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Report on the United Nations/Islamic Republic of Iran Workshop on the Use of Space Technology for Dust Storm and Drought Monitoring in the Middle East Region

(Tehran, Islamic Republic of Iran, 5-9 November 2016)

I. Introduction

1. The United Nations Programme on Space Applications, implemented by the Office for Outer Space Affairs, was established in 1971 to assist Member States with capacity-building in the use of space science, space technology and space applications in support of sustainable development, and to promote international space cooperation. Since its inception, the Programme has organized several hundred training courses, conferences, seminars and meetings for the benefit of Member States.

2. The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), through its resolution entitled "The Space Millennium: Vienna Declaration on Space and Human Development", recommended that activities of the United Nations Programme on Space Applications should promote collaborative participation among Member States, at the regional and international levels, in a variety of space science and technology activities, by emphasizing the development and transfer of knowledge and skills to developing countries and countries with economies in transition.[1]

3. The Workshop was organized by the United Nations in cooperation with the Government of the Islamic Republic of Iran (the Government) represented through the

* A/AC.105/C.1/L.355.

[1] *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. I, resolution 1, sect. I, para. 1 (e)(ii), and chap. II, para. 409 (d)(i).

Ministry of Information and Communications Technology (Ministry of I.C.T.) and the Iranian Space Agency, and hosted by the Government in Tehran.

4. The Workshop was closely linked to the 2030 Agenda for Sustainable Development, in particular to the relevant Sustainable Development Goals (SDGs) and targets set out (SDG 3, 13 and 15 and targets 3.9, 3.d, 13.1, 13.3, 15.2, 15.3 and 15.b respectively)[2]. In addition, the outcomes of the Workshop, summarized into concise, relevant and important observations and recommendations, will be used to inform the preparations for the anniversary United Nations Conference on the Exploration and Peaceful Uses of Outer Space, to be held in 2018 (UNISPACE+50) marking the fiftieth anniversary of the first such Conference (UNISPACE I), held in 1968. The Workshop specifically addressed agreed UNISPACE+50 thematic priorities No. 5 “Strengthened space cooperation for global health”, No. 6 “International cooperation towards low-emission and resilient societies” and No. 7 “Capacity-building for the twenty-first century” (A/71/20, para. 296).

A. Background and Objectives

5. Climate Change and its numerous consequences such as frequent drought conditions have led to a steady increase in frequency and intensity of dust and sand storms in many parts of the World. The severity of such storms is anticipated to continue to increase over the coming years. Dust- and sand storms, which present environmental and health risks (such as desertification, respiratory diseases and others) and can affect the regional climate, have worsened also in the Middle East region over the last decade. Monitoring such storms and related drought conditions from space using satellite remote sensing technologies and geospatial data has therefore become more important. It is also important that development policies of areas affected by such conditions are designed to be environmentally, socially and economically sustainable, and space technologies can play an important role in better defining such policies.

6. Space technology is one of several technologies essential for successfully implementing the 2030 Agenda. It helps provide data, information and services that can directly or indirectly contribute to achieving particular SDGs or to assessing and monitoring the status of the implementation progress.

7. The Workshop was thus primarily aimed at raising awareness and promoting the use of space technologies related to dust storm and drought monitoring for the benefits of the host country, for the Middle East region and in general for developing countries globally, by exploring how current space technologies help to identify and monitor the effects of a changing climate – including the onset of drought and causes of dust or sand storms - on vulnerable regions on an international and regional scale.

8. As remote sensing satellites help provide data on several key variables (such as rainfall, precipitations, water storage, soil moisture and evaporation, land use and even wind force and direction more recently) at spatial and temporal scales appropriate for reliable assessments, a satellite-based approach to assessment and management of drought in particular is very important in countries and regions of the world where adequate water resources are acutely lacking, to support decision makers anticipate food shortage and famine, or to take preventive actions.

