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Office for Outer Space Affairs

DLR

Federal Ministry
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United Nations/Germany International Conference on Earth Observation

Global Solutions for the Challenges of Sustainable Development in Societies at Risk

26-28 May 2015, Bonn, Germany
hosted by the UN-SPIDER Bonn Office

Report

Image: ESA/JAXA

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The United Nations Office for Outer Space Affairs (UNOOSA) implements the decisions of the General Assembly and of the Committee on the Peaceful Uses of Outer Space and its two Subcommittees, the Scientific and Technical Subcommittee and the Legal Subcommittee. The Office is responsible for promoting international cooperation in the peaceful uses of outer space, and assisting developing countries in using space science and technology. In resolution 61/110 of 14 December 2006 the United Nations General Assembly agreed to establish the “United Nations Platform for Space-based Information for Disaster Management and Emergency Response - UN-SPIDER” as a new United Nations programme to be implemented by UNOOSA. UN-SPIDER is the first programme of its kind to focus on the need to ensure access to and use of space-based solutions during all phases of the disaster management cycle, including the risk reduction phase which will significantly contribute to the reduction in the loss of lives and property.

United Nations/Germany International Conference on Earth Observation - Global Solutions for the Challenges of Sustainable Development in Societies at Risk

Organized by the

United Nations Office for Outer Space Affairs/ UN-SPIDER

Together with the

German Aerospace Center (DLR)

With the support of

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Bonn, Germany

26th-28th May 2015

Table of Contents

Acknowledgements

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Background

2015 is a decisive year as governments worldwide will culminate negotiations with the support of the United Nations, and will launch three global agreements that are geared to steer development trends worldwide as a way to continue efforts towards sustainable development while addressing the challenges posed by climate change and natural hazards. Already in March of this year, during the World Conference on Disaster Risk Reduction held in Sendai, Japan; governments of 187 countries launched the Sendai Framework for Disaster Risk Reduction. This framework defines goals and priorities for action as a way to enhance the resilience of nations in the next fifteen years (2015- 2030). Later in September of this year, the Sustainable Development Goals (SDGs) will be launched as a way to provide continuity to the Millennium Development Goals (MDGs) that were launched a decade ago. Furthermore, governments will use the 21st Conference of Parties to be held in Paris, France, to launch a new Climate Change Agreement.

This United Nations/Germany International Conference on Earth Observation – Global Solutions for the Challenges of Sustainable Development in Societies at Risk, brought together experts from a variety of sectors of development, decision makers from government agencies, researchers and stakeholders to showcase the most recent developments on the use of Earth observation and integrated space technology applications to address the challenges of climate change and disaster risk reduction and to contribute to efforts targeting sustainable development worldwide. They used the Conference to discuss ways in which Earth observation can be used to contribute to assess the effectiveness of the processes to be launched in the coming years as a way to reach the goals and targets included in these three global agreements.

Earth observation is an essential resource to track the status of our natural resources, the climate, our oceans, polar ice caps and other features of our planet. When incorporated in routine monitoring activities, Earth observation supports informed decision making at the local, national, regional and global level; helping us find ways to reduce disaster risks; identify different alternatives to plan our adaptation to climate change, prepare better for unavoidable losses and damages triggered by disasters, and contribute to monitor how well our efforts are leading to sustainable development; providing relevant information to align targets and indicators included in these global agreements; and can be used to develop harmonized national reporting systems.

The Conference facilitated the coordination of global efforts carried out by the space community to contribute to the implementation of the Sendai framework for disaster risk reduction; particularly to assess disaster-risks and in the area of disaster preparedness, specifically early warning systems.

Furthermore, the conference also promoted the use of Earth Observation to assess climaterelated extreme events affecting sustainable development efforts worldwide. It provided a forum for experts to discuss novel methods to use Earth Observation to assess potential losses and damages contributing to the mechanism launched in 2013 during the Conference of the Parties (COP) in Warsaw; and to use Earth observation to contribute to adaptation efforts which were launched during the COP in Cancun in 2010;

In addition, the conference allowed experts and decision makers focusing efforts on sustainable development; to explore how best to take advantage of the opportunities offered by the Space community to contribute to their efforts. In this context, the conference was used to identify ways in which Earth Observation can be used explicitly to contribute to the implementation of the new framework for sustainable development and to track progress in the various targets that the framework includes.

The conference was structured in terms of High Level Panels where distinguished panelists addressed specific issues and provided key messages to keep in mind during the conference. A UN-SPACE High level Panel addressed the role of regional and international organizations in contributing to the achievement of the goals and targets contemplated in the three global agreements and frameworks. The conference also included sessions dedicated to disaster risk reduction (session 1); climate change (session 2), and sustainable development (session 3). Two specific sessions focussed on Earth observation and space-based solutions to address these challenges (session 4) and on mechanisms that contribute to enhance the resilience of nations (session 5). The sessions allowed experts taking part in the conference to express their views, comments and suggestions regarding how to promote the use of Earth observation in these three key topics.

All presentations of the conference are available for download at the UN-SPIDER Knowledge Portal: www.un-spider.org/post2015.

Experts

The conference brought together 120 experts representing the following institutions:

United Nations organizations:

United Nations Office for Disaster Risk Reduction (UNISDR)

United Nations Framework Convention on Climate Change (UNFCCC)

World Health Organization (WHO) - European Centre for Environment and Health (ECEH)

United Nations University, Institute for Environment and Human Security (UNU-EHS)

United Nations Economic Commission for Africa (UNECA)

United Nations Educational, Scientific and Cultural Organization (UNESCO)

International Telecommunication Union (ITU)

United Nations Office for Outer Space Affairs(UNOOSA)

UN-SPIDER Regional Support Offices:

Iranian Space Agency (ISA)

Space Research Institute NAS Ukraine and SSA Ukraine (SRI NASU-SSAU)

Regional Centre for Mapping of Resources for Development (RCMRD)
National Center for Remote Sensing National Space Research and Development (NASRDA)
Algerian Space Agency (ASAL)
National Institute of Aeronautics and Space (LAPAN)

Government Ministries and National Agencies:
National Emergency Management Agency (NEMA), Nigeria
UAE Government
Surveys and Mapping Division, Trinidad and Tobago
German Federal Ministry of Transport and Digital Infrastructure (BMVI)
Institut des Regions Arides de Medenine (IRA)
German Federal Institute for Geosciences and Natural Resources (BGR)
National Authority for Remote Sensing and Space Sciences (NARSS)
German Federal Ministry for Economics and Energy (BMWi)
National Disaster Operations Centre, Kenya
National Disaster Reduction Center of China (NDRCC)
City of Bonn
National Emergency Commission and Civil protection, Dominican Republic
Ghana Irrigation Development Authority
National Observatory of Athens
Ministry of territorial administration, decentralization and security of Burkina Faso
Department of Disaster Management, Bhutan

Space agencies:
German Aerospace Center (DLR)
Italian Space Agency (ASI)
Mexican Space Agency (AEM)
European Space Agency (ESA)

Non-Governmental Organizations:
Information Technology for Humanitarian Assistance, Cooperation and Action (ITHACA)
Sustainable Development 360
Welthungerhilfe
German Committee for Disaster Reduction (DKKV)
Secure World Foundation (SWF)

International and regional organization:
European Commission, EC
European Astronaut Centre (EAC)

European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) / Global Climate Observing System (GCOS)

Universities and Research Centres:
National Research Centre, Sudan
University of Bonn
Rhine-Westphalia Institute of Technology Aachen
Helmholtz-Association
Technical University of Wiener Neustadt
Council for Scientific and Industrial Research (CSIR)
Environmental Science for Social Change (ESSC)
University of Bayreuth
University of Bochum
Institute for Advanced Study of Pavia (IUSS)
University of Batna
INPE - Brazilian National Space Research
Tohoku University
University of Cologne
DIAEE - 'La Sapienza' University of Rome
Beuth Hochschule Berlin
International Institute of Space Law (IISL)
IABG Industrieanlagen-Betriebsgesellschaft mbH
European Academy of Bozen/Bolzano (EURAC)
Lagos State University
University of Koblenz-Landau
South China Sea Institute of Oceanology, Chinese Academy of Sciences
VSB-Technical University Ostrava

In addition, representatives from various **private companies** were present:
GAF AG
Geoscience Consulting Pte Ltd
Airbus Defense & Space - Geo-Intelligence
Evenflow
DigitalGlobe
SISTEMA GmbH
EOMAP GmbH & Co. KG
European Space Imaging (EUSI)
OHB SE
GMV Aerospace and Defence

In addition, 17 **UNOOSA staff** participated in and supported the conference.

Countries

Approximately 120 experts and participants from more than 35 Member States from Africa, Asia, Europe, Latin America and the Caribbean convened in Bonn to discuss the benefits of Earth observation for sustainable development, including climate change and disaster risk reduction. The representative came from the following member states of the UN:

Algeria (People's democratic Republic of)
Austria (Republic of)
Belgium (Kingdom of)
Bhutan (Kingdom of)
Brazil (Federative Republic of)
Burkina Faso
China (People's Republic of)
Czech Republic
Dominican Republic
Egypt (Arab Republic of)
France (French Republic)
Germany (Federal republic of)
Ghana (Republic of)
Greece (The Hellenic Republic)
Indonesia (Republic of)
Iran (Islamic Republic of)
Italy (Republic of)
Japan
Kenya (Republic of)
Mexico (United Mexican States)
Netherlands (Kingdom of the)
Nigeria (Federal Republic of)
Philippines (Republic of the)
Singapore (Republic of)
South Africa (Republic of)
Spain (Kingdom of)
Sri Lanka (Democratic Socialist Republic of)
Sudan (Republic of)
Switzerland (Swiss Confederation)
Trinidad and Tobago (Republic of)
Tunisia (Republic of)

Ukraine
United Arab Emirates
United Kingdom of Great Britain and Northern Ireland
United States of America

Welcome remarks

The conference was opened Mr. Juan Carlos Villagran de Leon, Head of Office of the UNOOSA/UN-SPIDER Bonn Office, Mrs. Margitta Wülker-Mirbach, Head of Division at the German Federal Ministry for Economic Affairs and Energy (BMWI), and the Lord Mayor of the City of Bonn, Jürgen Nimptsch.

In his welcome remarks Mr. Villagran de Leon stressed that Earth observation plays a role in making us aware of our environment, how it is changing, and how different extreme events are manifesting themselves worldwide. He introduced the role of the Committee for Peaceful Uses of Outer Space (COPUOS) to promote the peaceful use of outer space and technologies associated with it, in order to use space sustainably and help to shape development. Mr. Villagran concluded that Earth observation can help us to monitor global efforts to reach goals and targets, and that space applications offer opportunities for global cooperation.

Mrs. Wülker-Mirbach gave an overview of the post 2015 process and the importance of space-based information to monitor and respond to environmental changes making reference to the the Rio+20 summit declaration. This Rio+20 declaration already stressed the possible benefits regarding the use of Earth observations. She highlighted the importance of the Financing for Development conference in Addis Ababa, Ethiopia, on July 3rd 2015, which will be followed by the Climate Agreement in Paris, where the importance of space-based information needs to be recognized, as well as the World Humanitarian Summit in 2016. From a German perspective, Mrs. Wülker-Mirbach also highlighted that the G-7 summit in Bavaria taking place in July 2015 is also of utmost importance to Germany in informing the role it will play in achieving the Sustainable Development Goals (SDGs). She concluded that coordination and actions using space-based information need to be directed at the operational level in order to be useful.

Lord Mayor Jurgen Nimptsch stated that this conference is about advancements in technical performance and enhancing capacities, including those of citizens of countries around the world in order to increase their resilience. He acknowledged that Bonn can be seen as a city where technical knowledge and vision come together.

Keynotes

In her keynote speech, UNOOSA's Director, Mrs. Simonetta Di Pippo stressed the importance of satellite data in sustainable development, climate change and disaster risk reduction. She stated that "This conference, beginning today, is a vital component in UNOOSA’s continuing work. The conference is conducted as a way not only to contribute to the Post-2015 Development Agenda, but also to bring together stakeholders to embark on joint efforts to facilitate the use of Earth observations for sustainable development. We will discuss how best to integrate Earth observations and space capabilities into national development programmes, how to identify strategies to capitalize on space technology-derived solutions to support global agendas, to leverage and foster partnerships and to make participants aware of the most recent developments in the context of integrated space applications."

Mr. Johann-Dietrich Wörner, Chairman of the Executive Board of the German Aerospace Center (DLR) showed different examples of space-based applications in the context of sustainable development such as monitoring of deforestation or ice cap melting, as well as applications for flood early warning, sustainable energy and humanitarian issues. He stated that "Space-based technology including Earth observation can significantly support the challenges of disaster management, sustainable development and climate change. DLR is developing systems and algorithms to process and archive the ever-growing volumes of data, and to ensure their timely availability. Radar interferometry, for instance, permits registration of ground displacements with millimetric accuracy. Movements of this kind occur during earthquakes, for example recently in Nepal."

