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United Nations/Germany Expert Meeting on Space-based Information for Flood and Drought Risk Reduction[1]

5-6 June 2014, Bonn, Germany

Organised by: UNOOSA/UN-SPIDER (`http://www.un-spider.org`); German Aerospace Center (DLR) (`http://www.dlr.de`); German Federal Ministry for Economic Affairs and Energy (BMWi) (`http://www.bmwi.de`); With the support of: Secure World Foundation (SWF) (`http://www.swfound.org/`)

Reporting Author: VILLAGRAN DE LEON, Juan Carlos[a], HECHELTJEN, Antje[a] and PUSTINA, Anne[a]

[a]UNOOSA/UN-SPIDER, 53113 Bonn, Germany, un-spider@unoosa.org

Abstract – Recent disasters such as the Fukushima disaster triggered by the tsunami in 2011, the extremely large floods in Europe and in the Philippines in 2013, as well as other disasters around the world are manifesting the fact that risks remain hidden from view and from perception until disasters uncover them. As a way to address this lack of perception, the Hyogo Framework for Action (HFA), which emerged from the World Conference on Disaster Reduction held in Kobe, Japan in January 2005, highlighted that starting points to reduce disaster risk include the generation of knowledge regarding the hazards that communities are exposed to; their physical, social, economic and environmental vulnerabilities; and the knowledge regarding the ways in which such hazards and vulnerabilities are changing in the short and long term.
Space technologies, especially Earth observation and global navigation satellite systems, provide data which can be used for risk assessment. However, the potential contribution of space-based information to disaster-risk management is not yet fully exploited – technical solutions are not tailored enough to the needs on the ground, and space-based information is rarely easily accessible to disaster managers.
UNOOSA/UN-SPIDER organized the United Nations/Germany Expert Meeting for Flood and Drought Risk Reduction on 5 and 6 June 2014 in Bonn, Germany to discuss the potential applications of space-based information for drought and flood-risk management and identified which elements would be of relevance for the Post-2015 Framework for Disaster Risk Reduction. The objective of the Expert Meeting was to identify and take note of potential ways in which space-based applications can contribute to the achievement of the goals and targets to be defined in the Post-2015 Framework for Disaster Risk Reduction.

Keywords – *Drought, Flood, Satellite, Space Technologies, Remote Sensing, Knowledge Management*

1. Introduction & Context

Recent disasters such as the Fukushima disaster triggered by the tsunami in 2011, the extremely large floods in Europe and in the Philippines in 2013, as well as other disasters around the world are manifesting the fact that risks remain hidden from view and from perception until disasters uncover them. As a way to address this lack of perception, the Hyogo Framework for Action (HFA), which emerged from the World Conference on Disaster Reduction held in Kobe, Japan in January 2005, highlighted that starting points to reduce disaster risk include the generation of knowledge regarding the hazards that communities are exposed to; their physical, social, economic and environmental vulnerabilities; and the knowledge regarding the ways in which such hazards and vulnerabilities are

[1]This article is a summary of the above mentioned conference with a special focus on proposed elements for consideration in the Post-2015 Framework for Disaster Risk Reduction.

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Figure 1: Participants of the expert meeting

2. Conference Aims & Objectives

2.1. Profile of participants

The expert meeting brought together 57 international experts representing United Nations organizations, UN-SPIDER Regional Support Offices, Government Ministries and National Agencies, Space Agencies, Non-Governmental Organizations, Universities and Research Centres as well as private companies. These included:

- Experts from the space community who focus their efforts on disaster-risk management and emergency response activities;
- Experts from the Disaster-Risk Management and Emergency Response communities who are involved in early warning and disaster preparedness activities;
- Experts from the UN-SPIDER Network of Regional Support Offices;
- Experts from the UN-affiliated Regional Centres for Space Science and Technology Education,
- and other national, regional, and international Centres of Excellence

2.2. Major aims and objectives

The United Nations/Germany Expert Meeting on the Use of Space-based Information for Flood and Drought-risk reduction focused on the use of space technologies to contribute to disaster-risk reduction. The outcomes related to this Expert Meeting included:

- The exchange of information on the most up-to-date satellites and Earth observation methodologies to improve flood and drought risk assessment;
- The elaboration of recommendations to improve flood- and drought-risk management through the use of space-based information;
- The identification of elements to contribute to the Post-2015 Framework for Disaster-Risk Reduction (HFA-2) and to the upcoming World Conference on Disaster-risk reduction to take place in Sendai, Japan, in March 2015.

