks are resulting from dynamic interactions between climate-related hazards and the exposure and vulnerability of the affected human or ecological system to the hazards. Owing to the impact of climate change, the hazards, exposure and vulnerability are matters of uncertainty in terms of magnitude and likelihood of occurrence.

7. Space-based applications, specifically Earth observation, and geospatial data play an important role in supporting disaster risk reduction, response and recovery

efforts by providing accurate and timely information for decision makers. Monitoring floods, drought conditions and water resource environments using satellite remote-sensing technologies has become more essential recently, in particular for developing countries.

8. The Office for Outer Space Affairs, through its United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), ensures that all countries and international and regional organizations have access to and develop the capacity to use all types of space-based information to support the full disaster management cycle. It also helps developing countries to keep pace with rapidly developing space technologies and build capacity for their effective utilization in building disaster resilience.

9. 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.

10. In this regard, the Workshop focused on drought, floods and water resources management, key areas that benefit significantly from space-related technology, and contributed to the most recent and significant initiative of the Secretary-General of the United Nations, the Food Systems Summit, and the decade of action to achieve the Sustainable Development Goals by 2030.

11. The Workshop provided an opportunity to deepen awareness and understanding of the possibilities offered by outer space for monitoring floods, drought conditions and water resource environments.

12. The Office for Outer Space Affairs, together with the Islamic Republic of Iran, offered a platform to promote collaborative research, identify challenges and provide recommendations to enhance regional efforts for disaster management and emergency response.

13. The main objectives of the Workshop were the following:

(a) To introduce the latest applications of space-based technologies to the management of natural resources and the environment, as well as disaster management, in particular for drought, flood and water resources;

(b) To promote greater exchange of experiences on space-based applications projects related to water resources at national and/or regional scales;

(c) To encourage greater cooperation among stakeholders in disaster management and to promote regional partnerships;

(d) To define recommendations and findings for forging partnerships to strengthen and deliver capacity-building on satellite remote sensing and other technologies for disaster risk reduction and management, to be forwarded as a contribution to the Office for Outer Space Affairs.

B. Attendance

14. The Workshop was hosted as an online event owing to travel restrictions resulting from the COVID-19 pandemic.

15. 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 and others in full.

II. Programme

16. The Workshop comprised an opening session with two keynote speeches and six technical sessions. A total of 32 presentations were given during technical sessions on the following topics:

(a) Session 1. National, regional and international initiatives for flood and drought monitoring;

(b) Session 2. Space technology for ecosystem health, drought and flood monitoring, early warning, preparedness and response;

(c) Session 3. Vulnerability mapping and risk analysis of sand and dust storms;

(d) Session 4. Earth observation and environmental modelling for flood and water resources management in the context of global climate change;

(e) Session 5. Geoinformatics applications in water resources management: challenges and opportunities;

(f) Session 6. Advocacy session: institutional strengthening and preparedness for improving disaster management risk assessment.

III. Programme of activities

A. Opening session

17. The opening session emphasized the importance of addressing issues such as drought, flood and water resources management that constituted the theme of the Workshop and acknowledged the importance of space technology for addressing some of the biggest challenges posed by extreme weather events leading to unparalleled heat, droughts, floods, cold and wet conditions in various places.

18. The management of natural and technological disasters in all their phases benefits considerably from space assets through weather forecasting and modelling, early warnings, reliable communication, assessment of damage, facilitation of first-aid delivery or locating those in need.

19. Advanced space technologies make it possible to monitor and analyse soil moisture, atmospheric moisture, area and volume of surface water, water pollution, oxygen content in aquatic ecosystems, changing polar ice cover, rainfall, the amount of snow in the mountains, agricultural water consumption, and so on.

20. Extreme events such as drought, floods, storms, tsunamis, wildfires, and pest and disease outbreaks exact a heavy toll on agriculture. Water-related disasters such as droughts, floods and water scarcity severely impact elements of food systems such as crops, livestock, forestry, fisheries and aquaculture. The Workshop also contributed to the Food System Summit by highlighting the link between disasters and food systems.

21. The Workshop is an attempt to enhance regional cooperation through joint projects and capacity-building programmes aimed at the proper management of water-related disasters and water resources in West Asia and on the global scale through collaboration between the Office for Outer Space Affairs, through its UN-SPIDER programme, and the Iranian Space Agency, which is a regional support office of UN-SPIDER.

B. Technical sessions

1. Session 1. National, regional and international initiatives for flood and drought monitoring

22. The session highlighted the importance of international frameworks, such as the Sendai Framework for Disaster Risk Reduction, in guiding national and regional initiatives for disaster risk reduction and proven methodologies incorporating the use of advanced Earth observation satellites for flood and drought monitoring.

23. The *Global Assessment Report on Disaster Risk Reduction 2019* provided an understanding of systemic risks that are emergent in nature and are a result of a series of past events. Space-based information helps us to understand these systemic risks and provides evidence-based information to influence research, policies and programmes to deal with such risks.

