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# Report on the United Nations/Germany International Conference on Earth Observation: global solutions for the challenges of sustainable development in societies at risk

**(Bonn, Germany, 26-28 May 2015)**

## I. Introduction

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

2. In its workplan for the biennium 2014-2015 (A/AC.105/C.1/2013/CRP.6), the programme committed itself to organizing international workshops to enhance horizontal cooperation and knowledge transfer and to focus on specific thematic issues.

3. The United Nations/Germany International Conference on Earth Observation: global solutions for the challenges of sustainable development in societies at risk was conducted on the premises of the United Nations in Bonn, Germany, from 26 to 28 May 2015. The Conference was organized by the UN-SPIDER programme on behalf of the Office for Outer Space Affairs of the Secretariat, in cooperation with the German Aerospace Center (DLR), and benefited from the generous support provided by the Federal Ministry for Economic Affairs and Energy of Germany, the Secure World Foundation (SWF) and the government of the city of Bonn. The Conference provided an opportunity to discuss the most recent developments in the use of Earth observation and integrated space technology applications to address the challenges of climate change and disaster risk reduction and contribute to efforts aimed at promoting sustainable development worldwide, as well as to discuss ways

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in which Earth observation could facilitate assessment of countries' progress in implementing global agreements or frameworks as part of the post-2015 development agenda. The present report describes the background to and objectives of the Conference, provides a summary of the discussions and contains observations and recommendations made by the participants.

# II. Organizational framework

4. The Conference was organized as part of the outreach activities contemplated in the UN-SPIDER workplan for the biennium 2014-2015. It was one of the activities funded by the Government of Germany, the city of Bonn and SWF through their voluntary contributions to the programme.

## A. Background and objectives

5. The year 2015 is critical: Governments worldwide, with the support of the United Nations, will conclude three global agreements geared to steer development trends worldwide as a means of maintaining efforts towards sustainable development while addressing the challenges posed by climate change and natural hazards; at the Third United Nations World Conference on Disaster Risk Reduction held in Sendai, Japan, from 14 to 18 March 2015, the Governments of 187 States launched the Sendai Framework for Disaster Risk Reduction 2015-2030, which defines goals and priorities for action as a way to enhance the resilience of nations in the next fifteen years; and in September 2015, the sustainable development goals will be launched to provide continuity to the Millennium Development Goals. Furthermore, Governments will use the twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, to be held in Paris from 30 November to 11 December 2015, to launch a new climate change agreement. These global frameworks, which will be serving as policy frameworks at the highest international level, will provide guidance on the efforts that need to be undertaken at local and national levels and ways in which regional and international organizations should work together to support those efforts.

6. Earth observation is an essential resource for tracking the status of natural resources, the climate, oceans, polar ice caps and other features of the planet. When incorporated in routine monitoring activities, Earth observation supports informed decision-making at the local, national, regional and global levels, helps stakeholders to find ways to reduce disaster risks, assists in identifying actions to facilitate adaptation to climate change and makes it possible to prepare better for unavoidable loss and damage caused by disasters. It facilitates monitoring of the effectiveness of efforts at all levels in fostering sustainable development and will provide information to support the alignment of targets and indicators set out in the aforementioned global agreements. Furthermore, it can be used to develop harmonized national reporting systems.

7. The use of Earth observation, space-based technologies and geographic information systems is already explicitly included in Priority 1 of the Sendai Framework for Disaster Risk Reduction 2015-2030, which focuses on improving the understanding of risks. At the local and national levels, the Framework encourages

the use of geospatial information technology and space and in situ information to develop, update periodically and disseminate location-based disaster risk information to decision makers, the general public and communities at risk. At the regional and global levels, the Framework encourages regional and international organizations to cooperate as a means of promoting and enhancing real-time access to reliable data, to use geospatial and space-based technologies, to maintain and strengthen in situ and remotely-sensed Earth and climate observations and to disseminate risk information through the optimal use of geospatial information technologies. There are two specific opportunities for the use of Earth observation through space-based technologies under the Framework:

(a) To contribute to the implementation of the Framework, especially under priorities 1 and 4, by providing relevant data and information at the national and regional levels;

(b) To contribute to the review of global progress in the implementation of the Framework by providing relevant data and information at the global levels.

8. The Conference brought together experts from a variety of development sectors, decision makers from government agencies, researchers and stakeholders to showcase the most recent developments in the use of Earth observation and integrated space technology applications as a means of addressing the challenges of climate change and disaster risk reduction and contributing to efforts to further sustainable development worldwide. The participants discussed ways in which Earth observation could be used to facilitate assessment of the effectiveness of actions to be implemented by States in the coming years in order to achieve the goals and targets set out in the above-mentioned global agreements.