The outcomes of this expert meeting will feed into UN-SPIDER's activities including capacity building, awareness raising, and Technical Advisory Support.

3. Outcomes & Contribution towards the Post 2015 Framework for Disaster Risk Reduction

Both the HFA and the recent declaration of the Rio+20 summit entitled "The future we want" make explicit reference to the need to promote the application of in situ and space-based Earth observations and space technologies to contribute to the assessment of disaster risks and to disaster risk reduction efforts worldwide. An enhanced HFA Monitor – the reporting mechanism for governments managed by UNISDR – is proposed to accompany the Post-2015 Framework for Disaster Risk Reduction. Such a monitoring system could also be instrumental to assess future sustainable development goals (SDGs) and targets related to the upcoming climate agreement.

Geospatial and space-based data provide a unique source of information to monitor large areas at regular time-intervals. The following advantages of geospatial and space-based information can be pointed out in this regard:

- With geospatial and space-based information, we can detect, map, monitor and visualize indicators relevant to risk analysis on a global scale. Earth observation provides advanced products and related tools that can be used to support risk analysis and risk reduction. Such products can be used in indicators related to infrastructure and land use (e. g. topography, urbanization, transportation networks), to measure atmospheric and environmental variables (e. g. soil moisture, precipitation and temperature) and to detect changes over time caused by both planned development and unforeseen crises.
- With geospatial and space-based information we can map the uneven distribution of risk across national borders in an objective way. Risk is unevenly dis-

tributed across continents, regions and countries. Disasters do not stop at national borders. National datasets from different countries are not always comparable. Spatially-consistent information is needed to measure and understand the uneven distribution of risks and losses. In addition, satellite-derived datasets facilitate the large-scale assessment of risk exposure. Further analyses of the spatial-temporal distribution of hazards are possible with regard to settlement areas, system services, and assets.

- Using space-based information, we can access data from the 1960s to date even in areas where no statistical data or ground-based measurements are available. Many countries face the difficulty of lacking environmental data. Ground-based monitoring systems like climate stations involve high costs, maintenance and data sharing policies. Therefore, they are often not available. Due to large-scale reprocessing activities the archives of satellite imagery are constantly growing. We can access time series covering more than 50 years. This facilitates the assessment of underlying risk factors and impacts of global change over time.
- Satellite information is increasingly available for free. The opening of the Landsat archives and the newly launched and planned Sentinel satellites are just two examples. Also, products derived from satellite imagery like global land-cover classifications, precipitation estimates, vegetation indices or soil moisture are available for free, in some cases even as near-real-time products.
- Satellite information cannot substitute all ground-based measurements that are necessary for risk assessment; they can complement them and at times provide the only available data source to determine environmental indices. In combination with ground-based measurements, satellite-derived information is invaluable for cross-validation and to improve the interpolation of data as a way to cover larger areas.
- Satellite data and related products aiming at improved decision-support have been enhanced immensely over the last ten years. They have matured to become a key source of information for risk assessment and the sustainability of human interventions. During the last ten years, the quality of satellite sensors and the accessibility to satellite imagery has improved immensely. Additionally, algorithms to analyze long-time series have been enhanced in this period. Furthermore, semi-automated object-recognition has been improved with regard to quality and speed. Tremendous progress has been achieved in the continuous development of powerful free and open-source software packages to process geospatial data. Improved processing facilities, the possibility to access archives and to disseminate datasets in near-real time via geo-web-services have led to new applications which can be used in disaster-risk management efforts. All this was not yet possible to such an extent when the Hyogo framework for Action was endorsed by the UN General Assembly following the 2005 World Conference on Disaster Reduction.