24. Preparedness through monitoring and early warning is an important step towards proactively enhancing disaster resilience among communities. Space-based information supports such efforts since it is successfully used for flood inundation modelling, drought early warning and risk assessment and crop health assessment that provides input to programmes related to crop insurance.

25. Such knowledge products and information services, coupled with institutional coordination and disaster risk governance, are critical for achieving disaster resilience and responding to climate shocks.

26. The session also highlighted the need for consistent efforts to build capacity among stakeholders to use space-based information and promote innovation to empower communities to deal with emerging risks.

2. Session 2. Space technology for ecosystem health, drought and flood monitoring, early warning, preparedness and response

27. Case studies were shared on the use of remote sensing and geospatial technologies in assessing ecosystem health as a nature-based solution to deal with disaster risks, monitoring of drought and flood, early warning, preparedness and response.

28. A variety of Earth observation technologies are used for early warning, including aerial photographs, satellite remote sensing and meteorological satellites. Several national, regional and international initiatives promote the utilization of Earth observation in disaster risk management.

29. Since it is difficult to define clear boundaries between meteorological, agricultural, hydrological and socioeconomic causes of drought, the type of satellite data and indices to be used in a particular case needs to be supported by sound ground-based knowledge.

30. Countries on different continents utilize space technologies in different ways and exploit the potential of Earth observation data to support agricultural drought monitoring. The methodology and indices developed on the basis of satellite remote sensing for drought monitoring remain specific to each region owing to the unique characteristics of land cover, climate and geography.

31. Studies have demonstrated the usefulness of remote sensing to determine agricultural drought and identify farm locations that have been severely impacted by drought. In such cases, the remote-sensing data are used in conjunction with meteorological and other field-based data.

32. The combined use of high- and coarse-resolution satellite images to locate city heat islands was demonstrated, and nature-based solutions were offered that may help to reduce the consumption of electricity and fossil fuels and the emission of greenhouse gases. These interventions may also help to reduce water consumption, thereby making water available for mitigating droughts.

33. Scientific studies were also presented on the use of satellite remote sensing for evapotranspiration estimation and refining hydrological models that are used for water resources assessment and rapid drought early warning systems for near-real-time decision-making.

3. Session 3. Vulnerability mapping and risk analysis of sand and dust storms

34. The session discussed applications of space-based information in vulnerability mapping and risk analysis of sand and dust storms, as well as drought monitoring in dry and sandy areas, which is one of the risks faced by countries in Asia. The session also discussed sand and dust storm impacts on ecosystems, air quality and human health, aviation and ground transportation, agriculture and fishing, energy and industries.

35. Satellite data such as the Modern-Era Retrospective Analysis for Research and Applications, Version 2 (MERRA-2) provide a key input for a broader understanding of climate-related disaster risks such as sand and dust storms. High dust deposition occurs in the Hindu Kush Himalaya mountain range and the Tibetan Plateau, the so-called Third Pole, which provides fresh water to more than 1.3 billion people in Asia. The risk of impacts of sand and dust storms is projected to increase in the 2030s owing to more extreme drought conditions in parts of Afghanistan, western Australia, Iran (Islamic Republic of) and south-eastern Turkey. The study revealed that more than 80 per cent of the entire populations of Iran (Islamic Republic of), Pakistan, Tajikistan, Turkmenistan and Uzbekistan are exposed to medium or high levels of poor air quality.

36. Different types of platforms and technologies, from satellites to unmanned aerial vehicles, are utilized for monitoring the occurrence of severe photosynthetic stress (severe drought, extreme heat, severe nutrient deficiency, severe foliar disease). By utilizing computer-assisted analysis of satellite and drone data, along with the systematic use of knowledge from application domain experts, scientific inputs can be provided for rainwater harvesting, precision irrigation and other measures such as planting crop varieties that have a tolerance to heat stress and drought stress.

4. Session 4. Earth observation and environmental modelling for flood and water resources management in the context of global climate change

37. The session highlighted the importance of methodological tools incorporating satellite data in environmental modelling for flood and water resources management in the context of global climate change.

38. Global warming triggered by global climate change has an impact on precipitation, increasing evapotranspiration and changing of run-off, which affects the water cycle and the Earth's ecosystem. Effective scientific intervention is required for improved observations of the water cycle. The idea of launching an initiative such as a global water cycle observatory was proposed with a view to advancing understanding of the water cycle.

39. The current age offers ample opportunities to access and utilize free and open-source Earth observation data that are needed for monitoring and modelling the variables that govern water resources and resulting disasters such as droughts and floods. It is necessary to have participatory approaches involving a network of institutions to carry out transdisciplinary research, develop knowledge and validate results.

40. Using remote sensing to improve water-use efficiency to prevent waste and loss has a great impact on risk reduction. Low-cost and free thermal remote-sensing data are accessible and easy to use and may be used to improve the efficiency of water delivery systems.

41. Several case studies were presented demonstrating Earth observation-based systems for integrated risk monitoring and early warning, daily risk monitoring analysis, typhoon risk monitoring analysis and flood and drought analysis through

multi-model risk assessment using big-data analysis and simulation for risk prediction. A study on identifying deep-water rice fields was presented that demonstrated remote sensing-based methodology to find deep-water fields where specific deep-water rice varieties can be cultivated.