9. The joint Inter-Agency Meeting on Outer Space Activities (UN-Space)-Bonn Conference high-level panel on space-based information for development was held on 28 May 2015 as an integral segment of the Conference. The panel provided Conference participants with an opportunity to engage in a dialogue with the United Nations system to review challenges and opportunities in mainstreaming space technology in key areas under post-2015 development agenda frameworks, and to examine shared perspectives for increasing the use of Earth observation in support of global development goals.

10. As part of the Conference programme, the Office for Outer Space Affairs conducted a session dealing specifically with the use of Earth observation in disaster risk reduction and highlighting efforts undertaken in the context of the Sendai Framework for Disaster Risk Reduction 2015-2030. The programme also included a session on the Global Earth Observation Partnership for disaster risk reduction, which is a voluntary undertaking by 17 partners, launched during the Third United Nations World Conference on Disaster Risk Reduction, to advocate for the use of Earth observation in disaster risk reduction efforts; to facilitate synergies among relevant institutions; to strengthen the capacities of government agencies and local institutions in the use of Earth observation; and to highlight the benefits of Earth observation through regional events organized by the United Nations Office for Disaster Risk Reduction.

11. Additionally, the Office for Outer Space Affairs, through its UN-SPIDER programme, hosted the annual spring meeting of the International Working Group on Satellite-based Emergency Mapping in Bonn on 28 and 29 May 2015, back to

back with the Conference. The Working Group is a voluntary group of organizations involved in satellite-based emergency mapping that supports disaster response by improving international cooperation in such mapping activities. At the meeting, special emphasis was placed on the topic of collaborative mapping, including the use of crowdsourcing, distributed analysis/computing and social media in satellite-based disaster mapping. A representative of UN-SPIDER took over the annually rotating position of chair of the Group.

12. The Conference facilitated the coordination of global efforts by the space community to contribute to the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030, particularly with respect to disaster risk assessment, disaster preparedness and early warning systems.

13. Furthermore, the Conference promoted the use of Earth observation to track and identify ways to assess extreme climatic events affecting sustainable development efforts worldwide. It provided a forum for experts to discuss novel methods of using Earth observation to assess potential loss and damage, thus contributing to the Warsaw international mechanism for loss and damage associated with climate change impacts, adopted by the Conference of the Parties to the United Nations Framework Convention on Climate Change at its nineteenth session (Warsaw, 11-23 November 2013), and to contribute to adaptation activities launched at the sixteenth session of the Conference of the Parties (Cancun, Mexico, 29 November-10 December 2010).

14. In addition, the Conference allowed experts and decision makers to explore how best to take advantage of the opportunities offered by the space community to contribute to space-related activities aimed at furthering sustainable development. In that context, the participants identified ways in which Earth observation can be used specifically to contribute to the implementation of the new sustainable development framework and to track progress towards the various targets that that framework establishes.

## B. Attendance and financial support

15. The Conference was attended by 120 experts and professionals from the following Member States: Algeria, Austria, Belgium, Bhutan, Brazil, Burkina Faso, China, Czech Republic, Dominican Republic, Egypt, France, Germany, Ghana, Greece, Indonesia, Iran (Islamic Republic of), Italy, Japan, Kenya, Mexico, Netherlands, Nigeria, Philippines, Singapore, South Africa, Spain, Sri Lanka, Sudan, Switzerland, Trinidad and Tobago, Tunisia, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, and United States of America. Altogether, the participants represented 76 national, regional and international organizations belonging to the United Nations system, the space community, the disaster risk management and the emergency response communities, knowledge transfer and academic institutions and internationally active private companies.

16. Funds allocated by the Federal Ministry for Economic Affairs and Energy through the UN-SPIDER programme and by SWF were used to defray the costs of air travel, daily subsistence allowance and accommodation for twenty-six participants from developing countries.

## C. Programme of activities

17. The programme of activities of the Conference was developed by the Office for Outer Space Affairs, through its UN-SPIDER programme, and DLR. The three-day programme included welcoming remarks, two keynote speeches, a high-level opening panel, a special talk, five sessions, two of which included both technical presentations and discussions in breakout groups, a special session, a summary and a closing ceremony. Opening and closing remarks were made by representatives of the Federal Ministry for Economic Affairs and Energy, the city of Bonn and UN-SPIDER. Keynote presentations were made by representatives of the Office for Outer Space Affairs and DLR. The high-level opening panel included representatives from the Italian Space Agency, SWF, the secretariat of the United Nations Framework Convention on Climate Change and the United Nations Office for Disaster Risk Reduction. The special talk was provided by an astronaut of the European Space Agency (ESA). The special session, entitled "Joint UN-Space — Bonn Conference high-level panel on space-based information for development", involved the participation of panellists from the Global Climate Observing System, the European Earth Observation Programme (Copernicus), the United Nations University and the World Health Organization (WHO).