9. While the potential benefits of space science and technology and its applications for developing countries are generally well-recognized, successful implementation and operational use of this technology is subject to continuous development of human

[2] https://sustainabledevelopment.un.org/?menu=1300.

resources at all levels, training of end-users, development of an appropriate infrastructure and policy regulations, as well as allocation of necessary budgetary resources. Such workshops are therefore a key element in making progress on these requirements.

10. The objectives of the Workshop were to:

(a) Address space technology contributions to sustainable environmental, economic and social development by supporting efficient monitoring of drought conditions and related hazardous phenomena;

(b) Enhance capabilities of countries in the use of space-related technologies, applications, services and information for dust storm and drought monitoring;

(c) Examine low-cost space-related technologies and information resources available for addressing such monitoring needs in developing countries;

(d) Strengthen international and regional cooperation by improving synergies among space agencies and specialized monitoring agencies;

(e) Increase awareness among decision makers and the research and academic community of space technology applications for addressing drought monitoring as well as dust or sand storms monitoring, primarily in developing countries; and

(f) Promote educational and public awareness initiatives in these domains, highlighting recent advances, as well as to contribute to capacity building efforts.

B. Attendance

11. The Workshop brought together stakeholders working in drought, dust or sand storm monitoring frameworks, including specialists with meteorological and hydrological expertise respectively, as well as representatives of the space industry and space agencies, other governmental and non-governmental organizations and international experts to discuss and share user requirements and experiences and to present relevant existing or planned space technologies and applications.

12. The Workshop was attended by up to 200 participants, with a larger number of national institutions being represented in the opening day plenary sessions. Participants included 18 international participants coming from the following 15 countries: Afghanistan, Austria, Azerbaijan, China, France, Germany, Iraq, Lebanon, Pakistan, Romania, Russian Federation, Switzerland, Sudan, Tunisia and Venezuela (Bolivarian Republic of).

C. Programme

13. The Workshop programme was developed together with the Iranian Space Agency to include plenary presentations grouped into thematic sessions, a poster session and discussion groups for agreeing on the actions and recommendations put forward by the participants. The following focus areas were identified:

(a) Applications of space technologies that provide cost-effective solutions and essential information for planning and implementation of programmes or projects to better monitor drought conditions and dust storms;

(b) Use of space-related technologies in mitigating drought or storm-related emergencies, and in combating desertification;

(c) Use of space technologies for early warning;

(d) Capacity building in drought monitoring and dust or sand storms monitoring, including development of human resources, establishing technical infrastructures and considering possible legal or cooperative frameworks, including access to financial resources if needed;

(e) International, regional and national initiatives and international and inter-regional cooperation in the domain of drought and dust storms monitoring;

(f) Review of specific conditions and information needs of the Middle East region in this context, within the broader scope of environmental monitoring; and

(g) Review of case studies on successful applications of space technologies for drought or dust storm monitoring in developing countries in general.

14. The discussions during the breakout sessions of the Workshop addressed ways of expanding the use of space technologies and derived data or information for better decision-making, as well as priority areas where potential pilot projects could be launched, examining also possible partnerships that could be established concretely.

15. The Workshop included a dedicated poster session with four posters registered and presented, allowing participants ample time to review each and address questions to the poster presenters as well.

16. The Workshop clearly demonstrated that space technology and its applications are already making essential contributions to addressing various drought and dust storm monitoring needs, and that space technology has advanced considerably and has become more accessible and affordable over the last years. At the same time data collected by satellites, especially in the very high resolution domain, remains difficult to access given prohibitive costs and other limitations. Detailed Workshop conclusions and recommendations are presented below.

17. On the second day of the Workshop, the Iranian Space Agency organized a technical visit for the international expert participants to the Iran Meteorological Organization, to allow for closer interaction of the international experts with local practitioners with a mandate in drought and dust storm monitoring. A number of national initiatives and challenges were presented, and data receiving and processing facilities were also visited. The visit was a great opportunity to interact with a larger number of local experts, and to address relevant questions in an informal setting.