5. Session 5. Geoinformatics applications in water resources management: challenges and opportunities

42. The session enabled the exchange of information on geoinformatics applications for water resources management. The challenges posed by climate change and opportunities for using space-based technologies to respond to those challenges were discussed.

43. The challenges emerging from water scarcity are addressed in global frameworks such as the Sendai Framework for Disaster Risk Reduction, the 2030 Agenda for Sustainable Development and the Paris Agreement. Both disaster risk reduction and climate change adaptation are key for the achievement of the Sustainable Development Goals; therefore, synergy between climate change adaptation and disaster risk reduction is necessary when countries prepare disaster risk reduction strategies and national adaptation plans.

44. It was emphasized that the water sector benefits immensely from the use of remote sensing and geographic information systems to address the three pillars of sustainable development: economic development, environmental protection and social equity.

45. Several case studies were presented on the use of the open-source synthetic aperture radar images from the Sentinel-1 satellite to help in the calibration and validation of flood inundation models, the recognition of yield potential among rain-fed wheat fields before harvest, the estimation of water consumption and crop-water productivity for wheat crops and the use of probabilistic flood hazard assessment to estimate potential losses due to floods of varying magnitudes and intensity.

6. Session 6. Advocacy session: institutional strengthening and preparedness for improving disaster management risk assessment

46. The session contributed to institutional strengthening and preparedness for improving disaster management risk assessment by focusing on strategies to increase cooperation among public and private stakeholders in disaster management on an international, national and regional scale.

47. A review of disaster management policies, strategies and plans of the Islamic Republic of Iran, co-host of the Workshop, were presented, with a focus on the various aspects of disaster management, such as education; awareness and culture of safety; promotion of research related to disaster risk reduction; recovery plans; risk transfer mechanisms; public participation; intersectoral coordination; and institutional development. The sand and dust storm adaptation strategy of the Islamic Republic of Iran was presented, while highlighting the need to perceive climatic risk and the use of evidence-based information in decision-making.

48. The report of the Special Reporting Committee on Iran Floods 2019, which investigated the economic, legal, social, cultural and communication dimensions of risk management and proposed structural and legal reforms to increase resilience and national capacity in flood management, was addressed. The report also pointed out the absence of flood risk management plans for cities, which contributes to increased damages due to floods.

49. The need for an integrated system for studying hydrologic change and its impacts on water resources, and related hazards such as drought, flood and water scarcity, was discussed. There is a need for support through improved in situ monitoring networks, rapid access to satellite data, better linkages between models, a

comprehensive framework for data management and improved delivery systems for decision makers.

50. The session also discussed the role of private entities by incorporating a presentation from a space entrepreneur that is offering affordable space solutions through such activities as launching a satellite, forming constellations of satellites, and acquiring data and running big-data analysis of the images obtained from those satellite constellations.

IV. Observations and recommendations

51. The Workshop was conducted in the same week as the release of the *Sixth Assessment Report, Climate Change 2021: The Physical Science Basis*, and reaffirmed the importance of space-based technologies for dealing with the challenges posed by climate extremes in coming decades. The Workshop also provided ways and means to address suggestions mentioned in the *Global Assessment Report on Disaster Risk Reduction: Special Report on Drought 2021* and to address links to the Food Systems Summit.

52. The Workshop was acknowledged as an important contribution towards bridging the gap between developed and developing countries concerning the use of space technology and enhancing international cooperation to leverage the full benefits of space technology in building resilience to floods and droughts. Recent satellite-based observations show that West Asia is facing severe drought; optimal management of water resources is one of the effective mitigation measures, and the Workshop rightly addressed applications of Earth observation in water resources management.

53. The Workshop reiterated the need for policy development, capacity-building, knowledge exchange and interdisciplinary thinking as driving factors for the achievement of the Sustainable Development Goals.

54. The importance of international and regional cooperation was highlighted by several participants, and it was suggested that a series of such workshops should be conducted to improve understanding of space-based technologies in disaster risk management among researchers, academicians and political leaders in the countries of West Asia.

55. The actions in follow-up to the Workshop should lead to an active network within the West Asia region for sharing methods, tools and knowledge and addressing the use of space-based information for monitoring cross-border disasters such as sand and dust storms.

V. Conclusion

56. The Workshop was successful in engaging a large number of participants, both from West Asia and from other parts of the world, and generating momentum for developing opportunities to enhance regional and international cooperation and knowledge exchange between policymakers, researchers, representatives of academia and the private sector.

57. The Workshop covered a variety of topics and issues in respect of water-related disasters faced by the countries of West Asia, such as drought, floods, sand and dust storms and water scarcity in the context of climate change, and provided a large number of examples of how the latest advances in space technology are used to address these issues.

58. Finally, the Workshop addressed the role of public-private partnership in emerging space nations and institutional coordination to ensure full utilization of space technologies for managing disaster-related risks.