18. The five thematic sessions addressed the following topics:

(a) The Sendai Framework for Disaster Risk Reduction 2015-2030: opportunities for Earth observation;

(b) Current capabilities and future potential of Earth observation to support climate change agreements;

(c) Global development agenda and national needs;

(d) Solutions to address those challenges; and

(e) Enhancing resilience: the role of space mechanisms.

19. The first session, entitled "The Sendai Framework for Disaster Risk Reduction 2015-2030: opportunities for Earth observation", was used to introduce the Framework, which recognizes the usefulness of Earth observation and space-based technologies in the context of disaster risk reduction, as reflected in its Priority 1, "Understanding disaster risk", and Priority 4, "Enhancing disaster preparedness for effective response and to 'Build Back Better' in recovery, rehabilitation and reconstruction". The Framework relies on the voluntary commitment of stakeholders to ensuring that the goals established by it are met. During the Third World Conference on Disaster Risk Reduction, the Office for Outer Space Affairs through its UN-SPIDER programme, DLR and 16 additional partners launched the Global Earth Observation Partnership as a voluntary commitment to contributing to achievement of the goals outlined in the Framework, and in particular to meeting the specific requirements stipulated in the Framework with respect to the use of Earth observation and space-based technologies.

20. The first presentation, by DLR, included a description of the main elements of the Framework, including its four priorities for action and its seven global targets, and provided examples of ways in which Earth observation helps to map hazards and exposed elements by referring to global data sets such as the Global Urban

Footprint and the Global Human Settlement Layer. It also described the use of global digital elevation models and 3D mapping as a way to categorize the structure of buildings, which is relevant to the assessment of potential damage caused by earthquakes. The DLR expert concluded his presentation by commenting on the benefits of the Global Early Warning System for Wildland Fire and on a global drought monitoring and forecasting system based on time series of vegetation indices.

21. The second presentation, by the United Nations Office for Disaster Risk Reduction, gave participants an overview of the Framework, highlighting that the Framework calls for a paradigm shift from disaster loss to disaster risk, from disaster management to disaster risk management and from "what to do?" to "how to do it". The presenter emphasized that, as in the case of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, under the Sendai Framework for Disaster Risk Reduction 2015-2030 primary responsibility for disaster risk reduction remains with Member States. He also explained the follow-up activities expected to be conducted in 2015 and beyond by the General Assembly, the various organizations and agencies of the United Nations system, national and local governments and stakeholders. United Nations organizations and agencies were called upon to update the United Nations Plan of Action on Disaster Risk Reduction for Resilience, to promote coherence among conferences and agreements (for example, the Third International Conference on Financing for Development, the United Nations summit for the adoption of the post-2015 development agenda, the twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, to be held in Paris from 30 November to 11 December 2015, the World Humanitarian Summit to be held in Istanbul, Turkey, on 23 and 24 May 2016 and the United Nations Conference on Housing and Sustainable Urban Development (Habitat III), to be held in Quito from 17 to 20 October 2016) and to support Member States in the implementation of the Framework according to their respective capacities. Member States are expected to implement the Framework, to report on the status of its implementation and to establish an open-ended intergovernmental working group to develop indicators for measuring progress in implementation and to update terminology relating to disaster risk reduction.

22. The third presentation, by a representative of the UN-SPIDER programme, gave participants an overview of that programme, including the provision of technical advisory support to developing countries, activities relating to the UN-SPIDER knowledge portal, capacity-building activities, outreach efforts and the programme's forums for cooperation among stakeholders. The presenter drew attention to the programme's network of regional support offices and network of national focal points and the efforts made under the programme to work with selected Member States as a way to incorporate explicit text on the use of space-based information within the Sendai Framework. Participants were informed of the activities conducted by UN-SPIDER in cooperation with other national, regional and international partners to launch the Global Earth Observation Partnership. The aims of the Partnership are to continue facilitating dialogue among stakeholders, to serve as a collective source of information, to generate policy-relevant advice and to facilitate the use of Earth observation and related satellite-based technology as a way of contributing to the integration of Earth observation into disaster risk reduction practices. The presenter indicated that the

Conference would include a working session dedicated to the Partnership, and that the Partnership would commence its activities in the coming months. He concluded his presentation by pointing out that UN-SPIDER would work with its partners to promote the incorporation of the use of Earth observation data as a source for the proposed indicators to be developed in the coming months to monitor the progress made by States in achieving the goals and targets established in the Sendai Framework.

23. The first session included a discussion segment during which three breakout groups discussed the following issues: Earth observation to support the Sendai Framework for Disaster Risk Reduction 2015-2030; national information needs; and the Sendai Framework on Disaster Risk Reduction 2015-2030 and the Global Earth Observation Partnership.