18. Following the technical visit, international participants were also offered a cultural tour of Tehran, including visits to a number of national museums, a unique occasion for participants to learn about the impressive history and heritage of the host country.

19. The final Workshop programme, presentations and poster presentations will be also made available online on the dedicated Workshop webpage hosted on the Office for Outer Space Affairs website.

II. Summary of the Workshop

A. Opening Session

20. The Workshop was formally opened by Prof. Mohsen Bahrami, Deputy Minister of Ministry of I.C.T. and President of the Iranian Space Agency, and welcoming addresses were also given by the Deputy Minister of Road and Urban Development and President of the Iran Meteorological Organization, by the Vice President of the Iranian Space Agency, by the Head of the National Center for Combating Dust Storms,

National Department of Environment and by the representative of the Office for Outer Space Affairs.

21. The speakers highlighted the importance of the Workshop in the national and regional context as well as in the context of the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction 2015-2030 and the Paris Agreement on Climate Change. It was noted by both the host country representatives and the United Nations representative that the outcomes of the Workshop should be carefully addressed and should also contribute to defining the roadmap for UNISPACE +50.

B. Session 1: Space Technology for Dust Storm (SDS) Monitoring and Risk Assessment

22. Presentations were introduced on sand and dust storms (SDS) and drought early warning by a representative from the United Nations Convention to Combat Desertification (UNCCD), on support provided by the Group on Earth Observations (GEO) towards the Sustainable Development Goals by a representative of the GEO Secretariat, on vertical interaction of synoptic systems in producing dust storms in the Middle East by a representative of the Iran Meteorological Organization and on comprehensive guidelines for using remotely sensed data for dust storm studies and investigations by a participant from the University of Tehran.

23. It was shown that sand and dust storms (SDS) are one of the challenges to achieve the SDGs given an increased frequency in the last decades, and are having environmental, socio-economic and health impacts on the ground, with soil and meteorological factors also contributing to their development.

24. Speakers stated that mobilizing resources through building effective partnerships among all stakeholders at all levels is key in addressing such challenges, and that UNCCD is developing new strategies focusing on land degradation, global coordination and consolidated policies for SDS, preparedness measures and strategies for risk reduction, and financing opportunities for SDS actions. Easy and flexible access to space-based data for monitoring of the SDS sources is of high importance. The GEO Secretariat is also working on improving observation systems coordination and promotion of open space data policies.

25. The GEO System of Systems (GEOSS) was also introduced and its services presented to the participants, highlighting the value of the GEO common infrastructure (GCI) for the discovery of and access to relevant datasets and services.

26. The three main mechanisms responsible for provision of dust in the Middle East region were also discussed, among them being the migrating cyclones and strong associated vertical and frontal activities, the Nocturnal Low Level Jet (LLJ) development and turbulence associated, and the convective activities with strong gusty winds together with downbursts of dry cold air at local scales.

27. Speakers also pointed to the main types of information and datasets needed for an effective study of SDS and drought phenomena such as meteorological data (wind speed, wind direction, precipitation), soil properties, available water capacity, land degradation trends, land use and land cover, geology and geomorphology, morphogenetic processes, agricultural activities and socioeconomic factors.

C. Session 2: Using Space Technology for Drought Monitoring and Risk Assessment

28. Presentations made in this Session included one comparing actual satellite-based emergency mapping activities against stakeholder evaluations of geoinformation benefits for space-based information supporting drought monitoring and mitigation by a participant from Germany, one on lessons learned from climate change and drought monitoring efforts for dust storm management by a participant from the University of Tehran, one on drought risk assessment activities using remote sensing data in the Iranian Space Agency and one on monitoring drought, land degradation and desertification in arid Tunisia by a representative of the Institut des Regions Arides.

29. The comparison presented by the first speaker included a review of past materials as well as of a recent Science Magazine review article[3] published by a group of satellite-based emergency mapping experts, and concluded that widespread space-based drought mapping and monitoring activities are not the case in all affected regions, still, indicating an underutilization of space technologies for better monitoring of such phenomena, and that space-based data is mainly used for vulnerability mapping currently.