High level opening panel: Setting the agenda on the relevance of Earth observation

Recalling the statement by Secretary General of the United Nations, Mr. Ban Ki Moon, that “we must work closely together to make this year a year of global action, one that will be remembered as the dawn of a new era of sustainable development”; the conference included in its opening segment a High Level Panel aiming to set the stage for the conference by looking at the broader context of collaboration in Earth Observation and how organisations and governements can work together to achieve sustainable development. The panelists shared their views on key issues related to sustainable development, climate change, and disaster risk reduction. They commented on how Earth observations can contribute to identify global solutions to the challenges of sustainable development in societies at risk.

The high level opening panel was commenced by **Mrs. Simonetta Di Pippo**. Considering the latest disasters like typhoon Haiyan in the Philippines, the earthquake in Nepal, the Ebola crisis in Africa and the challenges that vulnerable people face in many countries around the world on a day-to-day basis and the effects of climate change; Mrs. Di Pippo emphasized the need to recognize the interlinkages among these problems and to identify holistic solutions. Making reference to the agreements of post 2015 process, she highlighted the role that satellite data can play in reaching the goals of disaster risk reduction, sustainable development and climate change mitigation and adaptation.

Mr. Johann-Dietrich Wörner, stated that now is the time to enhance the use of Earth Observation in these topics of climate change, sustainable development and disaster risk reduction. He then introduced the panelists: Mr. Roberto Battiston, President of the Italian Space Agency (ASI), Mr. Michael K. Simpson, Director of Secure World Foundation (SWF), Mr. Halldor Thorgeirsson, Director for Strategy at

UNFCCC, and Mr. Pedro Basabe, Senior Programme Officer at the UN Office for Disaster Risk Reduction (UNISDR) representing the ISDR secretariat on behalf of Mrs. Margareta Wahlström.

When asked regarding how he sees the linkage between Earth observation and sustainable development, **Mr. Simpson** answered that the Secure World Foundation has worked very hard to broaden the base of those benefitting from space capabilities for sustainable development, for example in Mexico or Nepal. He emphasized the need to use satellite data for informed land-use and urban planning before a disaster strikes to increase resilience and to prevent a high level of damage. Based on his experiences in supporting the preparation of the Ministerial meeting Group on Earth Observation (GEO) in January 2014, he identified capacity development on the use of shared data as a critical issue.

Mr. Thorgeirsson of the Secretariat of UNFCCC summarized the key expected outcomes of UNFCCC's COP 21 in Paris as follows: First, the accountability of states and the states' self-determination of their contributions – these national contributions are the core of the action and they will be included in the synthesis report; second, the question of longer term, which is referring to the whole convention – the convention was not set up to prevent climate change but to manage climate change as there is a huge risk in a two degree rise in global temperatures; third, building resilience, which impacts vulnerability and adaptation – there is an increasing interest in looking at risks for extreme events and thus dealing with the manifestations of climate change; fourth, the significance of implementation and cooperation at all levels – away from a purely government-driven process towards a conversation at all levels including local authorities like mayors, the regional and municipal level, as well as the private sector and other relevant actors. Mr. Thorgeirsson underlined that at the international level there is need for a "new treaty, not an action plan" and that this is very different from the action-oriented Sendai framework; the new climate treaty will not mention specific components and pick certain elements of the solution base, which is why neither space nor the atmosphere is mentioned in the current draft. Establishing a link between climate change and the Sendai framework, Mr. Thorgeirsson stated that climate-related risks are a manifestation of the failure to deal with climate change, and that climate change is a cross cutting underlying driver of risk. Regarding the use of space-based information, he stated that the promotion of the use has been supply-driven for a long time, and that the recognition of the potential at the ground level is needed. In that regard, he recommended to not only work with the national but also with the regional level in order to identify and eliminate obstacles why the potential of Earth observation is not fully exploited for disaster risk reduction. He further recommended focusing on the means of implementation and on capacity building in developing countries, where the private sector could also play a role.

Asked about his recommendations about the use of Earth observation in the context of the Sendai framework **Mr. Basabe's** key recommendation was to find ways to make satellite data for disaster risk reduction easily accessible to Member States. While emergency mechanisms like the International Charter on Space and Major Disasters provide easy and free access to satellite information in case of disasters, a similar service should be implemented to provide access to free data for disaster risk reduction[1]. Mr. Basabe highlighted that space-based information plays an important role in disaster risk reduction "the usefulness of space-based information was already manifested in the Hyogo Framework for action and it is now re-iterated in the Sendai Framework." Furthermore, Mr. Basabe strongly recommended to continue intensifying cooperation to strengthen the knowledge, capacities, and institutions of countries to use Earth observation for the implementation of the Sendai framework. He stressed that technology alone does not help countries but it needs political frameworks like the Sendai Framework to support the use of the technologies for the benefits of countries – the Sendai Framework provides the linkage between the political and the technical part.

Mr. Battiston described the role of space agencies as taking their responsibility for planet Earth by linking top level decision making with industrial technological development and implementation, for example by observing changes in our land, oceans, and atmosphere trying to understand the effects of global warming. The advantage of satellite imagery in this context is that a multitude of physical parameters can be observed in a single shot. Mr. Battiston highlighted four key issues: first, the need to agree on tools (including the steps to get data, compare, create information, and communicate) – measuring preparedness in an objective way remains a challenge; second, the need to adopt a different approach to space economy, which should not only consider the effects of selling data but also the reduction of risks when using satellite data – economical values linked to the prediction of weather for example are invisible in classical economic calculations; third, the role of science and research – even with large research projects the results are minor compared to the great challenge of trying to understand our planet, which also includes cultural habits – still, there is no alternative but to use the language of science, to apply rational thinking, and to share data in a uniform way, failure would mean that our science has not been implemented correctly; fourth, the coverage of satellite data and need for global constellations, dynamic and continuous observation of the Earth (as provided by google skybox), and the delivery of the right data in the right time, which is especially crucial for emergency intervention – Italy, in collaboration with Argentina, will deploy ten additional radar satellites to cover each point on Earth in ten to twenty minute intervals. Consequently, Mr. Battiston recommended that space agencies focus on the goal of delivering effective results and good data in time, which can only be done if space agencies of a region are acting as one as it has been done with Global Monitoring for Environment and Security (GMES)/Copernicus in Europe.

Mr. Wörner opened the floor for **questions and statements from the plenary participants**.

The discussion focused on capacity building. It was stated that many capacity building activities including webinars and face-to-face training in countries do not reach enough people. Mr. Thorgeirsson stressed that investing in capacity does not mean general awareness raising potential but it means an embedded

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[1] In the course of the conference this question was discussed and the Copernicus EMS service on risk and recovery mapping products was identified as an already existing operational service to provide free access to satellite-based information products for disaster risk reduction like reference maps, pre-disaster situation maps (including hazard exposure, vulnerability, resilience, risk status, evacuation plans, modelling scenarios), and post-disaster situation maps (including post disaster needs assessment, recovery plans, reconstruction/rehabilitation monitoring, Internally Displaced Persons (IDP) monitoring, Refugee Camp monitoring).

effort to meet human needs. Mr. Simpson pointed out that capacity building is bidirectional - with each training activity the trainers learn more about the needs and can adapt future training activities accordingly.

Another issue tackled during the discussion was on risk maps. A statement was made that more dynamic risk maps are needed in order to enhance knowledge of where the vulnerable elements are when a disaster strikes.

Finally the issue of scale was raised. The need was articulated for very high spatial and temporal resolution satellite imagery. Currently, very high temporal resolution is only possible with geostationary satellites, which have a coarse resolution. Satellite sensors are always a trade-off between the spatial and temporal resolution. Mr. Wörner pointed out that while there have been significant advancements in satellite and sensor development, there are physical limits as to what is technically possible.

Mrs. Di Pippo closed the high level panel and proposed to present results of the conference at the upcoming sessions of the Committee on the Peaceful Uses of Outer Space (COPUOS) in June 2015. She also invited all participants to take part in the participatory process for UNISPACE+50.

Special talk: The Blue dot perspective (Alexander Gerst, ESA astronaut)

In a special talk, Mr. Alexander Gerst, a German astronaut of the European Space Agency (ESA) discussed his experience in the International Space Station, and the new perspective it gave him of the Earth. Coming from an Earth Science background, he emphasized how understanding Earth system processes and space technology are interlinked. He discussed how the view of Earth from above can change one's perception: "One of the most valuable things that we can find in space is a new perspective on our planet. This perspective is one of a small blue planet with limited resources, surrounded by a paper thin layer of air and with a highly fragile ecosystem. We get a special view on the only place known in our universe where humankind can live and on which everything is connected."

Topic 1: Disaster Risk Reduction

Session 1: The Sendai Framework for Disaster Risk Reduction 2015-2030 – Opportunities for Earth observation

The Sendai Framework for Disaster Risk Reduction recognizes the usefulness of Earth observation and space-based technologies in the context of disaster risk reduction. Earth observation and space-based technologies will contribute to priority of action 1 "Understanding disaster risk" and to priority of action

4 “Enhancing disaster preparedness for effective response and to ‘Build Back Better’ in recovery, rehabilitation and reconstruction”.

The Sendai Framework includes the notion of voluntary commitments on behalf of stakeholders to ensure that the goals stipulated in the Sendai Framework are met. During the World Conference on Disaster Risk Reduction UNOOSA/UN-SPIDER, DLR and 17 additional partners launched an Earth observation partnership as a voluntary commitment to contribute to the achievement of the goals outlined in the Framework, and in particular to address the specific requirements stipulated in the Sendai Framework that make reference to the use of Earth observations and space -based technologies.

Session 1 – Plenary presentations

Session 1 of the Bonn conference started with three plenary presentations on opportunities for Earth observation within the Sendai framework for disaster risk reduction by Mr. Günter Strunz, head of department at the Earth Observation Center of DLR; the Sendai framework for disaster risk reduction by Pedro Basabe, Senior Programme Officer at UN office for Disaster Risk Reduction; and the role of UN-SPIDER in contributing to the goals and priorities included in the Sendai framework by Juan Carlos Villagran de Leon, head of UN-SPIDER Bonn office.

In the first part of his presentation **Mr. Günter Strunz** introduced the Sendai framework including its four priorities for action and the seven global targets, which will be measured at the global level, and the outcome and goal of the framework, which will be monitored by national targets and indicators. He underlined that the framework identified two concrete recommendations for follow-up activities for the UN General Assembly: first, to include the review of the global progress in the implementation of the Sendai Framework; second, to establish an open-ended intergovernmental working group for the development of a set of possible indicators to measure global progress in the implementation of the Sendai Framework in conjunction with the work of the inter-agency expert group on sustainable development indicators.

In summary, Mr. Strunz identified the following concrete **opportunities for the use of Earth observation within the Sendai framework**:

- To contribute to the review of the global progress in the implementation of the Sendai framework by providing relevant data and information at the global level;
- To contribute to the implementation of the Sendai framework, especially in priorities for action 1 and 4, by providing relevant data and information at the national and regional level.

In the second part of his presentation, Mr. Strunz gave **examples of contributions of Earth observation to map hazards and exposed elements**: Global data sets, like the Global Urban Footprint and the Human Settlement Layer, developed by the European Commission Directorate General Joint Research Centre, which can be used to map exposed areas where people are living; Global digital elevation models, as TanDEM-X with a height accuracy of 2m and 12m resolution have great importance in risk mapping and analysis; 3D mapping and categorization of buildings regarding their structure and material is relevant for the assessment of potential damages due to earthquakes; a combination of hazard and risk assessment and Geographical Information System (GIS) technologies can be used e.g. to calculate an evacuation time map for tsunami hazard; the global early warning system for wildland fires helps to identify areas that are currently prone to wildland fires; global drought monitoring and forecasting systems based on time series of vegetation indices can support decision makers to anticipate possible drought-induced famine and take relevant action to mitigate the disaster; and current research and development in automated flood mapping based on Moderate-resolution Imaging Spectroradiometer (MODIS), TerraSAR-X, and Sentinel-1 data reduces the response time.

Mr. Strunz concluded his presentation with an introduction of the Earth observation Global Partnership that was launched at the World Conference in Sendai with the aim to contribute to the achievement of the goals of the Sendai Framework by using Earth observation and space-based technologies.

Priority 1. Understanding disaster risk: -> National and local levels

To achieve this, it is important to:

National level:

… (c) Develop, update periodically and disseminate, as appropriate, location-based disaster risk information, including risk maps, to decision makers, the general public and communities at risk to disaster in an appropriate format by using, as applicable, geospatial information technology;

… (f) Promote real-time access to reliable data, make use of space and in situ information, including geographic information systems (GIS), and use information and communications technology innovations to enhance measurement tools and the collection, analysis and dissemination of data;

Global level:

… (c) Promote and enhance, through international cooperation, including technology transfer, access to and the sharing and use of non-sensitive data, information, as appropriate, communications and geospatial and space-based technologies and related services. Maintain and strengthen in situ and remotely-sensed earth and climate observations.;

… (g) Enhance the scientific and technical work on disaster risk reduction and its mobilization through the coordination of existing networks and scientific research institutions at all levels and all regions with the support of the UNISDR Scientific and Technical Advisory Group in order to: strengthen the evidence-base in support of the implementation of this framework; promote scientific research of disaster risk patterns, causes and effects; disseminate risk information with the best use of geospatial information technology; provide guidance on methodologies and standards for risk assessments, disaster risk modelling and the use of data; identify research and technology gaps and set recommendations for research priority areas in disaster risk reduction;

Figure 1: Reference to space-based and geospatial information in the Sendai framework for disaster risk reduction (highlighted in red)

Mr. Pedro Basabe gave a detailed presentation on the outcome of the Third UN World Conference on Disaster Risk Reduction (WCDRR), namely the Sendai framework for Disaster Risk Reduction 2015-2030. He summarized the innovations of the new framework, namely a shift from disaster loss to disaster risk; a shift from disaster management to disaster risk management; a shift from "what to do? " to "how to do"; focus on a people-centred preventive approach to Disaster Risk Reduction (DRR); delegation of primary responsibility of states for DRR; shared responsibility for DRR with stakeholders, the scope includes slow-onset, man-made and biohazards; a set of global targets; and a set of guiding principles. Mr. Basabe reiterated that paragraph 24 of priority one regarding the framework includes the mandate for the use of Earth observation. He stressed that new modalities of cooperation based on the Sendai commitments need to be identified, and modalities for periodic review have to be determined. While the main responsibility regarding DRR lies with governments, other stakeholders including civil society, academia and the private sector have a role to play. Furthermore, Mr. Basabe made the point that the means of implementation of the Sendai framework are important and they include the access of developing countries to finance, innovation, knowledge and information sharing; the incorporation of DRR into multilateral and bilateral assistance; increased UN financing; and the creation of progress indicators.