24. Participants highlighted the need for information systems to integrate information derived from remote sensing, modelling and in-situ measurements, especially for early warning purposes. They further underlined that the main components of such information systems were available but not yet integrated in a useful way, and stressed the need for further research in order to better understand underlying risk factors and processes and the need to better communicate risk information, especially in a target-oriented way, to different users. They mentioned the need for better access to, and improved gathering of, space-based data, and identified capacity development, especially in the use of space-based information, as a high priority. Additionally, the participants noted that cooperation with stakeholders needed to be improved, especially considering the diversity of cultures, backgrounds, level of understanding, capacities and expectations and the differing perspectives of researchers and practitioners.

25. It was pointed out that in some cases, products derived from Earth observation were not easily interpreted and applied by end users because the language they used differed from that used by scientists when presenting the results of their research. In addition, it was emphasized that different users had different needs and expectations with regard to ways in which data could be used.

26. With respect to the Global Earth Observation Partnership, the participants reaffirmed that the Partnership was a voluntary undertaking that should avoid any duplication of existing efforts, that it was not owned by any organization and that its membership was open to any relevant organization.

27. The second session, entitled “Current capabilities and future potential of Earth observation to support climate change agreements”, started with three presentations. The first, by the secretariat of the United Nations Framework Convention on Climate Change, provided an overview of ongoing work on systematic observation of the climate system under the Convention and the benefits of using Earth observation in the mitigation of, and adaptation to, loss and damage. The presenter drew attention to the essential role of systematic observation of the Earth’s climate system in understanding changes in that system and projecting future changes, and thus in formulating climate policies. He highlighted the importance of improved continuity, geographical and temporal sampling and accuracy of Earth observations in contributing to improved climate model projections, including short-term and regional projections, and the increasingly important role of systematic observation in decision-making with respect to mitigation and adaptation, noting that there were

still challenges to ensuring long-term observations. Any improvements, such as the placing of an instrument for measuring carbon dioxide on the International Space Station, would benefit the work on adaptation and mitigation carried out under the Convention.

28. The second presentation, delivered by a representative of the Global Climate Observing System, focused on the role of satellite data in climate monitoring. The presenter underlined that one of the System's greatest achievements was the elaboration of the essential climate variables, which establish common terminology and ensure that work is carried out in a coherent manner. Underscoring the importance of continuing and enhancing climate observation in the future, the presenter concluded by introducing the plans of the Global Climate Observing System for 2015 and 2016.

29. The third presentation of the session, by a representative of DLR, stressed the need for the implementation of reliable space-based control mechanisms to ensure the adherence of Member States to climate change agreements. The presenter stressed that space-based research must respond to the urgent challenges of the twenty-first century, including climate change, global migration and the safeguarding of sufficient food supplies, and underscored the need to develop sufficient tools and models to monitor atmospheric processes. He also advocated for greater use of the International Space Station as an existing technological platform for Earth observation.

30. The second session also included a discussion segment during which three working groups discussed the extent to which space-based technology and information could be used by nations in the context of climate change mitigation, adaptation and loss and damage; issues relating to the calibration of space-based products against ground measurements; the identification and listing of needs that could potentially be addressed by space-based applications through further research and development efforts; data policy issues such as data access and costs, resource allocation, knowledge transfer and capacity-building; the definition of elements of a strategy to promote the use of space-based applications in tackling extreme climatic events; the use of such applications in multi-hazard early warning systems; the formulation of recommendations for improved management of extreme climatic events through the use of space-based information; and potential recommended practices tailored to such events.

31. Participants noted the usefulness of combining ground-based, aerial and space-based observations to generate more precise information, and attention was drawn to the many ongoing efforts relating to the use of Earth observation in addressing climate change, and to the need to avoid duplication of such efforts. The benefits of coordinated approaches among regional and international organizations were highlighted as leading to improved quality of the information provided to decision makers and thus facilitating the decision-making process in international negotiations relating to climate change.

32. Participants emphasized the need to use long-term vessels in space, such as the International Space Station, as a means of extending observation time when using space-based applications. The Station, currently used for a variety of experiments relating to material science, biology and pharmaceutical products, could be fitted with instruments to monitor the Earth. One such instrument could be used to

monitor greenhouse gas emissions, thereby contributing to the monitoring of emissions at the national level, which in turn could be used as the basis for international agreements on emissions.

33. With regard to adaptation to climate change, participants highlighted the importance of bearing in mind that adaptation efforts encompass many areas and sectors of development, such as coastal urban areas, agriculture and the management of natural resources. Earth observation can contribute to the identification of ways to adapt to the various manifestations of climate change, such as land-use planning in coastal areas, particularly in the case of megacities, which are growing exponentially. In the case of agriculture, data and information derived from Earth observation can be used in irrigation to alleviate the effects of droughts and in the construction of dams to mitigate the extent of floods in floodplains. Earth observation data can also be used in the area of health.

