GP-STAR

Global Partnership Using Space-Based Technology Applications for Disaster Risk Reduction

GP-STAR

Contents

Foreword

by Mr. Robert Glasser, Special Representative of the UN Secretary-General for Disaster Risk Reduction, United Nations Office for Disaster Risk Reduction (UNISDR)

The Sendai Framework for Disaster Risk Reduction is people-centred, focuses on managing risks rather than managing disasters, and covers both natural and man-made hazards. The goal of the Sendai Framework is to reduce disaster losses through preventing the creation of new risk and reducing existing levels of disaster risk. The focus of implementation is on measures that prevent and reduce hazard exposure and vulnerability to disasters, and that increase preparedness for response and recovery, and so strengthen resilience.

The Sendai Framework recognizes the importance of a multi-hazard approach to disaster risk reduction and makes explicit reference to promoting real-time access to reliable data making use of space and in-situ information under Priority for Action 1, “Understanding disaster risk”.

Such access is key to developing an understanding of disaster risk in all its dimensions including exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be leveraged for risk assessments, and improved planning and preparedness.

The use of space-based technologies and earth observation are essential elements in developing evidence-informed national and local disaster risk reduction strategies which are due to be in place by 2020, a key target and deadline for implementation of the Sendai Framework.

Satellite meteorology is important to understand the earth’s atmosphere and oceans and for weather forecasting. Satellite telecommunication contributes to reliable transmission of sensor data to early warning centers, dissemination of warning messages as well as supporting the functioning of communication infrastructure in crisis regions.

There is a welcome trend towards free and open access to satellite data and growing capacity to extract knowledge and information useful for disaster risk reduction. However, many countries do not benefit yet to the extent possible.

To foster the use of space-based technologies and applications, and earth observation, in the context of the Sendai Framework, the voluntary, multi-stakeholder “Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR”, was established at the UN World Conference on Disaster Risk Reduction in Sendai, Japan, in 2015.

GP-STAR aims to provide advice and conceptual guidance to governments and organizations, and today comprises thirty-three partners representing national, regional and international organizations. The present brochure and compilation of fact sheets provides guidance on the use of space-based technology applications to support Sendai Framework implementation.

I would like to acknowledge the contribution of GP-STAR and would like to encourage all partners and relevant actors to actively contribute to this well-targeted initiative which is a good example of the kind of international cooperation that the Sendai Framework seeks to encourage.

GP-STAR

Foreword

by Prof. Hans-Jörg Dittus, Executive Board Member for Space Research and Technology of DLR

Disasters, basic uncertainty, deteriorating environmental conditions, climate change, population growth, urbanization, insecurity regarding food supplies, water scarcity, mass migration, and a growing increase in the demands for limited resources, are all notable developments we face today. They already are, and are becoming more and more interconnected, thus resulting in significant consequences on a worldwide scale. Space research and technology is instrumental in delivering a substantial contribution towards tackling these global challenges.

DLR's Space Research and Development program delivers solutions for technological applications in space and its main feature is delivering end-to-end system capability. Its goal is to advance science in the exploration of the Earth and the Solar System in addition to protecting the environment. DLR is capable of achieving this objective by covering the entire chain of activities - from fundamental research to the development of products and services for tomorrow. It offers assistance by providing scientific findings, information and knowledge that is both useful and usable for the private and public sector.

The Sendai Framework for Disaster Risk Reduction 2015-2030 is a voluntary, non-binding agreement which recognizes that the State has the primary role of reducing disaster risk, but that the responsibility should be shared with other stakeholders also from local government and the private sector. Its goal is "the substantial reduction of disaster risk and loss of life, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries". The Sendai Framework therefore calls for science and technology-based disaster risk reduction and promotes multi-stakeholder partnerships to support the implementation of the agreement.

GP-STAR

DLR has responded to this call and joined forces with the United Nations Office for Outer Space Affairs, its UN-SPIDER program and many other partners to establish the "Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR" in 2015 forming an alliance between space science entities, the technological community and disaster risk management institutes and agencies. The participants are committed to fostering the use of space-based technologies and applications and also Earth observation in the context of the Sendai Framework.

It is of great importance to transfer scientific evidence and technological know-how if the operational requirements and realities of different countries are to be met. One of the priorities of carrying out space research, and working on further developing technology should be to make it usable, useful and feasible, also in developing countries. Many techniques, procedures and tools have already been developed and are currently being suggested for use. Both society and the economy largely benefit from these developments. At the same time, many potential users and countries are either not aware, feature limited capacity, or have difficulty evaluating which application best fits their purpose. GP-STAR is addressing this specific issue.

Recent progress made in space research and development has been impressive. Space technology applications in various areas of current global concern have been created and made available. DLR has contributed to the advancements with several Earth observation missions, e.g. the highly successful TanDEM-X radar mission. In addition, modern innovative and improved systems have been introduced which can deliver highly relevant output at an unprecedented spatial resolution, as in the case of the global digital elevation model, flood mapping and the global urban footprint. DLR is now working on new missions, for example the planned Tandem-L radar satellite constellation. Tandem-L, a highly innovative satellite mission for the global observation of dynamic processes on the Earth's surface could enable, amongst other things, a systematic recording of surface deformations up to a millimeter in size for earthquake research and risk analysis and a fine-scale measurement of surface moisture for water cycle research. The satellite design includes capturing data using high resolution optical processes including infrared detection and hyperspectral sensory methods to cover the whole surface of the Earth within a matter of days.

The DLR Center for Satellite Based Crisis Information (ZKI) offers a service that provides 24/7 assistance for the rapid provision, processing and analysis of satellite imagery during natural and environmental disasters which is invaluable in dealing with humanitarian relief activities and civil security issues worldwide. Future projects in the field of Earth observation are dedicated to global observations of the Earth featuring high temporal and spatial resolution and with the aim of not only delivering geo-information to better understand earth system processes, but also to support the monitoring and evaluation requirements of international conventions like the Paris Agreement and the Sendai Framework. DLR is working on innovative and precise satellite communication and navigation systems. These will contribute to the reliable transmission of sensor data e.g. to a warning center, the dissemination of warning messages and support in the functioning of communication infrastructures in crisis regions. Civil satellite-based positioning and navigation is essential for location-based data gathering and services.

The GP-STAR brochure at hand is the first step in gathering information on the availability of applications and services and linking them to specific Sendai Framework requirements. This global stock-take needs to continue, but the current compilation has already proven to be valuable in fostering the use of space-based technology and applications and Earth observation within the context of the Sendai Framework. Teamed with the feedback and requirements of the users, it will give rise to new research and development aspects and further advancements can be made. We, at DLR, are definitely looking forward to this exchange of ideas.

What is GP-STAR, how to engage and what is the benefit?

The Global Partnership Using Space-based Technology Applications for Disaster Risk Reduction (GP-STAR) is a platform fostering the use of Earth observation and Space-based Technologies and Applications to contribute to the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework).

All in all, GP-STAR contributes to "means of implementation" of the Sendai Framework and to "promote the use and expansion of thematic platforms of cooperation such as global technology pools and global systems to share know-how, innovation and research and ensure access to technology andf information on disaster risk reduction" (Sendai Framework, article 47. c)

All space agencies, universities, governmental, inter-governmental, United Nations entities, the private sector, financial institutions and non-governmental organizations active in the field of disaster risk reduction and / or Earth observation can apply to be members of GP-STAR.

Due to its voluntary nature, it is expected that the members will contribute with in-kind resources and may affiliate their programs and activities which are relevant to the GP-STAR.

The benefit to be part of this platform is:

- Facilitate the dialogue among stakeholders in EO, satellite-based technologies and the global community of DRR experts and policy makers;
- Access to source and repository of information on efforts carried out worldwide by the EO and the satellite-based technology communities, including surveys and guidelines to improve the applications of existing and emerging technology to monitor hazards, exposure and risks;
- Policy-relevant advice to contribute to the integration of EO and satellite-based technologies into development process and public policies relevant to DRR;
- Facilitate the use of EO and related satellite-based technology to monitor progress in the implementation of the post-2015 framework for DRR;
- Share Resources - Place to share of best practices, tools, methodology and capacity building of national organizations;
- Guidelines and methodology to conduct space based hazard, exposure and vulnerability mapping.

Space-based technology applications: relevance for Sendai Framework implementation

Space-based technology applications and Earth Observation have become an essential element in many national and local disaster risk reduction strategies. Satellite meteorology is important to understand Earth's atmosphere and oceans and for weather forecasting. Satellite telecommunication contributes to reliable transmission of sensor data e.g. to a warning center, dissemination of warning messages as well as supporting the functioning of communication infrastructure in crisis regions. Civil satellite-based positioning and navigation is essential for location-based data gathering and services. Earth Observation contributes to hazard onset detection, monitoring as well as to assessing exposure and vulnerability to contribute to risk-informed decision making. The Sendai Framework makes explicit reference to promote the use of space and in-situ information in Priority for Action 1 "Understanding disaster risk". Additionally Space technology applications find its relevance also in all other priorities for action and contribute to the expected outcome, goal and the global targets of the Sendai Framework. An increasing tendency of free and open access to satellite data and growing capacities and availability of value-adding procedures to extract knowledge and information, useful for disaster risk reduction, can be recognized.

The constellations of satellite Earth Observation platforms collect imagery with different detail, coverage and repeated cycles. In fact, satellite imagery, in combination with in situ data, is used to derive measure of the physical variables of the atmospheric, ocean and the terrestrial hazardous processes at the spatial and temporal scale these processes occur. Most Earth Observation missions have a global coverage, provide images at different time interval that can be used for crisis management purposes and provide a spatial detail for analysing physical and societal process. Earth Observation is also used to map urban areas and human settlements that are impacted by natural, technological and biological hazards and that describe the human presence on the planet and when in combination with physical variables their interaction with the environment.

Earth Observation is particularly well suited to measure natural hazard impact and thus to monitor progress towards the priorities and the targets of the Sendai Framework for Disaster Risk Reduction. Satellite imagery are used to quantify the hazards, the exposure, vulnerability, damages and losses and used to quantify disaster risk, disaster impact and other crisis management processes. Satellite imagery area also used to understand the underlying factors of disaster risks including environmental degradation, deforestation and rapid urbanization in hazard hotspot areas.

Earth Observation provides a number of information to improve our understanding of disaster knowledge as addressed in Priority 1 "Understanding disaster risk". The impact and the risks are typically measured through the three variables, hazard, exposure and vulnerability. Some example of the use of satellite imagery is provided below.

Hazards are measured through satellite directly or indirectly. When the hazard is visible on satellite images it is mapped directly. For example, Volcano hazard can be measured based on the land deformation occurring within weeks due to the tectonic forces (please see fact sheet on "Volcano monitoring"), or by analysing the extent of the lava flow or mud flows visible on imagery. Drought hazard can be assessed by observing soil moisture, precipitation and vegetation indices (please see fact sheets on droughts). Flooding is often measured based on the extent of flooded area as measured by radar satellite sensors (please see fact sheet "Copernicus services"). When the hazard it is not visible on the imagery it can still be measured indirectly based on the extent of the damage that can be recorded on the imagery. For example, seismic hazard is measured indirectly by analysing the severity and extent of the damage in the affected area by analysing collapsed or damaged buildings (see fact sheet Copernicus Services). In fact severity of the damage is well related to seismic intensity a relation consolidated in damage classification system of the Mercailli Modified scale. Similarly, tsunamis impact is clearly visible on satellite imagery (see fact sheet IRIDeS, Tohoku University) and satellite data are typically used to map coastal area, shallow bathymetry and low lying coastal areas that are the variables contributing to the severity of tsunami impact.

Exposure refers to the assets that can be damaged by a given hazard and relate to the land that provides the food base, the ecosystems that provide natural services, and the built environment within urban areas and settlements. Exposure is measured based on a combination of the hazard areal extent and the human assets lying within that area. For example, the physical exposure includes the built environment that is best recorded in urban and settlement maps (please see information sheet on morphological characterization of urban environments, global urban footprint and global settlement layer). The agricultural areas are available from land cover and land use maps that are also typically produced from satellite imagery and aerial photography. One example to be highlighted is the estimation of crop mapping, providing valuable exposure data for the agricultural sector (see fact sheet on crop production). Droughts are often measured based on the lack of vigour of crops as a result of lack of precipitation (see fact sheets on drought).

Earth Observation helps to measure vulnerability, the likelihood to suffer damage, in different ways. In urban context, the vulnerability is measured from the typology of buildings, their spatial arrangements, the evacuation areas, the location of health facilities or that of shelters. Food system vulnerability can be addressed by analysing infrared bands and vegetation vigour patterns over time against the standardized plant growing pattern.

The Sendai targets aim to measure possible reduction of negative outcomes from the impact of natural hazards including reduce mortality (target a), exposed people (target b), economic losses (target c), damage to critical infrastructure and basic services (d). Targets also call for better risk governance (target e); cooperation among all stakeholders (target f); and the deployment of early warning systems (target g) all targets that require information on hazard, exposure and vulnerability that in part can be derived from Earth Observation. Target a to d assume that loss data are recorded in loss databases. Establishing loss data bases to be used to monitor target a-d is mostly a governance task (target e), and the big challenge for Sendai is to collect data to populate the loss database. That loss data collection process is not yet standardized and it is systematically carried out only within selected countries. Often post disaster satellite damage assessment still provide some of the most objective damage and loss estimates. Earth observation may contribute to a systematic assessment of losses and damages and consequently to assessing the targets. Furthermore and in order to understand the root causes of losses and mortality we should normalize the information based on exposure, e.g. the people exposed and the built-up exposed. This is a measure that can be derived from pre-disaster baseline information. In fact, over the decades which separate two Sendai Framework measurements, the exposure can dramatically increase due to urbanization, and that knowledge needs to be factored in the Sendai Framework measures in order to truly understand progress towards disaster risk reduction. The normalized loss data are key to plan mitigation, and preparedness, develop early warning systems that are clearly addressed in priority 2 and 3 of the Sendai Framework. Urbanization monitoring and planning typically performed using Earth Observation data is also required for the “building back better” the 4th priority for action in the Sendai Framework.

Addressing Sendai Framework targets is also about international cooperation in a number of ways. First, countries that have accumulated knowledge and good practices can be set an example. The same countries can help to build capacity in countries that aim to close the disaster knowledge gap. International organizations may provide datasets, including Earth Observation, which would not be otherwise available and accessible to countries with a scarce supply of disaster related information. In that sense investing in Space technology application and earth observation will contribute to disaster risk reduction for resilience (Priority 3). Finally, international partnership initiatives including GP-STAR with its associated institutions can provide the forum for dissemination of information, knowledge, data and best practices, to help the implementation of the Sendai Framework.

The way forward

Space-based technology applications have become an essential element in national and local disaster risk reduction strategies. Many successful applications exist, one can observe an increasing tendency towards accessible and open data, tools and available services, and strong capabilities have evolved in the service provision sector to meet the known and - in research – the rising new demands.

Under these circumstances and recognizing that there is a clear demand for conceptual guidance on how to use the different available Space-based technology applications for disaster risk reduction (DRR) efforts at the local and national levels, the Global Partnership Using Space-based Technology Applications for Disaster Risk Reduction (GP-STAR) has been established during the Sendai Conference in 2015. GP-STAR is a rather new, voluntary partnership. The rational of GP-STAR is not to duplicate efforts by different organizations or initiatives. The rational is to leverage on ongoing DRR activities and to fill a gap: to jointly work towards a conceptual guidance on the use of Space-based technology applications for DRR responding to demands from National Authorities and actors involved in DRR efforts. It shall serve as a global hub, interface and network for Space technology applications in support of the Sendai Framework implementation.

With this purpose in mind, GP-STAR agreed on an initial work plan. The current compilation of fact sheets is a first step to take stock on existing and available pilot studies, demonstration projects, operational services, policy options and guidelines with reference to the Sendai Framework. This already demonstrates that manifold procedures targeting similar information demands exist and need to be compared, evaluated, and documented respecting agreed criteria. The inventory shall support countries to evaluate which application best fits their needs.

To continue the work of GP-STAR, the following items should be discussed and considered in more detail:

- Approach and integrate private sector entities to GP-STAR
- Attract more National Disaster Management Authorities to GP-STAR
- Better integration of space technology application and earth observation into development cooperation
- Better interaction and coordination with other voluntary partnerships under the Sendai Framework
- Higher recognition and visibility of GP-STAR in the wider DRR community
- Technical advisory support and capacity-building
- Integration of Climate Change adaptation and SDG aspects and fostering synergistic uses of space technology applications
- Attract funding to conduct pilot studies and implementations by partners reflecting conceptual guidance provided by GP-STAR

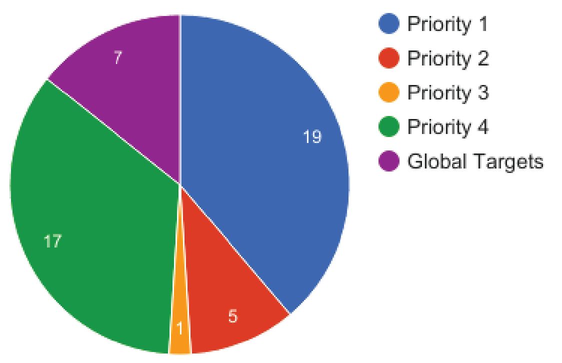
GP-STAR is a voluntary partnership and currently builds on in-kind contributions several partners. It seeks additionally resources for its specific tasks. It pursues for strategic partnerships with development banks and for additionally resources for its specific tasks. Also GP-STAR is open to new partners especially from National Disaster Management Authorities and the private sector.

Factsheets

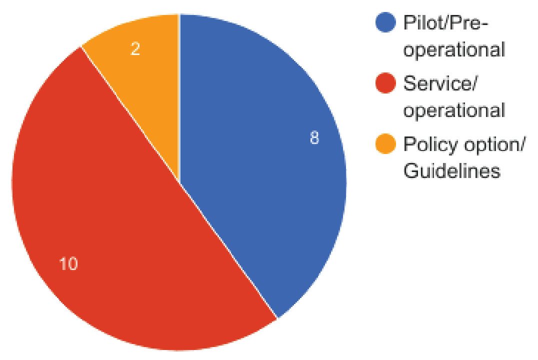
In this brochure we present the current compilation of so-called factsheets provided by the GP-STAR partners. The factsheets compile in a systematic and concise fashion earth observation and space technology applications usable for certain Sendai Framework components and requirements. Each factsheet addresses area of action, reference to Sendai Framework, example product, application field, methodology, key result, innovative impact, application status, area coverage along with background information, key publications and contact details. The graphics on the right highlight the contribution of the factsheets to specific Sendai Framework components and the application status. While most applications address Priorities 1 and 4, several are available contributing to global targets as well as Priority 2. It is remarkable that altogether ten factsheets can be categorized as operational/service.