He identified concrete follow-up actions, especially regarding the monitoring system for the implementation of the framework, which will need to include baseline and target data, global to regional reviews, national and local reports, public debates and voluntary commitments; all of which will be fed to the General Assembly. Mr. Basabe summarized the follow-up action items by institution:

Follow-up by UN General Assembly:

- endorse the Sendai framework;
- establish an open-ended inter-governmental working group to develop indicators and terminology (May 2015).

Follow-up by UN

- Update the UN Plan of Action on DRR for Resilience;
- Promote coherence across conferences and agreements (e.g. Financing for Development; UN Summit on post-2015 development agenda; UNFCCC COP21; World Humanitarian Summit; and Habitat 3);
- Support the States in the implementation according to their respective mandates and scopes.

Follow-up by States

- Appoint national focal points (multi-sectoral National Platforms);
- Nominate experts to the open-ended inter-governmental working group for the development of indicators and terminology;
- Update risk information and data bases;
- Update national and local DRR strategies and plans;
- Report on the status of implementation plans;
- Update regional DRR strategies;
- Promote local platforms on DRR;
- Promote coherence across agreements.

Follow-up by stakeholders

- Support the development of a guide for the implementation of the framework implementation;
- Implement commitments which were made;
- Integrate the Framework in their work;

- Support states in the implementation;
- Support the inter-governmental process, for example to update the terminology;
- Promote coherence across conferences;
- Prepare for the 2017 Global Platform and regional platforms.

Follow-up by UNISDR

- Implement activities as mandated in the Sendai Framework;
- Support the implementation, follow-up, monitor and report;
- Promote coherence among international agendas;
- Lead the revision of the United Nations Plan of Action on Disaster Risk Reduction for Resilience;
- Generate evidence-based and practical guidance for the implementation of the framework in close collaboration with States and partners;
- Prepare the next cycle of regional and Global Platforms.

Mr. Juan Carlos Villagran de Leon discussed the efforts of UN-SPIDER in the context of the Sendai Framework. He gave a short introduction of the UN-SPIDER activities including the Knowledge Portal, which is a tool for information, communication and process support; UN-SPIDER's aim to create forums for cooperation between stakeholders; the capacity building activities implemented through the program such as e-learning and the technical advisory support given to countries. He commented that UN-SPIDER has a network of Regional Support Offices (RSOs) all over the world and conducts technical advisory missions.

Mr. Villagran noted that UN-SPIDER, with the support of DLR and other partners, worked on incorporating explicit text on the use of Earth observation and space-based technologies in the Sendai Framework. He pointed out that the added value of Earth observations for Disaster Risk Reduction are: the saving of costs of field monitoring, the quality improvement of combining Earth observations with in-situ data, consistency in the coverage and scope of satellites, the ability to gain a synoptic overview of regions, the ability to compare risks, the ability to represent complex dynamics and processes and the unique means to monitor the progress of the implementation of the framework. He reitered that UN-SPIDER has committed itself to continue facilitating the 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. It was stressed by Mr. Juan carlos Villagran de Leon mentioned that a global partnership with international, regional and national disaster risk reduction and space organisations has been launched in Sendai as a voluntary contribution on behalf of UN-SPIDER and more than 15 partners. The partnership will contribute to integrate Earth observation into disaster risk reduction practices. This conference should therefore address the next steps for the partners in the Earth observation partnership, and to create synergies to contribute to the use of Earth observations and space-based applications in Disaster Risk Reduction.

Session 1 – Working Group 1: Earth observation to support the Sendai Framework for Disaster Risk Reduction 2015-2030

This working group focused its discussion on the current and upcoming capabilities of Earth observation to support the requirements laid down in the Sendai Framework. Several means of implementation were outlined in terms of applicability (scale, transferability, technical and human capacities needed. This working group had the following aims:

- To elaborate and propose Earth observation (EO) applications to support the implementation of the Sendai framework in the context of priorities for action 1 (understanding risk) and 4 (preparedness, response and recovery);
- To identify gaps which could be filled in the use of EO in DRR via further research and development work;
- To take note of future EO applications (under development or to be developed in the near future) to support the Sendai framework on DRR.

In this working group academics, operational personnel and decision makers were present.Two presentations were given, followed by a discussion. The first presentation was given by **Mr.Shunichi Koshimura** of the Tohuku University, in Japan. The topic of the presentation was "Advances of remote sensing for mapping disaster impact" and it addressed the improved results than can be achieved by combining simulation, remote sensing and spatial information science. He presented a case study on the tsunami that hit Japan in 2011. This study demonstrated that flooding simulation and damage assessment are possible and that further improvements can be made through the use of sensor and Unmanned Aerial Vehicles (UAV) technology for tracking human movements and the availability of pre-event data. Lastly, he commented on the uncertainties around human reactions and movements during an evacuation, which could be improved potentially by using cell phone data in real time.

The second presentation was given by **Ms. Nataliia Kussul** of the National Space Agency of Ukraine on the topic of "Drought risk assessment in Ukraine using satellite data". In Ukraine satellite data is used to monitor crop species, crop yield and soil moisture because agricultural losses due to droughts are a serious issue. The information gathered through EO is used to map vulnerable and less vulnerable areas. Furthermore, satellite data is used to determine the regularity of droughts, the dimension/degree of droughts and to estimate financial losses.

The discussion afterwards addressed challenges in information systems to integrate remote sensing, early warning systems and modeling; coordination and capacity building. Figure 2 shows the most relevant topics/challenges, and potential follow up activities as discussed in this working group.

Topic / Challenge	Description	Potential follow up activities
Information Systems to Integrate remote sensing, early warning systems and modeling	**All pieces are available but must be put together in an useful way**	**Put together using information systems technologies to achieve the goals. These systems would incorporate different user's requirements and provide information in a way that is understandable by each user.**
Science	**The underlying phenomena**	**Physics of the underlying phenomena have to be continuously improved, as well as the dynamics and use of Earth observations.**
Communication	**Need to communicate better with different users**	**The presentation to different users should be improved. Decision makers require better presentation of the EO Science. Include different communication strategies when targeting the general public, responders, and others.**
Data	**Increase the availability of data**	**Sensor Calibration and Inter-sensor calibration should allow continuous monitoring with different sensors. Data acquisition should be made a priority by countries.**
Coordination		**Improve the engagement of Academia and National organizations by drawing plans and laws. Support the update of existing Civil Protection agencies.**
Capacity Building		**All actors must be trained, including decision makers**

Figure 2: Summary of most relevant topics and challenges identified by the Working Group on Earth observation to support the Sendai Framework for Disaster Risk Reduction 2015-2030

Session 1 – Working Group 2: National Information Needs

Working group 2 focused on national information needs and requirements contemplated in the Sendai Framework. Participants in this working group discussed these needs as well as ways in which Earth observation and other space-based technologies could be use d to fulfil those requirements. One main focus was on the user perspective (e.g. civil protection agencies, other mandated organizations or interest groups). This working group was tasked to:

- Discuss ways to identify and compile national information gaps and needs (for example through surveys targeting National Disaster Reduction Agencies of National Platforms for Disaster Risk Reduction);
- Identify which of the information gaps and needs can be potentially filled through the use of EO;
- Identify challenges related to access to data and its processing; and discuss ways to address those challenges through resource allocation, knowledge transfer and capacity building.

In this working group two presentations were given: one by **Mr. Axel Rottlaender** of the German Committee for Disaster Reduction (DKKV) about "Collaboration of Science and Practitioners – Information as a Key Element for Effective Collaboration" and one by **Mr. Pema Thinley** of the Department of Disaster Management of Bhutan on "Disaster Management in Bhutan: The Demand for Information".

Mr. Axel Rottlaender's presentation stressed that Disaster Risk Reduction requires close collaboration between scientists and practitioners. Practitioners most often have information needs which are often not met by scientific outcomes. Mr. Axel Rottlaender suggested that communication/dialogues about common language, mapping, requirements and expectations are needed for efficient information management. Possible solutions include involving practitioners already at the proposal stage, identifying information needs and exchanging staff.

The presentation by Mr.Pema Thinley focussed on disaster management in Bhutan. The components of the multi-hazard assessment which is used in Bhutan include: risk assessment and identification, risk reduction, risk retention and transfer, and disaster management. Mr. Pema Thinley points out that the elements of hazard, exposure and vulnerability are combined to estimate the expected damage which is then used to determine and calculate the losses. In order to elaborate hazard maps, base maps, geological maps, land cover maps, soil maps, rainfall data, topographic data, digital elevation model (DEM), hydrological data etc. are needed. Other information to determine exposure include road networks, power supply, buildings (including schools and hospitals). High resolution satellite imagery can be used to locate such infrastructure. The risk mapping is then a multiplication of hazard, exposure and vulnerability. However, currently information collecting agencies around the globe don´t share information.Therefore bodies are needed to ensure information dissemination.

The working group identified that the scientific perspective regarding information needs is not necessarily the perspective of practitioners. Figure 3 illustrates the main topics, challenges and the potential follow up activities that were identified during the discussion of this working group. The group concluded that main issue is not information but rather communication. It is necessary to identify information needs and communicate information at an early stage and continuously. In terms of Disaster Risk Reduction the aim should be to deliver practical results, usable tools and methodologies. If information is not delivered at the right time and in the right format and to the right people then it will hamper innovation and also the implementation of for example the Sendai Framework.

Topic/Challenge	Description	Potential Follow Up Activities
Differences in approaches	**Scientists versus Hands on Practitioners**	**These two should be assembled in one group and work together.**
Differences in Backgrounds	**Educational Backgrounds**	**A common language should be found.**
Differences in Understanding	**Lack of communication**	**Targets should be streamlined.**
Differences in Objectives	**Scientists have a completely different objective as compared to practitioners**	**Available networks should be used to eliminate these differences.**
Differences in Capacity and Expectations	**Expectations between scientists and practitioners are completely different**	**Ensure that expectations are explicitly stated and work to minimize them.**

Figure 3: Summary of most relevant topics and challenges identified by the Working Group on national information needs

Session 1 – Working Group 3: The Sendai Framework on Disaster Risk Reduction 2015 – 2030 - Global Partnership on Earth observation

In order to effectively advocate for and promote the use of Earth observation and space-based technologies within the context of the Sendai framework, UNOOSA/UN-SPIDER co-initiated together with key partners a “Global Partnership focusing on Earth observations and space-based technologies” as a voluntary commitment . This partnership aims to facilitate the use of Earth observation and related space-based technologies through a variety of efforts including through the provision of technical advisory support. This working group was tasked to:

- Review and refine the aims of the partnership, its Terms of Reference and governance, and governance issues;
- Elaborate a Plan of Work for the Earth observation partnership and modalities for month-to-month communication and for implementation;
- Define modalities to update the Earth observation White paper.

The objectives of the partnership are to facilitate dialogue among experts, serve as a source of information, give policy relevant advice, promote the use of space technology and mobilize additional stakeholders. This working group's main topics, challenges, descriptions and potential follow up activities are summarised in figures 4 and 5.