34. Taking into consideration the effects of climate change in exacerbating hydrometeorological events such as floods and droughts, participants agreed that it was important to identify ways of using Earth observation to facilitate preparation for and responses to such events. In addition, they stressed the need to strengthen links between the space community and those developing countries affected by hydrometeorological events and consequently in need of solutions to the effects of climate change.

35. Participants highlighted the need to extend the application of essential climate variables to adaptation, loss and damage and to make greater use of the International Space Station for Earth observation, and called for greater international cooperation in that regard.

36. The third session, entitled “Global development agenda and national needs”, focused on the use of satellite data, as a key element of the post-2015 process, to provide a good knowledge base with respect to the status quo, needs and challenges, thereby allowing decision makers to shape effective policies and allocate resources appropriately, and to continuously monitor progress or setbacks in the implementation of related measures, thus helping countries to stay on track. The session included three plenary presentations.

37. The first presentation, by a representative of the Office for Outer Space Affairs, dealt with global space governance and the role of the Committee on the Peaceful Uses of Outer Space and UN-Space. The presenter drew attention to the fact that the year 2018 would mark the fiftieth anniversary of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space and stressed that inter-agency coordination was needed with regard to outer space affairs and that global sustainable development required not only the use of space tools but also the long-term sustainability of space-related activities and the outer space environment.

38. The second presentation, by the Joint Research Centre of the European Commission, focused on the need for global, fine-scale settlement mapping and monitoring. The expert from the Centre introduced the Global Human Settlement Layer as a multiscale and multisensor approach to automatic image information retrieval, including information relating to built-up areas and the size and density of settlements. Earth observation can provide information about the development of human settlements globally at high spatial resolution, and long-term missions such

as the Copernicus Sentinel series and Landsat will ensure continuous monitoring of future developments. However, the gap between the Earth observation community and decision makers needs to be closed through the development of easy-to-use indicators.

39. The third presentation, delivered by a representative of WHO, dealt with space-based information for public health and the sustainable development goals, with a particular focus on the expectations and needs of decision makers. The presenter explained that decision makers in the health sector used space-based information when other information was not readily available or not up-to-date, when the collection of ground-based information was time-consuming and resource-intensive or when additional, complementary evidence of causal epidemiological links was required. Space-based information was also useful for local decision makers requiring rapid, ad hoc, short-term information; for national decision makers in long-term monitoring on large geographic scales to guide local interventions; and for environmental health researchers to make the case for and collect evidence of causal links, generate support for decisions and set priorities.

40. During the fourth session, entitled “Solutions to address these challenges”, representatives of the private sector and international and regional organizations presented their perspectives and solutions and ways to address the challenges of climate change, sustainable development and disaster risk reduction. The discussion focused on how to integrate private- and research-sector solutions into the implementation and monitoring of the three post-2015 frameworks and agreements. The session included five plenary presentations. An expert from DigitalGlobe provided an overview of his company and the Earth observation technologies that the company uses, and gave three examples of situations in which those technologies had been useful: in contributing to the response to typhoon Haiyan in the Philippines, in supporting relief efforts following the earthquake in Nepal in April 2015 and in assisting efforts to combat elephant poaching in Garamba National Park, Democratic Republic of the Congo. An expert from GAF AG explained the use of Earth observation to monitor deforestation and degradation in the context of the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries. He presented a short summary of the Programme, experiences of the Programme’s pilot projects in tropical humid and dry forests and technical issues relating to its forest monitoring activities. An expert from SISTEMA GmbH introduced the Multi-sensor Evolution Analysis (MEA) system as a support tool for meeting global sustainable development challenges. An expert from EOMAP GmbH focused his presentation on the use of Earth observation technologies for harmonized multi-resolution water quality monitoring services for inland and coastal waters. An expert from the Copernicus Unit of the European Commission’s Directorate-General for Internal Market, Industry, Entrepreneurship and Small and Medium-Sized Enterprises made the fifth presentation, the subject of which was the need for and benefits of sustainable provision of operational services (for example, in disaster risk reduction), analysing the different ways in which a variety of stakeholders contributed to such sustainability. He clarified the ideal role of each stakeholder and the interests that motivated them, and highlighted the need to develop networks among public, private and research stakeholders in order to make Earth observation-based information services available at the national and local levels.

