

GEO-DARMA Preliminary Implementation Plan

1 Executive Summary

Increased severity of weather events and rapid urbanization has led to growing economic and human losses from disasters, requiring international organisations to act much more in risk prevention mitigation and preparedness through improved disaster risk reduction (DRR) policies and programmes. As part of this effort, space agencies have implemented a series of actions aimed at fostering the use of Earth observation (EO) data to support DRR and at raising the awareness of policy and decision-makers and major stakeholders of the benefits of using satellite EO in all phases of disaster risk management (DRM). GEO-DARMA is one of those major initiatives supported by space agencies.

GEO-DARMA aims to support operational risk reduction activities through the implementation of end user priorities in line with the Sendai Framework for Risk Reduction, on a trial basis in regions of the developing world. The main goal is to address critical issues related to Disaster Risk Reduction (DRR) affecting most of the countries in a region (e.g. South-East Asia or South America) through a series of projects (first demonstrators) that rely on the use of multiple source of observation data (space, in-situ, socio-economic, models outputs, ..). Each project will involve data providers, data & information practitioners, regional institutions, governmental agencies, local decision makers, and scientists. Main outcomes (information products) from each project will be defined and generated with the objective of improving the quality and accuracy of information made available to national and local decision-makers in political and socio-economic sectors, to implement disaster risk reduction and resilience measures, during all disaster risk management phases, whenever those products and services require satellite EO combined with other sources of data (in-situ ground observations, socio-economic, model outputs). The ultimate goal is to establish an inclusive, comprehensive process to address local DRR requirements by using EO technologies efficiently. Long-term outcomes of GEO-DARMA are to foster the use of EO data and EO-based risk information by end users and to increase awareness within donor agencies of the promise of EO solutions. EO-related capacity building is a key challenge in many developing countries. GEO-DARMA includes a capacity building component both at the outset, from the project initiators towards early pilot countries, and throughout the project, as knowledge gained in the early phases is transferred between pilot countries and the GEO-DARMA effort is extended from early adopters to other countries in region.

The Partners sought for GEO-DARMA include:

- Representatives from national end user communities, national institutions and agencies
- International and regional stakeholders knowledgeable about regional issues related to disaster risk management, such as relevant UN agencies, GFDRR¹, Development banks...
- EO and non-EO data providers (e.g. Satellite data providers such as CEOS² Agencies (incl. major space agencies in the world) and commercial satellite operators when possible)

¹ Global Facility for Disaster Reduction and Recovery (GFDRR)

² Committee on Earth Observation Satellites - www.ceos.org

- Providers of risk and other relevant information derived from EO data (e.g. Practitioners such as value added information providers), scientists and researchers

Three phases are foreseen:

	<u>PHASE</u>	<u>DURATION</u>
1	Concept phase	Start at KO, end at KO+ up to 18 months. Might vary from one region to another.
2	Prototyping phase	Start at approval of regional assessments, end at KO+36 months at the latest. Prototyping might start at different time depending on the project. It is not envisaged to continue the prototyping activities including its operation beyond a period of 4 years. Go/no go decision to determine sustainability and implementation of operations.
3	Operational phase	On a case by case, might start for a given project at KO+36 months depending on the funding and opportunity to transition the activities from a prototype to an operational system.

2 Introduction

Impacts of disaster events on economic and human lives are increasing every year due to growing urbanization and an increase in the number and severity of weather-extreme events; by 2050, the number of people exposed to storms and earthquakes in large cities could double and by 2100, damages from weather-related hazards may triple. Nine of the ten fastest growing urban mega-cities in the world are in Asia, and most of these are in vulnerable coastal areas.³

Until recently, stakeholders involved in disaster risk management (DRM), including space agencies, have focused their efforts mainly on the response phase, immediately after the crisis. The International Charter Space and Major Disasters is one of the most successful initiatives resulting from the coordination among space agencies but it is restricted to the response phase. Independent studies from organisations including the World Bank and the European Commission have indicated that for every \$1 invested in disaster prevention, \$4 to \$7 are saved in disaster response.