Topic / Challenge	Description	Potential follow up activities
The nature of the partnership	**The partnership is understood as a voluntary commitment on behalf of its partners; but it must ensure that it does not duplicate the efforts of its partners.**	
Voluntary contributions proposed by partners	**UNISDR: to provide the political support to facilitate the efforts of the partnership to support developing countries; and to link the partnership with the Science and Technology Advisory Group of UNISDR.** **UN-SPIDER: to provide space in its Knowledge Portal to host the content generated by the EO Partnership; to contribute with content for publications; facilitating links with national civil protection / DRR agencies and support in the coordination efforts needed by the partnership.** **The EU / COPERNICUS: to facilitate access to the Earth observation data provided by the Sentinel satellites; support through its Information Services targeting Risk and Recovery; and links to the new initiative for Africa targeting DRR and Climate Change.** **DLR - Germany: to conduct research & development efforts and the extraction of information from Earth observation data.** **NDRCC – China: to deduct and share lessons learned regarding the use of Earth observation products and to provide support in capacity building activities.** **Ministry of Marine Affairs – Indonesia: to provide in-situ data related to coastal hazards and coastal issues to complement Earth observation data.** **NASRDA – Nigeria - contributions to identify needs and gaps, and contributions to training activities.**	**Partnership needs to consider these voluntary contributions**

Figure 4: Summary of most relevant topics and challenges identified by the Working Group on the Sendai Framework for DRR and the Earth Observation Global Partnership (Part 1)

Topic / Challenge	Description	Potential follow up activities
Voluntary contributions proposed by partners (cont)	IWG-SEM to provide knowledge / lessons learned regarding their efforts related to the elaboration of Earth observation products.	
A concrete plan of work with concrete outputs and commitments to support countries through technical support	Several institutions suggested specific products such as: a) The provision of technical support to one or two countries per region on an annual basis. b) The elaboration of a User guide explaining to DRR institutions and end-users the benefits of the use of Earth observation with a particular emphasis on Understanding Risk (Priority 1) and Preparedness, Response and Recovery (Priority 4). c) The development of a guideline to be used for capacity building efforts.	The User guide to be developed within one year. The guideline to be developed within one year.
Terms of Reference and steering modality	a) A first draft termes of References document was discussed. b) There was a suggestion to establish a steering modality of a Rotating Chair within the group which could be rotated on e.g an annual basis.	An updated version of the Terms of References, based on the comments made during the working group discussions will distributed

Figure 5: Summary of most relevant topics and challenges identified by the Working Group on the Sendai Framework for DRR and the Earth Observation Global Partnership (Part 2)

Topic 2: Climate Change

Session 2: Current capabilities and future potential of Earth observation to support climate change agreements

Introduction

Climate change is a threat to the economic, social, and environmental dimensions of sustainable development. In December 2015, world leaders will convene in Paris, France to adopt a global treaty that will address climate change mitigation, mainly through the reduction of greenhouse gas emissions, as well as the capability of countries and societies to adapt to the realities of climate change, such as extreme weather events. It will also address how to cope with climate change related losses and damages.

Satellites offer a unique way of observing essential climate variables at the global level which may be too difficult or costly to observe from the ground. Such variables cover the atmospheric domain e.g. air temperature, precipitation, cloud properties, wind speed and direction, carbon dioxide etc.; the oceanic domain, e.g. sea surface temperature, sea level; and the terrestrial domain, e.g. glaciers and ice caps, land cover (including vegetation type), the fraction of absorbed photosynthetically active radiation (fAPAR), leaf area index (LAI), fire disturbance and soil moisture. Satellite information can also be used to monitor variables that help societies to adapt better to the realities of climate change and to quantify losses and damages associated with climate change.

The need for systematic observations is highlighted in articles 4 and 5 of the UN Framework Convention on Climate Change: "to promote and cooperate in research and systematic observation of the climate system and exchange of information" and "systematic observations must support decision making on mitigation and adaptation for the 2015 agreement and beyond".

Session 2 – Plenary Presentations

Session 2 included three plenary presentations on the role of UNFCCC and on the use of systematic observations in climate change by Mr. Florin Vladu, of the Adaptation Programme of UNFCCC; on the Global Climate Observing System and the role of satellite data in climate monitoring by Mr. Kenneth Holmlund, Chairman, GCOS Atmospheric Observation Panel for Climate (AOPC); and on the potential use of the International Space Station (ISS) to monitor the climate by Mr. Hansjoerg Dittus, member of the Board of DLR.

Mr. Florin Vladu presented on the on-going work on systematic observations under the UNFCCC and the benefits of using Earth observations, including the monitoring of greenhouse gas (GHG) emissions, adaptation, loss and damage. Mr. Vladu stated that that systematic observations of the Earth climate system plays an essential role in observing and understanding the changes in the climate system; and allow us to foresee future changes, which are fundamental in informing climate policy makers. Mr. Vladu highlighted the strengths and contributions of Earth observations to systematic monitoring:

- Scientist can track better, for example, changes in land cover, ice sheets, water resources, sea level, extreme events, and human activities such as urban growth, land change, agriculture and deforestation, dam and other infrastructure construction that impact the environment;
- Images from space are a powerful way to illustrate the changes due to climate change;
- Space-based observations play a major role in supporting disaster management by providing accurate and timely information to decision makers (from disaster risk reduction to disaster response and recovery);

Improved continuity, space and time sampling and accuracy of Earth observations contribute to improved projections of climate models, including the near term and regional level. Such results enhance the policy relevance of the latest assessment report of Intergovernmental Panel on Climate Change (IPCC) (AR5).

In his brief overview on the developments in climate change research and systematic observations, Mr. Vladu identified new emerging needs like the assessment of risks of climate change, trends related to adaptation, mitigation, loss and damage and sustainable development. He also pointed out that despite advances in observational capacity, gaps still exist, in particular in developing countries, where ensuring long-term observations remains a challenge. Mr. Vladu gave a thorough overview on the different players involved in the implementation and explained who is undertaking systematic observations and how. In his summary on the work already done, he highlighted the reporting gaps and needs identified by parties and organizations, funding, and cooperation with Global Climate Observing System (GCOS).

He noted that the following gaps and needs were identified by parties:

- Not all climate information needs under the convention are met;
- There are large areas for which in situ observations and measurements are not available, for example large areas in Africa;
- There is a need for support to digitalize historic data;
- There is a need to ensure sustained long-term operation of essential in situ networks.

Mr. Vladu concluded his presentation with the following statements for the future:

- Systematic observations play an increasingly important role for decision making on mitigation and adaptation in the context of the 2015 agreement and beyond;
- Despite wealth of data and information available, systematic observations must not be taken for granted;

- New sets of observation requirements to support adaptation , mitigation loss and damage and sustainable development are still emerging;
- Resources and efforts need to be maintained and improved, particularly on behalf of developing countries, to support their adaptation planning and mitigation efforts;
- There are still challenges in ensuring long-term observations. Any improvements, such as by placing an instrument for measuring CO2 on the International Space Station, would benefit the work on adaptation and mitigation under the Convention;
- It is imperative to better liaise with the implementation bodies, including in the identification of the negotiating items under which systematic observations are required and to provide relevant information to stakeholders and regional hubs, and to the systematic observation community;
- High quality observations are the foundation for solid decision-making on future action on climate change.

In the subsequent discussion, Mr. Pedro Basabe stated the ongoing interest of UNISDR to collaborate with UNFCCC.

On behalf of the GCOS chair Mrs. Caroline Richter, **Mr. Kenneth Holmlund** (EUMETSAT, chair of AOPC) presented the Global Climate Observing System (GCOS) and the role of satellite data in climate monitoring. After the overview on the history of the GCOS programme he emphasized that the rationale for the establishment of GCOS and its purpose, concept of operation, governance and financial arrangements was defined in the GCOS Memorandum of Understanding signed by World Meteorological Organization (WMO), International Oceanographic Commission (IOC), International Council for Science (ICSU), and United Nations Environment Programme (UNEP) in 1992 and updated in 1998. Mr. Holmlund introduced the concept of GCOS as a system of systems for climate observations: GCOS encompasses the components of the WMO observing systems (WMO Integrated Global Observing System (WIGOS): Global Observing System(GOS), Global Atmospheric Watch (GAW), World Hydrological Cycle Observing System (WHYCOS), the IOC-led co-sponsored Global Ocean Observing System (GOOS), the Food and Agriculture Organization (FAO)-led co-sponsored Global Terrestrial Observing System (GTOS), observational elements of research programmes included in the World Climate Research Programme(WCRP), the International Geosphere-Biosphere Programme (IGBP) and other systems contributing to climate observations, data management or products, which together form the overall global observing system for climate, and the climate-observing component of the GEO System of Systems (GEOSS). GCOS takes advantage of a surface network with 1017 stations covering all continents and oceans, of an upper air network with 117 stations, and the space-based observing system including satellites like the European Meteosat and Metop satellites, the United States' National Polar-orbiting Operational Environmental satellite System (NPOESS) and Geostationary Operational Environmental Satellite (GOES) satellites, the Japanese Geostationary Meteorological Satellite (GMS), the Korean Communication Satellite (COMSAT), the Chinese FY-2/4, and the Indian Indian National Satellite System (INSAT)s, the Russian Geostationary Operational Meteorological Satellite (GOMS) and the Meteorological satellite(METEOR), and others. Mr. Holmlund stressed that the integration of ground-based and space-based data is of utmost importance. GEOSS is therefore aiming to develop such an integrated system of different types of observations. He underlined that a great achievement of GCOS is the elaboration of Essential Climate Variables (ECVs), which define a common terminology, and make sure that work is done in a coherent way. He pointed out that ECVs were not defined to cover all the best possible variables to observe climate, but to define the best measurable variates in order to help maximize the use of data. He defined a strong need for the inter-calibration of systems including pre-launch and on-board calibration with space and ground references as well as the re-calibration of archived data. GCOS, together with Committee on Earth observation Satellites (CEOS)/Working group on calibration & validation (WGCV), are currently working on a Global Satellite Inter-calibration System (GSICS). Mr. Holmlund also shared the following arguments regarding why climate observations must be enhanced and continued into the future so that the user is able to:

Detect further climate change and determine its causes;

- Model and predict the climate system;
- Assess impacts of climate variability and change;
- Monitor the effectiveness of policies for mitigation climate change;
- Support adaptation to climate change;
- Develop climate information services;
- Promote sustainable national and economic development; and
- Meet other requirements of the UNFCCC and other international conventions and agreements.

He concluded his presentation introducing GCOS' plans and schedules for 2015 and 2016, which include:

- The finalization of the GCOS status report, progress report, and assessment of adequacy of GCOS ECVs by December 2015; and
- The elaboration of the new GCOS Implementation Plan by August 2016, which will enhance the overall message of continuity with progress, i.e. the primary purpose (UNFCCC) remains intact but a broader context of implementation is introduced including the cross-convention use of observations, and the framing of adaptation and mitigation. It is worth noting that new ECVs may be introduced and planning for an updated satellite supplement are to be determined.

Finally Mr. Holmlund invited the participants to take part in the upcoming international science conference in March 2016 in Amsterdam.

During the discussion, the question was raised regarding how the Earth observation and the disaster risk reduction community can approach the upcoming COP in Paris. It was stated that risk will increase not because of vulnerability but because of exposure; the DRR community has already analyzed risk as a function of hazard, vulnerability and exposure while the climate change community has not yet separated exposure from vulnerability.

The third presentation of the second session two was provided by **Mr. Hansjörg Dittus**, member of the Executive Board of the German Aerospace Center (DLR). He dealt with the implementation of reliable control mechanisms from space to ensure the adherence to climate change agreements. He made the point that we are living in the Anthropocene, i.e. human beings are the driver of global change in the socio-economic as well as in the ecologic domains, and these changes can be monitored through the use of satellite data. He stressed that research from space must deliver answers regarding the urgent challenges of the 21st century including climate change, safeguarding sufficient food supplies and global migration. He identified the need to develop sufficient tools and models to monitor atmospheric processes. After he had shown examples of prediction models of nitrogen dioxide emissions based on Global Ozone Monitoring Experiment (GOME)-2 data, he stressed that new sensors are needed for future applications. Mr. Dittus introduced the planned Tandem-L mission, which will provide urgently needed information to answer pressing scientific questions in the areas of the biosphere, geosphere, cryosphere and hydrosphere. Despite the progress and the achievements made in observing the Earth using satellite sensors, he identified several limitations of Earth observation systems, e.g. the still high costs to build, launch, and operate satellites, the short lifetime of satellites, the lack of launch opportunities, and the long time from the demand to launch and the operation of satellites. He therefore called for a paradigm shift and advocated for the use of the International Space Station (ISS) as an already existing technological platform for Earth observation. He enumerated several advantages like the global coverage (except the Poles), the low orbit and the opportunity for high spatial resolution, the potential for up to 34 instruments onboard ISS, the relatively good power and data range, and the possibility of refurbishment on a sub-decadal timescale; only mass is a problem as it has to get to the ISS. He also introduced ideas for a follow-up space station after the end of the ISS life cycle, which would provide a platform that can be used for monitoring purposes. He concluded with an invitation to the Climate Change Conference in Cologne, Germany, which is organized by DLR in cooperation with UNOOSA from 5-7 April 2016.

Session 2 – Working Group 1: Systematic Observation and Monitoring for Climate Change Mitigation

This working group discussed aspects and requirements related to climate change mitigation as contemplated in the current convention and how Earth observation contributes to the monitoring of greenhouse gas emissions. Current gaps in terms of knowledge or gaps in transferring /implementing existing capabilities of Earth observation to support climate change mitigation were identified and possibilities to fill these gaps in the future were discussed. The tasks delegated to this working group were to:

- Discuss to what extent spacebased technology and information can be used by nations in the context of climate change mitigation;
- Discuss calibration issues of space-based products against ground measurements;
- Identify and list requirements which can potentially be served by spacebased applications through further research and development efforts;
- Elaborate on open issues like data access and costs, resource allocation, knowledge transfer and capacity building.