3.1. Policy improvement for the Post 2015 Framework for Disaster Risk Reduction

- There is a need to lobby with national governments to highlight the value of geospatial and space-based information in the Post-2015 Framework for Disaster Risk Reduction, so that the application of such technologies becomes part of national policies.
- Investment into satellite data pays off as such data can help prevent damages to a much larger extent than the costs of the data. However, one of the main constraints regarding the use of satellite data worldwide is that developing countries sometimes cannot afford the cost associated with purchasing, processing and storing commercial, high-resolution satellite data. In recent years several space agencies have changed their policies regarding access to data, providing access to satellite imagery free of charge (for example Landsat and the Sentinels). Workshops or other events could raise awareness on and encourage the use of open data and open standards such as those promoted by the Open Geospatial Consortium OGC.
- Even though a lot of data is already available for free, there is a need to continuously lobby with data providers as a way to facilitate access to data for disaster-risk management.
- The space community could benefit from coordinating its efforts at the international level as a way to provide technical advisory support to Member States under the umbrella of the new framework for disaster-risk reduction to be launched during the WCDRR.
- The sharing of information and data derived from satellites among people working in the field, national experts, and different ministries needs to be strengthened to avoid duplication of efforts and duplication of spending (for example by purchasing the same satellite data set twice).
- Stakeholders should be brought together to jointly develop procedures that make use of such data in the context of disaster-risk reduction. Inter-institutional expert groups at the national or regional level and geospatial databases are means to facilitate more effective cooperation of stakeholders.
- Risks assessed through the use of space-based information and geospatial information should be communicated in a clear and concise way, especially to decision makers who are not always technical experts on remote sensing. Satellite-derived information and maps should also be communicated to the general public through social networks. For example, flood risk maps could help people become aware that they are living in a flood-prone area. However, there might also be downsides to communicating such hazard assessments, for example negative effects on taxes and prices.

3.2. Education and training in the Post 2015 Framework for Disaster Risk Reduction

- As a way to promote the use of space-based information, it is important to become aware of examples and lessons learned in recent events regarding how space-based information may have been elaborated and disseminated to decision makers at local levels and how it was used. The dissemination of case studies, best practices and guidelines on the use of space-based applications in disaster-risk assessment and reduction should be enhanced in order to facilitate the discovery of relevant data, products and methodologies for disaster risk reduction.
- Channels for this dissemination as well as for further knowledge management and capacity building efforts in an effective, yet low-cost manner could include e-learning and online portals such as the UN-SPIDER Knowledge Portal (www.un-spider.org).

3.3. Implementation and practice in the Post 2015 Framework for Disaster Risk Reduction

- Participants made reference to novel satellites, sensors and applications that should be promoted in the context of flood- and drought-risk assessment and reduction. Among them:
  - The recently launched Sentinel 1 satellite and the other Sentinel satellites to be launched in the coming years;
  - The Global Precipitation Monitoring Core Observatory that will ensure continuity to the TRMM satellite in the context of rainfall data derived from satellite observations;
  - The Soil Moisture and Ocean Salinity mission which provides soil moisture maps in areas exposed to droughts;
  - DLR's Environmental Mapping and Analysis Programme (EnMAP) that will include a hyperspectral sensor, planned to be launched in 2017;
  - A novel Lidar sensor to be launched by the United States which could be used to monitor soil moisture and underground water.
- The assessment of hazard, exposure, and vulnerability related to floods and droughts benefits from the combined use of space-based and ground-based data. Disaster-risk assessment cannot be conducted exclusively with satellite data; additional ground-based information including socio-economic variables needs to be assessed and made available.
- The combination of archived and up-to-date satellite imagery offers disaster-risk managers the opportunity to visualize how exposure of vulnerable elements has changed in recent decades in urban and rural areas through land-cover and land-use maps and offers the possibility to identify measures which can be implemented as a way to reduce the extent of floods. In addition, such imagery can be used to track environmental degradation.
- Satellites generate low, moderate and high resolution imagery; all of which can be used in risk assessment and to track changes in the level of risk over time. While high-resolution data can be used to assess the exposure of buildings including critical infrastructure, moderate resolution data can be used to track the effects of droughts on crops at the national level.

4. Conclusions

The UN-SPIDER expert meeting on the use of space-based information for flood and drought-risk reduction provided a fruitful venue for discussions among experts from many countries. The diversity of the participants was essential to achieve the proposed outcomes. Discussions facilitated the exchange of perspectives and experiences from government ministries and national agencies, non-governmental organisations, space agencies, universities and research centres, United Nations agencies, UN-SPIDER Regional Support Offices, and the private sector.

Being convinced of the benefits of geospatial and space-based information in efforts related to disaster-risk reduction sustainable development, *the participants of the expert meeting strongly recommend integrating a respective paragraph into the Post-2015 Framework for Disaster Risk Reduction.* This paragraph could be drafted following the example of the UN General Assembly in 2012 (GA resolution 66/288) following the UN Conference on Sustainable Development in 2012. In paragraph 274 the resolution stresses the "importance of space-technology-based data, in situ monitoring, and reliable geospatial information for sustainable development policy-making, programming and project operations" and recognizes "the need to support developing countries in their efforts to collect environmental data". Sendai is a key milestone for UN-SPIDER. UN-SPIDER will therefore use the outcomes of the expert meeting to further prepare for the WCDRR.

Conference Documentation

`http://www.un-spider.org/ExpertMeeting2014`

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