41. UN-Space, which is the central United Nations coordination mechanism for space-related activities, under the leadership of the Office for Outer Space Affairs, conducted its thirty-fifth session on 27 May 2015 and organized a high-level panel on space-based information for development on 28 May 2015, tackling the question of how the international community could promote the use of space-based applications to address the post-2015 development agenda frameworks. The panel was composed of high-level representatives of the Global Climate Observing System, the Copernicus programme of the European Commission, the United Nations University and WHO. The panel provided the participants of the Conference with an opportunity to engage in dialogue with representatives of various organizations of the United Nations system, to review challenges and opportunities in mainstreaming space technology in key areas addressed in the post-2015 development frameworks and to identify common perspectives on increasing the use of Earth observation as a means of achieving global development goals. During the discussion the panellists agreed that Earth observation was a key tool in understanding various aspects of the planet, specifically climate change, disaster risk reduction and sustainable development. They highlighted the need to find ways to improve cooperation at the regional and national levels and to continue assisting countries in the use of Earth observation. Capacity-building and institutional strengthening were presented as main activities to improve the use of Earth observation. The panellists also agreed on the need to carry out awareness efforts to enhance public understanding of how the United Nations was contributing to achievement of the sustainable development goals. The challenge of working together to enhance the use of Earth observation with respect to climate change, disaster risk reduction and sustainable development goals remained as the main future goal. The panellists announced the themes of the sessions of the Committee on the Peaceful Uses of Outer Space and its subsidiary bodies to be held in 2018 in the context of the United Nations Conference on the Exploration and Peaceful Uses of Outer Space, namely enhancing global space governance, capacity-building, resilience and interoperability.

42. The fifth session, entitled “Enhancing resilience: the role of space mechanisms”, showcased through five plenary presentations several of the mechanisms that have been established by the space community to contribute to disaster risk management, response and recovery efforts and provided examples of Earth observation efforts set up at the national level (in Germany and China). The representative of the European Commission’s Directorate-General for Internal Market, Industry, Entrepreneurship and Small and Medium-Sized Enterprises introduced the Copernicus Emergency Management Service, a service providing disaster management information in the form of standardized products 24 hours a day, seven days a week. The Service can be activated by member States’ civil protection agencies, European services and United Nations agencies via the European Commission’s Humanitarian Aid and Civil Protection Department in two modes: rapid mapping mode and risk and recovery mode. The expert highlighted that the Service also provides early warning services in the event of floods and forest fires through its European Flood Awareness System and its European Forest Fire Information System. The second presentation, by a representative of DLR, was used to introduce the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters and its aim of providing space-based information to contribute to disaster

response efforts. The presenter highlighted the universal access initiative of the Charter, which allows any national disaster management authority to become an authorized user of the Charter and as such to submit requests to the Charter for emergency response. The DLR representative also gave a presentation on the DLR Center for Satellite-based Crisis Information, which works closely with public authorities, non-governmental organizations, satellite operators and other space agencies and develops remote sensing services tailored to specific needs. The presenter stressed that the Earth observation community needs to demonstrate more visibly that disaster risk reduction contributes to the prevention of disasters. The UN-SPIDER programme coordinator reported on the contribution of UN-SPIDER to sustainable development as a gateway to space-based information for disaster management support, as a bridge connecting the disaster management and space communities and as a facilitator of capacity-building and institutional strengthening. The fifth presentation, by a representative of the National Disaster Reduction Centre of China, dealt with practices in the use of Earth observation resources to reduce disaster risks in China. The presenter outlined the comprehensive national disaster prevention and reduction plan developed in China between 2011 and 2015 and highlighted the role of Earth observation as a major technical support tool.

43. The Conference included an extended coffee break in the afternoon of Thursday 28 May to facilitate informal and one-to-one discussions with representatives of the private sector.

# III. Outcomes and recommendations

44. At the Conference, the Office for Outer Space Affairs and its UN-SPIDER programme, DLR and their partners achieved a variety of outcomes and made several recommendations as presented below.

## A. Outcomes

45. The Conference enabled participants:

(a) To learn about space-based applications and solutions developed in recent years to contribute to disaster risk reduction, sustainable development and climate change mitigation and adaptation;

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

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

46. In addition, the Conference enabled the Office for Outer Space Affairs and DLR:

(a) To collect a variety of suggestions and recommendations made by experts with regard to the use of space-based applications and solutions aimed at disaster risk reduction, sustainable development and climate change mitigation and adaptation;

(b) To facilitate the coordination of global efforts undertaken by the space community to contribute to implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030;

(c) To promote the use of Earth observation to track and identify ways to assess extreme climatic events affecting sustainable development efforts worldwide; and

(d) To identify ways in which Earth observation can be used specifically to contribute to the implementation of the new sustainable development framework and to track progress towards the various targets that that framework establishes.

## B. Main recommendations

47. Several recommendations were made by participants with regard to disaster risk reduction, sustainable development, climate change and cross-cutting issues.