Mrs. Laras Toersilowati of the National Institute of Aeronautics and Space (LAPAN), Indonesia, gave an ignite talk at the start of the session on the "Impact of land use and land cover changes on the urban climate and environment studied with satellite observation, GIS, Weather Research Forecast (WRF) model, and atmospheric database management". She identified the problems associated with rapid urbanisation and a lack of research concerning changing urban climates. Good urban design and remote sensing software adapted to urban climate monitoring is needed. She concluded her presentation with the following findings:

- The relationship between urban heat islands and land cover type has been studied comprehensively by remote sensing and GIS. Urban Heat Islands have been found to be centralised in downtown areas, spreading to surrounding areas.
- Net radiation and latent heat flux in urban areas was found to be relatively lower than in vegetated and water areas.

The working group identified the following problems related to the use of EO to monitor climate change mitigation:

- The relationship between land use, land cover and urban heat island change needs to be investigated using remote sensing data;
- Analysis of surface energy balance in each land cover category;
- Drought Monitoring-using evaporative fraction and surface energy balance (SEB). High SEB indicates drought and low evaporative fraction indicates drought;
- Design of Surface Energy Balance Interface using software -(SEBALIS)- using Visual Basics (VB) and GIS;
- Urban climate monitoring using weather research forecast models for sustainable development.

Topic / Challenge	Description	Potential follow up activities (e.g. joint projects)

Essential Climate Variables	What ECVs should be considered in the observation and monitoring of climate change mitigation .	From space we can get about 2/3 of the ECVs . Integrated Carbon Observation System (ICOS)- European focused, Carbon Observations. Biodiversity. Habitat Measurements, most of these cannot be observed directly but can be deduced. Evapotranspiration to be included as an ECV.

Figure 6: Summary of most relevant topics and challenges identified by the Working Group on Systematic observation and monitoring for climate change mitigation (part 1)

Topic / Challenge	Description	Potential follow up activities
Data gap Identification when dealing with Climate Change		Data availability is no longer considered to be an issue. However, it is difficult to get data for large scale areas (villages). Consistency in Satellite data is needed. Characteristics of Satellites should be maintained to ensure consistency in data continuity (Spatial Resolution, Swath, spectral resolution). Note:Avoid too much dependency on science as an early warning in order to react to disasters .

Figure 7: Summary of most relevant topics and challenges identified by the Working Group on Systematic observation and monitoring for climate change mitigation (part 2)

Topic / Challenge	Description	Potential follow up activities
Sensors to be included in the Internation Space Station (ISS)	**What can be included on the ISS to ensure more variables are available**	**Technical Obstacles should be considered.** **Astronauts to be matched to the most important sensors.**

Figure 8: Summary of most relevant topics and challenges identified by the Working Group on Systematic observation and monitoring for climate change mitigation (part 3)

What is required for future observations:

- Right data at the right place at the right time;
- Coordination is key to avoid duplication of efforts;
- Communication, Cooperation, Coordination.

Session 2 – Working Group 2: Systematic Observation and Monitoring for Climate Change Adaptation and Loss and Damage

This working group focused on the aspects and requirements related to climate change adaptation as well as losses and damages as provided by the current conventions and on how Earth observation can contribute to adaptation efforts.

Space-based information can provide capabilities to support efforts related to adaptation, loss and damage. For climate change-induced loss and damage assessment, a rather new and emerging field in the climate change convention domain, several relevant issues such as investigating how loss and damage affects particular vulnerable countries, comprehensive risk management approaches, the risk posed by slow onset events and issues pertaining to capacity and coordination arise. This working group was tasked to:

- Discuss to what extend space-based technology and information can be operationally used by nations in efforts targeting climate change adaptation, loss and damage;
- Discuss calibration issues of space-based products against ground measurements;
- Identify and list requirements which can potentially be served by space-based applications through further research and development efforts
- Elaborate on open issues like data access and costs, resource allocation, knowledge transfer and capacity building

Mr. Kumaran Raju Durairaju of Geoscience Consulting Pte Ltd, India, gave an initial talk on "Vulnerability and risk assessment – A pilot study for central region of Singapore". Singapore contains a number of high rise residences, hotels, and seafront residences, and flooding often occurs in basements and along coasts. Research from Geoscience Consulting conducted a coastal inundation risk assessment, under a number of modeled IPCC climate change scenarios. They also generated a DEM from stereo satellite imagery and field based surveys using mobile Light Detection and Ranging (LIDAR), with a vertical accuracy of 0.30-0.70 cm. Their aim was to calculate the extent of flooding and vulnerable areas in the case of a 100 year flood event. They found that proper land use planning is highly important in mitigating future impacts of climate change.

Mr. Francis Ohemeng of the Irrigation Development Authority in Ghana gave a talk on "Technology and irrigation answers to climate change: the irrigation sub-sector contribution to climate change adaptation measures in Ghana". Water availability in Ghana as a whole is not distributed evenly throughout the year. During the rainy season there are floods around the country, while at other times there is extensive drought. Ghana is experiencing high climatic variability, and adaptation mechanisms are needed.

Adaption mechanisms include irrigation, water harvesting and conservation, soil conservation, agroforestry and catchment area protection. The government of Ghana plans to expand its irrigation infrastructure in the next 10 to 15 years, and needs to conduct water and land resource inventory mapping in order to plan for this expansion. Space technology will be used in the site selection, soil and water resource assessments and in the operational phase of the project, for water, crop and livestock monitoring. Irrigation infrastructure monitoring will also be conducted to protect against leaching during times of flood and to help calculate ongoing water requirements.

Topic/Challenge	Description (key questions, requirements, identified groups	Potential follow up activities
Sea level rise threat on coastal reclamation land (i.e. Singapore)		
Scenario, probability, loss/damage estimation	**Similar/different scenario between one to another area in simulating/modeling SLR**	**Expanding case studies to other countries (i.e. from Singapore to Sri Lanka, Thailand and etc.).**

Data availability for larger area: H-res. DEM (< 10m)	**Data accessibility in developing countries is still limited**	**TanDEM-X (?)**
Connection with decision makers (funding and implementation)	**Public Private Partnership on the project development**	**Extending best practices to other countries (i.e. from Singapore to Sri Lanka, Thailand and etc.).**
Availability of National Spatial Data Infrastructure for data interoperability	**Resource availability and commitment from relevant institutes**	
Water preservation	**Education and participatory approach to integrate the local knowledge and the space-based information**	**Natural water storage.**
The use of space-based information to enhance CCA measures	**Participatory approach to integrate the local knowledge and the space-based information**	**The use of global archives of data to enhance analysis.**

Figure 9: Summary of most relevant topics and challenges identified by the Working Group on Systematic observation and monitoring for climate change adaptation and Loss and Damage

Session 2 – Working Group 3: Extreme Climatic Events

Working group 3 of Session 2 addressed the use of space-based Earth observation to improve the management of extreme climate-related events. The group focused on demonstrating how specific space-based applications fulfil identified needs and gaps, especially in developing countries, and facilitates synergies among stakeholders.

This working group was tasked to:

- Define elements for a strategy to promote the use of space-based applications in extreme climatic events;
- Discuss the use of space-based applications in multi-hazard early warning systems in extreme climatic events;
- Provide recommendations for improved management of extreme climate-related events through the use of space-based information (prevention, early warning, preparedness and response);

- Discuss potential Recommended Practices tailored to extreme climatic events.

The discussion on the challenges and key questions on extreme events was guided by two presentations, the first of which was given by **Mr. Shirish Ravan**, Head of the UN-SPIDER Beijing Office. He gave a short introduction on the issues of climate change, disaster risk reduction and space technology initiatives, challenges and opportunities. He talked about his experience in Asia as one of the most affected areas by extreme events, especially Bangladesh which is suffering from an increasing frequency and severity of climatic events like floods, cyclones and droughts with the consequence of an increasing loss of assets and livelihoods .

Mr. Ravan also emphasized that climate change can have an impact on the livelihoods of people even when extreme high intensity events do not occur. There are additional risks due to climate change that should be integrated into broader efforts to reduce the risk of natural disasters. Mr. Ravan said that Earth observation can really make a difference to these efforts.

A second speaker, **Mr. Julio Castillo** from the Mexican Space Agency gave a short introduction to his work and remote sensing applications regarding the mitigation of floods in Mexico. Mexico's geographical location makes it susceptible to natural disasters, in particular in the southeastern territories comprised of tropical evergreen forest and wetlands. The States of Oaxaca, Chiapas, Tabasco and Veracruz as well as the Yucatan Peninsula are affected by hurricanes, cold fronts and tropical storms. As Mexico doesn't have its own satellite system, it is dependent on international cooperation. A particularly useful tool used by the Mexican Space Agency is remote sensing. Satellite imagery was used in the aftermath of floods to prevent larger disaster; the most vulnerable areas for future flooding were detected. Remote sensing was used to develop accurate cartography that helped to visualize the impacts of extreme events.

Topic / Challenge	Description (key questions, requirements, identified groups working on that)	Potential follow up activities
The need to prepare well in advance - preemptive preparation in anticipation of extreme events	**How to identify and map risk?** **How to provide timely assistance e.g. rapid mapping ?** **How to assist developing countries in SDI policies national/regional ?** **Help is needed in capacity building.**	
Data availabilty and	**How can data access can be**	**Use Sendai framework to launch the appeal for in-situ data. Use national**

dissemination **Availability of in-situ data**	**improved?** **Much needed high resolution data is not readily available.** **How could coarse to medium resolution data, which is more readily available, be effectively used.** **How could the data management be improved?** **How could various nations, public and private organisations help to collect and provide in-situ data ?**	**assets e.g. University to collect in-situ data.** **Universal access of International charter.**
The need for greater International cooperation	**How could cooperation between various space agencies and developing countries in particular be enhanced?**	
The challenge of development of national policies because of multiple stakeholders	**How could the Sendai framework be used to facilitate the development of national policies?**	**Use Sendai framework to faciliate the development of national policies – political window but policies will depend on other agencies .**
Placing responsibility on developing nations is misplaced	**How could the burden of responding to extreme events, building national policies etc. on developing countries be alleviated?**	**The international bodies should play a greater role e.g. The Sendai framework is the results of contribution by Member States and provides direction at the global, regional and national level.**
Border or boundary issues are a challenge to the whole catchment land use modelling for flood risk assessment.	**Boundary conditions are an impediment to land use modelling across border**	**Regional organisations could be of help .**
Differences between space agencies and users of the data	**How could cooperation between space agencies and user communities be enhanced?**	**Regional organisations could play a greater role in bridging the gap .**

Early warning systems – regional systems and national systems	There is a gap between regional and national systems. Important link between national agencies and national protection systems	
The need for greater assistance to African countries	African countries are not adequately prepared to deal with extreme events .	DRR is taken seriously be the African Union (AU). Several centres in Africa receive and calibrate satellite information. There are also training programmes available.
Building awareness at the political level (little knowledge on the potential of EO) The lack of current database Reliable funding	Lack of data for many areas in Africa. How can information be packaged in a simple way for easier up-take e.g. Tables instead of maps ? How should the issue of lack of funding be handled?	Sendai framework will assist in this. Need a complete package of a financial model. The Sendai framework is open to different sectors and for developing partnerships. Identify hotspot through modeling.
Reliable funding	Funding agencies do not push for EO because they are generally not aware of the potential of EO. Managers are principally social scientists who are not aware of the importance of EO	Manual is needed. Engagement of development agencies and space agencies e.g. GIZ. Space agencies need to engage national development agencies.
Bureacratic bottlenecks hamper rapid mapping and assessment of risk and response to extreme events.	How to avoid bureacratic bottlenecks to repond to extreme events ?	Suggestion to deal directly with universities or implementing agencies .

Figure 10: Summary of most relevant topics and challenges identified by the Working Group on extreme climatic events

Topic 3: Sustainable Development

Session 3: Global Development Agenda and national needs

From 25 to 27 September 2015, world leaders will gather in New York to jointly shape the Post-2015 Sustainable Development Agenda. The outcome will be the Sustainable Development Goals (SDGs), which will provide continuity to the Millennium Development Goals (MDGs) and place great emphasis on the joint responsibility of all countries in the world to achieve together a sustainable future for all.

The preliminary list of goals elaborated by the UN General Assembly's Open Working Group on Sustainable Development Goals in 2014 includes 17 goals and 169 targets. They cover an array of relevant topics including poverty, hunger, health and water, education, gender equality and natural resource management. The goals will only be successfully implemented if countries and multilateral actors have access to reliable information in order to plan accordingly.

Goal 17 stresses the importance to "increase significantly the availability of high quality, timely and reliable data disaggregated by (…) geographic location". Satellite-derived data and information can be a key element in this process on two levels: First, they can provide a good knowledge base on the status quo, the needs and challenges allowing decision makers to shape effective policies and allocate resources appropriately. Second, satellite data can serve to continuously monitor the progress or setbacks when implementing such measures, thus helping countries to stay on track.

This session included three plenary presentations targeting:

- An overview of the efforts conducted by UNOOSA in the context of the sustainable development goals;
- Examples of the way in which Earth observations can be used to cover some of the issues addressed in the sustainable development goals;
- An example on the links between health and the environment in the context of the Sustainable Development Goals.