30. Speakers also agreed that availability of disaggregated and suitable socio-economic data continues to be a bottleneck for regional drought vulnerability and risk assessment, and that drought hazard may be better mitigated with measures to downscale the water cycle through afforestation, reforestation or agroforestry for example, and that satellite remote sensing is the method of choice for monitoring such mitigation measures.

31. It was noted by some presenters that drought can happen in any climate, and that over 70% of droughts with economic impact is caused by natural (meteorological) causes, with an expected increase in drought-affected areas during the 21st century leading to adaptation challenges. Dry farming and overgrazing in many areas of the world also contribute to desertification. Given these, and the increase in water demand globally, drought and dust storms will remain long-term global challenges in the future.

32. The importance of larger time windows (5 years) for observation and monitoring was also pointed out by the speakers. Adequate intervals between assessment steps (10 years for example) would be needed to allow for recordable changes to be systematically observed, as often active degradation took place prior to observed or analysed time periods. Practitioners therefore need to clearly state such requirements to satellite operators and data providers in general.

D. Session 3: Space Technology for Disaster Management

33. This session included presentations on the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) Regional Support Office in Iran by the Iranian Space Agency, on environmental parameters data collection between 2005 and 2014 by a representative of the Khavaran Institute of Higher Education (KHI) in Iran, on impacts of climate change on land productivity in Western Asia by a participant from China, on land capability and regional Landsat-based drought monitoring from 1982 to 2014 by a participant from Lebanon and on the assessment of meteorological parameters for drought identification using satellite data by a representative of the Institute for Space Technology of Pakistan.

[3] http://science.sciencemag.org/content/353/6296/247

34. The speakers highlighted the role and activities of the UN-SPIDER Regional Support Office in the context of provision of case studies and awareness raising materials for drought monitoring using satellite imagery, the various projects and data collection activities that could be or are relevant to drought or sand and dust storm related disasters management, as well as examples of using freely available satellite imagery (Landsat in this case) for long-term drought monitoring over large areas.

35. Presentations in this session considered mainly the use of space technologies and space-based data in disaster management and mitigation activities, with a focus on drought- and dust storm related disasters and their impact in the Middle East region, highlighting also the value and importance of various local data collection and processing facilities and laboratories that could more efficiently support such efforts at the country levels when needed.

E. Session 4: Using Space Technology for Drought Monitoring and Risk Assessment

36. This follow-up session was organized given the large number of presentations submitted for this specific topic. Six presentations were given, including one on Afghanistan perspectives on drought and use of space technologies to reduce its effects by a representative of the Independent Directorate of Local Governance (IDLG) from Afghanistan, one evaluating a remotely sensed drought index for mapping drought patterns in the Urmia Lake basin of Iran by a representative of the Shahid Beheshti University, one addressing spatio-temporal drought monitoring using Remote Sensing and geospatial techniques by a representative of the Salahaddin University of Iraq, one on InSAR (radar image processing) technique applied for land subsidence assessment over Iran's residential areas as a result of high drought frequency by a representative of the Tarbiar Modares University in Iran, one addressing challenges and drought risk management in Iran by a representative of the Forests, Range and Watershed Management Organization in Iran and one introducing air temperature extraction from MODIS imagery by a representative of Khavaran Institute of Higher Education (KHI) in Iran.

37. The session introduced innovative procedures such as air temperature extraction from moderate resolution satellite imagery, highlighted the complex, interdisciplinary and cross sectoral nature of drought, introducing a good combination of various research methods and standpoints as well, while also pointing out the challenges that remain in terms of data access, availability or capacity to work with space-based technologies and data in countries like Afghanistan. It was nevertheless emphasized that resources in addressing climate change and droughts are for example underutilized in some other countries at the same time.