48. With respect to disaster risk reduction, participants made the following recommendations:

(a) It will be important to define time-bound and measurable indicators for monitoring the progress of implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 at the country level and to incorporate Earth observation and other satellite technologies in the methods used to measure such indicators;

(b) In order to achieve a coordinated international approach to the use of Earth observation in disaster risk reduction, the partners that established the Global Earth Observation Partnership should undertake the efforts agreed on during the Conference as a way to advance the Partnership so that it can promote and facilitate the use of Earth observation and other satellite-based applications as provided for in the Sendai Framework for Disaster Risk Reduction 2015-2030;

(c) Communication between producers and users of space-based information needs to be improved through clear and concise communication of the quantitative and scientific aspects of results to decision makers to enable them to make informed decisions, and through enhanced articulation of practitioners' requirements both in emergency situations and for long-term planning. The differences in approaches between scientific researchers and practitioners need to be identified and addressed;

(d) There is a need to focus on disaster preparedness in anticipation of extreme climatic events. Early warning systems operated at local, national and regional levels could decrease the level of damage and destruction caused by such events. Preparedness (for example, in the form of early warning systems) can make a significant difference, especially in developing countries;

(e) Taking into consideration the critical issue that at times Earth observation results are presented in a format that cannot be easily interpreted by end users and decision makers, it is important for the recently launched Global Earth Observation Partnership to facilitate the tailoring of Earth observation information for ease of understanding and use by decision makers and end users involved in disaster risk reduction and emergency response. The Partnership should also facilitate communication among scientists who generate information and end users in civil protection or disaster management agencies. Such an effort will help

scientists to understand needs from the point of view of end users and will enable those users to understand the possibilities and limitations of satellite technologies.

49. With regard to the sustainable development goals, participants made the following recommendations:

(a) As satellite data are not yet explicitly mentioned in the outline text of the sustainable development goals, advocacy efforts may be needed in future in order to integrate the use of such data in the sustainable development agenda;

(b) There is a need to identify the capacities of different actors within the Earth observation community and determine how they can contribute to monitoring progress towards achievement of the sustainable development goals.

50. With respect to climate change, participants made the following recommendations:

(a) It was acknowledged that essential climate variables are well defined and can be used as an important tool to monitor the various manifestations of climate change. A common methodology for observing changes in the Earth's atmosphere, hydrosphere, climate and surface will facilitate more efficient data sharing and provide greater insights into Earth processes;

(b) Currently, nearly one half of essential climate variables are monitored using space-based applications. The Global Earth Observation Partnership should promote the increased use of Earth observation to monitor those variables. Awareness of the possibilities of Earth observation could also increase funding possibilities;

(c) Consistency in and cross-calibration of satellite observations derived from different types of satellite sensors, and from fleets of the same types of satellite, and with respect to archive data, will be needed for precise long-term monitoring;

(d) Earth observation is pivotal in monitoring essential climate variables. While satellites contribute to monitoring greenhouse gas emissions, their lifetime in orbit may be short in comparison to the lifetime of the International Space Station. Nations operating the International Space Station should therefore consider its use in monitoring several essential climate variables over a longer period of time than satellites allow.

51. Participants also made the following recommendations with respect to cross-cutting issues:

(a) Improvements need to be made regarding the capabilities of satellites to monitor habitats and biodiversity. Further research is needed in this area;

(b) There is a need to bring all stakeholders together to increase awareness of advances in order to improve decision-making;

(c) There is a need to continue building on the data available and to promote greater inter-calibration of different satellite sensors. It is important to identify and draw attention to gaps in current methods and processes;

(d) There is a need to increase the capacity of institutions to use Earth observation for a variety of applications in developing countries by harmonizing the

capacity-building efforts of the various stakeholders. Such harmonized efforts might lead to greater capacity than independent capacity-building efforts on the part of individual stakeholders. It is expected that such an approach will increase the global use of Earth observation and improve accessibility;

(e) Thus far, the space community has been at the forefront of promoting the use and benefits of Earth observation in a variety of applications. However, there is a lack of recognition of the potential offered by such observation among developing countries that are desperately looking for solutions. It is therefore important to continue efforts to promote the benefits of the use of Earth observation and other satellite applications; to demonstrate the value of the investments made in placing satellites in orbit to carry out Earth observation activities; and to incorporate the value of Earth observation in the global economy;

(f) Earth observation is systematically used by organizations such as the Global Climate Observing System to monitor several essential climate variables, for example in tracking deforestation and the melting of the polar ice caps and glaciers. However, in some other applications it is not used systematically but rather in research projects focusing on specific applications in selected geographic regions. There is therefore a need for efforts to streamline and institutionalize the use of Earth observation in specific applications, for example in disaster risk reduction, and to monitor variables that can be integrated in and improve the validity of the indicators to be applied in the context of disaster risk reduction, climate change and sustainable development;