The first presentation by **Mr. Niklas Hedman**, the Chief of the Committee Services and Legal Affairs Section of UNOOSA, dealt with global space governance and the role of COPUOS and UN-Space. He introduced COPUOS and current issues of the space agenda, which are dealt with through a number of working groups. Mr. Hedman stated that since UNISPACE 3, the committee has worked actively in promoting the use of space based mechanisms to solve common problems. In order to prioritize the implementation of UNISPACE recommendations, member states were grouped into a number of action teams, which led to concrete results including the establishment of UN-SPIDER, which will celebrate its tenth anniversary in 2016. He drew the attention of participants to the upcoming UNISPACE+50 conference in 2018, which will cover topics like space governance, capacity building, the resilience of space systems, interoperability and space for sustainable development. In his conclusion, Mr. Hedman underlined that interagency coordination is needed with regard to outer space affairs and that global sustainable development not only implies the use of space tools, but also requires that space related activities and the outer space environment continue to be sustainable in the long term.

Mr. Thomas Kemper, Scientific Officer at the European Commission's Joint Research Centre, commented on the need for global, fine scale, settlement mapping and monitoring. He pointed out that due to population growth especially in developing countries, informal settlement areas will continue to grow, and that unplanned, unregulated and poorly attached buildings are most vulnerable to natural hazards. Reliable settlement information is thus needed for disaster risk reduction and crisis management efforts, including rapid mapping, damage assessment, disaster risk assessment (exposure), and population estimations as well as for sustainability and resilience of cities including regional and local planning, poverty mapping and slum upgrading. The Global Human Settlement Layer (GHSL) is a multi-scale and multi-sensor approach for automatic image information retrieval including built-up area, size, and density following an inclusive concept of human settlements, i.e. considering not only urban areas but also refugee camps, slums and rural hamlets. Mr. Kemper defined "built-up area" as all spatial units (approx. 38m*38m for the Landsat-based GHSL) where a building or part of a building can be recognized. With this concept and based on high-resolution data like Landsat, GHSL can map the entire footprint of human settlements. MERIS-based mapping projects before mapped the main urban areas well, but missed smaller cities. Mr. Kemper further elaborated on the potential uses of the new GHSL data and information, for example generating statistics, translating maps into tables and graphs; using this information for the SDGs so that it is picked up by decision makers. He concluded that Earth observation is ready to provide information about the development of human settlements globally at high spatial resolution. Long term missions such as Copernicus Sentinel series and Landsat allow monitoring of future developments; but the gap between the Earth observation community and decision makers needs to be closed through development of easy-to-use indicators. The objective of the Global Human Settlement initiative is to develop a new generation of measurements and information products based on new scientific evidence on global human settlements; and to support global policy processes with agreed actionable and goal-driven metrics. Finally Mr. Kemper shared some cooperation examples in the framework of the GEO GHS initiative such as the cooperation with South Africa's National Space Agency (SANSA) to map South African informal settlements, with the Global Urban Footprint team of DLR as well as with WorldPop, which is already using GHSL data for their models. He underlined that anyone is welcome to become part of the GEO initiative on global human settlements that is currently being prepared for the Habitat III international conference.

Mrs. Bettina Menne, Programme Manager at the World Health Organisation (WHO), made a presentation on space-based information for public health and the SDGs focusing on the expectations and needs of decision makers. She gave an overview on the proposed sustainable development goals and the processes feeding into the Post-2015 Development agenda. She highlighted that a list of proposed preliminary indicators for the SDGs has been sent to national governments in February 2015 for their comments, i.e. there is still some room to shape the indicators before they will be approved in April 2016. The main part of the presentation focused on health issues within the SDGs and the role of space-based information. Mrs. Menne summarized that decision makers in the health sector use space-based information when:

- Other information is not readily available;
- Other information is not up-to-date or areas are not accessible;
- Collection is too time- and resource intense;
- Further evidence to causal epidemiological links is required.

She shared six examples of the use of satellite information in the health sector: air pollution health risk assessment, urban heat island detection, access to green space, monitoring and prediction of vector-borne diseases, e-atlas of disaster risk, and interventions and post-disaster relief. Mrs. Menne underlined that WHO is progressing in its work to use space-based information, especially regarding the standardization of the collection of geographical data, reporting and monitoring, big data, integration of data, spatial analysis and modelling, combination of topics and with qualitative data, and development of tools like indicators. She stressed that "scientific reliability and accuracy of space-based information is impressive and the lack of policy action cannot be justified by a lack of knowledge or insufficient reliability of data." However, she stressed that space-based information will not substitute in-situ measurements and ground-truth will always be needed when working with satellite imagery. Mrs. Menne concluded that space-based information is useful:

- For local decision makers: rapid ad hoc-short-term information;
- For national decision makers: long-term monitoring at large geographic scales to guide local interventions; and for environmental health-researchers: to make a case and create evidence on causal links, generate decision-support, and help setting priorities.

Session 4: Solutions to address these Challenges

During this session, representatives of the private sector and other international and regional organizations presented their perspectives and solutions as well as ways to address the challenges of climate change, sustainable development, and disaster risk reduction.

The discussion focussed on how to integrate solutions from the private sector as well as from research into the implementation and monitoring of the respective UN frameworks and agreements. The session had the following aims:

- To present examples of ways to involve the private sector and the research community linked to space-based Earth observations in efforts targeting sustainable development, climate change, and the Sendai framework for disaster risk reduction;
- To discuss issues related to cost of and access to data;
- To discuss ways to shape and conduct technology and knowledge transfer.

The first presentation by **Mr. Nilesh Mistry** from DigitalGlobe offered an overview about the company, the EO technologies they use and three examples in which their tools were useful: Typhoon Haiyan, the disaster in Nepal and in an application in Garamba National Park.

Mr. Thomas Haeusler from GAF AG was in charge of the second presentation, where he explained to the audience the use of EO to monitor deforestation and degradation in the context of the global initiative entitled **Reducing emissions from Deforestation and forest Degradation** (REDD). With this aim he presented a short background of the REDD initiative, experiences with REDD pilot projects in tropical humid forests and tropical dry forests and technical issues in forest monitoring related to REDD.

The third presentation was made by **Mr. Stefano Natali** representing SISTEMA GmbH; its central topic was using the Multi-sensor Evolution Analysis (MEA) system as a support tool for global sustainable development challenges. Earth observation climate data was presented as a support tool for sustainable development policy makers and MEA as a climate data management platform. Success stories and cooperation models such as Earth Observation for Climate-related Health Risk in Africa (EOCHA) andUrban Mobile Instruments for Environmental Monitoring (URBMOBI) projects were highlighted before introducing the main lesson learnt: user's requirements and cross-disciplinary attitudes are essential for a successful implementation of services and applications.

The presentation of **Ms. Karin Schenk** from EOMAP GmbH dealt with harmonized multi-resolution water quality monitoring services for inland and coastal waters. Ms. Schenk went through the technology and specifications of harmonized water quality products, their applications through case studies and their validation, and access and integration requirements together with solutions and customizations.

Mr. Peter Zeil from the European Commission's Copernicus Unit made a presentation regarding the provision of operational services (e.g. for DRR) in a sustainable manner, analyzing how involved actors contribute in different ways. He clarified the ideal role of each actor an by which interests they are motivated. Mr. Zeil highlighted the need to develop networks between public, private and research actors as a way to bring EO-based information services down to the national and local level.

Special session: Joint UN-Space – Bonn Conference High-Level Panel on Space-based Information for development

This high level panel was part of a joint session of the Bonn Conference on Earth Observation and UN-Space, which is the central United Nations coordination mechanism for space-related activities. It served to promote the dialogue among the participating entities, Member States and other stakeholders to enhance the understanding of the potential of space-based information for global development, including in the area of disaster risk management and emergency response. The panelists addressed how the international community can promote the use of space-based applications to contribute to some of the issues contemplated in the post-2015 development frameworks.

The High Level Panelists made participants aware of:

- The Global Climate Observing System as a platform that has been set up to contribute to address the information needs related to climate change;
- The European Union's Copernicus Earth Observation Programme;
- The relationships between health and the environment;
- The role of the United Nations University (UNU) in contributing to the generation of policy-relevant information to be used in disaster risk reduction, climate change, and sustainable development.

In parallel to the conference, UN-Space conducted its 35th session on 27 May and organized a high-level panel on 28 May as part of the conference's programme tackling the question how the international community can promote the use of Space-based applications to address the post-2015 development frameworks.

During the discussion the panelists agreed on addressing Earth observation as a key factor to ease the understanding of our planet, specifically climate change, disaster risk reduction and sustainable development. Earth observation can furthermore serve as a bridge between different areas such as environment and health. The need to find ways to better cooperate on a regional and national level and to continue assisting countries in using Earth observation was highlighted. Capacity building and institutional strengthening were presented as main factors to improve Earth observation use.

In a similar fashion the panelists agreed on the need to better handle the SDGs to achieve public understanding on how the UN is acting in this regard. The challenge of working together to enhance the use of Earth observation in climate change, disaster risk reduction and SDGs remained as the main future goal. For now they could announce the implementation of UNISPACE + 50 in June 2018, enhancing global space governance, capacity building, resilience and interoperability.

Session 5: Enhancing resilience – The role of space mechanisms

According to UNISDR, resilience can be defined as the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

Building resilience requires urgent attention. It is imperative that policymakers, communities and the private sector work together to weave resilience into economic, social and environmental policies. Space-based information provides an important base for decision making to improve resilience. The international space community has established mechanisms to enhance the use of space -based information in disaster response as well as to address prevention, preparedness, disaster risk reduction or recovery phases.

The session showcased through plenary presentations several of the mechanisms, which have been established by the Space community to contribute to disaster-risk management, response and recovery efforts; and examples of Earth observation efforts set up at the national level (Germany, China).

Mrs. Francoise Villette, from the European Commission's DG GROW, gave a presentation on the activities of the Copernicus Emergency Management Service (EMS). Copernicus is a European Union space programme, providing relevant information in the fields of the environment, disaster management and security. The EMS is a 24/7 service providing standardized products like reference maps, delineation maps, and grading maps. It can be activated in two modes: the rapid mapping mode and the risk & recovery mode. The service has had 141 activations in total since its launch in April 2012. An example of its use was during the typhoon Haiyan in the Philippines in 2013, where warnings based on Global Disaster Alert and Coordination System (GDACS) facilitated the prediction of the typhoon path and early satellite tasking. A number of reference, delineation and damage grading maps were produced to assist those involved in emergency response efforts. She also explained how the March 2013 Risk & Recovery activation in Nepal covering earthquake risk as well as road network and built-up area vulnerability assisted and complemented the Rapid Mapping activation for the recent earthquake of Nepal. Activations are received from civil protection agencies of member states, European services, and UN agencies via DG ECHO. Mrs. Villette highlighted that Copernicus is also providing early warning services in case of floods and forest fires with its European Flood Awareness System (EFAS) and its European Forest Fire Information System (EFFIS).

Mr. Jens Danzeglocke, from DLR, and a member of the Executive Secretariat of the International Charter Space and Major Disasters, gave an introduction to the International Charter and its aim of providing space based information for disaster response. It began as a collaboration between three space agencies in 2000, who came together to provide satellite imagery to UN member states in times of crisis, and has grown to a group of 15 members. The Charter provides space-based information to nations in need following large and sudden events which have a high impact on lives, infrastructure and the environment. It can be activated through a single access point which is available 24/7, under which the space agencies contribute through satellite tasking on a priority basis and organize the production of maps related to the disaster area. Between 2000 and 2014 there were 443 charter activations. Mr. Danzeglocke highlighted the Universal Access initiative of the Charter, which allows any national disaster management authority to become an Authorized User of the Charter, and to submit requests to the Charter for emergency response. He welcomed similar initiatives like Copernicus EMS or Sentinel Asia; since the number of activations shows an increasing trend globally. Mr. Danzeglocke concluded that while the scope of the Charter is strictly on immediate disaster response, the Charter is indirectly related to disaster resiliency: countries prone to natural disasters can become better prepared by benefitting from the Charter's Universal Access initiative.

Mr. Stefan Voigt from DLR also talked about DLR's disaster risk reduction initiatives. DLR has set up a dedicated centre for crisis information to facilitate the use of its Earth-observation capacities as a way to contribute to national and international response efforts related to major disaster situations, humanitarian relief and civil security issues. DLR's Center for Satellite Based Crisis Information (ZKI) works closely with public authorities, NGOs, satellite operators and other space agencies. ZKI develops remote-sensing-based services tailored to specific needs. Mr. Voigt stressed that the Earth observation community needs to work on demonstrating that disaster risk reduction contributes to prevent disasters.

Mr. Luc St-Pierre commented on how UN-SPIDER contributes to sustainable development by acting as a gateway to space-based information for disaster management support, serving as a bridge to connect the disaster management and space communities and being a facilitator of capacity building and institutional strengthening. He showed concrete examples of follow-up activities based on the recommendations of Technical Advisory Missions to support developing countries in a sustainable way. He also highlighted UN-SPIDER's involvement in different working groups like United Nations Geographic Information Working Group (UNGIWG) and IWG-SEM.

Ms. Suju Li of the National Disaster Reduction Centre of China talked about practices in China regarding the use of Earth observation resources in disaster risk reduction. A large variety of high frequency natural disasters occur in China which have a wide impact and incur heavy losses in Chinese society. The National Disaster Reduction Center of China (NDRCC) is one of the leading scientific and technical centers providing support to the government to address disaster-related issues by focusing on the whole cycle of disaster management by providing information, technical and consultation services. Ms. Li outlined how a comprehensive National Disaster Prevention and Reduction Plan was developed between 2011 and 2015 in China and addressed Earth observation as a major technical support tool.