38. It was also noted that changes in water availability and the increase in droughts are caused by both anthropogenic and natural causes, and that in particular decrease in river flows are linked to drought and sand or dust storms. Similar to previous session speakers, some of the presenters proposed various drought mitigation measures such as green belts creation or targeted agricultural measures, and emphasized the importance of having in place programs and strategies to cope with drought and of prioritizing integrated water resources- and watershed management. All speakers agreed that there is also a strong need for education and public awareness raising in this domain.

F. Session 5: Using Space Technology for Dust Storm Monitoring and Risk Assessment

39. This follow-up session included three presentations. Topics addressed were vulnerability mapping of dust storms using remotely sensed data and geospatial modelling by a representative of the University of Tehran, visibility estimation using combined Visible and Thermal Infrared bands of MODIS in West and South-West Iran by a representative of the Atmospheric Science and Meteorological Research Center (ASMERC) in Iran, and analysis of dust hazard in the West of Iran by a representative of the Kharazmi University in Iran.

40. Presenters gave an overview of the SDS damage costs to countries, highlighting the importance of a regional collaboration in order to prevent and mitigate the effects of SDS. The conversion of indicators used in the region to remote sensing indices and the elaboration of an accurate vulnerability map of West Asia was also proposed, given that this specific area has the highest risk to be affected by SDS. Studies have shown that the path of dust particles as simulated can even go through the south of Turkey, through Syria, Iraq before arriving in the West of Iran for example, indicating the extent and complexity of these phenomena.

41. The need for installing more instruments for ground measurements and collection of in-situ data as well as the importance of combining many indicators to create early warning systems for SDS was also highlighted.

42. Synoptic analysis in Iran also showed that the existence of thermal low pressure cells can lead to air convergence and air intake at near ground level, and strong vorticity can result in cyclonic movements acting as dust catchers. Often in such situations, the usual measures such as planting a protective green belt of trees would not help as the dust particles are too high up in the air. The major areas where such phenomena often happen are in Turkey, Syria and Iraq, so it was concluded that international cooperation is needed to tackle the problem.

G. Session 6: Education and Capacity Building

43. The final session of the Workshop considered the important aspects of education, capacity building and awareness-raising. Two presentations were given in this session, one introducing the In-service ICT Training for Environmental Professionals (ISEPEI) Project of the Central European University and the Eye on Earth initiative, and one detailing the Office for Outer Space Affairs and its capacity building efforts in the framework of the Programme on Space Applications and of the UN-SPIDER Programme

44. It was emphasized that as addressing drought requires a multidisciplinary approach, needing many environmental, social, economic and technical disciplines to explain such complex phenomena, universities and networks or communities such as those developed during the Eye on Earth process can provide support by acting as knowledge hubs in promoting practical applications of ICTs and of space technologies, filling gaps where needed.

45. The Office for Outer Space Affairs presentation highlighted the different benefits of space activities and presented the Office mandates including promoting collaboration and capacity building aspects. The numerous conferences and workshops, fellowship programmes aiming at building capacity and discussing many problems related to natural disasters and available space technology to address them was also presented.

46. At the end of the session, a discussion focusing on the capacity building needs in the region developed, with ideas and suggestions exchanged among participants. It was stressed that image processing software is often prohibitively expensive and solutions should be promoted for either open source software or acceptable software licensing terms to ensure that relevant projects that require satellite imagery processing can be adequately completed. Ways of addressing sanctions-related difficulties in accessing adequate software and data tools in a number of countries (including Iran, Sudan, or Syria as mentioned) was also considered important by some participants. The need for a more comprehensive dust forecasting system with enhanced capabilities was highlighted as well.

H. Discussion Groups

47. Time was also dedicated to break-out discussion groups where participants could address drought or dust storm specific issues and requirements in smaller informal settings, with a view to develop recommendations for the Workshop plenary. On the final day of the Workshop the break-out groups reported their findings to the plenary, together with suggested recommendations that were then discussed, further refined and agreed upon by all Workshop participants, as presented in this document.