Organisation	Area of application
Chinese Academy of Sciences – the World Academy of Sciences Centre of Excellence on Space Technology for Disaster Mitigation (CAS-TWAS SDIM)	Drought Monitoring and Assessment in Typical Regions of the Belt and Road – using the Drought-Watch System by CAS-TWAS SDIM
Committee on Earth Observation Satellites (CEOS)	Volcano Monitoring using Earth Observing Satellites – CEOS WG Disasters Volcano Pilot
Disaster Management Training and Education Centre for Africa (Dimtec), South Africa	Indicator Thresholds for Drought Classification at the Country Level - Developing Indicator Thresholds for South Africa.
European Commission, Copernicus (EC)	Copernicus Emergency Management Service (CEMS) A European Union Concrete Tool to Disaster Risk Reduction in the World
Food and Agriculture Organization of the United Nations (FAO)	Watching from Space Agricultural Drought Worldwide – using the FAO-ASIS (Agricultural Stress Index System)
German Aerospace Center (DLR)	Global Urban Footprint (GUF) Precise Map of Human Settlements Location
German Aerospace Center (DLR)	Large-Area Morphological Characterization of Urban Environments for Exposure Modelling
German Aerospace Center (DLR)	Automatic Rapid Flood Mapping by means of Sentinel-1 and TerraSAR-X Imagery
International Centre for Integrated Mountain Development (ICIMOD)	Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods
International Centre for Integrated Mountain Development (ICIMOD)	Rapid response mapping in support of rescue and relief effort
International Society for Photogrammetry and Remote Sensing (ISPRS)	Analysis of Debris Flow due to Heavy Rain

Sendai Framework components



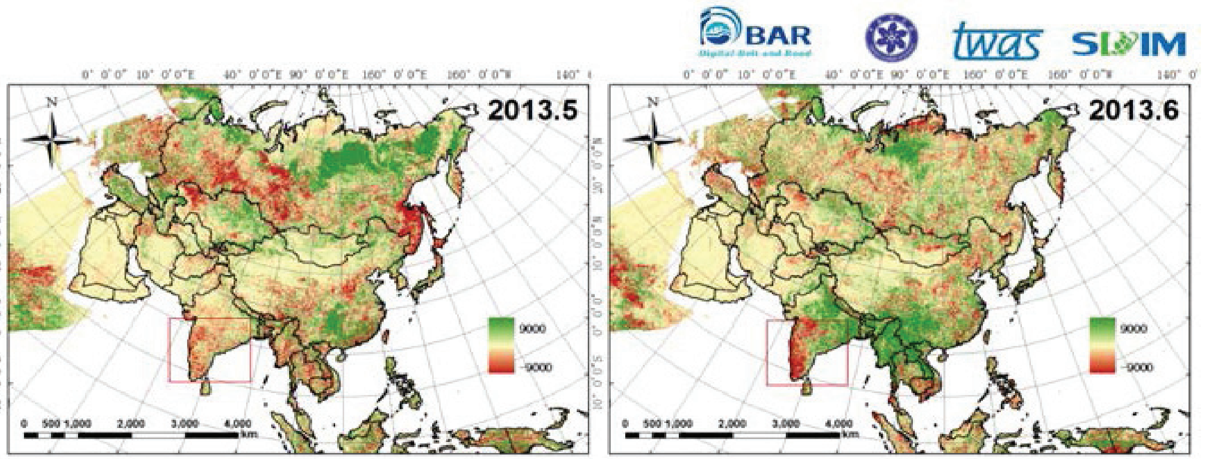
Application status



Organisation	Area of application
International Working Group on Satellite Emergency Mapping (IWG-SEM)	Satellite-based Emergency Mapping Guidelines
Joint Research Center, European Commission (JRC)	Global Human Settlement Layers Open data to measure global exposure in time
Global Human Settlement Layers Open data to measure global exposure in time	Food Security Risk Assessment – Crop Production Estimation and Risk of Droughts
Tohoku University, International Research Institute of Disaster Science (IRIDeS)	Mapping Tsunami Disaster Impact using Earth Observation Satellites
United Nations Convention to Combat Desertification (UNCCD)	Policy Options for Improved Drought Resilience in Africa
United Nations Institute forTraining and Research (UNITAR), UNITAR's Operational Satellite Applications Programme(UNOSAT)	UNOSAT Operational Satellite Mapping Service
United Nations Office for Outer Space Affairs (UNOOSA) and United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER)	UN-SPIDER Knowledge Portal
United Nations Office for Outer Space Affairs (UNOOSA) and United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER)	Recommended Practices
United Nations Office for Outer Space Affairs (UNOOSA) and United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER)	UN-SPIDER Technical Advisory Mission (TAM)

Drought Monitoring and Assessment in Typical Regions of the Belt and Road – using the Drought-Watch System by CAS-TWAS SDIM

Priority for Action 1 - Drought Severity and Drought Risk in the Belt and Road



Application field: To improve drought monitoring abilities in the Belt and Road (B&R), activities were implemented with close cooperation among the B&R countries. Activities included the prioritization of drought indices, field observations, model calibration and validation, capacity building for drought monitoring technology and systems, and customization of a drought monitoring system, Drought-Watch, developed by SDIM.

Methodology and workflow: The Drought-Watch system applies several Earth observation drought indices (EO-derived drought indices), as well as meteorological drought indices, e.g., PED index and Standard Precipitation Index (SPI), for drought monitoring at different temporal scales (day, month, pentad and decade) in the Belt and Road. Drought severity is categorized into 5 levels, indicating normal, abnormally dry, moderate drought, severe drought and extreme drought.

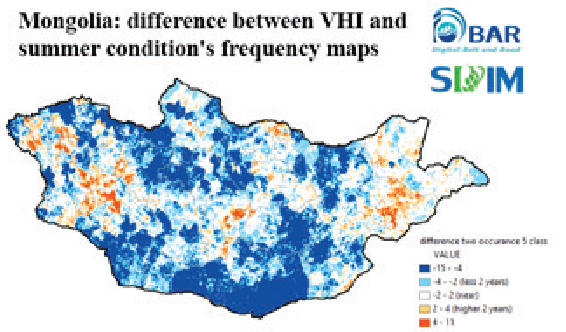
Key results: Using the five types of Drought-Watch drought products (NDDI, VSWI, TCI, VCI and VHI), drought conditions in the Belt and Road can be assessed. For example, Drought-Watch EO-derived drought indices demonstrate that a severe drought occurred in India during the period from May to June in 2013, where similar results were detected using the PED index, SPI, soil moisture, summer conditions, biomass normalization, and biomass anomaly.

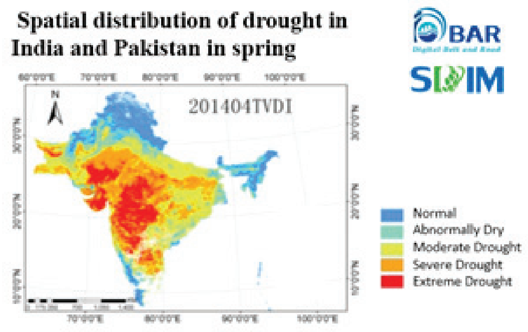
Innovative impact: The simplicity of the system, availability of free data, evidence-based research, and minimal requirements for input are deemed to be the main innovations. Some improvements should be considered in the future for perfecting the drought monitoring model.

GP-STAR Factsheet

Drought Monitoring and Assessment in Typical Regions of the Belt and Road – using the Drought-Watch System by CAS-TWAS SDIM

Application status: Pre-operational at the country-level in the Belt and Road, in countries such as Mongolia, Pakistan, Sri Lanka, Cambodia and Thailand.





Background: The Drought-Watch Indices module can calculate five EO-derived drought indices and two meteorological indices in four temporal scales (day, month, pentad and decade), with composition parameters. Both the single index and combination index are applied for drought classification in the drought module.

Key publications:

Nana Yan, Bingfang Wu, Vijendra K. Boken, Sheng Chang, and Yang Leidong (2016). A drought monitoring operational system for China using satellite data: design and evaluation, Geomatics, Natural Hazards and Risk, 7,264-277

Bin Li, Fang Chen, Feng Xu, and Wang Xinrui (2016). Changes of the time-varying percentiles of daily extreme temperature in China, Theoretical and Applied Climatology, DOI:10.1007/s00704-016-1938-z

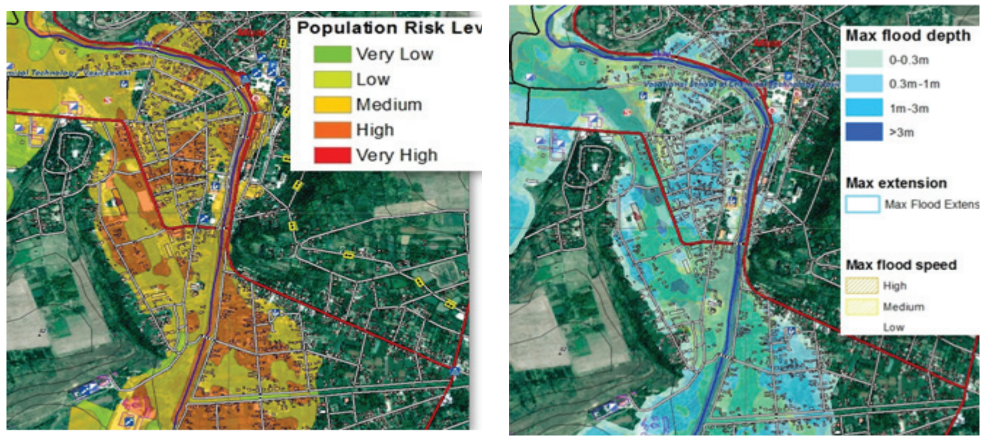
http://www.castwas-sdim.org/

chenfang@radi.ac.cn

CAS-TWAS Centre of Excellence on Space Technology for Disaster Mitigation (SDIM), No.9 Dengzhuang South Road, Haidian District, Beijing 100094, China

Copernicus Emergency Management Service (CEMS) - A European Union Concrete Tool to Disaster Risk Reduction in the World

Global targets, Priority for Actions 1, 2 and 4.



Application field: The Mapping component of the Emergency Management Service (CEMS) is an operational service of the European Union's Earth Observation programme Copernicus. It provides all actors involved in the management of natural disasters, man-made emergency situations and humanitarian crises, with timely and accurate geospatial information derived from satellite remote sensing data, and complemented by available in-situ and other open data sources.

Methodology and workflow: CEMS Mapping is an on-demand service that is provided in two temporal modes, in order to support all phases of the emergency management cycle: **Rapid Mapping** and **Risk & Recovery Mapping**. It can only be activated by authorised users and is free of charge for the user. Unauthorised users can submit service requests to the Emergency Response and Coordination Centre (ERCC) in Brussels.

Key results: Risk & Recovery Mapping assists disaster managers by delivering maps and analyses in support of disaster risk reduction, preparedness, prevention, recovery and reconstruction. It focuses on the pre-disaster situation when lending support in disaster prevention and preparedness actions, and on the post-disaster situation when providing support following a disaster; such as reconstruction, planning, and progress monitoring, and as such complements the Emergency Rapid Mapping service. The types of disasters that are supported by this service range from natural hazards such as floods, fires, storms, tsunamis, volcanic eruptions, landslides, and earthquakes - to industrial accidents and humanitarian crises. Core datasets consist of satellite images and geographic information layers. In addition, a study is currently looking into the use of imagery from different aerial platforms (airplanes and/or drones - as a complement to satellite imagery).

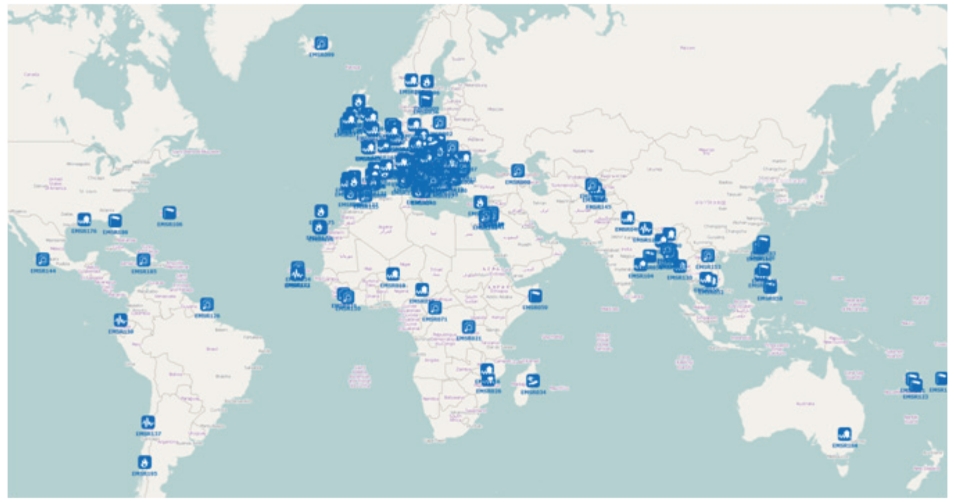
Innovative impact: The service has a unique combination of global coverage, fully operational set-up, tailor-made requests, in addition to being free of charge. It also offers intensive detailed analysis when required.

GP-STAR Factsheet

Copernicus Emergency Management Service (CEMS) - A European Union Concrete Tool to Disaster Risk Reduction in the World

Application status: Fully operational service.

Area of application: Regional, National and Global Level



Background: CEMS is a core service of the European Union's Earth Observation programme, Copernicus. It supports all phases of the disaster management cycle, by delivering warnings and risk assessments of floods and forest fires, in addition to providing geospatial information derived from satellite images on the impact of natural and man-made disasters all over the world (before, during or after a crisis). The two Mapping services of CEMS (Rapid Mapping, Risk and Recovery Mapping) have been delivering products since April 2012. The Risk & Recovery Mapping has provided, for example, information on preparedness, disaster risk assessment and risk reduction related to earthquakes in Nepal, several post-disaster assessments on flood and fire events, reconstruction and recovery monitoring in Haiti; and multi-risk assessments for the Azores Islands in Portugal.
CEMS is managed by the European Commission (joint coordination between the Directorate Generals GROW, ECHO, JRC). Activation requests are all coordinated by DG ECHO's Emergency Response Coordination Centre (ERCC) in Brussels.

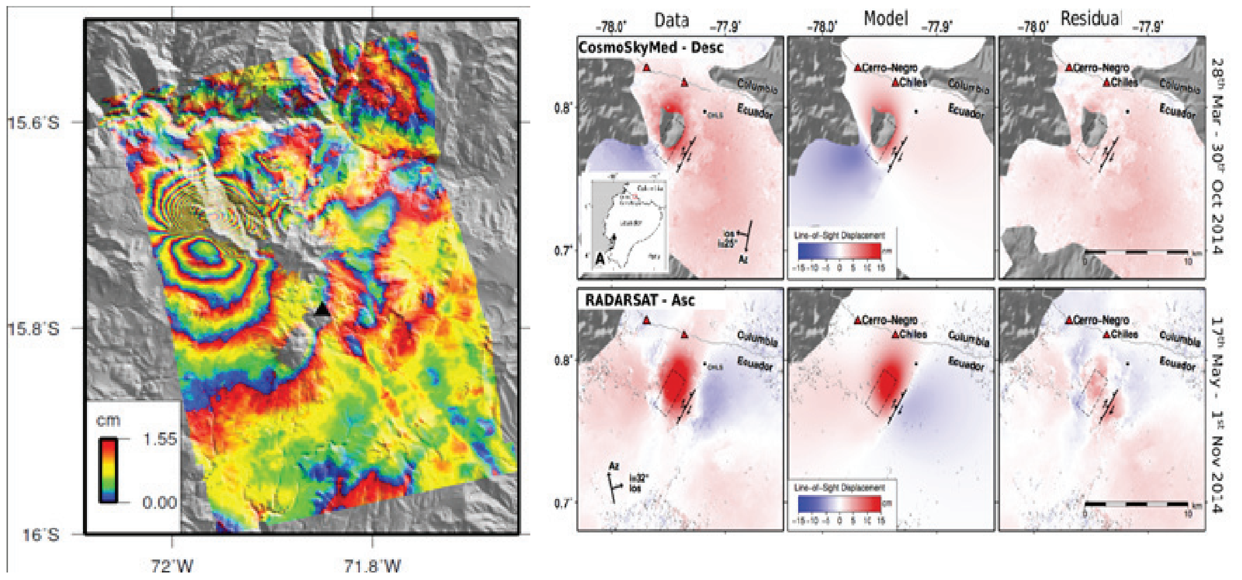
emergency.copernicus.eu/mapping/

Grow-Copernicus-EMS@ec.europa.eu

<jrc-ems-mapping@jrc.ec.europa.eu>

Volcano Monitoring using Earth Observing Satellites – CEOS WG Disasters Volcano Pilot

Priority for Action 1: "Understanding Disaster Risk"
Priority for Action 4: "Enhancing disaster preparedness for effective response"



Left: Interferogram from TerraSAR-X radar satellite shows ground displacement and active faults around Sabancaya volcano in Peru in May to July 2013. This data supported the local Volcano Observatory to make informed decisions about the potential eruptive hazard. (Image credit: Jay et al. 2015)
Right: Observed (left), modelled (middle), and residual deformation (data minus model) caused by an earthquake near Chiles and Cerro Negro volcanoes in 2014, based on COSMO-SkyMed and RADARSAT-2 data. All deformation can be explained by the earthquake, suggesting that any magma accumulation or transport associated with the episode of unrest was small. (Image credit: Ebmeier et al. 2016)

Application field: About 1500 volcanoes worldwide are known to have erupted in the last 12.000 years. Yearly, ca. 50 of them have observable eruptions. It is estimated that less than 10% of active volcanoes are monitored on an on-going basis. Modern space-borne radar satellites provide recognized techniques for the early detection of possible magma injections, for monitoring the stability of volcanoes, and for creating 3D digital elevation models anywhere on Earth. Such techniques provide key information for identifying volcanic hazards and assessing associated risks.

The **Volcano Pilot** activity of the **CEOS Disasters Working Group** in which volcanologists, remote sensing specialists, and Space agencies work together pursues the following aims:

a. Demonstrate the utility of integrated, systematic space-based EO as a volcano monitoring tool on a regional basis and for specific case studies;
b. Provide space-based EO products to the existing operational community (such as volcano observatories and VAACs) that can be used for better understanding volcanic activity and reducing impact and risk from eruptions;
c. Build the capacity for use of EO data at the majority of the world's volcanoes (particularly those that are not monitored by other means).