Extended coffee break with the Private Sector

As a way to facilitate one-to-one discussions with representatives of the private sector, the conference included an extended coffee break in the afternoon of Thursday, 28 May. Participants had the opportunity to approach these representatives in the more informal setting of a coffee break.

Back-to-back: International Working Group on Satellite-based Emergency Mapping (IWG-SEM) spring meeting

UNOOSA/UN-SPIDER hosted the annual spring meeting of the International Working Group on Satellite-based Emergency Mapping (IWG-SEM) back to back with the Conference. The IWG-SEM is a voluntary group of organizations involved in satellite-based emergency mapping which supports disaster response by improving international cooperation in such mapping activities. In the group's spring meeting in Bonn a special emphasis was given to the topic of collaborative mapping, including crowd-sourcing and distributed analysis/computing and aspects of social media for satellite-based disaster mapping. The meeting was also the occasion for UNOOSA/UN-SPIDER to take over the annually rotating position of official Chair of the group. A detailed report of the IWG-SEM spring meeting will be made available at the IWG-SEM webpage at www.iwg-sem.org.

Key results and outcomes

The United Nations/Germany International Conference on Earth Observation – Global Solutions for the Challenges of Sustainable Development in Societies at Risk led to several outcomes, building up on past activities and providing a roadmap to achieve future objectives.

From the **participants' perspective**, the working group discussions, plenary presentations, panel discussions, and informal networking opportunities allowed them:

- to become aware of space-based applications and solutions developed in recent years to contribute to disaster risk reduction, sustainable development, and climate change mitigation and adaptation;
- to network and exchange views and lessons learned with representatives of a variety of countries and regional and international institutions as well as the private sector; and
- to explore how best to take advantage of the opportunities offered by the Space community to contribute to their efforts.

In the context of **UNOOSA and DLR**, the international conference allowed the organizations:

- to collect a variety of suggestions and recommendations from experts related to the use of space-based applications and solutions targeting disaster risk reduction, sustainable development, and climate change mitigation and adaptation;
- to facilitate the coordination of global efforts carried out by the space community to contribute to the implementation of the Sendai framework for disaster-risk reduction;
- to promote the use of Earth observation to track and to identify ways to assess climaterelated extreme events affecting sustainable development efforts worldwide; and
- to identify ways in which Earth observation can be used explicitly to contribute to the implementation of the new framework for sustainable development and to track progress in the various targets that the framework includes.

During the conference the following **key recommendations** were made **by participants** in the areas of disaster risk reduction, sustainable development, and climate change as well as on cross-cutting issues.

Disaster Risk Reduction

1. With regard to the Sendai framework, it will be important to define the **indicators** and measurements of implementation of the framework at the level of countries, as the responsibility for implementing disaster risk reduction efforts has delegated to the national level. Time-bound and measurable indicators will need to be available to measure the progress of adoption of this framework.

2. As a way to carry out a coordinated international approach to the use of Earth observations in disaster risk reduction, the United Nations Office for Outer Space Affairs (UNOOSA) and United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), the United Nations Office for Disaster Risk Reduction (UNISDR), the United Nations Institute for Training and Research (UNITAR), UNITAR's Operational Satellite Applications Programme (UNOSAT), the Group on Earth Observations (GEO), the Committee on Earth Observation Satellites (CEOS), the Food and Agriculture Organization (FAO), the European Union (EU), the International Working Group on Satellite Emergency Mapping (IWG-SEM), the German Aerospace Center (DLR), the Chinese Academy of Sciences – the World Academy of Sciences Centre of Excellence on Space Technology for Disaster Mitigation (CAS-TWAS SDIM), the International Centre for Integrated Mountain Development (ICIMOD), the International Water Management Institute (IWMI), the National Emergency Commission of the Dominican Republic (CNE), the Disaster Management Centre of Sri Lanka (DMC), the National Disaster Reduction Center of China (NDRCC), the Tohoku University, International Research Institute of Disaster Science (IRIDeS) and the World Meteorological Organization (WMO)) have joined forces to launch the **Global Earth Observation Partnership** during the World Conference for Disaster Risk Reduction held in Sendai, Japan. It was agreed by all partners present during the UN/Germany international conference to further strengthen and advance this voluntary partnership so that it can promote and facilitate the use of Earth observation and other satellite-based applications as stipulated in the Sendai framework for DRR. The conference led to the agreement on the next step related to the implementation of the Global Partnership in terms of a governance mechanism, member engagement, open and transparent dialogue and a defined plan of work. Progress was made during the conference towards a Terms of Reference for members of the Global Partnership. During the working group meeting on the partnership, many participants described the contributions their organisations could make. The partnership will need to take note of and act on these statements. For the Global Partnership, a recommendation from discussions was that a user guide for DRR would be developed within one year, along with associated guidelines.
3. Engage/enable Earth Observation to play a greater role in **monitoring efforts conducted in the area of disaster risk reduction**. Curently Earth observation plays a significant role in emergency response, but it needs to be integrated further into all stages of the disaster cycle, especially in terms of risk reduction and early warning.
4. **Communication between producers and users of space based information** will need to be improved by clearly communicating quantitative and scientific aspects of the results in a concise manner to decision makers to enable them to make informed decisions as well as enhanced articulation of practitioners' requirements both in emergency situations and for long term planning. The differences in approaches between scientific and hands-on practitioners will need to be identified and addressed.

5. **Focus on preparedness and preemptive preparation** in anticipation of extreme events. Early warning systems operated at local, national and regional levels could decrease the level o damage and destruction triggered by extreme events. Preparedness (e.g. early warning systems) can make a significant difference especially in developing countries.
6. The use of Earth observations is more common in the context of disaster response efforts. The space community has established mechanisms such as the International Charter Space and Major Disasters, Sentinel Asia, and COPERNICUS EMS. However, there are only very few efforts targeting disaster risk reduction, for example the COPERNICUS risk and recovery service and COPERNICUS EMS Early Warning Systems on Floods and Forest Fires. Hence, there is a need to support the implementation of the Global Earth Observation Partnership which is geared to target disaster risk reduction specifically.
7. Taking into consideration the critical issue that at times Earth observation results are presented in a format that is not easily interpreted by end users and decision makers, it is important for UNOOSA/UN-SPIDER and the recently launched Global Earth Observation Partnership to facilitate the generation or **translation of Earth observation information into a format or modality that is easy to use by decision makers and end users involved in disaster risk reduction and emergency response**. In a similar fashion, it is important to facilitate the communication among scientists who are generating information and end users in civil protection or disaster management agencies. Such an effort will help scientists understand the needs from the point of view of end users and will allow end users to become aware of what is possible when using satellite technologies.

Sustainable Development Goals

1. Through a variety of high level panel discussions and presentations during the conference it became clear that Earth observation plays an important role supporting sustainable development, and has great potential for example in monitoring the progress of implementation of the Sustainable Development Goals (SDGs). This function is also closely related to climate change and risk reduction. As satellite data are not yet explicitly mentioned in the outline text of the SDGs, **advocacy efforts may be needed in future in order to integrate the use of such data into the sustainable development agenda**.
2. A key recommendation from the conference was the **need to identify the capacities of different actors within the Earth observation community** and what they can contribute to monitor progress towards achieving the SDGs.

Climate Change:

1. It was **acknowledged that Essential Climate Variables (ECVs) are well defined and can be used** as an important tool to monitor the different types of manifestations of climate change. A common methodology to observe changes in the Earth’s atmosphere, hydrosphere, climate and

terrestrial changes will allow for more efficient data sharing and greater insights into earth processes.

2. Promote further Earth observations which already play an important role in observing the Essential Climate Variables. Currently, about 50% of the ECVs are monitored by the use of space-based data. The Global Partnership should push forward the **increased use of Earth observation to monitor the Essential Climate variables**. Awareness of the possibilities of Earth observation could also increase funding availabilities.
3. **Consistency in and cross-calibration of satellite observations of different types of satellite sensors as well as fleets of the same sensors and in archive data** will be needed for precise long term monitoring.
4. Earth observation is pivotal in monitoring ECVs. Satellites contribute to monitor greenhouse gas emissions. However, their lifetime in orbit may be short in comparison to the lifetime of the International Space Station (ISS). Hence, nations operating the ISS should consider its use to monitor several ECVs over a longer period of time than satellites allow.

Cross-cutting issues:

1. Improvements will need to be made regarding the **capabilities of satellites to monitor habitats and biodiversity**; further research is needed in this area.
2. Encourage **bringing all stakeholders together** to increase awareness of advances for better decision making, which includes more communication between different stakeholders.
3. Continue to build on the data available and push for a greater **intercalibration** of different satellite sensors. It is important is to **identify gaps in the current methods** and processes and to communicate these gaps.
4. Increase the capacity available by **harmonizing the capacity building efforts carried out by different stakeholders**. Joint efforts might lead to a greater capacity than single capacity building efforts. It is expected that this approach will increase the global use of Earth observations and improve the accessibility.
5. 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 of the use of this type of observation stemming from developing countries which are desperately looking for solutions. Therefore, it is important to continue efforts to promote the benefits of the use of Earth observation and other satellite applications. It is important to **showcase explicitly the value of the investments** done in placing satellites in orbit to carry out Earth observation activities. It is important to incorporate the value of Earth observations in the global economy.
6. Earth observation is systematically used to monitor several Essential Climate Variables (ECVs) by organizations such as the Global Climate Observing System(GCOS); e.g. to track deforestation processes and to track the melting of ice in polar caps and glaciers among others. However, there are other applications where such observations are not carried out in a systematic fashion,

but more in the modality of research project focusing on specific applications in selected geographic regions. Hence, there is a need to conduct 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 launched in the context of disaster risk reduction, climate change and sustainable development.

7. . The **notion of ECVs should be promoted in the context of DRR and in adaptation to climate change**. Those stakeholders involved in DRR and in adaptation to climate change could benefit from sets of agreed variables that can be used to track progress, to monitor processes and when assessing risks. UNOOSA and UN-SPIDER will investigate the processes conducted years ago by key stakeholders involved in the definition and agreement of ECVs as a way to outline a procedure which could be used to agree on a set of variables to be used for DRR and for adaptation to climate change. This task should also incorporate the notion of inter-calibration as a way to ensure that data collected via in-situ measurements is consistent with data collected using satellites (for example rainfall data in specific regions and estimations of rainfall in those regions based on satellite measurements).
8. Taking into consideration existing efforts on the use of Earth observation and the requests included in frameworks such as the Sendai framework regarding the need for the provision of technical support and the need to facilitate technology transfer; it is important for agencies and organizations, including those of the private sector, to find ways to **cooperate through partnerships and joint activities** so as to avoid duplication of efforts, to make stakeholders at local and national levels aware of existing initiatives and opportunities offered by the space community, and to facilitate the combination of ground-based, aerial and space-based data.
9. 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 think of **integrated solutions** as those that can be provided through private-public partnerships. These could also be in the form of integrated tools or applications which can combine ground-based, aerial, and space-based data. in this context, it is important to **continue bringing together stakeholders from the disaster risk reduction, the climate change and the 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 and national organizations involved in disaster risk reduction, climate change and sustainable development.
10. Further efforts are also needed to appropriately **transfer space-based information and Earth observation to support goals and targets included in the agreements and frameworks as well as to contribute to the evaluation of the outcomes of the agreements and frameworks** in the fields of disaster risk reduction, climate change and sustainable development. Of particular relevance is the need to facilitate the transfer of science/technology developments into routine practices as a way to enhance the effective use of the information and knowledge provided by space-based technologies and Earth observation.

11. Furthermore, participants and experts reiterated the need to **continue efforts to promote the use of Earth observation** in the context of the Sendai framework, as well as in the context of the frameworks and agreements to be launched regarding the sustainable development goals and climate change.

Steps ahead

A key message of the conference is that currently windows of opportunities are open to promote the use of space-based information in all three processes and to demonstrate that Earth observation is useful, usable and used to support the most pressing global issues, namely sustainable development, climate change mitigation and adaptation as well as disaster risk reduction. DLR and UNOOSA invites all actors to undertake concrete steps and to continue their engagement in the three processes. These steps will include:

- Joining forces to integrate Earth observation into the indicator list for sustainable development goals;
- Contributing to the work of the Open Ended Intergovernmental Expert Working Group on Indicators and Terminology on Disaster Risk Reduction;
- Strengthening the Global Partnership on Earth Observation;
- Providing input to the elaboration of the new GCOS Implementation Plan by August 2016, especially regarding the definition of new ECVs; and
- Joining forces to ensure sustainable funding of these activities.

They also agreed to collaborate on efforts towards the upcoming UNISPACE+50 conference in 2018, which will cover topics like space governance, capacity building, the resilience of space systems, interoperability, and space for sustainable development.

In order to collaborate and improve the outcomes, efficiency and relevance of Earth observation, synergies within the UN system have to be intensified and improved.