Progress in every aspect of Disaster Risk Reduction (DRR) requires strong international collaboration given limited capacities and resources. No single group or organisation can address every aspect of DRR.

³ *Demographia World Urban Areas (2013)*: <http://demographia.com/db-worldua.pdf>

Disasters are complex problems demanding a collective response. GEO-DARMA⁴ aims at supporting the practical implementation of some critical elements of the *Sendai Framework for Disaster Risk Reduction 2015-2030* adopted at the 3rd United Nations World Conference on Disaster Risk Reduction (WCDRR, Sendai, Japan, 14-18 March 2015). While many initiatives are going forward with this objective, GEO-DARMA is an open initiative that aims to group the broadest possible partnership to implement operational use of EO products for risk reduction according to user defined priorities.

Several studies and R&D activities demonstrate that Earth observations (EO) could play an increasingly important role in making societies more resilient to natural hazards and more adaptive to climate change, and could contribute significantly to DRR. Today, EO data is largely unexploited except during the response phase. Large-scale use of EO data for DRM, particularly from satellites, is hindered by a lack of user awareness of possible applications and the complexity of both acquiring data from a wide range of providers and delivering ready-to-use risk information products to the end user.

Ensuring high-quality risk-related information to support national and local decision makers requires the combined use of multiple sources and tools, including satellite, airborne and in-situ EO measurements; socio-economic data; computer models; and higher order information products derived from EO data. Synergistic use is possible only through international cooperation efforts. The GEO-DARMA initiative will bring together relevant stakeholders from governments, intergovernmental organizations, the UN system and civil society. For its success, GEO-DARMA requires strong involvement of the end user community with identified needs and vetted for local application by relevant regional institutions (see section 4, “User engagement”).

The broad goal is to define and implement end-to-end solutions that respond to the real needs of the user community. A balance must be achieved between, on the one hand, focus on technical capabilities and new data products or data services, and on the other, meeting pressing and urgent and currently unaddressed needs. Space EO technology presents new opportunities in this area of work; the challenge is matching such capabilities to those end users most urgently in need. GEO-DARMA will facilitate the sustained provision of accurate EO-based risk information products and services to national and local decision-makers in political and socio-economic sectors, to implement disaster risk reduction and resilience measures, during all disaster risk management phases, whenever those products and services require satellite EO combined with other sources of data (in-situ ground observations, socio-economic, model outputs). The ultimate goal is to establish an inclusive, comprehensive process to address local DRR requirements by using EO technologies efficiently. Long-term outcomes of GEO-DARMA are to foster the use of EO data and EO-based risk information by end-users (e.g. Civil protection agencies, and other agencies and ministries at the national level) and to increase awareness within Donor agencies of the promise of space solutions.

⁴ **DARMA = Data Access for Risk Management.**

The Japanese **Daruma** or **Darma**, a traditional handmade Japanese wishing doll (referred to as a "GOAL DOLL") that keeps people focused on achieving their goals.

As a first step, the project seeks independent identification of disaster risk management priorities at regional level (e.g. most prevalent hazards and most severe impact; hurdles in implementing effective DRR and resilience measures in the region,...) by authoritative Regional Institutions, in line with the priorities from the “Sendai Framework for Disaster Risk Reduction 2015-2030. There is no limitation on the types of hazards and of DRM-relevant issues that will be addressed in GEO-DARMA.

Then a series of projects are set up to implement solutions to some of the recommendations from the Regional Institutions; those projects will include the provision of any kind of observation data.

3 Need for action

GEO-DARMA aims at addressing priorities of the *Sendai Framework for Disaster Risk Reduction 2015-2030* that are relevant for satellite EO but not limited to satellite data only. The series of projects to be defined might include use of other EO sources (airborne, in-situ, socio-economic, model outputs, ...), in association with partner providers. With an expected increase in human and economic losses in the coming decades, traditional tools and methods used by the disaster risk management community might not be sufficient and will have to be complemented by other means.