(g) The concept of essential climate variables should be promoted in the context of disaster risk reduction and adaptation to climate change. Stakeholders in those areas could benefit from sets of agreed variables that can be used to track progress, monitor processes and assess risks. The Office for Outer Space Affairs and UN-SPIDER should refer to the deliberations of key stakeholders involved in the definition and negotiation of essential climate variables several years ago as a basis for outlining a possible procedure for negotiating a set of variables to be used in disaster risk reduction and adaptation to climate change. That task should also incorporate the concept of inter-calibration as a way to ensure that data collected via in situ measurements are consistent with data collected using satellites (for example, rainfall data in specific regions and estimations of rainfall in those regions based on satellite measurements);

(h) Taking into consideration existing efforts relating to the use of Earth observation and the requirements of frameworks such as the Sendai Framework for Disaster Risk Reduction 2015-2030, it is important for agencies and organizations, including those in the private sector, to find ways to cooperate through partnerships and joint activities so as to avoid duplication of effort, to make stakeholders at the local and national levels aware of existing initiatives and opportunities offered by the space community and to facilitate the combined use of ground-based, aerial and space-based data;

(i) As a way to advocate and facilitate the use of Earth observation in applications related to disaster risk reduction, climate change and sustainable development, it is important to consider integrated solutions that can be provided through private-public partnerships. Such solutions might also be found in integrated tools or applications that combine ground-based, aerial and space-based

data. In that context, it is important to continue bringing together stakeholders in the disaster risk reduction, climate change and sustainable development communities to facilitate the exchange of lessons learned, information and knowledge on the use of Earth observation and other space-based technologies, and to facilitate linkages among stakeholders representing local, national, regional and international organizations working in those areas;

(j) Further efforts are also needed to transfer space-based information and Earth observation as appropriate in support of the goals and targets established in the relevant agreements and frameworks, and to contribute to evaluation of the outcomes of those agreements and frameworks in the areas of disaster risk reduction, climate change and sustainable development. There is also a need to facilitate the incorporation of developments in science and technology into routine practices as a way of enhancing the effective use of the information and knowledge provided by space-based technologies and Earth observation;

(k) It is important to continue efforts to promote the use of Earth observation in the context of the Sendai Framework for Disaster Risk Reduction 2015-2030 and the frameworks and agreements to be launched in connection with the sustainable development goals and climate change.

## C. The way forward

52. A key message of the Conference was that there are currently a number of opportunities to promote the use of space-based information in addressing sustainable development, climate change mitigation and adaptation and disaster risk reduction as the most pressing global issues, and to demonstrate that Earth observation is useful, usable and used in supporting those efforts. DLR, the Office for Outer Space Affairs and UN-SPIDER invite all actors to take concrete steps and continue their engagement in those areas. Those steps should include:

(a) Joining forces to integrate Earth observation data into methods for measuring the indicators established within the framework of sustainable development goals;

(b) Contributing to the work of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction;

(c) Strengthening the Global Earth Observation Partnership;

(d) Providing input in the elaboration of the new Implementation Plan for the Global Climate Observing System by August 2016, especially with regard to the definition of new essential climate variables; and

(e) Joining forces to identify sustainable funding for those activities.

53. Participants also agreed to collaborate in preparing for the United Nations Conference on the Exploration and Peaceful Uses of Outer Space to be held in 2018, which will cover such topics as space governance, capacity-building, the resilience of space systems, interoperability and space for sustainable development.

54. The efficiency and applicability of Earth observation and synergies within the United Nations system must be intensified and improved as a means of facilitating the activities outlined.

# IV. Conclusions

55. The Office for Outer Space Affairs and DLR have joined forces with several partners to continue promoting the use of space-based information in the context of the post-2015 process, including the Sendai Framework for Disaster Risk Reduction 2015-2030, the sustainable development goals and climate change adaptation, mitigation, loss and damage.

56. The Conference enabled the organizers and participants:

(a) To agree on next steps regarding the Global Earth Observation Partnership;

(b) To gather recommendations on the valuation of space-based information for climate change mitigation, adaptation and loss and damage;

(c) To gather recommendations with regard to promotion of the use of space-based information in monitoring sustainable development goals.

57. Recognizing that disasters affect both developed and developing countries but that the most vulnerable are those that suffer most, the outcomes of the Conference will also help the Office for Outer Space Affairs and its UN-SPIDER programme to improve their efforts in implementing their respective mandates with a view to assisting national, regional and international agencies and organizations engaged in disaster risk management in preventing new and reducing existing disaster risks, as envisaged in the Sendai Framework for Disaster Risk Reduction 2015-2030.