GP-STAR Fact sheet

Volcano Monitoring using Earth Observing Satellites – CEOS WG Disasters Volcano Pilot

Application status: pre-operational Pilot

The pilot activity consists of a **regional study in the Latin American volcanic arc** (from Mexico through to Chile) to develop methodologies and protocols. The regional demonstration is a precursor to **showcase how volcano monitoring would work on a global scale.** It has shown that local observatories can highly benefit from satellite-based observations, especially from interferometric analyses of ground deformations based on radar-satellite data. Such geospatial information significantly adds to other sources of information, such as point data from GPS stations and visual observation from the ground. The Volcano Pilot is well on its way towards demonstrating that space-based remote sensing has exceptional value in monitoring and assessing volcanic risks.

Workflow: SAR data is analysed to assess deformation of volcanoes, providing insights on the types of data and repeat times best suited to monitoring volcanoes in different environments and supplying deformation information to local users.

Key results:
- Identification of volcanoes that are in a state of unrest in Latin America;
- Demonstration of the feasibility of operational volcanic monitoring using satellite-based EO;
- Tracking of unrest / eruptive activity using satellite data in support of hazards mitigation;
- Validation of EO-based methodology for improved monitoring of surface deformation;
- Improved EO-based monitoring of key parameters for volcanoes;
- Capacity-building in countries that do not currently have access to abundant EO data and/or the ability to process and interpret such data.

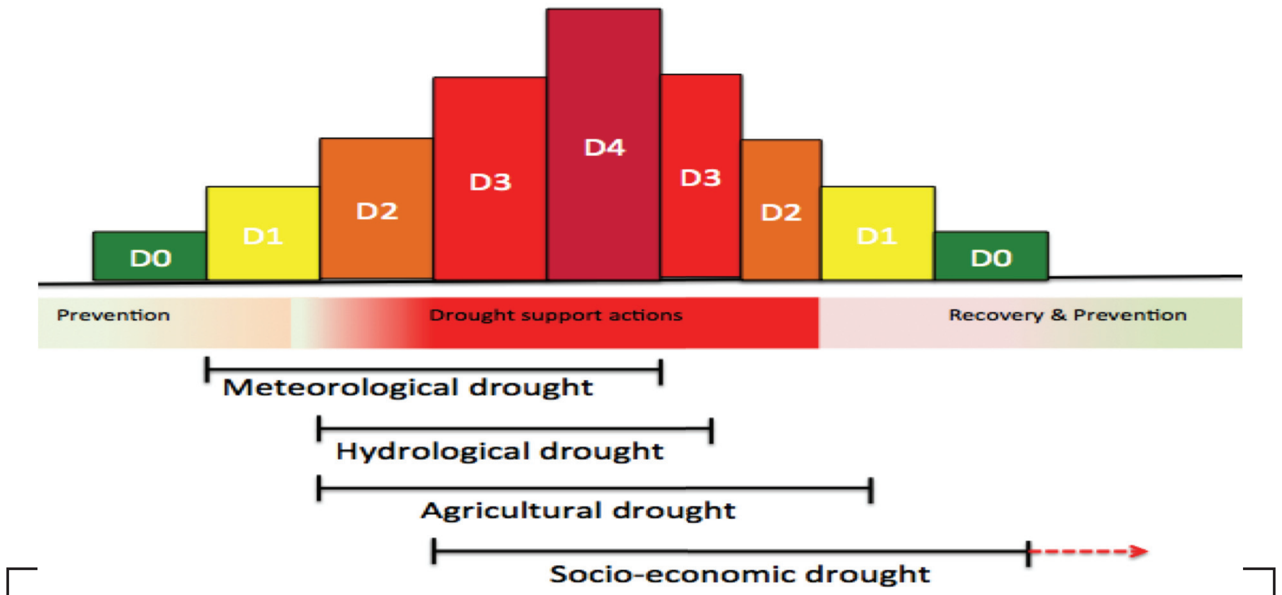
Innovative impact: The activity is ongoing. Noteworthy results have been yielded for numerous volcanoes. In all cases, these results were either achieved collaboratively with, or communicated to, local scientists and stakeholders. Feedback from several local stakeholders confirms the relevance of these results to local decision-making.

References:
Ph. Bally (Ed., 2012): Satellite Earth Observation for Geohazard Risk Management. The Santorini Conference, Santorini, Greece, 21-23 May 2012. (http://esamultimedia.esa.int/docs/EarthObservation/Geohazards/esa-geo-hzrd-2012.pdf)
CEOS (2015): Satellite Earth Observations in Support of Disaster Risk Reduction. The CEOS Earth Observation Handbook. Special 2015 Edition for the 3rd UN World Conference on Disaster Risk Reduction. (http://ceos.org/home-2/eohandbook2015/)
CEOS ad hoc Disasters Team (2013): CEOS Disaster Risk Management Observation Strategy. Issue 2.1. (WGDisasters_DRM-Observation-Strategy_Nov2013.pdf)
Ebmeier, S. et al. (2016): Shallow earthquake inhibits unrest near Chiles–Cerro Negro volcanoes, Ecuador–Colombian border. Earth and Planetary Science Letters, 450.
Jay, J. A. et al. (2015): Deformation and seismicity near Sabancaya volcano, southern Peru, from 2002 to 2015. Geophys. Res. Lett., 42, doi:10.1002/2015GL063589.
Poland, M., Zoffoli, S. et al. (2014): CEOS Volcano Pilot Overview. 7 October, 2014 ceos.org/document_management/Working_Groups/WGDisasters/Pilots/Volcano/WGDisasters_Volcano-Pilot-Overview_Oct2014.pdf)

http://ceos.org/ourwork/workinggroups/disasters/ **Contact: Jens.Danzeglocke[at]dlr.de**

Indicator Thresholds for Drought Classification at the Country Level - Developing Indicator Thresholds for South Africa

Priority for Actions 1 and 4 - Drought Severity Classification and Monitoring



Application field: To identify indicators and related thresholds for drought classification at the national level. Research completed by the University of the Free State highlighted the importance of indicator thresholds for drought classification for different sectors. As a result, the Department of Agriculture Forestry and Fisheries (DAFF) in South Africa proposed the use of a suite of indicators for drought classification. Drought classification is important, in that it guides the declaration of disaster droughts and the activation of safety nets for different sectors.

Methodology / workflow: Drought severity and intensity is categorised into 5 levels; namely, (i) D0: Dry,(ii) D1: Moderate dry, (iii) D2: Severe drought, (iv) D3: Extreme drought, (v) D4: Exceptional drought. Indicators are categorised as meteorological, remotely sensed and hydrological. In this case, three to four indicators were selected under each category. Thresholds for each indicator were determined based on literature and practical application, yet improved calibration would be required for different climate ecological zones and different agricultural systems.

Key results: Identification of drought thresholds for different agricultural sectors. The communal farming sector experience normal dry periods as disaster droughts due to high vulnerability while the resilience of commercial farming sector allows them to withstand dry periods. Acknowledgement of varying thresholds for drought disasters in different sectors is a key result.

Innovative impact: Drought categorization allows for improved drought management practices to be implemented. Identification of drought indicators; based on quantitative thresholds, limits political interference or qualitative evaluation of drought disasters. Drought classification that is based on a suite of indicators, allows for sound decision making during activation of safety nets and disaster declaration.

GP-STAR Factsheet

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Indicator Thresholds for Drought Classification at the Country Level - Developing Indicator Thresholds for South Africa

Application status: Pre-operational
Drought classification framework based on a suite of indicators is proposed for South Africa

Area of application: Implemented at National and Provincial levels in South Africa with local calibrated thresholds under three categories; namely, (i) meteorological, (ii) remotely sensed, and (iii) hydrological

Identified indicators are also combined with impact related indicators at the catchment and farm level.

Jordaan, A.J. (Ed), Sakulski, D.M., Muyambo, F., Shwababa, S., Mdungela, N., Phatudi-Mphahlele, B., Mashimbye, C., Mlambo, D., Fadeyi, O., Miya, T., Bahta, Y. & Owusu-Sekyere, E. 2017. Vulnerability, adaptation to and coping with drought: The case of commercial and subsistence rain fed farming in the Eastern Cape. Water Research Commission (WRC) Report 2280/2/17. Pretoria, South Africa.

DAFF. 2016. Drought indicators for South Africa. Department of Agriculture Forestry and Fisheries. Pretoria,
South Africa.

http://www.dimtecrisk/ec.ufs.ac.za

Contact: Prof Andries Jordaan, Director, Disaster Management Training and Education
Centre for Africa, University of the Free State, Bloemfontein, South Africa.
+27(0)834470449

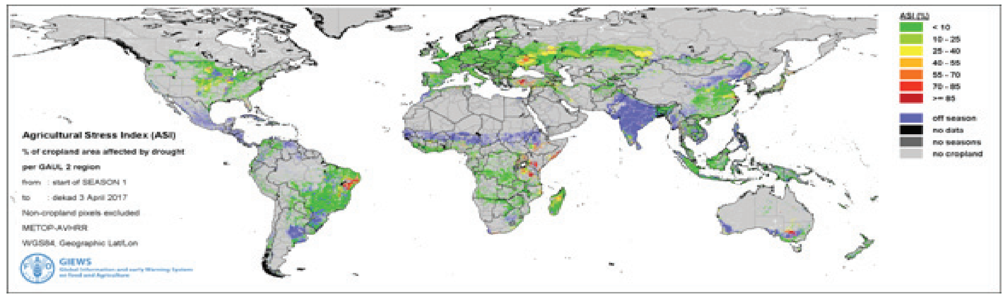
jordaana@ufs.ac.za; ajjrdn@gmail.com

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Watching from Space Agricultural Drought Worldwide – using the FAO-ASIS (Agricultural Stress Index System)

Priority for Actions 1, 2 and 4 - Hazard Characterization and Monitoring of Agricultural drought

Figure 1. ASIS shows the agricultural areas with a high likelihood of water stress (red areas) during the third dekad of April 2017.



Application field: FAO has developed ASIS in order to support its global food security monitoring work; by detecting agricultural areas with a high likelihood of water stress (dry-spells and drought), based on Earth observation data and information. The Flemish Institute for Technological Research (VITO) is supporting the scientific and technical development of ASIS, while the Joint Research Centre of European Commission (JRC) and the University of Twente in the Netherlands are members of the steering committee for the development of ASIS.

Methodology and workflow: ASIS is based on the Vegetation Health Index (VHI), derived from NDVI and developed by Kogan (1997). VHI can detect drought conditions at any time of the year. For agriculture, however, we are only interested in the period most sensitive for crop growth (temporal integration), so the analysis is only performed between the start (SOS) and end (EOS) of the crop season and restricted to crop areas. ASIS assess the severity (intensity, duration and spatial extent) of the agricultural drought, and express the final results at an administrative level, given the possibility to compare it with the agricultural statistics of the country (Figure 2).

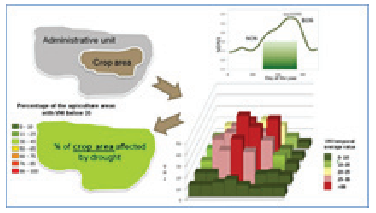


Figure 2. The first step on ASIS is to determine a temporal average of the VHI; assessing the intensity and duration of the dry period(s) incurred during the crop cycle at pixel level. The second step would involve calculating the percentage of agricultural area affected by drought (pixels with VHI<35), as a way of assessing the extent of the drought. Finally, the whole administrative area would be classified according to the percentage area affected.

Key results: Following the successful completion of the global system http://www.fao.org/climatechange/asis/en/, the team is now concentrating on the development of a standalone ASIS to support regional and national early warning systems. In the standalone version, adapting analysis parameters to each region or country´s specific agricultural conditions will allow for more accurate results to be yielded. The final index could be used as a trigger for activating drought mitigation activities in countries, or for the implementation of index-based crop insurance.

Innovative impact: Availability, simplicity, free of charge data, good research literature and citation, and minimum requirements of inputs, are deemed to be the main criteria. Sustainability (will be) guaranteed by the automatization of the analysis.

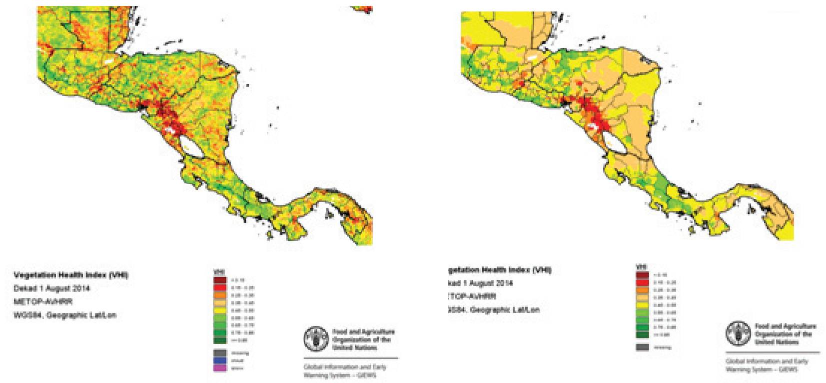
GP-STAR Factsheet

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Watching from Space Agricultural Drought Worldwide – using the FAO-ASIS (Agricultural Stress Index System)

Application status: Country-Level ASIS has been implemented at Regional Level in Central America and at Country-level in: Mexico, Nicaragua, Panama, Bolivia, Chile, Paraguay, Vietnam, Pakistan and the Philippines.

Area of application: Regional or National level ASIS calibrated with local information.



Background: The Agricultural Stress Index System (ASIS) is based on 10-day (dekadal) satellite data, of vegetation and land surface temperatures, from the METOP-AVHRR sensor at 1 km resolution. Data for Country-level ASIS is freely available for download from FAO FTP. Time Series Database from 1984.

Key publications:

ROJAS, O. VRIELING, A. and REMBOLD, F. 2011. Assessing drought probability for agricultural areas in Africa with remote sensing. Remote Sensing of Environment 115 (2011) 343-352 pp.

REMBOLD, F., ATZBERGER, C., SAVIN, I. and ROJAS, O. 2013. Using Low Resolution Satellite Imagery for Yield Prediction and Yield Anomaly Detection. Remote Sensing ISSN 2072-4292 www.mdpi.com/journal/remotesensing. Remote Sensing 2013, 5, 1704-1733; doi: 10.3390/rs5041704.

ROJAS, O. and AHMED, S. 2013. Feasibility of using the FAO Agricultural stress index system (ASIS) as a remote sensing-based index for crop insurance. In: The challenges of index-based insurance for food security in developing countries. Ed. Rene Gommes and Francois Kayitakire, European Commission, Joint Research Centre. 246-253 pp.

ROJAS, O., LI, Y. and CUMANI, R. 2014. Understanding the drought impact of El Niño on the global agricultural areas: An assessment using FAO's Agricultural Stress Index (ASI). Environmental and Natural Resources Management Series No. 22, FAO. 42 p. http://www.fao.org/3/a-i4251e.pdf

VAN HOOLST, R., EERENS, H., HAESEN, D., ROYER, A., BYDEKERKE, L., ROJAS, O., LI, Y. & RACIONZER, P. (2016) FAO's AVHRR-based Agricultural Stress Index System (ASIS) for global drought monitoring, International Journal of Remote Sensing, 37:2, 418-439, DOI: 10.1080/01431161.2015.1126378

http://www.fao.org/giews/earthobservation/

Contact: Oscar Rojas, Natural Resources Officer (SLM/CBC), Food and Agriculture Organization of United Nations.

Building 238, City of Knowledge, Clayton, Panama

oscar.rojas@fao.org

Global Urban Footprint (GUF)
Precise Map of Human Settlements Location

Global targets, Priority for Action 1, 4.

Application field: Currently, more than half of the world's population are urban dwellers and this number is still rapidly increasing. Settlements - and urban areas in particular - represent the centres of human activity. The environmental, economic, political, and societal impacts of urbanization are far-reaching. They include negative aspects like the loss of natural habitats, biodiversity and fertile soils, climate impacts, pollution, crime or traffic problems, making urbanization one of the most pressing global challenges. Accordingly, a profound understanding of the global spatial distribution and evolution of human settlements is a key requirement to enable sustainable development of urban and rural settlements.

Methodology and workflow: The GUF dataset is based on the radar (SAR) satellite imagery of the two German satellites, TerraSAR X and TanDEM X. A huge dataset of roughly 180,000 very high resolution SAR images, with about 3 m ground resolution, were processed for this data-set. At the German Remote Sensing Data Center (DFD) of the DLR, a newly developed method, implemented in the fully automated Urban Footprint processor, was used to generate a global raster map of the world's settlement patterns, resulting in the GUF data set.

Key results: The GUF product is a worldwide map of settlements with unprecedented spatial resolution of 0.4 arcsec (~12 m, for scientific use only) of the years 2010-2013. For

non-commercial use, the GUF is available with a spatial resolution of 2.8 arcsec (~84 m). The resulting map shows the Earth in three colours only: black for "urban areas", white for "land surface" and grey for "water". This reduction emphasizes the settlement patterns and allows for the analysis of urban structures.

Innovative impact: The GUF exhibits great potential for enhancing climate modelling, risk analyses in earthquake or tsunami regions, and the monitoring of human impact on

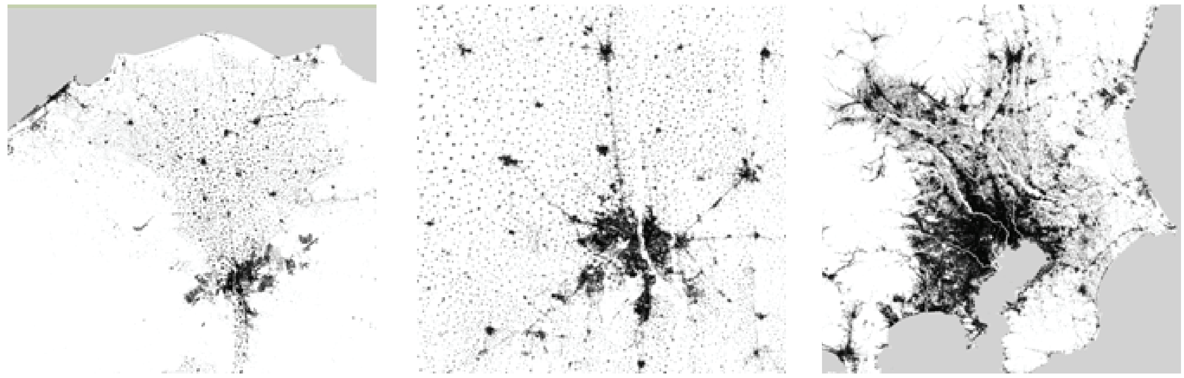
ecosystems. Moreover, it can also be employed as the basis for monitoring both the historical growth of different settlements, as well as their ongoing and future development. The GUF therefore allows for effective comparative analyses of urban dynamics amongst different regions of the world.

GP-STAR Factsheet

Global Urban Footprint (GUF)
Precise Map of Human Settlements Location

Application status: Data set available, operational.

Area of application: Local, regional, global level.