Annex – Programme of activities

TUESDAY, 26 MAY 2015

Time	Activity	Speakers
08:00 - 09:00	Registration of participants	
09:00 - 09:15	Welcome remarks	**Juan Carlos Villagran de Leon**, UN Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), Head of UN-SPIDER Bonn Office **Margitta Wülker-Mirbach**, German Federal Ministry for Economic Affairs and Energy, Head of Division **Lord Mayor Jürgen Nimptsch**, City of Bonn Moderated by **Christiane Lechtenbörger**, German Aerospace Center
09:15 - 10:15	Keynotes	**Simonetta Di Pippo**, UN Office for Outer Space Affairs, Director "UNOOSA and the post-2015 development agenda" **Johann-Dietrich Wörner**, German Aerospace Center, Chairman of the Executive Board "Contributions of Earth observation to global solutions for the challenges of sustainable development"
10:15 - 10:45	Coffee break	
10:45 - 12:00	High level opening panel: Setting the agenda on the relevance of Earth observation	**Roberto Battiston**, Italian Space Agency, President **Michael K. Simpson**, Secure World Foundation, Director **Halldór Thorgeirsson**, UN Framework Convention on Climate Change, Director for Strategy **Pedro Basabe**, UN Office for Disaster Risk Reduction, Senior Programme Officer Moderated by **Simonetta Di Pippo** and **Johann-Dietrich Wörner**
12:00 - 14:00	Group photo, lunch break, incl. VIP lunch, press conference	
14:00 - 14:45	Special talk	**Alexander Gerst**, ESA Astronaut "The Blue Dot perspective"

Time	Activity	Speakers
Session 1: The Sendai Framework for Disaster Risk Reduction 2015-2030 - Opportunities for Earth observation ***How can space-based information effectively contribute to the post2015 Framework for Disaster Risk Reduction and what are the expectations and needs of decision makers?***		
14:45 - 15:45	Session 1: Plenary presentations	**Günter Strunz, German Aerospace Center, Head of Department** "The Sendai Framework for Disaster Risk Reduction – Opportunities for Earth observation" **Pedro Basabe, UN Office for Disaster Risk Reduction, Senior Programme Officer** "The Sendai Framework for Disaster Risk Reduction: Priorities and roles of stakeholders" **Juan Carlos de Villagran de Leon, UN Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), Head of UN-SPIDER Bonn Office** "UN-SPIDER efforts in the context of the Sendai Framework for Disaster Risk Reduction"
15:45 - 16:15	Coffee break	
16:15 - 18:00	Session 1: Parallel working groups	
	1.1: Earth observation to support the Sendai Framework for Disaster Risk Reduction 2015-2030	**Shunichi Koshimura, Tohuku University, Japan** "Advances of remote sensing for mapping disaster impact" **Nataliia Kussul, National Space Agency of Ukraine** "Drought risk assessment in Ukraine using satellite data"
	1.2: National information needs	**Axel Rottländer, German Committee for Disaster Reduction** "Collaboration of science and practitioners - Information as a key element for effective collaboration" **Pema Thinley, Department of Disaster Management, Bhutan** "Disaster management in Bhutan: The demand for information"
	1.3: The Sendai Framework on DRR Global Partnership on Earth observation	
18:30	Boat trip on Rhine River, hosted by the German Aerospace Center	

WEDNESDAY, 27 MAY 2015

Time	Activity	Speakers
09:00 - 09:20	Session 1: Working group presentations	

Session 2: Current capabilities and future potentials of Earth observation to support climate change agreements

How can space-based information effectively contribute to climate change agreements, especially considering adaptation as well as loss and damage and what are the expectations and needs of decision makers?

Time	Activity	Speakers
09:20 - 10:40	Session 2: Plenary presentations	**Florin Vladu, UN Framework Convention on Climate Change, Manager Science and Review Adaptation** "Systematic observations of the climate system under the UNFCCC: An overview" **Kenneth Holmlund, Global Climate Observing System, Chair** "GCOS and the role of Satellite Data in Climate Monitoring" **Hansjörg Dittus, German Aerospace Center, Member of the Executive Board** "Implementation of reliable control mechanisms from space to ensure the adherence of climate change agreements"
10:40 - 11:10	Coffee break	
11:10 - 12:30	Session 2: Parallel working groups	
	2.1: Systematic observation and monitoring for climate change mitigation	**Laras Toersilowati, National Institute of Aeronautics and Space (LAPAN), Indonesia** "Impact of land use and land cover changes on the urban climate and environment studied with satellite observation, GIS, WRF model, and atmospheric database management"
	2.2: Systematic observation and monitoring for climate change adaptation and Loss & Damage	**Durairaju Kumaran Raju, Geoscience Consulting Pte Ltd, Singapore** "Vulnerability and risk assessment - A pilot study for central region of Singapore" **Francis Ohemeng, Ghana Irrigation Development Authority** "Technology and irrigation answers climate change: The irrigation sub-sector contribution to climate change adaptation measures in Ghana"
	2.3: Extreme climatic events	**Shirish Ravan, UN Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), Head of UN-SPIDER Beijing Office** "Climate change and disaster risk reduction: Space technology initiatives, challenges and opportunities" **Julio Castillo, Mexican Space Agency** "Remote sensing applications for the mitigation of floods in Mexico"
12:30 - 14:00	Lunch Break	
14:00 - 14:30	Session 2: Working group presentations	

Time	Activity	Speakers
Session 3: Global Development Agenda and national needs *How can Space-based information effectively contribute to the forthcoming Sustainable Development Goals and what are the expectations and needs of decision makers?*		
14:30 - 15:30	Session 3: Plenary presentations	**Niklas Hedman, UN Office for Outer Space Affairs, Chief of the Committee Services and Legal Affairs Section** "Global Space Governance: The role of COPUOS and UN-Space" **Thomas Kemper, EU Joint Research Centre, Scientific Officer** "The need for fine scale global human settlement mapping and monitoring" **Bettina Menne, World Health Organization, Programme Manager** "Space-based information for public health and decision making"
15:30 - 16:00	Coffee Break	
Session 4: Solutions to address these challenges *How can the private and public sectors as well as the research community and the UN be involved in the use of Earth observation to address challenges in the contexts of sustainable development, climate change and disaster risk reduction?*		
16:00 - 18:00	Session 4: Plenary presentations	**Nilesh Mistry, Digital Globe** "Seeing a better world" **Thomas Häusler, GAF AG** "Contribution of EO to the monitoring of deforestation and degradation in the context of REDD" **Stefano Natali, SISTEMA GmbH** "The MEA system as support tool for global sustainable development challenges" **Karin Schenk, EOMAP GmbH** "Harmonized multi-resolution water quality monitoring services for inland and coastal waters" **Peter Zeil, European Comission Copernicus Management Services Unit** "Providing operational solutions in a sustainable manner – who does what best?"
19:00	Reception hosted by the City of Bonn, Old City Hall	

THURSDAY, 28 MAY 2015

Time	Activity	Remarks/Speakers
Special session: Joint UN-Space - Bonn Conference High-Level Panel on Space-based information for development *How can the international community promote the use of Space-based applications to address the post2015 Development Frameworks?*		
09:00 – 10:30	High-level panel discussions	**Kenneth Holmlund**, Global Climate Observing System, Chair **Peter Breger**, European Commission Copernicus Services, Deputy Head of Unit **Jakob Rhyner**, UN University, Vice Rector **Elizabet Paunovic**, World Health Organization, Head of Bonn Office Introduction and moderation by **Simonetta Di Pippo**
10:30 - 11:00	Coffee break	
Session 5: Enhancing resilience: The role of Space mechanisms *How can regional and international mechanisms contribute to sustainable development?*		
11:00 - 12:30	Session 5: Plenary presentations	**Françoise Villette**, European Commission, Copernicus Emergency Management Service Manager "Copernicus Emergency Management Service" **Jens Danzeglocke**, International Charter Space and Major Disasters "The International Charter 'Space and Major Disasters': An international initiative providing space-based information for disaster response" **Luc St-Pierre**, UN Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), UN-SPIDER Programme Coordinator "How UN-SPIDER contributes to sustainable development" **Stefan Voigt**, German Aerospace Center, German Remote Sensing Data Center "The DLR Center for Satellite Based Crisis Information" **Suju Li**, National Disaster Reduction Centre of China "Exchanging the practice of using Earth Observation for Disaster Risk Reduction in China"
12:30 - 14:00	Lunch	
14:00 - 14:30	Summary	
14:30 - 16:50	Extended coffee break: Open space for networking, hosted by DigitalGlobe	
16:50 - 17:00	Closing ceremony	

As of 28 May 2015
For more information and updates visit www.un-spider.org/post2015

Annex II– Acronyms

AEM- Mexican Space Agency

AOPC - Atmospheric Observation Panel for Climate

ASAL - Algerian Space Agency

ASI - Italian Space Agency

AU – African Union

BGR - German Federal Institute for Geosciences and Natural Resources

BMVI - German Federal Ministry of Transport and Digital Infrastructure

BMWi - German Federal Ministry for Economic Affairs and Energy

CCA – Climate Change Adaptation

CEOS/WGCV – Committee on Earth Observation Satellites/Working group on calibration & validation

COMSAT – Communication Satellite

COP –Conference of the Parties

COPUOS - Committee on the Peaceful Uses of Outer Space

CSIR- Council for Scientific and Industrial Research

DEM – Digital Elevation Model

DKKV - German Committee for Disaster Reduction

DLR - German Aerospace Center

DRR – Disaster Risk Reduction

EAC - European Astronaut Centre

ECEH - European Centre for Environment and Health

ECVs - Essential Climate Variables

EFAS - European Flood Awareness System

EFFIS - European Forest Fire Information System

EMS - Emergency Management Service

EO - Earth Observation

EOCHA – Earth Observation for Climate-related Health Risk in Africa

ESA - European Space Agency

ESSC - Environmental Science for Social Change

EUMETSAT - European Organisation for the Exploitation of Meteorological Satellites

EURAC - European Academy of Bozen/Bolzano

EUSI - European Space Imaging

FAO – Food and Agriculture Organization

fAPAR - fraction of absorbed photosynthetically active radiation

GAW- Global Atmospheric Watch

GCOS - Global Climate Observing System

GDACS – Global Disaster Alert and Coordination System

GEO - Group on Earth Observations

GEOSS - GEO System of Systems

GHG – Greenhouse gas

GHSL - Global Human Settlement Layer

GMES – Global Monitoring for Environment and Security

GIS – Geographic Information System

GIZ- Deutsche Gesellschaft für Internationale Zusammenarbeit

GMS – Geostationary Meteorological Satellite

GOES – Geostationary Operational Environmental Satellite

GOME – Global Ozone Monitoring Experiment

GOMS- Geostationary Operational Meteorological Satellite

GOOS - Global Ocean Observing System

GOS – Global Observing System

GSICS- Global Satellite Inter-calibration System

GTOS - Global Terrestrial Observing System

ICOS - Integrated carbon Observation System

ICSU – International Council for Science

IDP - Internally Displaced Persons

IISL - International Institute of Space Law

INSAT- Indian National Satellite System

IOC – International Oceanographic Commission

IGBP – International Geosphere-Biosphere Programme

IPCC – Intergovernmental Panel on Climate Change

IRA - Institut des Regions Arides de Medenine

ISA - Iranian Space Agency

(UN)ISDR - United Nations Office for Disaster Risk Reduction

ISS - International Space Station

ITHACA - Information Technology for Humanitarian Assistance, Cooperation and Action

ITU - International Telecommunication Union

IUSS - Institute for Advanced Study of Pavia

IWG-SEM - International Working Group on Satellite-based Emergency Mapping

JRC – Joint Research Centre

LAI - Leaf Area Index

LAPAN - National Institute of Aeronautics and Space

LIDAR – Light Detection and Ranging

MDGs - Millennium Development Goals

MEA - Multi-sensor Evolution Analysis

METEOR – Meteorological satellite

MODIS – Moderate-resolution Imaging Spectroradiometer

NARSS - National Authority for Remote Sensing and Space Sciences

NASRDA - National Center for Remote Sensing National Space Research and Development

NDRCC - National Disaster Reduction Center of China

NEMA - National Emergency Management Agency

NPOESS – National Polar-orbiting Operational Environmental satellite System

RCMRD - Regional Centre for Mapping of Resources for Development

REDD – Reducing emissions from deforestation and forest degradation

SANSA- South Africa's National Space Agency

SDI – Spatial data Infrastructure

SDGs - Sustainable Development Goals

SEB – Surface Energy Balance

SEBALIS – Surface Energy Balance Interface Software

SRI NASU-SSAU - Space Research Institute NAS Ukraine and SSA Ukraine

SWF - Secure World Foundation

UAE - United Arab Emirates

UAV – Unmanned Aerial Vehicle

UNECA - United Nations Economic Commission for Africa

UNEP – United Nations Environment Programme

UNESCO - United Nations Educational, Scientific and Cultural Organization

UNFCCC - United Nations Framework Convention on Climate Change

UNGIWG - United Nations Geographic Information Working Group

UNOOSA - United Nations Office for Outer Space Affairs

UN-SPIDER – United Nations Platform for Space-based Information for Disaster Management and Emergency Response

UNU – United Nations University

URBMOBI – Urban Mobile Instruments for Environmental Monitoring

VB – Visual Basics

WCDRR - World Conference on Disaster Risk Reduction

WCRP – World Climate Research Programme

WHYCOS – World Hydrological Cycle Observing System

WIGOS – WMO Integrated Global Observing System

WHO - World Health Organization

WMO – World Meteorological Organization

WRF - Weather Research Forecast

ZKI – Center for Satellite Based Crisis Information