It is clear from the challenges in addressing the Hyogo Framework for Action that a comprehensive, objective means of informing risk reduction is required at an international level. EO has the potential to provide such information. Through a series of connected projects, GEO-DARMA will demonstrate that coordinated Earth observations from multi-sources can provide reliable, accurate, consistent and continuous information, which is the foundation for the development and operation of national DRM systems. More specifically, the overall goal is to develop a common approach for the use of various observations, models, tools and methodologies in order to provide advice and guidelines to countries willing to strengthen their DRM systems.

Since the mid-1970s, satellite observations have for example gathered an exceptionally valuable but still largely un-harvested record of flood inundation worldwide. Commencing in late 1999, two NASA MODIS sensors also obtained daily information on all of the Earth’s flood waters; this archival record is now supplemented by frequent-repeat, wide-swath ground-imaging sensors aboard the National Polar-orbiting Partnership (NPP) Suomi and the European Sentinel-2⁵. Such combined EO data can be likened to the record of earthquake seismicity provided by seismographic stations in that they provide the only objective characterization of many extreme, damaging flood events. This globally consistent information of past events could be deployed to its maximum utility in defining areas of flood risk, and be used as well during new floods to assist with their characterization. The remote sensing record of flood inundation and damage can also be used to identify defended floodplains where levees have failed, sometimes even repeatedly, during relatively common floods. This is just one example of the need for and utility of EO data from many sources to be combined, processed, and analysed to assist with DRM and DRR.

⁵ Sentinel-2 is an EO mission developed by the European Space Agency (ESA) as part of the Copernicus Programme

4 User engagement

How user communities join the initiative

EO data providers are seeking input from user communities on priorities in term of disaster risk reduction at the regional and national levels. National needs will be collated and vetted at a regional level by authoritative regional partners who are already working with local and national stakeholders on risk reduction initiatives. These institutions have well established relationships with end users (e.g. national civil protection, national and local decision makers, national resource management agencies, ...). Regional Institutions may be regional offices of international organizations or regional coordination bodies. Their first task will be the identification of hazards and DRR-related issues that should be addressed as top priorities at the regional level, in line with the priorities from the *Sendai Framework for Disaster Risk Reduction 2015-2030*, as well as to identify the principal obstacles to implementing effective DRR in each region, and the countries where pilot implementation should be started. The next step will be the definition and implementation of a series of projects aiming at responding to some of the top priorities & recommendations coming from the Regional institutions. Projects will also include capacity building activities.

How the activity would benefit stakeholders (in particular developing countries)

The development and subsequent improvement of prototype solutions for a smaller set of initial target countries will also benefit to the neighbouring countries with marginal additional efforts through capacity building activities. EO-related capacity building is a key challenge in many developing countries. GEO-DARMA includes a capacity building component both at the outset, from the project initiators towards early pilot countries, and throughout the project, as knowledge gained in the early phases is transferred between pilot countries and the GEO-DARMA effort is extended from early adopters to other countries in region.

How it feeds into decision-making processes

Currently, risk reduction decisions are taken without fully understanding the consequences of risk reduction measures. GEO-DARMA aims to increase the availability and accuracy of risk related information to allow decision makers to simulate the impact of risk reduction measures and make informed decisions about risk reduction investment. In the long term, national and local users will benefit from a more accurate risk-information in complement to their other tools, helping to take appropriate DRR and resilience measures.

5 Previous development and results

The initiative will leverage on-going projects and initiatives as much as possible through improved coordination. For instance, relevant outcomes and experience from the CEOS Flood, Volcano and Seismic Hazard Pilots and the Recovery Observatory will be included and improved on; GEO-DARMA

may become a mechanism to ensure successful elements of early pilots find a path towards sustainability. In each region, the GEO-DARMA team will examine past experience and identify elements that can be built on.

6 Partners

The accomplishment of the task will require the active support of major stakeholders in the field of DRM at global, regional and national level in order to implement a series of pilot projects.

The partnership will be constructed progressively according to the implementation needs and phases.