Cairo (Egypt), Delhi (India), Tokio (Japan)

Background: For a comprehensive and objective analysis of the settlement patterns, the DLR additionally developed an approach to display the spatial networks between the mapped settlements. It enables the computation of various form and centrality measures to characterize settlement patterns, at different spatial units, ranging from global to local scale.

Key publications:

Esch, T., Taubenböck, H., Roth, A., Heldens, W., Felbier, A., Thiel, M., Schmidt, M., Müller, A., Dech, S. (2012): TanDEM-X mission-new perspectives for the inventory and monitoring of global settlement patterns. Journal of Applied Remote Sensing, vol. 6, issue 1, 061702 (October 04, 2012); 21 pp., doi: 10.1117/1.JRS.6.061702.

Esch, T., Marconcini, M., Felbier, A., Roth, A., Heldens, W., Huber, M., Schwinger, M., Taubenböck, H., Müller, A., Dech, S. (2013) Urban Footprint Processor – Fully Automated Processing Chain Generating Settlement Masks from Global Data of the TanDEM-X Mission. IEEE Geoscience and Remote Sensing Letters, Vol. 10,.

Website: www.dlr.de/guf

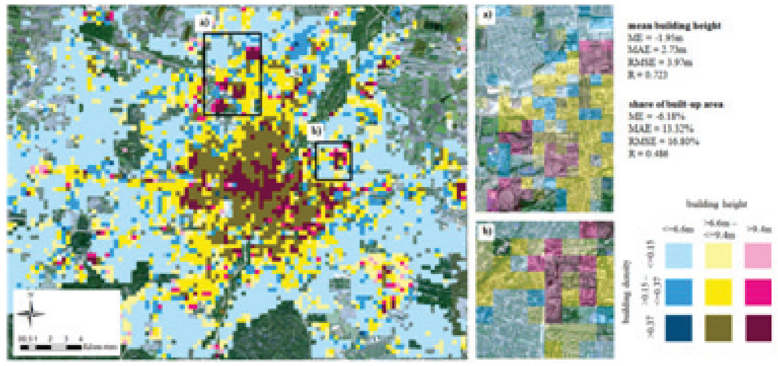
Email: guf@dlr.de

Geoservice: https://geoservice.dlr.de/web/maps/eoc:guf:4326

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Large-Area Morphological Characterization of Urban Environments for Exposure Modelling

Global targets, Priority for Action 1, 4.



An example showing the mapping of built-up height, and share of built-up areas in the city of Munich.

Application field: To support exposure modelling by providing large-area information on the physical morphology of urban environments, a fully automated processing chain based on imagery of the Sentinel-2 satellite mission, operated by the European Space Agency (ESA) in the frame of the European Union Copernicus Programme, and of the German satellite mission TanDEM-X, is currently being developed for application in disaster risk reduction efforts worldwide.

Methodology and workflow: Recent Earth observation missions feature a notable trade-off between a fairly high spatial resolution and large-area coverage. TanDEM-X, in particular, is a spaceborne radar interferometer that delivers a global digital surface model with an unprecedented pixel spacing of 0.4 arc seconds (~12m). In addition, ESA's recently launched Sentinel-2 satellites provide multispectral imagery with a spatial resolution of 10m for the bands covering visible light and near infrared, and a repetition rate of about 5 days. The developed workflow comprises of three main modules. The first module relies on the so-called Global Urban Footprint, which provides binary information on "built-up" and "non built-up" areas. The second module includes the derivation of height information of objects in urban environments from the digital surface model generated by the TanDEM-X mission. The third module contains computation of the features used for characterization of urban morphology. The final output comprises built-up heights and share of built-up areas.

Key results: Derivation of built-up heights and built-up densities, which can serve as key proxies for exposure patterns.

Innovative impact: This initiative aims at quantitatively characterizing urban environments without the incorporation of prior knowledge, and a priori determination of thematic classes according to specific semantics. This is done to allow for consistent and automated large-area analysis. Moreover, local peculiarities are bypassed, and a more objective statistical description of settlements is provided. Such a quantitative characterization can be transferred into thematic classes a posteriori, and also allows for a targeted collection of in situ knowledge for specific applications in exposure mapping.

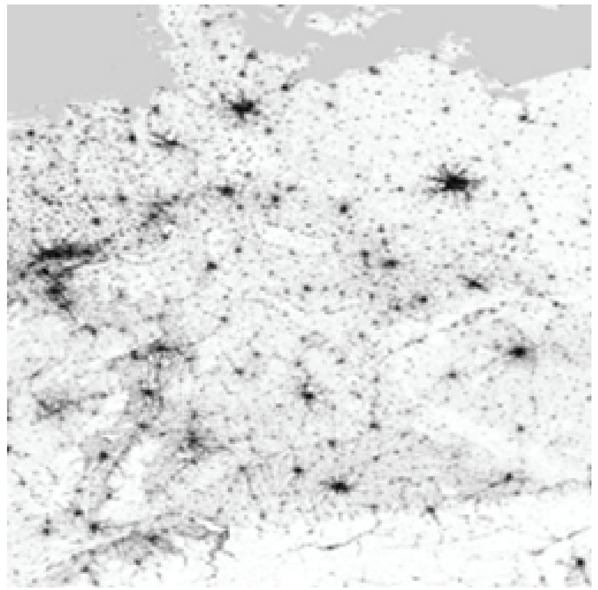
GP-STAR Factsheet

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Large-Area Morphological Characterization of Urban Environments for Exposure Modelling

Application status: Pilot/pre-operational.

Area of application: National Level



Background: Derivation of built-up heights and built-up densities using data from the TanDEM-X mission and Sentinel-2. Data from TanDEM-X can be accessed free of cost for specified areas via a scientific proposal, whereas data from Sentinel-2 is accessible free of cost via an ESA data hub.

Key publications:

Geiß, C., Wurm, M., Taubenböck, H. (2017) Towards large-area morphologic characterization of urban environments using the TanDEM-X mission and Sentinel-2, JURSE 2017 - Joint Urban Remote Sensing Event, pp. pending. Joint Urban Remote Sensing Event, 6.-8. March 2017, Dubai, United Arab Emirates.

Geiß, C., Wurm, M., Breunig, M., Felbier, A., and Taubenböck, H. (2015): Normalization of TanDEM-X DSM Data in Urban Environments with Morphological Filters. IEEE Transactions on Geoscience and Remote Sensing, 53(8), 4348-4362.

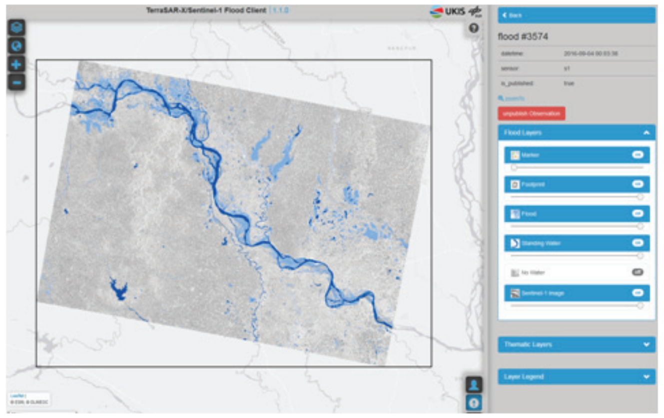
http://www.dlr.de/eoc/en/desktopdefault.aspx/tabid-5290/9370_read-18028/

Prof. Dr. Günter Strunz, Guenter.Strunz@dlr.de;
Dr. Christian Geiß, Christian.Geiss@dlr.de

German Aerospace Center (DLR), German Remote Sensing Data Center (DFD), Georisks & Civil Security; Münchener Straße 20, 82234 Wessling, Germany.

Automatic Rapid Flood Mapping by Means of Sentinel-1 and TerraSAR-X Imagery

Global target a, b, c; Priority for Action 1 – Hazard Characterization.



Application field: This fully automated processing chain for flood mapping is based on radar data of the German satellite mission TerraSAR-X and the Sentinel-1 mission, which is operated by the European Space Agency (ESA) in the frame of the European Union Copernicus Programme. It is used to support flood rapid mapping activities by providing fast-paced information on the extent of a flood situation.

Methodology and workflow: Radar sensors provide useful data of the Earth's surface both during the day and night, and amid all weather conditions. This makes SAR satellite remote sensing an ideal tool for the rapid mapping of floods. The developed TerraSAR-X and Sentinel-1 flood services consist of fully automated processing chains, containing the following steps: automatic data ingestion, pre-processing of the Earth Observation data, computation and adaption of global auxiliary data (digital elevation models, topographic slope information and topographic indices, as well as reference water masks), unsupervised initialization of the classification, post-classification refinement, and dissemination of the crisis information via a web-client.

Key results: The derived flood masks can be used to support decision making processes regarding emergency response.

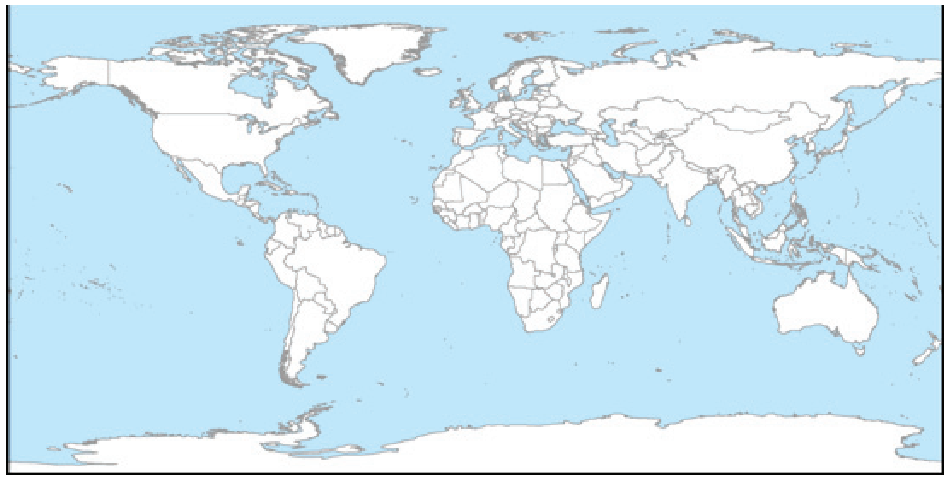
Innovative impact: To support the rapid mapping activities of the Center for Satellite Based Crisis Information (ZKI) of the German Aerospace Center (DLR), e.g. within the International Charter 'Space and Major Disasters', automatically computed flood masks can be delivered to the users of the Charter less than one hour after the satellite data is received at DLR.

GP-STAR Factsheet

Automatic Rapid Flood Mapping by Means of Sentinel-1 and TerraSAR-X Imagery

Application status: Operational.

Area of application: Global Level



Background: The automatically derived flood masks are based on Sentinel-1 and TerraSAR-X radar data. TerraSAR-X data can be accessed free of cost via scientific data proposals or are provided by DLR during activations of the International Charter 'Space and Major Disasters'. Data from Sentinel-1 is accessible free of cost via ESA's Copernicus Open Access Hub.

Key publications:

Martinis, S., Kersten, J. & Twele, A., 2015: A fully automated TerraSAR-X based flood service. – ISPRS Journal of Photogrammetry and Remote Sensing 104: 203–212.

Twele, A., Cao, W., Plank, S. & Martinis, S., 2016: Sentinel-1 based flood mapping: a fully automated processing chain. – International Journal of Remote Sensing, 27 (13): 2990-3004.

http://www.dlr.de/eoc/en/desktopdefault.aspx/tabid-5290/9370_read-18028/<contact

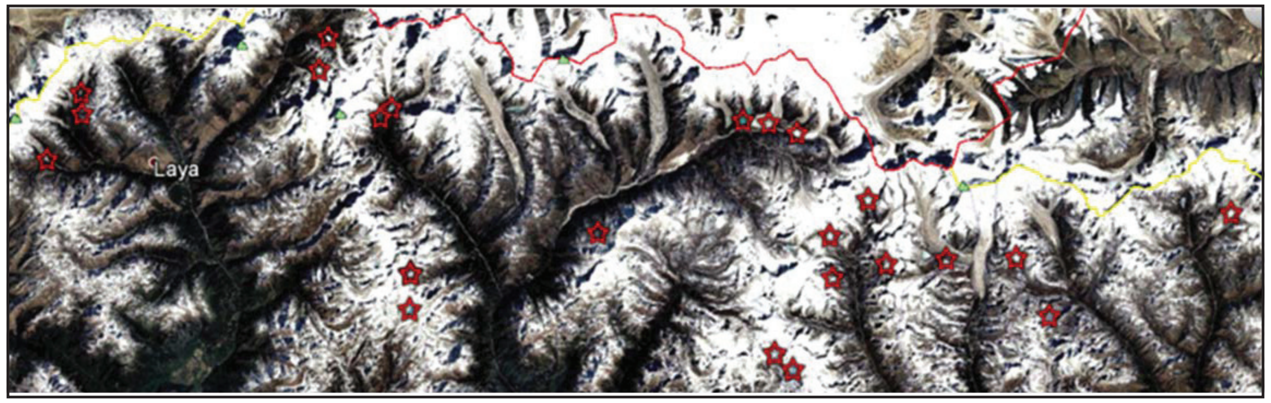
Guenter.Strunz@dlr.de, Sandro.Martinis@dlr.de

German Aerospace Center (DLR), | German Remote Sensing Data Center (DFD) | Center of Satellite Based Crisis Information (ZKI)

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods

Priority for Actions 1 and 4 - Hazard characterization and early recognition



Application field: Visual observation and mapping of glacial lakes and associated glaciers along with physical features in the vicinity using Landsat data series provides vital information to identify critical glacial lakes with potential for outburst in future. This allows early identification of potential hazard and make timely investment on risk management interventions including outburst mitigation options.

Methodology available / workflow: Evolution of glacial lake is studied using time series Landsat data which in conjunction with other factors like size of mother glacier and proximity to, type of glacial lake, moraine condition, and physical condition of lake surrounding, the criticality of the glacial lake is assessed. Criteria for identifying critical glacial lake is presented in Ives et al., 2010.

Ives, JD; Shrestha, RB; Mool, PK (2010) Formation of glacial lakes in the Hindu Kush-Himalayas and GLOF risk assessment. Kathmandu: ICIMOD.

The reference is available at: https://www.unisdr.org/we/inform/publications/14048

Key results: There are over 200 critical glacial lakes in the Hindu Kush Himalayan region some of which are monitored regularly using remote sensing and occasionally in the field.

Innovative impact: The approach provides a simple methodology using freely available data to identify looming hazard up in the difficult and inaccessible terrain.

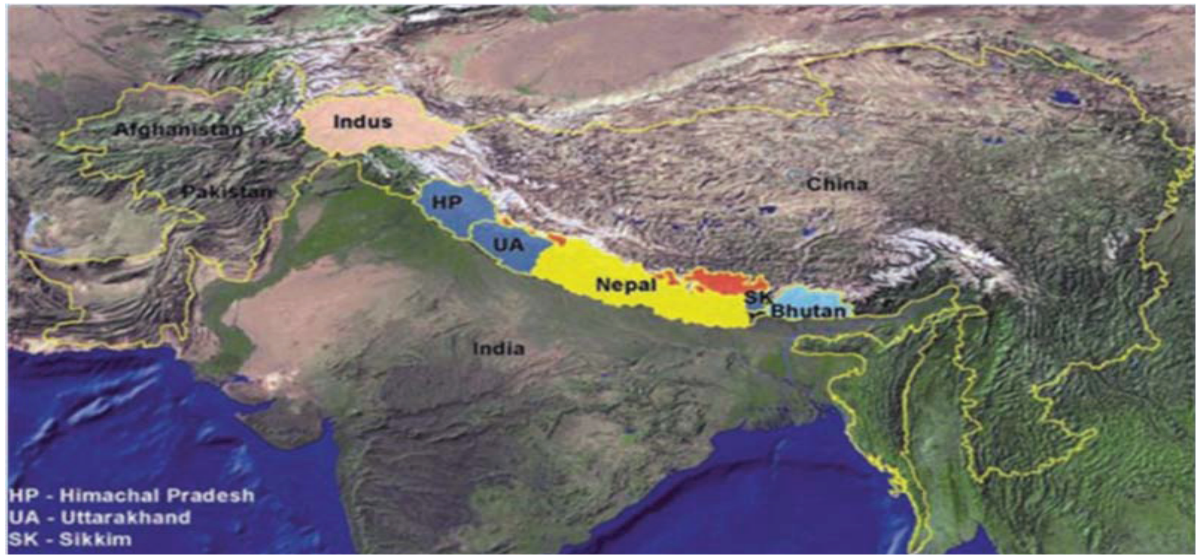
GP-STAR Factsheet

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Inventory of Glaciers, Glacial Lakes and Glacial Lake Outburst Floods

Application status: Recommended Practice, pre-operational

Hindu Kush Himalaya region



The identification of critical glacial lakes is based on remote sensing method in which several criteria related to glacial lakes, glaciers and physical condition of surrounding area is considered to assess potential for future outburst and possible glacial lake outburst flood (GLOF).

Mool, P.K.; Bajracharya, S.R.; Joshi, S.P. (2001) Inventory of Glaciers, Glacial Lakes, and Glacial Lake Outburst Flood Monitoring and Early Warning Systems in the Hindu Kush Himalayan Region – Nepal. Kathmandu: ICIMOD

Mool, P.K.; Bajracharya, S.R.; Joshi, S.P. (2001) Inventory of Glaciers, Glacial Lakes, and Glacial Lake Outburst Flood Monitoring and Early Warning Systems in the Hindu Kush Himalayan Region – Bhutan. Kathmandu: ICIMOD

http://geoapps.icimod.org/glacierlakes/index.html

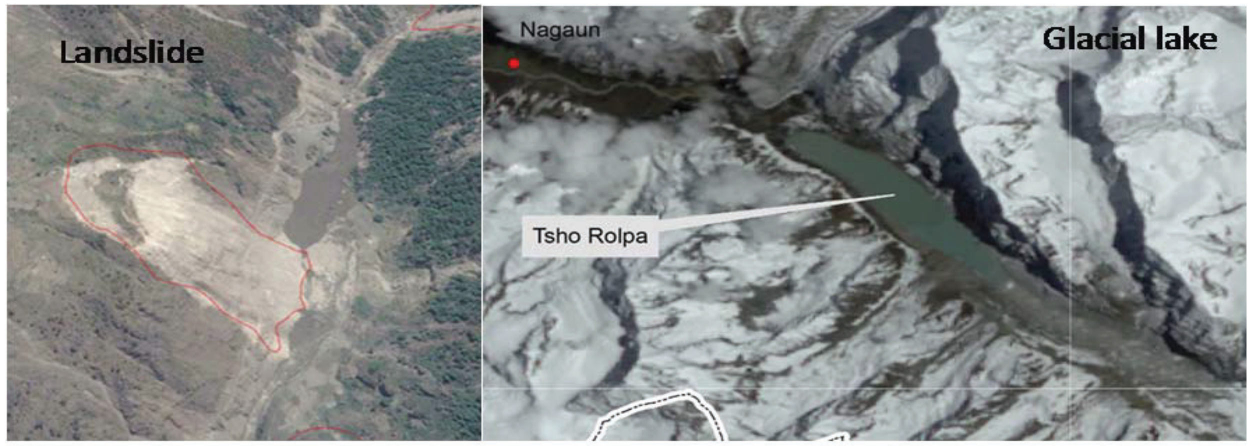
Mr. Samjwal Bajracharya, samjwal.bajracharya@icimod.org

International Centre for Integrated Mountain Development, P.Box: 3226, Khumaltar, Lalitpur, Nepal.