48. For drought monitoring in particular, the main concerns raised were difficulties and limitations of data in general, country-specific challenges that are more difficult to address, gaps in Landsat data over certain regions such as North Africa with data access mechanisms difficult to use often, lack of expertise in remote sensing for many specialists working on climate change or other environmental disasters, the low resolution of satellite sensors for soil moisture or the availability of such soil moisture value-added products over only certain regions of the world, and less over the Middle East, the lack of more online access options to imagery and image processing to reduce the need for downloading large sets of imagery data.

49. For dust and sand storm monitoring, discussions highlighted the need for considering these phenomena as disasters rather than natural occurrences, for using more remote sensing techniques to identify mineralogy and help model (at more accurate local level rather than globally) such phenomena for more accurate forecasting, the importance of a possible soil erodibility index developed using satellite imagery, and the need for more cross-country cooperation and knowledge exchange in the regions more affected, including joint research, master and doctoral programmes addressing these topics.

50. The Iranian Space Agency has also offered its readiness to establish a regional data centre for the monitoring of drought and SDS and for sharing data with the neighbouring countries, using its two data collection facilities and the national laboratory for remote sensing and spectrometric studies.

51. Some participants noted that while many presentations highlighted advances in technologies, user needs or demands were not as clearly articulated and that often donor projects have a fragmented approach in addressing user needs on the ground, while others emphasized the importance of taking into consideration the traditional techniques and local knowledge as well in working in the drought and dust storms domains.

52. Calls were addressed for the United Nations to consolidate methodologies in working with drought or dust storms monitoring, including the standardization of data requirements, and it was agreed that for that purpose UNCCD might the best positioned, in cooperation with other regional mandated United Nations entities with responsibilities in disaster management, while other entities such as the Office for

Outer Space Affairs can support with data access and bridging technology gaps where possible.

I. Poster Session

53. A special session was dedicated to allow participants to view and discuss the four poster submissions and to give an opportunity to the poster presenters to quickly also introduce their work to the plenary.

54. The four posters included one on space-borne detection and monitoring of dust storms by a participant from France, one on design of the on-board imaging sensor and required signal processing in monitoring of dust storms and drought using small satellites by a representative of the Institute of Space Research and Aerospace (ISRA) of the Ministry of Higher Education and Scientific Research of Sudan, one on the benefits and applications of the Venezuela satellite platform "Miranda" by a representative of the Bolivarian Agency for Space Activities (ABAE) of Venezuela, and one on the assessment of drought severity using the Vegetation Temperature Condition Index (VTCI) from Terra/MODIS data by a representative of the Institute of Technical and Vocational Higher Education in Iran.

III. Observations and Recommendations

55. The conference enabled participants and the organizers to:

(a) learn about space-based applications and techniques developed in recent years to contribute to dust storm and drought monitoring in the Middle East region;

(b) communicate and exchange views and lessons learned with representatives of a variety of other countries, regional and international institutions and the private sector;

(c) explore how best to take advantage of the opportunities offered by the space community to contribute to its activities;

(d) collect a variety of suggestions and recommendations made by experts with regard to the use of space-based applications and solutions aimed at dust, sand storm and drought monitoring;

(e) facilitate the coordination of global efforts undertaken by the space community to contribute to the implementation of the global drought protocol from October 2017;

(f) promote the use of Earth observation to track and identify areas affected by or vulnerable to dust storm or drought.

A. The Role of Space Technology

56. It was commonly agreed that space technology, in particular Earth observation satellites and Global Navigation Satellite Systems (GNSS) can play a more important role in helping to monitor drought development and dust or sand storms in general, and in supporting policy- and decision-making.

57. Participants agreed that remote sensing by satellites is not currently always capable to cover and analyse the entire range of phenomena addressed in this Workshop. More specific sensors and very high resolution satellite imagery together with broader scientific approaches (including hydrology and ecology) are needed to

identify quickly chemical compositions and others aspects on the ground, as required. End-users and decision makers should also be aware of the limitations of space technologies, and adequately informed of the possibilities.