The Partners sought for GEO-DARMA will be typically from the following groups:

- International and regional stakeholders knowledgeable about regional issues related to disaster risk management such as relevant UN agencies, GFDRR⁶, Development banks, etc ...
- National institutions and agencies
- Representatives from the end user communities
- EO and non-EO data providers:
 - Satellite data providers such as CEOS⁷ Agencies (incl. major space agencies in the world) and commercial satellite operators when possible.
 - Other EO data and information providers
- Providers of risk and other relevant information derived from EO data
 - Practitioners – Value added information providers including private sector
 - Scientists

Respecting the voluntary nature of GEO, the Partners' engagement in GEO-DARMA will be based on voluntary contributions and the Partners' participation will be legally non-binding.

The activities to be undertaken by the various categories of Partners during each phase, are described in section 7.

7 Activities description

7.1 Task definition and overall logic and phasing

In order to coordinate their actions, immediately following the kick-off of the GEO-DARMA initiative, the partners will identify and assess the critical needs of the participating disaster management communities and establish priorities. The identification of user needs takes place at a local level, but establishing priorities requires the active involvement of regional entities and organizations with a stake in DRR and/or in EO and remote sensing, as encouraged by the Sendai Framework. Given the limited resources available, GEO-DARMA will begin by selecting a few priority themes, building on strong

⁶ Global Facility for Disaster Reduction and Recovery (GFDRR)

⁷ www.ceos.org

elements from existing initiatives and choosing those elements most likely to be scalable at a regional and global level. Once the usefulness of the implemented prototypes has been demonstrated in a few countries, the extension to neighbouring areas could be envisaged whenever applicable.

Given that a growing number of countries are expected to be involved in the use of EO in the coming years, GEO-DARMA adopts an incremental approach with three main stages. A **Concept phase** and a subsequent **Prototyping phase** will first be developed to focus on strengthening the initiative and its capacity to address the critical needs of national and regional users. The partnership will be built progressively. One of the major tasks during the early Concept phase will be to select projects and related user needs to be implemented as a priority. Then the initiative will focus on the implementation of prototype solutions to provide specific risk information products and services and capacity building elements through the active cooperation of partners. A limited number of early adopter countries from different regions may serve as National Demonstrators. These demonstration initiatives will serve to develop and test approaches and methodologies and may involve some or all of the partners and attract additional regional and local partners. Proposed activities and related timeframe towards the development of a GEO global initiative on the use of EO for DRR are presented below.

The Prototyping phase will be limited in time. Before the end of the Prototyping phase, each project will be assessed according to a list of criteria (to be defined later) to determine whether the project should stop or on the contrary, transition to the **Operational Phase**. The explicit and strong request from the user community to ensure in the long run, the sustained provision of risk-information and risk-related services demonstrated for a given project during the Prototyping phase, would be a necessary condition to transition to operations. The availability of sustained funding would be another necessary condition.

7.2 Tasks description (for each of them: description, planning, partners responsibilities, resources)

PHASE	PARTNER CATEGORY	TASK DESCRIPTION
Concept phase	International and regional stakeholders	<ul style="list-style-type: none"> • Consolidate GEO-DARMA proposal together with other GEO-DARMA initial partners. Includes the identification of the regions considered in GEO-DARMA; will depend on the availability of International and regional stakeholders for each region foreseen. • Compile on national user needs in collaboration with national and regional actors • Identify hazards in each selected region. • Identify most critical DRR measures to be implemented at regional level, and that could benefit from EO data and EO-based risk information. • Identify hurdles in the establishment of high priority DRR