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Rapid response mapping in support of rescue and relief effort - Geo-hazard mapping using high resolution

Priority for Actions 1 and 4 - Hazard characterization and early recognition



Application field: Application of earth-observation and remote sensing tools to map geohazard during major disaster event like earthquake. Primary hazard like earthquake triggers secondary hazards such as landslide, rockslide and glacial lake outburst flood (GLOF). Landslide and rock-slide in turn can trigger tertiary hazard in the form of landslide dam outburst flood (LDOF). These events can take catastrophic dimension and needs regular monitoring to take timely action to minimize risk.

Methodology available / workflow: Post event high resolution satellite image is first georefer-enced and visually scanned for any fresh scar from recent landslide or rockslide. In case of citing of landslide or rockslide close to the river, construction of river with impounded water body is to be carefully checked. Regular monitoring of glacial lakes using temporal series of high resolution satellite data to observe any change in lake dimension and moraine condition provides informa-tion necessary to access GLOF hazard.

Key results: Close to 2000 landslide mapped in 14 districts affected by 2015 earthquake, several landslide dammed river and glacial lakes monitored in the aftermath of the earthquake.

Innovative impact: The approach provides a simple methodology to map and identify geohazard which has multiple utility from effective response planning to long term reconstruction.

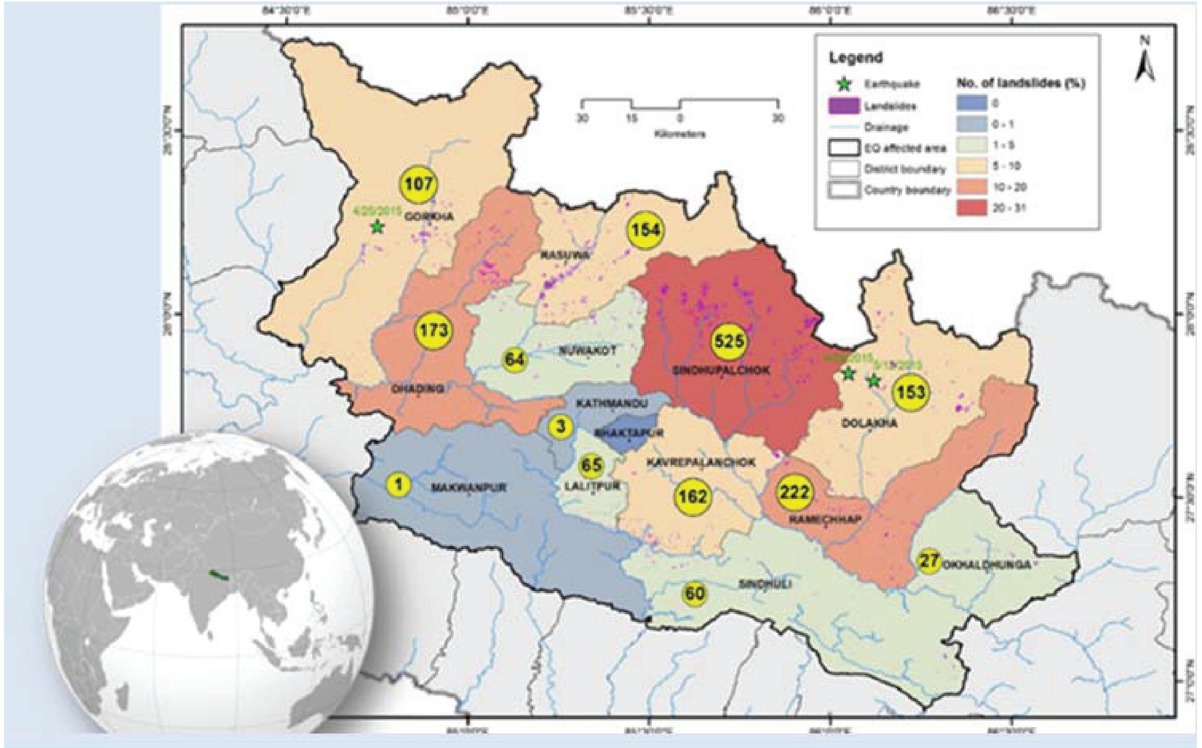
GP-STAR Factsheet

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Rapid response mapping in support of rescue and relief effort - Geo-hazard mapping using high resolution

Application status: pre-operational, recommended practice

Earthquake Affected Districts



Close to 2000 landslides were mapped using high resolution image of post 2015 Nepal Earth-quake made available through International Charter for Space and Major Disaster, and Sentinel Asia. The images were geo-referenced if not done prior to visual scanning for fresh scar from landslide and rockslide. Cross-checking with pre-event images most of which are available on Google Earth helped confirm whether or not the event is related to the earthquake.

There are many large glacial lakes in and around the earthquake affected region, which was regularly monitored using multi-temporal high resolution satellite data to pick up signs of po-tential failure.

Mapping of landslide and monitoring of glacial lake using earth-observation data provided much needed situational awareness on geo-hazard situation.

http://geoapps.icimod.org/ndrrip/

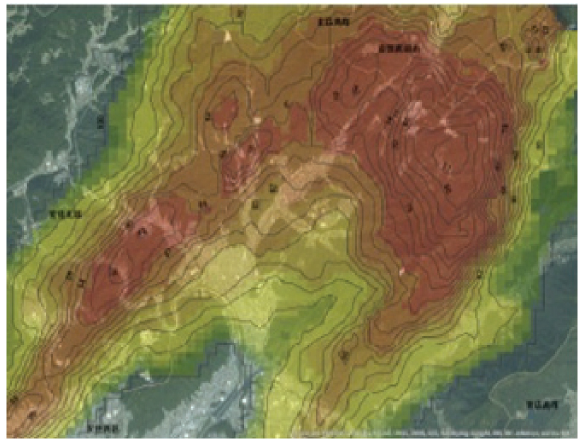
Mr. Deo Raj Gurung, deoraj.gurung@icimod.org

International Centre for Integrated Mountain Development, P.Box: 3226, Khumaltar, Lalitpur, Nepal.

Analysis of Debris Flow due to Heavy Rain

Priority for Actions 1 and 4 - Detection of accumulated rainfall using SAR data and for developing scenarios of future risks

Result of taking rainfall information of the X-band MP radar into GIS (2014.8.20 1:00 and 4:00)



Application field: Authors of the paper developed a method on how to determine rainfall from radar data.

Methodology available/workflows: The X-band MP radar observes local rainfall in near-real time. Therefore, the data of flood damage and landslide disaster caused by localized torrential and heavy rains (downpours) can be analyzed for appropriate river management and disaster prevention activity. The X-band MP radar collects detailed observations of regional heavy rain in real time (observation radius = 60 km, versus 120 for the C-band radar), which makes it suitable for gauging large-area rainfall. The high resolution of the X-band MP radar is enabled by its shorter wavelength (8-12 GHz), when compared directly with that of the C-band radar (4-8 GHz).

The raindrop shape can be understood by transmitting vertically and horizontally polarized light. The rainfall can be deduced from the flatness and other shape-like properties of the raindrops. Such highly accurate rainfall data, collected in real time, requires no correction by the ground rain gauge. Information on the movement, direction and transfer rate of the raindrops, which can be useful for rainfall prediction, can be deduced from the Doppler function.

Key results: The X-band MP radar can observe at a frequency 5 times higher than that of the C–band radar, with a resolution that is 16 times greater. Its minimum observation area is a 250m mesh, and its delivery period is 1 min.

Innovative impact: The special data structure of the X-band MP radar is difficult to process by GIS or other software. Therefore, to enable compatibility with GIS, original software was developed. The result of this method can not only be used to calculate the rainfall, but the spatial distribution of the rainfall also.

GP-STAR Factsheet

Analysis of Debris Flow due to Heavy Rain

Application status: Pre-operational. Methodology including new software

Hiroshima City

Background: Many of the sediment disasters were likely generated by the heavy rain. Sediment danger is alerted to during heavy rainfalls (≥20 mm/h), or when the total rainfall exceeds 100 mm. The new system can analyse the amount of accumulated rainfall, which is important for landslide disaster prevention.

Key publications:

Kim, G., Yune, C. Y., Paik, J., and Lee, S. W.: ANALYSIS OF DEBRIS FLOW BEHAVIOR USING AIRBORNE LIDAR AND IMAGE DATA, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLI-B8, 85-88, doi:10.5194/isprs-archives-XLI-B8-85-2016, 2016.
H. Yamamoto, H. Kobayashi: Characteristics of Heavy Rainfall and Debris Flow Disaster in Hiroshia City by Akisame-front, 20 August 2014, J. JSNDS, Vol.33, No.3, pp.293-312, 2014.
M. Nishio, M. Mori: The Web-based accumulated rainfall amount monitoring system by X-band MP radar, Journal of Flood Risk Management, online: AUG.,jfr3.12196, 2015. 220152015.jfr3.12196, 2015.

http://www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XLI-B8/85/2016/

Contact: S. W. Lee - swl@gwnu.ac.kr

Dept. of Civil Engineering, Gangneung-Wonju National University, 7 Jukheon-gil, Gangneung, South Korea

Satellite-based Emergency Mapping Guidelines

Priority for Actions 2 and 4:
Towards harmonized response information products derived from satellite data

Application field: The objective of these guidelines is to help support an effective exchange of satellite-based emergency mapping efforts leading to improved possibilities for cooperation amongst involved Emergency Mapping Organisations. This will facilitate the convergence of the mapping procedures and the thematic content across production teams in multiple response organisations, especially in the early response phases of disaster events.

Methodology available / workflow: The guidelines provide a framework to facilitate the emergency mapping community to better cooperate during emergency response. To achieve this, the IWG-SEM conducts the following activities:
a. Define fundamental principles
b. Establish a procedure for interactions and sharing of data, analysis and mapping results
c. Organize mapping products, templates and dissemination policies
d. Anticipate problems of uncertainty in communication
e. Commit to assurance of capacity and qualification
f. Prepare a glossary for emergency mapping vocabulary

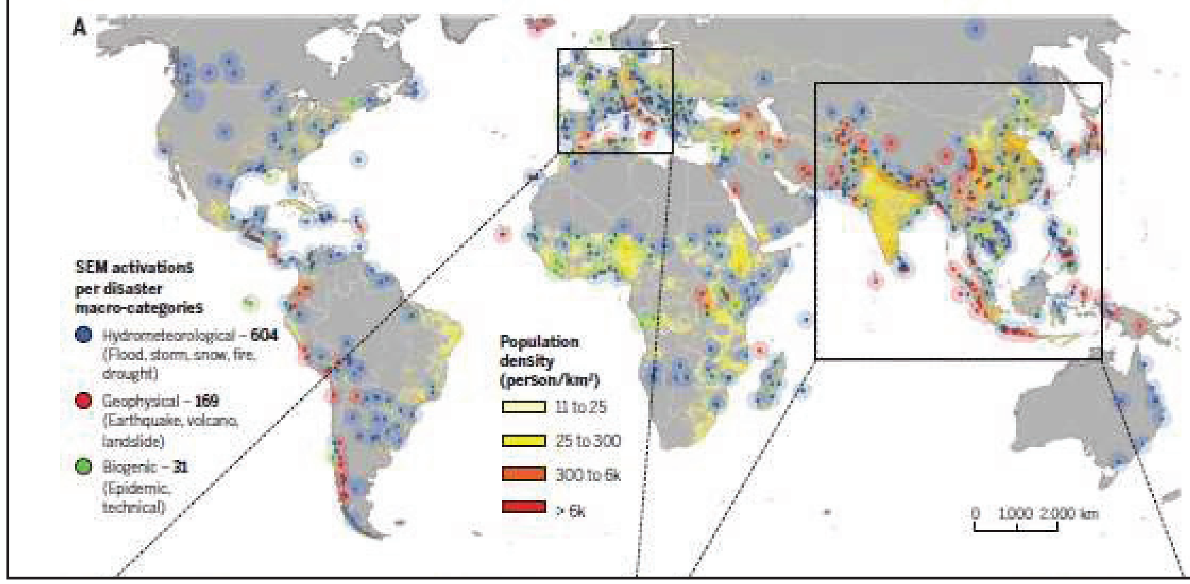
Key results: The general guidelines are available as revised version 1. The second part of the guidelines focuses on geo-information/map production related to specific disaster types using a common document structure to be applied to the different disaster types. Presently, guidelines for flood mapping are included and those for earthquake damage assessment are in preparation.

Innovative impact: By enabling easier exchange, merging and quality checking of individual data/information layers generated by more than one Emergency Mapping Organisation, the final objective of enhancing coordination and community effectiveness can be achieved among those willing to engage.

Satellite-based Emergency Mapping Guidelines

Application status: Guideline
The guidelines are an on-going effort, will be reviewed/updated periodically, in order to integrate new best practices and evolutions in technology and end-user needs. The IWG-SEM chair has the responsibility to initiate the review, by agreement of the Working Group.

Area of Application: Global



The production and the maintenance of the guidelines is reliant on a joint effort by the members of the International Working Group on Satellite-based Emergency Mapping (IWGSEM), a voluntary group of organizations involved in satellite based emergency mapping. It was founded to improve cooperation, communication and professional standards among the global network of satellite based emergency mapping providers. The chairperson of the group is nominated for a term of one year and is responsible for organizing the monthly telecons and bi-annual meetings. The current chair is from the Department of Geoinformatics, Z_GIS University of Salzburg / Spatial Services Ltd, Austria.

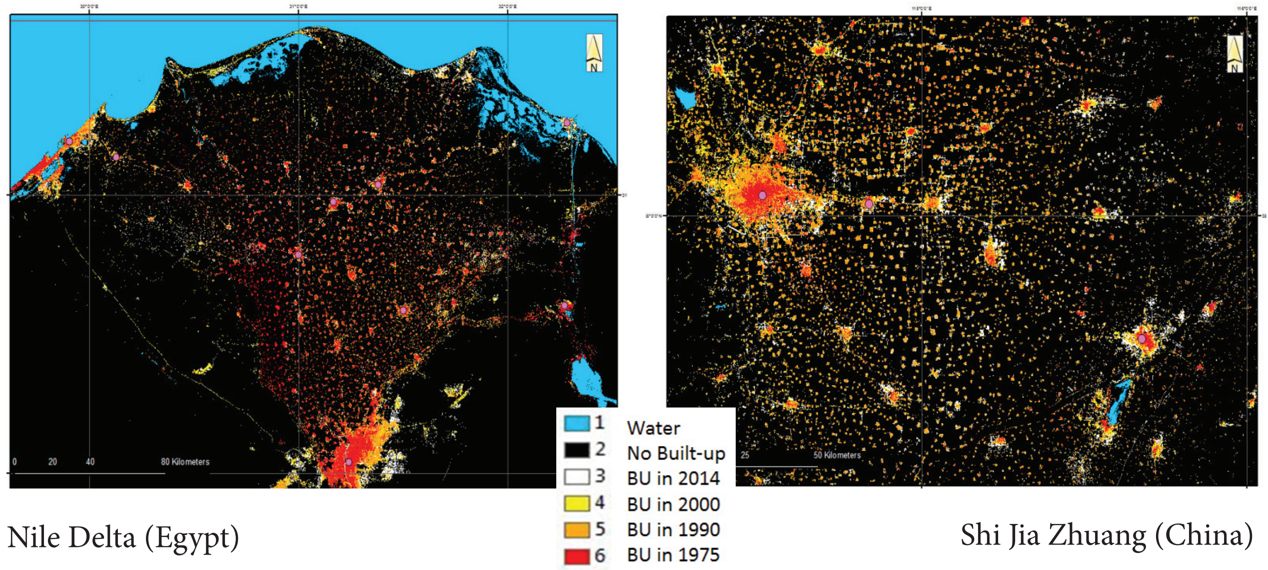
Access to the Guidelines Version 1.0 (2015) : www.iwg-sem.org
A related scientific publication: Voigt S., Giulio-Tonolo F., Lyons J., Kucera J., Jones B., Schneiderhan T., Platzeck G., Kaku K., Kumar Hazarika M., Czaran L., Li S., Pedersen W., Kadiri J. G., Proy C., Muthike D. M., Bequignon J., Guha-Sapir D. (2016): Global trends in satellite-based emergency mapping. Science 353 (6296), 247-252. [doi: 10.1126/science.aad8728]

www.iwg-sem.org

present IWG-SEM chair: Peter Zeil peter.zeil@spatial-services.com

Global Human Settlement Layers Open data to measure global exposure in time

Priority for Action 1 and 4, global targets, quantifying global exposure for improved risk analysis and for developing scenarios of future risks



Nile Delta (Egypt)

Shi Jia Zhuang (China)

Application field: Settlement information layers for exposure mapping in time. The Global Human Settlement project of the Joint Research Centres delivers four built-up layers and four population density layers for the years 1975, 1990, 2000, 2014 respectively. The Built-up layers are produced from Landsat imagery at resolution of 38 x 38m. The population density layers are derived by dis-aggregating the census data available at administrative layers to the built up. For practicality both built up and population layers are released at grid resolution of 250x250m.

Methodology used / workflow: The built-up layers are derived by processing the entire Landsat image archive. The imagery is processed automatically image by image based on a standardized information extraction methodology. The procedure first removes the clouds, it then classifies the imagery in built up areas and finally mosaics the built-up information products into global built-up mosaics for four periods. The global population density layers are derived by disaggregating the population totals available at the administrative unit to the finer scale built-up layers.