58. It was also suggested that a large-scale, accurate drought and dust storm vulnerability map for West Asia should be developed using satellite imagery available, and following best practices in satellite-based vulnerability mapping. This would require a coordinated satellite imagery data identification and collection effort.

B. Governance Considerations

59. Information and data sharing between various Ministries at national levels was also seen as problematic, and identified as a general problem present in many countries. It was agreed that for geospatial and space-based data, the National Spatial Data Infrastructure (NSDI) approach should be encouraged and implemented without delay. Full and open sharing of information and data nationally and across relevant institutions must be encouraged and even enforced.

60. An important recommendation agreed upon was the need for regional or sub-regional collaborations in West Asia, given the high risk for drought and related problems. This was also stressed by some experts from institutions that could not participate in the Workshop but have made contributions electronically.

61. The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), although unable to participate, also contributed to recommendations informing the Workshop organizers submitting input about the Regional Action Programme for Asian Countries to strengthen the existing capacity of the member countries and to form specific networks for effective measures to combat desertification.

C. Capacity Building

62. Participants highlighted the need to obtain space-based data more easily, as there is a gap in data availability, coverage and data access for many years or areas of interest. Such needs could also be brought to the attention of data access and distribution entities such as the U.S. Geological Survey (USGS, for Landsat data), the European Space Agency (ESA) or Google (specifically the Google Earth Engine platform) to mention a few. Ready imagery-derived products or image layers of interest could also be made more accessible via online services.

63. National participants suggested that there is a need for similar workshops in the near future, mainly to focus on more specific processes or technology applications, and taking into account concrete local needs, and requested the Office for Outer Space Affairs to consider such support, and to also aim at inviting more representatives from the energy sector or the finance sector as those could add valuable input to such workshops.

64. Participants also welcomed efforts highlighted by the Office for Outer Space Affairs with regard to putting in place data access and data sharing agreements with several national space agencies and commercial entities to enable easier and more simplified access to those very high resolution satellite data collections for a broader disaster-related support.

65. It was also agreed that any algorithm for drought monitoring needs validation, to ensure accurate results. Calibration sites could be used for that purpose, such as the Committee on Earth Observing Satellites (CEOS)-led reference Supersites that already

hold a large number of datasets for sensor calibration and results validation purposes. A dedicated supersite for drought monitoring could thus be also proposed to CEOS.

66. Several participants called for better communication and information sharing in general, and in that context the possibility of creating more online resources and a dedicated social media presence or collaborative web presence for drought monitoring, where all experiences and knowledge could be easily shared, was seen important. This approach could include customized online courses and webinars as well.

D. Other Matters

67. The participants expressed their hope that the Office for Outer Space Affairs will continue to work with relevant stakeholders to promote the use of space science, technology and its applications for drought and dust storm monitoring, as it focuses on the thematic priorities related to UNISPACE+50.

68. Finally, the Workshop participants thanked the Government of the Islamic Republic of Iran for hosting the Workshop, and to the Iranian Space Agency and its staff in particular for making all the arrangements and co-sponsoring the Workshop.

IV. Conclusions

69. The United Nations/Islamic Republic of Iran Workshop played an important role in bringing together relevant stakeholders working on the development, use and application of space-based and geospatial technology for addressing drought and dust storms in the Middle East region and beyond. A range of possible follow-up activities have been identified, as presented in this document.

70. This Workshop report will be brought to the attention of relevant policy- and decision-making bodies in a targeted way, and will also inform the Committee on the Peaceful Uses of Outer Space and the United Nations General Assembly. It will also serve as a basis for identifying specific follow up activities in the planning process towards UNISPACE +50, as detailed above.

71. Making full use of the framework and opportunities provided by UNISPACE+50, the Office for Outer Space Affairs stands ready to assist any Member States in developing and implementing the capacity building actions necessary to address the SDG monitoring processes and the global challenges of our rapidly changing world in the 21st century.