PHASE	PARTNER CATEGORY	TASK DESCRIPTION
		<p>and resilience measures</p> <ul style="list-style-type: none"> • Identify countries in the region that would be willing to participate in the initial definition implementation of solutions in the GEO-DARMA framework. • Discuss implementation with National institutions and agencies and with Representative of end user communities. • Establish a prioritized list of recommendations to the GEO-DARMA partners that combine the identified hazards, most critical DRR measures, hurdles in DRR and initial countries • Select together with all other Partners of the activities to be started in the next Prototyping phase , in the form of pilot projects.
	National institutions and agencies	<ul style="list-style-type: none"> • Cooperate with International and regional stakeholders whenever needed • Confirm willingness to participate in the definition and implementation of pilot projects during the next Prototyping phase.
	Representative of end user communities.	<ul style="list-style-type: none"> • Cooperate with International and regional stakeholders whenever needed • Confirm willingness to participate in the definition and implementation of pilot projects during the next Prototyping phase.
	EO & non-EO data Providers and risk information Providers	<ul style="list-style-type: none"> • Consolidate GEO-DARMA proposal together with users and other GEO-DARMA initial partners. • Assess recommendations from International and regional stakeholders • Select together with all other Partners of the activities to be started in the next Prototyping phase, in the form of pilot projects. • Articulate end user commitment for implementation
Prototyping phase	International and regional stakeholders	<ul style="list-style-type: none"> • Ensure interface between national authorities, projects implementers (e.g. EO & non-EO data Providers and risk information Providers, National institutions and agencies) and the user communities • Define with all other Partners of the series of pilot projects to be implemented in the voluntary countries within each region • Within each region / country, support the implementation of the pilot project(s) to be implemented in the country • Continuously assess the pilot projects being implemented. In case of satisfactory pilot projects, propose to the

PHASE	PARTNER CATEGORY	TASK DESCRIPTION
		<p>Partners the next countries that could benefit of the geographical and gradual extension of the pilot projects from the initial countries in the region to the neighboring countries.</p> <ul style="list-style-type: none"> • For the successful pilot projects, assess the resources at regional level necessary to transition from prototype to operations; and work with potential financial and donor institutions to define the sources of funds to support both the transition and the sustained operations in several countries in the same region.
	National institutions and agencies	<ul style="list-style-type: none"> • Within each country, together with all other relevant Partners, define the pilot project(s) to be implemented in the country. • Within each country, support the implementation of the pilot project(s) to be implemented in the country. • Continuously assess of the pilot projects being implemented • For the successful pilot projects, assess the national resources necessary to transition from prototype to operations
	Representative of end user communities	<ul style="list-style-type: none"> • Within each country, together with all other relevant Partners, define the pilot project(s) to be implemented in the country in particular by providing detailed user needs. • Within each country, support the implementation of the pilot project(s) in particular by a continuous assessment of the pilot projects implementation. • For the successful pilot projects (i.e. projects of great importance for the national and local end user community), assess the resources necessary to transition from prototype to operations.
	EO and non-EO data Providers and risk information Providers	<ul style="list-style-type: none"> • Define with all other Partners of the series of pilot projects to be implemented in the voluntary countries within each region • Within each region / country, support the implementation of the pilot project(s) to be implemented in the country. • Continuously assess the pilot projects being implemented • For the successful pilot projects, assess the resources necessary to transition from prototype to operations to ensure a sustained provision of EO data, non-data and EO-based risk information.

Note: Operational phase planning to be completed during Concept phase.

8 Planning, milestones and deliverables

Three phases are foreseen; the following durations are indicative and shall be confirmed at the kick-off (KO):

	<u>PHASE</u>	<u>DURATION</u>
1	Concept phase	Start at KO, end at KO+18 months. Might vary from one region to another.
2	Prototyping phase	Start at approval of regional assessments (concept phase completion), end at KO+36 months at the latest. Prototyping might start at different time depending on the project. It is not envisaged to continue the prototyping activities including its operation beyond a period of 4 years. Go/no go decision to determine sustainability and implementation of operations (transition to Operational phase)
3	Operational phase	On a case-by-case basis, might start for a given project at KO+48 months depending on the funding and opportunity to transition the activities from a prototype to an operational system.

An overlap of the phases can be envisaged as GEO-DARMA will consist in a series of projects that could be implemented at different paces.

9 Data management & policy

GEO –DARMA will be implemented in the GEO framework and will apply the GEO Data Sharing principles. A large volume of EO instrument data from CEOS agencies is already accessible for free through the Internet. In the case of commercial satellite missions, EO data can sometimes be obtained through space agencies or directly from commercial satellite operators--for instance, every year a limited volume of commercial data is provided at no cost to the CEOS Pilot projects.

10 Management arrangements

The GEO-DARMA initiative will be managed as a project with an effective dedicated Steering Committee that oversees implementation of the Initiative. Members of the Steering Committee are representatives of stakeholders interested in GEO-DARMA success or organisations providing significant resources to the implementation or representing various communities involved including representatives of user communities as appropriate.