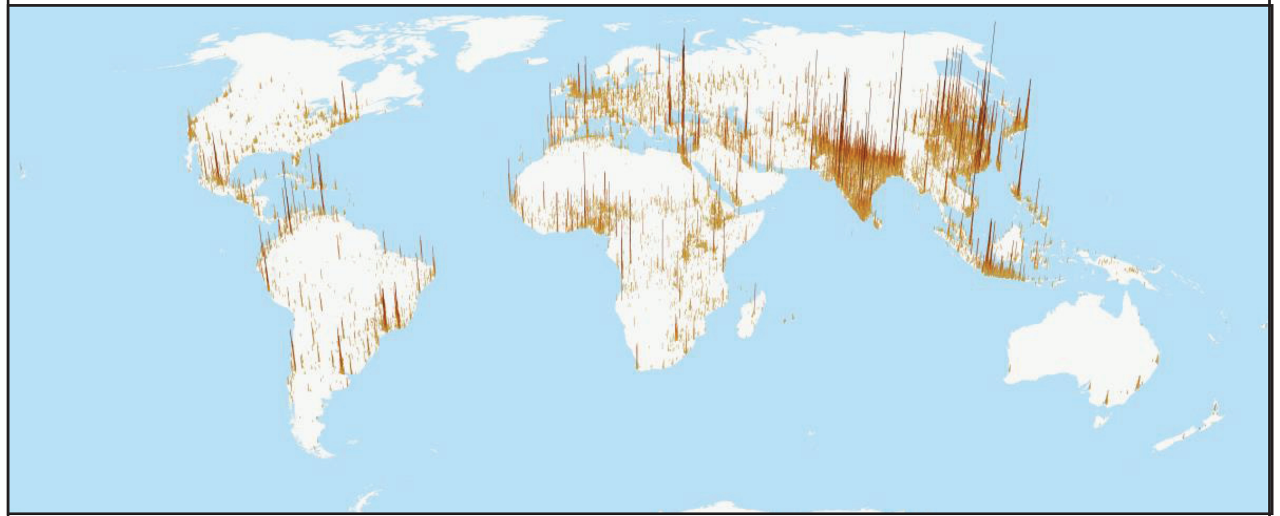
Innovative impact: The four built up and our population density layers are open source data, global and derived with the same methodology. The information can be used by users at local, regional, national and global level. The ability to analyse the growth of cities in the last 40 years and compare them is its most important characteristics.

Key results: The results can be used for quantifying exposure at local, regional, national and global level. The built-up and density layers are standardized information products in tie and space and thus suitable for spatial comparison, between cities, or temporal comparison, growth of the cities.

Global Human Settlement Layers Open data to measure global exposure in time

Application status: Operational Service

Area of Application: Global and National, Regional



Global Population Density Map

The Global Human Settlement (GHS) framework produces global spatial information about the human presence on the planet over time. This in the form of built up maps, population density maps (figure above) and settlement maps. This information is generated with evidence-based analytics and knowledge using new spatial data mining technologies. The framework uses heterogeneous data including global archives of fine-scale satellite imagery, census data, and volunteered geographic information. The data is processed fully automatically and generates analytics and knowledge reporting objectively and systematically about the presence of population and built-up infrastructures.

Pesaresi M., Ehrlich D., Ferri S., Florczyk A.J., Freire S., Halkia S., Julea A.M., Kemper T., Soille P. and V. Syrris. Operating procedure for the production of the Global Human Settlement Layer from Landsat data of the epochs 1975, 1990, 2000, and 2014. Publications Office of the European Union, EUR 27741 EN, 2016. doi: 10.2788/253582.

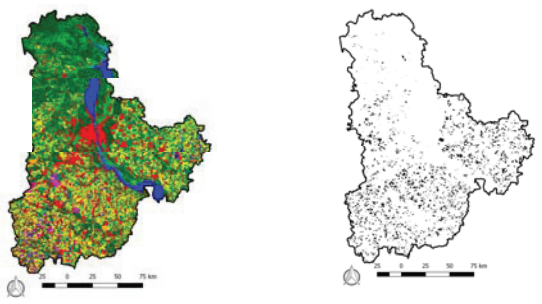
Pesaresi M., Guo H., Blaes X., Ehrlich D., Ferri S., Gueguen L., Halkia M., Kauffmann M., Kemper T., Lu L., Marin-Herrera M.A., Ouzounis G.K., Scavazzon M., Soille P., Syrris V. and L. Zanchetta, A Global Human Settlement Layer From Optical HR/VHR RS Data: Concept and First Results. IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens. 6(5):2102–2131, 2013.

http://ghsl.jrc.ec.europa.eu/data.php
contact: ghslsys@jrc.ec.europa.eu

European Commission

Food Security Risk Assessment – Crop Production Estimation and Risk of Droughts

Priority for Actions 1 and 4 - Crop State Monitoring



Winter wheat mask based on 10 m land cover (Kiev region, 2016, ESA Sen2-Agri)

Application field: Estimating crop production is one of the key components of ensuring food security. To improve risk assessment in the domain of food security risk assessment, activities on crop mapping and crop yield forecasting - with use of vegetation indexes - were implemented. In addition to this, corresponding automated information technologies were also developed.

Methodology available / workflow: Crop production risk assessment technology applies several Earth observation vegetation indices (NDVI), drought parameters (VHI), and biophysical parameters (LAI, FAPAR); for crop yield forecasting. Crop area estimation is performed with the use of deep learning and machine learning algorithms (supervised). Crop yield forecasting technology has been operational since 2012, with regional crop maps being accessible since 2013.

Key results: Crop yield forecasting technology, based on satellite vegetation indexes, biophysical parameters and crop type maps, allow for the estimation of total crop production. They also highlight the potential risks linked to crop production loss, as a result of droughts.

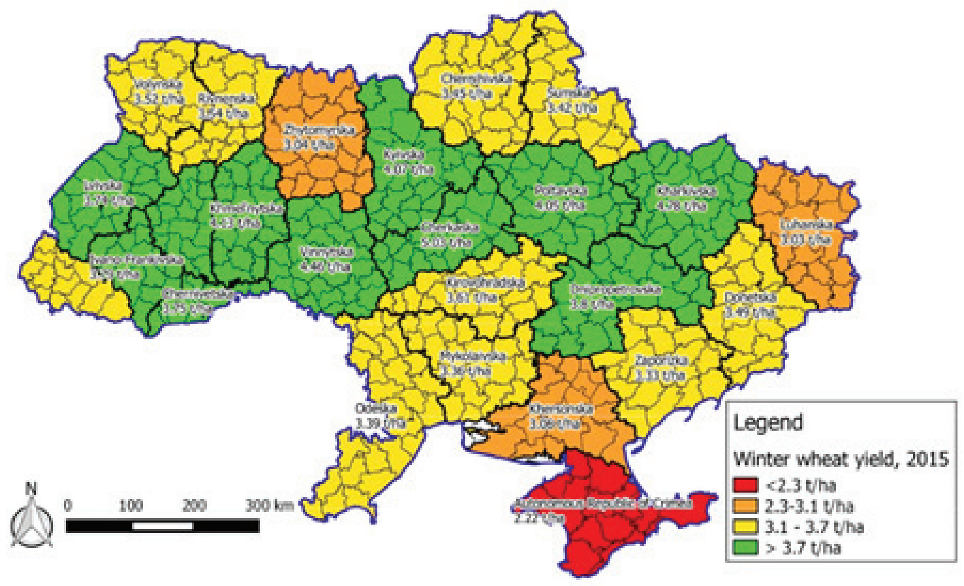
Innovative impact: Availability, simplicity, free of charge data, and minimum requirements of inputs, are deemed to be the main criteria. Sustainability is also guaranteed by the automatization of analysis. Further adaptation for use of hi-res biophysical parameters (namely LAI) from ESA's Sen2-Agri system is planned.

GP-STAR Factsheet

Food Security Risk Assessment – Crop Production Estimation and Risk of Droughts

Application status: Pilot/pre-operational

Area of Application: Implemented for the territory of Ukraine (NUTS-2 level)



- Time series of Sentinel-2 data;
- Time series of crop state estimates (Vegetation Indices, VI - LAI, NDVI, VHI);
- In-situ data (crop type dataset);
- Official winter wheat yield statistics (NUTS-2 level)

Kogan, F., Kussul, N., Adamenko, T., Skakun, S., Kravchenko, O., Kryvobok, O., ... & Lavrenyuk, A. (2013). Winter wheat yield forecasting in Ukraine based on Earth observation, meteorological data and biophysical models. International Journal of Applied Earth Observation and Geoinformation, 23,192-203.

Skakun, S., Kussul, N., Shelestov, A., & Kussul, O. (2016). The use of satellite data for agriculture drought risk quantification in Ukraine. Geomatics, Natural Hazards and Risk, 7(3), 901-917.

http://inform.ikd.kiev.ua

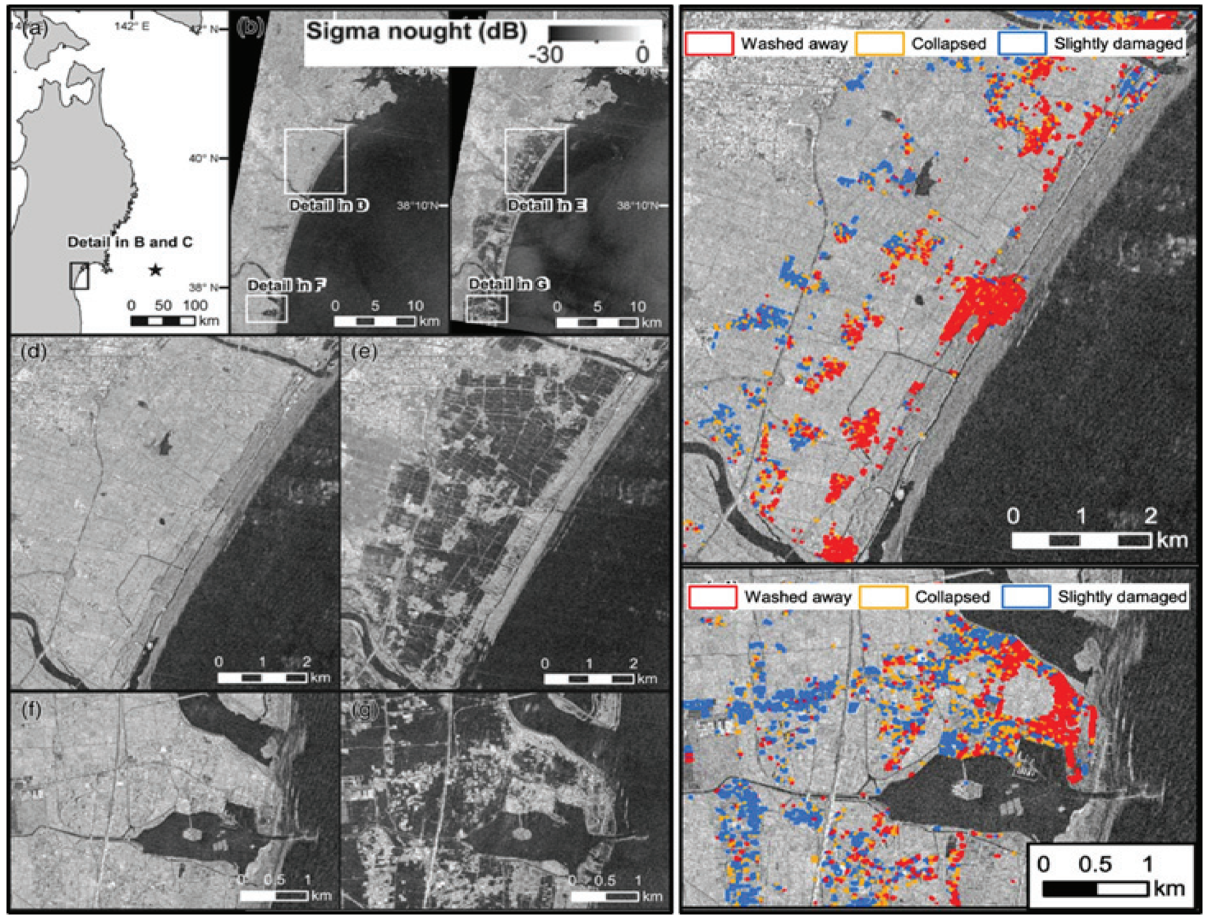
inform@ikd.kiev.ua

Space Research Institute NASU-SSAU, 40 Glushkov Ave, 03680, Kiev 187, Ukraine

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Mapping Tsunami Disaster Impact Using Earth Observation Satellites

Global targets, Priority for Action 1, 4.



TerraSAR-X pre and post event data set and mapping results of building damage from the 2011 Tohoku Tsunami

In the aftermath of catastrophic natural disasters, such as earthquakes and tsunamis, our society tends to experience significant difficulties in assessing disaster impact within the limited period of time available. In recent years, however, the quality of satellite sensors and access to, and use of satellite imagery and services, has greatly improved. More and more space agencies have embraced data-sharing policies that facilitate access to archived and up-to-date imagery. We developed a semi-automated method to estimate building damage using high-resolution synthetic aperture radar data. The damage function we developed examines the relationship between changes in the sigma nought values of pre- and post-event TerraSAR-X data, and the damage ratio of washed- away buildings.

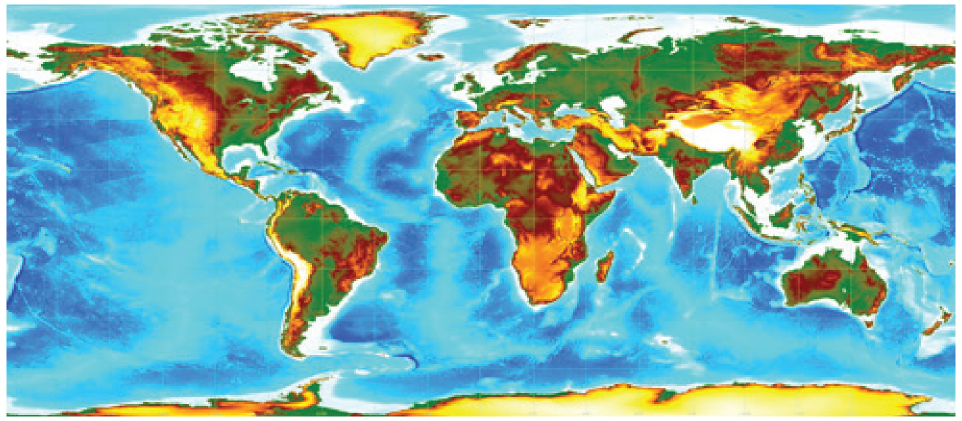
GP-STAR Factsheet

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Mapping Tsunami Disaster Impact Using Earth Observation Satellites

Application status: Service.

Area of application: National to global level.



Background: By bringing together state-of-the-art high-performance computing, remote sensing and spatial information sciences, we have established a method of real-time tsunami inundation forecasting, damage estimation, and mapping; to enhance disaster response. We are able to perform a real-time tsunami inundation forecasting, with the aid of high-performance computing platform. Given the maximum flow depth distribution, we carry on quantitative estimation of exposed populations using census data, and the **num**ber of damaged structures, by applying the tsunami fragility curve. After the potential tsunami-affected areas are estimated, the analysis focuses on to the "detection" phase which uses remote sensing to assess tsunami affected areas and structural damage. A semi-automated method, to estimate building damage in tsunami-affected areas has been developed using high-resolution SAR (Synthetic Aperture Radar) data. The method has been verified in the case studies of the 2011 Tohoku tsunami and recent coastal hazards.

Key publications:

Koshimura, S., Establishing the Advanced Disaster Reduction Management System by Fusion of Real-Time Disaster Simulation and Big Data Assimilation, Journal of Disaster Research, Vol.11 No.2, pp.164-174, 2016. doi: 10.20965/jdr.2016.p0164

Gokon, H., J. Post, E. Stein, S. Martinis, A. Twele, M. Mück, C. Geiß, S. Koshimura and M. Matsuokam A Method for Detecting Buildings Destroyed by the 2011 Tohoku Earthquake and Tsunami Using Multitemporal TerraSAR-X Data, IEEE Geoscience and Remote Sensing Letters, IEEE, doi: 10.1109/ LGRS.2015.2392792, 2015.

Shunichi KOSHIMURA, Professor
International Research Institute of Disaster Science, Tohoku University

Email : koshimura@irides.tohoku.ac.jp

www.regid.irides.tohoku.ac.jp

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Policy Options for Improved Drought Resilience in Africa

Priority for Actions 1 and 2- Understanding Drought Risk and Governance

The Windhoek Declaration for Enhancing Resilience to Drought in Africa

PREAMBLE

We, the African Member States and Parties to the United Nations Convention to Combat Desertification (UNCCD), Ministers, Heads of Delegation and Experts, attending the High Level Meeting of the first African Drought Conference (ADC);

Having met in Windhoek, Namibia from the 15 - 19 August 2016;

Application field: International attention towards enhancing drought preparedness has increased in recent years. A high-level meeting on national drought policies (HMNDP) was held in Geneva in 2013. March 2015 saw the development and adoption of the Sendai Framework for Disaster Risk Reduction which laid out priorities to reduce risks from natural disasters. UNCCD and the government of Namibia and other partners organised African drought conference with a view to developing a strategic framework and channelling support towards addressing these needs.

Methodology used / workflow: The conference comprised a three-day meeting of technical experts followed by a one-and-a-half day high level segment. The technical meeting identify and analysed the needs of African countries for effective drought mitigation to develop potential solutions for addressing these needs. National and international experts were invited to present papers on different thematic areas linked to droughts.

Innovative impact: The policy options and principles allow for enhanced and context specific drought risk mitigation measures. This will also allow African countries to plan for a common strategy on a region to harness the potential, synergize efforts and south-south cooperation.

Key results: The two major outputs include the deliberation of a white paper on Drought Resilient and Prepared Africa (DRAPA) and (b) the Windhoek Declaration. The framework highlights six principles: (i) drought policy and governance for drought risk management, (ii) drought monitoring and early warning, (iii) drought vulnerability and impact assessment, (iv) drought mitigation, preparedness and response, (v) knowledge management and drought awareness and (vi) reducing the underlying factors of drought risk. In the Windhoek declaration, establishment of a continent-wide African Network with national institutions for Drought Monitoring and Early Warning Systems is mentioned. The role of Space technology in this endeavor cannot be underestimated.

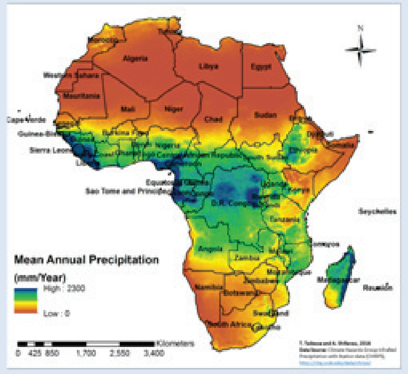
GP-STAR Factsheet

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Policy Options for Improved Drought Resilience in Africa

Application status: Policy option

Area of Application: Strategic Framework for Drought Risk Management and Enhancing Resilience adopted in Africa. Proposes for a Drought Resilient and Prepared Africa (DRAPA) to be implemented at national level.



African Member States and Parties to the United Nations Convention to Combat Desertification (UNCCD) declare commitment to implement the Strategic Framework for Drought Risk Management and Enhancing Resilience in Africa, which proposes a Drought Resilient and Prepared Africa (DRAPA).

Strategic Framework for Drought Management and Enhancing Resilience in Africa. White paper for African Drought Conference.

The Windhoek Declaration for Enhancing Resilience to Drought in Africa.

http://www.unccd.int

Contact: Daniel Tsegai, Ph.D.
Programme Officer, ERPA, UNCCD
UN Campus, Platz der Vereinten Nationen 1, 53113 Bonn, Germany
Tel: + 49 228 815 2835 Email: dtsegai@unccd.int

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

UNOSAT Operational Satellite Mapping Service

Global targets, Priority for Action 1: Understanding Disaster Risk, Priority for Action 4: Enhancing Disaster Preparedness for Effective Response, and to "Build Back Better" in Recovery, Rehabilitation and Reconstruction

Application field: UNOSAT is the Operational Satellite Applications Programme of the United Institute for Training and Research (UNITAR) delivering satellite imagery analysis and related geospatial information technology solutions in support of disaster risk reduction, humanitarian operations, human security, human rights and socio-economic development.

Methodology and workflow: UNOSAT provides timely and relevant satellite imagery analysis to support different stages of the disaster risk management cycle:

- Preparedness/Pre-Disaster phase: Multi-Hazard Risk Assessment, Alert & Early Warning, Elements at Risk Mapping, etc.
- Emergency response 24 - 72 hours: Exposure and Impact Analysis (Hazard Extent Mapping, Population & Landuse/Landcover exposure, IDPs & Camp Mapping, Humanitarian Access, Rapid Damage Estimation)
- Emergency response 72 hours - 2 weeks: Damage Assessment (Structural damage to buildings, transportation network, critical facilities).
- Recovery phase: Imagery Analysis Support for Reconstruction Monitoring (Cluster Specific / Sectorial Assessments).

Key results: Since 2001, UNOSAT has supported, with satellite imagery analysis, UN Agencies and Member States for the majority of disaster events worldwide that required International Humanitarian Assistance.

Innovative impact: Timely satellite imagery analysis is provided to humanitarian and development actors to support operational planning and decision making with reliable and evidence-based information.

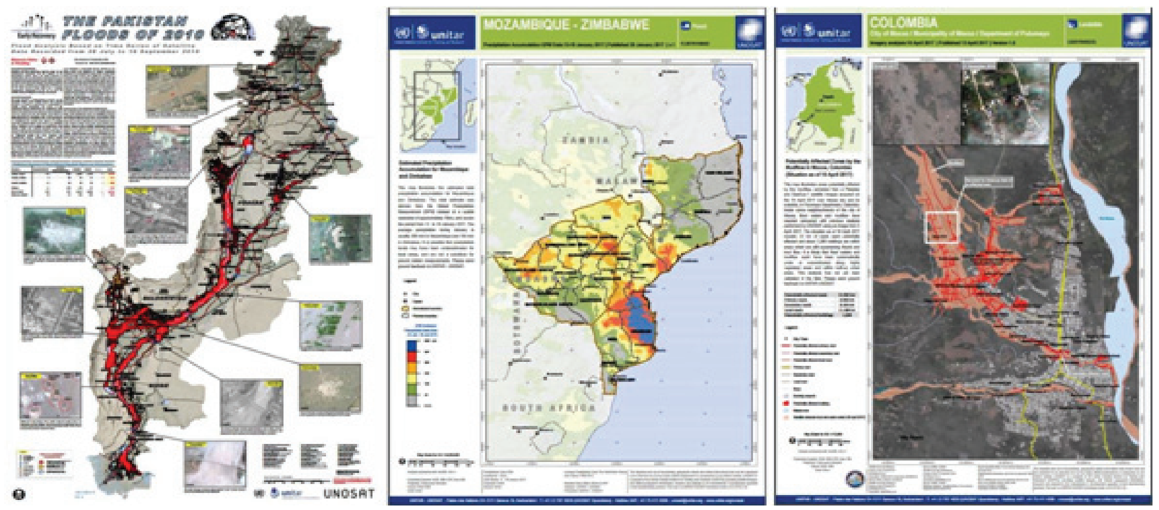
GP-STAR Factsheet

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

UNOSAT Operational Satellite Mapping Service

Application status: Fully operational service.

Area of application: Local, Regional, National and Global Level



Background: Based on optical and radar images of different resolutions, UNOSAT products are also enriched with the available baseline GIS datasets and crowdsourcing data. Satellite derived analysis performed by UNOSAT is delivered in the form of GIS Data, Static Maps, Live Web Maps and Reports, and is then shared with a wide range of end-users such as: UN Agencies, International Organizations and Governments.

Key publications:

- Report of the Executive Director of the United Institute for Training and Research to the General Assembly (Official Records, Fifty-ninth Session N. 14 (A/59/14)
- Geo-information for Disaster Management, Peter van Oosterom, Šiyka Zlatanova, Elfriede Fendel – 2006 (ISBN 978-3-540-27468-1)
- Managing Crises and Disasters with Emerging Technologies : Murray E Jennex, Feb. P. (2016) FAO's AVHRR-based Agricultural Stress Index System (ASIS) for global drought monitoring, International Journal of Remote Sensing, 37:2, 418-439, DOI: 10.1080/01431161.2015.1126378

https://unitar.org/unosat/ http://www.unitar.org/unosat/maps

email : unosat@unitar.org

UNITAR, International Environment House
11-13 Chemin des Anémones, CH-1219 Châtelaine, Geneva - Switzerland

UN-SPIDER Knowledge Portal

Global targets, Priority for Action 1 and 4

Application field: The Knowledge Portal represents a gateway to space-based information for disaster management and emergency response. It features content such as case studies and best practices in using space-based information in disaster risk reduction efforts and the implementation of the Sendai Framework. Stakeholders from the disaster risk management, emergency response and space communities can access relevant information about one another on the platform, as well as information on cross-cutting issues and opportunities for effective collaboration.

Methodology used / workflow: The Portal presents data and information generated by the space and disaster management communities through four channels: The Space Application Matrix is a search engine for scientific papers and technical reports, which allows content to be filtered according to criteria such as space technology and hazard type. Users can access an overview of the efforts of the disaster risk management and emergency repose communities through a dedicated section on Risk and Disasters. The Links and Resources page includes information on databases and GIS software, as well as training opportunities and institution profiles. Finally, the Recommended Practices page offers hands-on instructions on using space-based information for mapping hazards such as floods or droughts through various stages of the disaster management cycle.

Key results: The platform facilitates access to space-based information. It also fosters awareness of how products and applications developed by the space community can support disaster risk reduction efforts and, in a complementary fashion, how the disaster risk reduction and emergency response communities work and what space-based information they could benefit from.

Innovative impact: Centralisation and categorisation of information and data sets available on multiple websites - in order to help disaster risk management professionals find relevant space-based data and information products quickly, and to provide support on how to use this information in the context of DRR.

GP-STAR Factsheet

Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

UN-SPIDER Knowledge Portal

Application status: Operational

Area of Application: Global

In order to encourage the targeted retrieval of space-based information and data by disaster risk reduction practitioners, content on the Portal is systematically enriched with metadata. For instance, data sources are marked up with data about their file type, satellite/sensor and spatial coverage and whether they relate to the disaster risk management or emergency response phase. The tool features a range of filters that draw on the metadata, thereby allowing users to narrow down their search, for example, filtering available GIS software by hazard type. This ensures that users efficiently find the content that is most relevant to them. At the same time, the Portal encourages the discovery of resources related to those accessed by the user, by providing links to them on the same page. This allows for contextualisation and highlights links between resources from different areas that other platforms may display in an isolated fashion. A dynamic glossary, which means that terms in any text on the website will automatically be linked to corresponding glossary entries, helps in developing a shared understanding of key

UNOOSA/UN-SPIDER (2014). Report on the UN-SPIDER Knowledge Portal: recent advances (2014). Available at http://un-spider.org/sites/default/files/AC105_1075E.pdf

www.un-spider.org

Radu Botez – Associate Information and Outreach Officer - radu.botez@unoosa.org

UNOOSA / UN-SPIDER Bonn Office, UN Campus, Platz der Vereinten Nationen 1, 53113 Bonn, Germany

UN-SPIDER Recommended Practices

Priority for Actions 1 and 4

Application field and innovative impact: When using Space technologies for disaster risk management and emergency response, it is not only important to have access to the right data and software, it is also crucial to be aware of practices that have proven effective in a specific context. UN-SPIDER's partners and Regional Support Offices are therefore enhancing several recommended practices that provide practical insight and hands-on instructions on how to use satellite information for various hazards, in various phases of the disaster management cycle.

Workflow and key results: Currently, the UN-SPIDER knowledge portal has the following Recommended Practices available for use:

1. Flood Mapping/Flood Hazard Mapping - The objective of these practices is to determine the extent of flooded areas. The use of SAR satellite imagery for flood extent mapping constitutes a viable solution to process images quickly, providing near real-time flooding information to relief agencies.

2. Drought Monitoring (VCI/SVI) – Drought monitoring is an important component in drought early warning systems. The purpose of these recommended practices is to monitor impacts of meteorological drought on natural vegetation (rain fed, range land & forest). They have been developed in the context of the SEWS-D project.

3. Exposure Mapping - Mapping the extent of a natural hazard (e.g., assessing areas with a high risk or disaster is the first step in disaster risk management and emergency response. Subsequently, exposure mapping enables the estimation of the impact of hazards or disas ters - for example, the number of affected inhabitants or infrastructure.

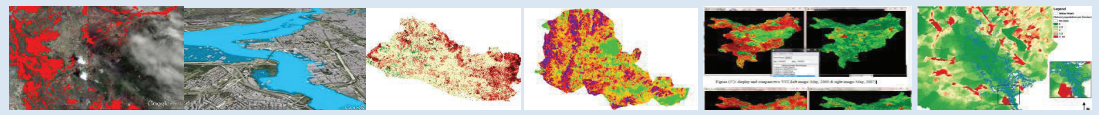
4. Burn Severity Mapping - This recommended practice was developed to help contribute in the assessment of areas affected by wildfires. The evaluation of these areas can be carried out using different methods; namely, on the ground and using remote sensing tools.

UN-SPIDER - Recommended Practices

Application status: Service, recommended practice

Area coverage: National to local level

Flood Mapping – Nsanje District around Chiromo, Malawi (Flood event in January 2015);
Flood Hazard Mapping – Cedar Creek Watershed/St. Joseph basin, Northeast Indiana, USA;
Drought **Monitoring VCI** - Five provinces in Iran: Alborz, Tehran, Semnan, Qom, Istahan;
Drought Monitoring SVI - Several countries in the dry corridor of Central America, Dominican Republic and Brazil;
Exposure Mapping – Applied in the context of the flood event in Malawi, in January 2015; Burn
Severity Mapping - Empedrado Commune, province of Talca, Maule region, Chile.



Background and Methodology

1. Flood Mapping/Flood Hazard Mapping - The practice shows the use of ESA's SNAP software for pre-processing and processing of SAR imagery using a threshold method for deriving the flood extent. Google Earth is used to visualize the results of image processing.
2. Drought Monitoring - This practice shows how to monitor the impacts of meteorological drought on natural vegetation using MODIS optical satellite imagery.
3. Exposure Mapping - This practice shows the use of Quantum GIS to analyze a disaster extent map in combination with auxiliary data such as population or land cover data.
4. Burn Severity Mapping - This methodology combines the use of Landsat 8 pre- and post-fire imagery, and the Normalized Burn Ration (NBR) index. It was designed specifically to assess large areas that have been impacted by wildfires.

http://www.un-spider.org/advisory-support/recommended-practices

www.un-spider.org

Juan Carlos Villagran - Head of UN-SPIDER Bonn Office - juan-carlos.villagran@unoosa.org

UNOOSA / UN-SPIDER Bonn Office, UN Campus, Platz der Vereinten Nationen 1, 53113 Bonn, Germany

UN-SPIDER Technical Advisory Mission

Priority for Actions 1, 2, 3 and 4; global targets - Use of space-based information analysis and for developing scenarios of future risks

Workshop with stakeholder

Capacity Building

Application field: A TAM is conducted to identify the needs of a Member State regarding its capacity to fully take advantage of space-based information. As an inter-institutional fact-finding mission, it is officially requested by the respective national government and is carried out by a team of experts that UN-SPIDER gathers.

Methodology used / workflow: Typically, TAMs are one-week long missions. It can be a series of meetings, a workshop or a training session, depending on the needs and scope of the request. The expert team meets with key disaster management and development authorities in the Government, United Nations organizations, regional and international organizations/initiatives, and private entrepreneurs; to discuss the use of space-based information for risk and disaster management in depth and to subsequently make recommendations on improvements.

Key results: The team makes recommendations and develops guidelines to improve the use of space-based information in the country. TAMs are often followed up by capacity building activities.

Innovative impact: Raising awareness, building capabilities, improving information and data management practices, updating policies and coordination, and promoting international cooperation, are the main impacts in the TAM countries. So far, UN-SPIDER has conducted Technical Advisory Support missions in 35 countries and supported more than 55 countries.

UN-SPIDER Technical Advisory Mission

Application status: Operational Service

Area of application: National level

Case study: Myanmar

Background: After the TAM was conducted in Myanmar, innovative impacts were completed following a recommendation. “Emergency Operation Centre (EOC)”, which is comprised of four units including “Remote Sensing Unit” and “Risk Assessment and Emergency Response Unit” was estabished in the Ministry of Social Welfare, Relief & Resettlement (MSWRR). The capacity building of MSWRR and other related institutes in remote sensing and GIS were strengthened. The Disaster Management Training Centre now conducts courses in remote sensing/GIS. Myanmar has also become the first country in ASEAN to apply for universal access to the International Charter. Myanmar governments are aware that the National Spatial Data Infrastructure (NSDI) and one map policy that have been initiated by the Ministry of Education, are very crucial.

Key publications:
Report of the Technical Advisory Mission to Myanmar. (2012)
Reports on UN-SPIDER Technical Advisory Mission follow up activities in Myanmar. (2012, 2016, 2017)

http://www.un-spider.org/advisory-support/advisory-missions/technical-advisory-missions

tong.tang@unoosa.org

UN-SPIDER Beijing Office, No.6, Guangbai Donglu, Beijing, CHINA

GP-STAR Partners

CAS-TWAS SDIM

CAS-TWAS Centre of Excellence on Space Technology for Disaster Mitigation (SDIM) is an international research center, aiming to strengthen the scientific capacity of Earth observation technology for disaster risk reduction (DRR) in developing countries. The SDIM is jointly sponsored by the Chinese Academy of Sciences (CAS) and The World Academy of Sciences for the advancement of science in developing countries (TWAS), and hosted at the Institute of Remote Sensing and Digital Earth (RADI), CAS.

The goal of SDIM is to conduct much-needed research on DRR through advanced space technologies, especially space-borne Earth observation technology and provide knowledge transfer in developing countries through joint research, education, training, workshop and advisory services. SDIM is guided by four objectives:

- To implement outstanding multi-disciplinary and collaborative scientific research activities focus on disasters in relation with floods, droughts, earthquakes, tropical cyclones, storms, etc. with a main emphasis in developing countries.
- To offer associated education programs and customized training for experts and decision makers from developing countries.
- To promote a scientific dialogue and a platform for the exchange of best practices of Earth observation in developing countries.
- To provide technical and strategic advisory services to developing countries.

CEOS

CEOS is made up of more than 50 Agencies from all around the world, with several Agencies committed to coordinating their satellite Earth observation programs and sharing data for a more sustainable and prosperous future. These satellite observations are critical for environmental monitoring, meteorology, disaster response, agriculture and many other applications that can improve life on Earth and save lives.

In support to the Sendai Framework for Disaster Risk Reduction 2015-2030, Space agencies have initiated a series of actions to support Disaster Risk Management (DRM), more efficiently, with a focus on Disaster Risk Reduction (DRR), by optimizing and better coordinating satellite Earth observations. CEOS members felt that it's critical that space agencies invest in disaster preparedness and prevention. It's in this context that CEOS created the Working Group on Disasters.

The overarching goals of this Working Group are to increase and strengthen satellite Earth observation contributions to the various DRM phases and to inform politicians, decision-makers, and major stakeholders on the benefits of using satellite Earth Observations in each of those phases. To achieve these goals, CEOS Agencies have agreed to a series of objectives/actions that will improve the coordination of Earth Observations satellites, improve satellite Earth Observation data distribution, and foster the use of satellite data for risk reduction as an added value to other data sources, in order to provide a more accurate information to the decision-makers. Those actions are largely user-driven.

For more information about CEOS Working Group on Disasters, please visit our website at http://ceos.org/ourwork/workinggroups/disasters
.

CEPREDENAC

The Central American Coordination Center for Natural Disaster Prevention (CEPREDENAC) is the intergovernmental body entrusted by the Central American Integration System (SICA) with coordinating disaster reduction in the isthmus. The headquarter is based in Guatemala, and its Spanish-language Web site contains ample information on the Center's programs and other activities.

The general objective of CEPREDENAC is to contribute to the reduction of vulnerability and the impact of disasters, as an integral part of the process of transformation and sustainable development of the region, within the framework of the Central American Integration System (SICA), through promotion, support and development of policies and measures of prevention, mitigation, adaptation, preparation and management of disaster risk

Disaster Management Centre of Sri Lanka (DMC)

The Sri Lanka Disaster Management Act No. 13 of 2005 was enacted on 13.05.2005 and Disaster Management Centre (DMC) was established with effect from 01.08.2005 as provided by the Act. The Act required establishing two important Institutions, namely The National Council for Disaster Management (NCDM) and The Disaster Management Centre (DMC) under the National Council for Disaster Management (NCDM) as the lead agency on disaster risk management in the country in implementing the directives of NCDM. In January 2006, the above Ministry was renamed as the Ministry of Disaster Management & Human Rights.

The principal functions of the DMC

- Assisting the Council in the preparation of the National Disaster Management Plan and the National Emergency Operation Plan and proposals for upgrading the same when it becomes necessary
- Taking responsibility for the implementation of the National Disaster Management Plan and the National Emergency Operation Plan, and upon the declaration of a state of disaster to direct and coordinate the implementation of the National Emergency Operation plan
- Ensuring that the various Disaster Management Plans prepared by Ministries, Government Departments or public corporations conforms to the National Disaster Management Plan
- Based on Disaster Management Plans prepared by various Ministries, Government Departments and public corporations under section 10, preparing and implementing programmes and plans for disaster preparedness, mitigation, prevention, relief, rehabilitation and reconstruction activities and coordinating of organizations which implement such programmes and plans and obtain financial assistance form the Treasury for such activities and release the same to the relevant regions and monitor and evaluate these activities
- Issuing instructions and guidelines to appropriate organizations, non-governmental organizations, district secretaries and divisional secretaries on activities relating to disaster management and initiating and implementing work programmes in co-ordination with such organizations and secretaries
- Promoting research and development programmes in relation to disaster management and setting up and maintaining a data base on disaster management
- Submitting reports to the Council from time to time and whenever required by the Council in regard to its activities.

DiMTEC
Disaster Management Training and Education Centre for Africa

Disaster Management Training and Education Centre for Africa (Dimtec), South Africa

At the University of the Free State (UFS) Disaster Management Training and Education Centre for Africa (DiMTEC), we strive towards informing the public about disaster risk reduction through education. Our master's, postgraduate degrees in disaster management, short courses, and research are of the highest quality. The recent addition of a PhD ensures that research towards making a difference continue in various fields.

DiMTEC's first course was approved and registered by the South African Qualifications Authority in 2001, after which DiMTEC we joined the Department of Agricultural Economics in the vision of becoming an independent center, which came about in 2005.

Copernicus
Europe's eyes on Earth

European Commission, Copernicus

Copernicus is the European system for monitoring the Earth and is coordinated and managed by the European Commission.

The development of the observation infrastructure is performed under the aegis of the European Space Agency for the space component and by the European Environment Agency and EU countries for the in-situ component.

It consists of a complex set of systems which collect data from multiple sources: earth observation satellites and in site sensors such as ground stations, airborne sensors, and sea-borne sensors. It processes this data and provides users with reliable and up-to-date information through a set of services related to environmental and security issues.

The services address six thematic areas: land, marine, atmosphere, climate change, emergency management, and security. They support a wide range of applications, including environment protection, management of urban areas, regional and local planning, agriculture, forestry, fisheries, health, transport, climate change, sustainable development, civil protection, and tourism.

FAO FIAT PANIS
Food and Agriculture Organization of the United Nations

Food and Agriculture Organization of the United Nations

Achieving food security for all is at the heart of FAO's efforts – to make sure people have regular access to enough high-quality food to lead active, healthy lives.

Our FAO's three main goals are: the eradication of hunger, food insecurity and malnutrition; the elimination of poverty and the driving forward of economic and social progress for all; and, the sustainable management and utilization of natural resources, including land, water, air, climate and genetic resources for the benefit of present and future generations.

The strategic objectives are:

- Help eliminate hunger, food insecurity and malnutrition
- Make agriculture, forestry and fisheries more productive and sustainable
- Reduce rural poverty
- Enable inclusive and efficient agricultural and food systems
- Increase the resilience of livelihoods to threats and crises

DLR
Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

German Aerospace Center (DLR)

The German Aerospace Center (DLR) is the national aeronautics and space research center of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programmed. DLR is also the umbrella organization for the nation's largest project management agency.

GEO GROUP ON EARTH OBSERVATIONS

Group on Earth Observations (GEO)

GEO is a partnership of more than 100 national governments and more than 100 Participating Organizations that envisions a future where decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations. GEO is a unique global network connecting government institutions, academic and research institutions, data providers, businesses, engineers, scientists and experts to create innovative solutions to global challenges at a time of exponential data growth, human development and climate change that transcend national and disciplinary boundaries. The unprecedented global collaboration of experts helps identify gaps and reduce duplication in the areas of sustainable development and sound environmental management.

Together, the GEO community is creating a Global Earth Observation System of Systems (GEOSS) to better integrate observing systems and share data by connecting existing infrastructures using common standards. There are more than 200 million open data resources in GEOSS from more than 150 national and regional providers such as NASA and ESA; international organizations such as WMO and the commercial sector such as Digital Globe.

ICIMOD
FOR MOUNTAINS AND PEOPLE

International Centre for Integrated Mountain Development (ICIMOD)

Is a regional intergovernmental learning and knowledge sharing center serving the eight regional member countries of the Hindu Kush Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Globalization and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people.

The principal functions of ICIMOD:

- Aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues.
- Support regional transboundary programmes through partnership with regional partner institutions.
- Facilitate the exchange of experience, and serve as a regional knowledge hub.
- Strengthen networking among regional and global centers of excellence.

International Society for Photogrammetry and Remote Sensing

Photogrammetry and Remote Sensing is the art, science, and technology of obtaining reliable information from noncontact imaging and other sensor systems about the Earth and its environment, and other physical objects and processes through recording, measuring, analyzing and representation.

The International Society for Photogrammetry and Remote Sensing is a non-governmental organization devoted to the development of international cooperation for the advancement of photogrammetry and remote sensing and their applications. The Society operates without any discrimination on grounds of race, religion, nationality, or political philosophy.

The Society's scientific interests include photogrammetry, remote sensing, spatial information systems and related disciplines, as well as applications in cartography, geodesy, surveying, natural, Earth and engineering sciences, and environmental monitoring and protection. Further applications include industrial design and manufacturing, architecture and monument preservation, medicine and others.

International Water Management Institute (IWMI)

Is a non-profit, scientific research organization focusing on the sustainable use of water and land resources in developing countries. IWMI works in partnership with governments, civil society and the private sector to develop scalable agricultural water management solutions that have a real impact on poverty reduction, food security and ecosystem health. Headquartered in Colombo, Sri Lanka, with regional offices across Asia and Africa, IWMI is a CGIAR Research Center and leads the CGIAR Research Program on Water, Land and Ecosystems (WLE).

IWMI's Mission is to provide evidence-based solutions to sustainably manage water and land resources for food security, people's livelihoods and the environment.

International Working Group on Satellite Emergency Mapping (IWG-SEM)

The IWG-SEM is the voluntary group of organizations involved in satellite based emergency mapping. It was founded in April 2012 based on the suggestions from an initial meeting organized by DLR in Hohenkamer in September 2011. The group agreed to have yearly rotating chair who takes care of the agenda. Currently the chairmanship is with the Center for Satellite based Emergency Mapping of the Germany Aerospace Center (DLR/ZKI).

The International Working Group on Satellite Emergency Mapping (IWG-SEM) is open to membership by representatives of not-for-profit organizations active in Satellite Emergency Mapping. Interested Representative Professional Associations that promote the use of satellite technology for emergency management activities are also invited to actively contribute to the Group's efforts (through a representative from the Association staff).

Joint Research Centre of the European Commission

As the European Commission's science and knowledge service, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle. The JRC draws on over 50 years of scientific experience. Among other thematic areas, the JRC's work addresses science for disaster risk reduction. The JRC also develops, and manages and maintains a number of tools and services.

The JRC manages the Disaster Risk Management Knowledge Centre (DRMKC) that aims at enhancing the EU and European Union Member States resilience to disasters and their capacity to prevent, prepare and respond to emergencies through a strengthened interface between science and policy.

The JRC processes satellite images to provide information products for more effective disaster risk reduction and conflict prevention, as well as for evaluating the needs for post-disaster response, recovery and reconstruction planning.

The JRC has developed and maintains the Global Human Settlement Layer framework that delivers global built-up and population density maps for all populated places in the world, be it cities or small rural villages. The Global Human Settlement layers are used in exposure modelling for risk assessment, as well as for damage assessment, recovery, and reconstruction planning.

The JRC is the technical coordinator of the Emergency Management Service of the European Union's Earth Observation programme Copernicus programme, which provides all actors engaged in civil protection and emergency response with timely and accurate disaster geo-spatial information and maps on the basis of remotely sensed data complemented by in-situ data when available.

Mexican Space Agency

The Mexican Space Agency is a decentralized and public agency of the Federal Government within the Ministry Communications and Transport. It uUses the science and space technology to attend the needs of Mexican population, boosting innovation and space sector development.

The National Space Activities Program has five guiding programs:

- Human resources training on Space sector.
- Scientific Research and Space technologic development.
- Industrial and Commercial Development and Competitiveness on Space Sector.
- International Affairs, Normative and Space Security.
- Financing and Space Information Management.

Ministry of Marine Affairs and Fisheries, Indonesia

Since reformation era in the middle of the Indonesian political arena, since then also the fundamental life change has developed in almost all the life of nation and state. Like the spread of various crises that hit the Unitary State of the Republic of Indonesia. One of them is related to Development Orientation. In the New Order period, development orientation was still concentrated in the land area.

The maritime sector can be said almost untouched, despite the fact that marine and fishery resources owned by Indonesia are very diverse, both types and their potential. The resource potential consists of renewable resources, such as fisheries resources, both capture fisheries and marine and coastal cultivation, non-conventional energy and energy and non-renewable resources such as oil and gas resources and various types of minerals. In addition to these two types of resources, there are also a wide range of marine environmental services that can be developed for marine and fisheries development such as marine tourism, maritime industry, transport services and so on.

National Aeronautics and Space Administration

Since its inception in 1958, NASA has accomplished many great scientific and technological feats in air and space. NASA remains a leading force in scientific research and in stimulating public interest in aerospace exploration, as well as science and technology in general. Perhaps more importantly, our exploration of space has taught us to view Earth, ourselves, and the universe in a new way. While the tremendous technical and scientific accomplishments of NASA demonstrate vividly that humans can achieve previously inconceivable feats, we NASA also are humbled by the realization that Earth is just a tiny „blue marble" in the cosmos.

NASA conducts its work in four principal organizations, called mission directorates:

- Aeronautics: manages research focused on meeting global demand for air mobility in ways that are more environmentally friendly and sustainable, while also embracing revolutionary technology from outside aviation.
- Human Exploration and Operations: focuses on International Space Station operations, development of commercial spaceflight capabilities and human exploration beyond low-Earth orbit.
- Science: explores the Earth, solar system and universe beyond; charts the best route of discovery; and reaps the benefits of Earth and space exploration for society.
- Space Technology: rapidly develops, innovates, demonstrates, and infuses revolutionary, high-payoff technologies that enable NASA's future missions while providing economic benefit to the nation.

National Disaster Reduction Center of China (NDRCC)

Is one of leading scientific and technical centers to provide the support for government in addressing disaster-related issues by focusing on the whole cycle of disaster management. Through its more than decade development, NDRCC has built up its unique capacities by applying leading-edge technologies and other software resources to conduct the work in disaster preparedness, disaster reduction, emergency response, post-disaster rehabilitation and reconstruction. On the technical front, NDRCC has been applying space technology, unmanned airborne and other advanced tools to support data management, risk assessment, emergency response and post-disaster recovery. From the scientific perspective, NDRCC has gathered abundant experiences and formed series of procedures in undertaking policy research, advocacy campaign and educational activities to help both government and public in awareness rising and capacity-building. Now NDRCC has gained sound output capacities to be provided to meet both domestic needs and needs of overseas countries. During the last decade, NDRCC has successfully worked for the government on dealing with major nature disasters such as Wenchuan earthquake, Yushu earthquake, and helped with Australia with forest fire etc.

National Emergency Commission of the Dominican Republic (CNE)

The National Emergency Commission is integrated by all the help organizations of the country.

The National Emergency Commission's main goal is to ensure for the appropriate response and management of disasters; caused by floods, earthquakes, storms, hurricanes, fires, shortages, inadequate distribution of material supply, or other similar reasons; and in general, to provide order, health/economic welfare, public security and prevention of life and property, in such circumstances.

Secure World Foundation

The mission of the Secure World Foundation is to work with governments, industry, international organizations, and civil society to develop and promote ideas and actions to achieve the secure, sustainable, and peaceful uses of outer space benefiting Earth and all its peoples.

The Foundation engages with the space and other relevant communities to support steps that encourage the long-term sustainability of outer space and the effective use of space to benefit humanity.

Space Research Institute Ukraine (NASU-SSAU)

Space Research Institute was established in 1996 at the National Space Agency of Ukraine and National Academy of Sciences of Ukraine for organization of scientific space researches in the country, conducting and co-ordination of scientific and engineering activities in peaceful exploration areas and use of outer space.

The Institute's main activities are:

pure and applied research in outer space, astrophysics research of objects in the universe, including in ranges unavailable from the earth surface;

development of strategy and principles of universe exploration means use in solving scientific and applied issues for the needs of the economy;

development and testing, in the space environment, of scientific space exploration equipment and relevant technological processes;

development of new spacecraft navigation and control systems and earth and space monitoring systems; improvement of existing ones; creation of information space systems;

working out suggestions on the conception and strategy for space programmes.

Tohoku University, International Research Institute of Disaster Science (IRIDeS)

The IRIDeS conducts world-leading research on natural disaster science and disaster mitigation. Based on the lessons from the 2011 Great East Japan (Tohoku) earthquake and tsunami disaster, IRIDeS aims to become a world center for the study of the disasters and disaster mitigation, learning from and building upon past lessons in disaster management from Japan and around the world. Throughout, the IRIDeS will contribute to on-going recovery/reconstruction efforts in the affected areas, conducting action-oriented research, and pursuing effective disaster management to build sustainable and resilient societies, the IRIDeS innovates the past paradigm of Japan's and world's disaster management to catastrophic natural disasters, hence to become a foundation stone of disaster mitigation management and sciences.

United Nations Convention to Combat Desertification

Established in 1994, UNCCD is the sole legally binding international agreement linking environment and development to sustainable land management. The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands, where some of the most vulnerable ecosystems and peoples can be found.

The Convention's 195 parties work together to improve the living conditions for people in drylands, to maintain and restore land and soil productivity, and to mitigate the effects of drought. The UNCCD is particularly committed to a bottom-up approach, encouraging the participation of local people in combating desertification and land degradation. The UNCCD secretariat facilitates cooperation between developed and developing countries, particularly around knowledge and technology transfer for sustainable land management.

As the dynamics of land, climate and biodiversity are intimately connected, the UNCCD collaborates closely with the other two Rio Conventions; the Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC), to meet these complex challenges with an integrated approach and the best possible use of natural resources.

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)

It Is the regional development arm of the United Nations for the Asia-Pacific region. Established in 1947 with its headquarters in Bangkok, Thailand, ESCAP works to overcome some of the region's greatest challenges by providing results oriented projects, technical assistance and capacity building to member States in the following areas:

- Macroeconomic Policy, Poverty Reduction and Financing for Development
- Trade, Investment and Innovation
- Transport
- Environment and Development
- Information and Communications Technology and Disaster Risk Reduction
- Social Development
- Statistics
- Subregional activities for development
- Energy

United Nations Institute for Training and Research (UNITAR), UNITAR's Operational Satellite Applications Programme (UNOSAT)

An autonomous UN body established in 1963, the United Nations Institute for Training and Research is a training arm of the United Nations System, and has the mandate to enhance the effectiveness of the UN through diplomatic training, and to increase the impact of national actions through public awareness-raising, education and training of public policy officials.

UNITAR provides training and capacity development activities to assist mainly developing countries with special attention to Least Developed Countries (LDCs), Small Island Developing States (SIDS) and other groups and communities who are most vulnerable, including those in conflict situations.

Through the use of Geographic Information Systems (GIS) and satellite imagery, UNOSAT provides timely and high-quality geo-spatial information to UN decision makers, member states, international organizations and non-governmental organizations. UNOSAT develops solutions on integrating field collected data with remote sensing imagery and GIS data through web-mapping and information sharing mechanisms, including remote monitoring of development projects and sharing of geographic data using web-services.

	United Nations Office for Disaster Risk Reduction (UNISDR) UNISDR was established in 1999 as a dedicated secretariat to facilitate the implementation of the International Strategy for Disaster Reduction (ISDR).It is mandated by the United Nations General Assembly resolution (56/195), to serve as the focal point in the United Nations system for the coordination of disaster reduction and to ensure synergies among the disaster reduction activities of the United Nations system and regional organizations and activities in socio-economic and humanitarian fields. It is an organizational unit of the UN Secretariat and is led by the UN Special Representative of the Secretary-General for Disaster Risk Reduction (SRSG). UNISDR led a process with 29 UN organizations to develop the UN Plan of Action on Disaster Risk Reduction for Resilience, which the Chief Executive Board of the United Nations adopted in March 2013. The UN Plan of Action hinges on UNISDR's role as the focal point for disaster risk reduction in the UN system, and for coordinating and integrating disaster risk reduction into UN country-level programmes and activities.
	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 Office for Outer Space Affairs (UNOOSA) works to promote international cooperation in the peaceful use and exploration of space, and in the utilization of space science and technology for sustainable economic and social development. The Office assists any United Nations Member States to establish legal and regulatory frameworks to govern space activities and strengthens the capacity of developing countries to use space science technology and applications for development by helping to integrate space capabilities into national development programmes. UN-SPIDER iIs a platform which facilitates the use of space-based technologies for disaster management and emergency response. It is a programme under the auspices of the United Nations Office for Outer Space Affairs (UNOOSA).
	World Meteorological Organization (WMO) WMO is a specialized agency of the United Nations (UN) with 191 Member States and Territories. It is the UN system's authoritative voice on the state and behavior of the Earth's atmosphere, its interaction with the land and oceans, the weather and climate it produces and the resulting distribution of water resources. As weather, climate and the water cycle know no national boundaries, international cooperation at a global scale is essential for the development of meteorology and operational hydrology as well as to reap the benefits from their application. WMO provides the framework for such international cooperation. Its mandate is in the areas of meteorology (weather and climate), operational hydrology and related geophysical sciences. Since its establishment, WMO has played a unique and powerful role in contributing to the safety and welfare of humanity. It has fostered collaboration between the National Meteorological and Hydrological Services of its Members and furthered the application of meteorology in many areas. WMO continues to facilitate free and unrestricted exchange of data and information, products and services in real- or near-real time on matters relating to safety and security of society, economic welfare and the protection of the environment. It contributes to policy formulation in these areas at national and international levels

	Worldbank GFDRR The Global Facility for Disaster Reduction and Recovery (GFDRR) is a global partnership that helps developing countries better understand and reduce their vulnerability to natural hazards and climate change. GFDRR is a grant-funding mechanism, managed by the World Bank, that supports disaster risk management projects worldwide. Working on the ground with over 400 local, national, regional, and international partners, GFDRR provides knowledge, funding, and technical assistance. GFDRR provides analytical work, technical assistance, and capacity building to help vulnerable nations improve resilience and reduce risk. GFDRR finances its demand-driven technical assistance through a number of implementing partners.

Acknowledgements

We are thankful to all GP-STAR partners who provided fact sheets for this brochure. Also, we would like to acknowledge contributions to the chapters provided by Ms. Lena Halounova (ISPRS), Mr. Daniele Ehrlich (JRC), Mr. Julio César Castillo Urdapilleta (AEM), Mr. Gustavo Arriaga Mendez (AEM), Mr. Srimal Samansiri (DMC), Mr. Jens Danzeglocke (DLR/CEOS), Mr. Stéphane Chalifoux (CSA/CEOS), Mr. Joachim Post (UNOOSA/UN-SPIDER) and Mr. Peter Zeil (IWG-SEM). We are especially thankful to Mr. Radu Nikolaus Botez, Ms. Cynthia Penaloza, Ms. Tereza Dohnalova and Ms. Sophia Hafeez (all UNOOSA/UN-SPIDER) for reviewing, integrating and designing brochure and web segments.

Published by GP-STAR
GP-STAR secretariat at UNOOSA/UN-SPIDER
Contact: joachim.post@unoosa.org
Online available at http://un-spider.org/network/gp-star-brochure