For each project, a Technical Committee is made up of all partners in the project, and for each a project a Project Coordinator will be identified. The Coordinator is responsible for coordinating the implementation of the agreed project and reporting to the GEO-DARMA Steering Committee on

progress and other related issues. A sufficiently resourced Initiative coordinator is an important criterion for accepting a new Initiative and plays a critical role in success of new initiatives.

11 Monitoring and evaluation approach and reporting

The monitoring of GEO-DARMA will be first performed internally (i.e. by the Steering Board) against the list of milestones & deliverables. The status of each GEO-DARMA activity will be regularly monitored in particular during the monthly teleconferences and made visible on the GEO-DARMA web site (TBC – to be developed).

The Project Coordinator will report the progress to GEO as requested providing in particular:

- Progress reports reviewed by the GEO Programme Board in contribution to the annual GEO Progress Report.
- Presentations to Plenary, the Executive Committee or the GEO Programme Board, as necessary.

12 Committed Resources and annual budget(s)

Each stakeholder engaged in the GEO-DARMA initiative will be requested to actively contribute to the various phases on a voluntary basis with contributions in kind.

Concept phase: this initial phase is a study phase that will require each actor to allocate enough time to generate and review documents, participate in teleconferences, and participate in a final GEO-DARMA workshop. During this workshop, all the recommended projects will be analysed and decisions will be made regarding which of them to start.

Prototyping phase: the number and nature of projects to be started will depend on the recommendations made by the Regional Institutions, on their assessment by the GEO-DARMA contributors and on the resources that can be allocated by the potential implementers. The series of projects will be defined at the end of the Concept phase and only at that time will it be possible to evaluate what specific resources will be needed for each project.

Operational phase: for each project, around the end of the Prototyping phase, the need to transition from a prototype to a sustainable solution will be assessed depending on the success of the prototype, on the request from the user community and on the availability of the necessary funding (transition and long term operations).

13 Transition to operational phase

International financial institutions and donor agencies will play a critical role to ensure a smooth transition from prototyping to operations, and their support of capacity building activities will be essential to ensure sustainability.

See also “**Operational phase**” paragraph in section 12.

14 Status of Implementation

Successes: GEO-DARMA began in earnest with its approval by the GEO Programme Board in fall 2016. In 2017, the Steering Committee (SC) was formed, made up of high-level executives from the DRM (Disaster Risk Management) sector to advise and structure the future projects that would go forward. GEO-DARMA successfully attracted a cadre of highly specialized professionals to volunteer their time to work together for GEO-DARMA.

Following a Concept Workshop and first SC meeting, the group selected a series of regional institutions and requested that they compile regional assessments, which were then collated and gathered into a single assessment per region. This process was complete on schedule in Asia and Africa, and is still on-going in the Caribbean and Latin America.

Following the approval of the regional assessments, the Steering Committee reviewed several project proposals and has approved one and earmarked three others for further development. The first GEO-DARMA proposal is an extension of the SERVIR Mekong project, which looks at integrated flood management in Myanmar and the Mekong Delta. The project is financed through NASA and USAID, and the CEOS component will add new resources to increase the temporal and spatial resolution of data used, thereby improving the accuracy and quality of the water information. The projects under development include coastal zone monitoring in Pacific Island states, Sustainable Development Goals and risk monitoring in southeast Asian mega cities, and regional drought and flood assessment in southern and Eastern Africa.

GEO-DARMA has achieved some success in attracting organisations that are self-funding projects.

Challenges and areas for improvement: a large number of people and organisations have been convinced to provide in-kind resources for GEO-DARMA project development, and before that to develop regional assessments. However, the in-kind approach has limitations, especially when GEO-DARMA imposes criteria and constraints on projects without providing funding. Eventually, in order to develop sustainable services, funding sources need to be identified beyond the prototyping phase.

The 1st GEO-DARMA project (extension of the SERVIR Mekong project) was approved in April 2018, but there are issues pertaining to data access and final CEOS sign-off which have caused delays and over time may affect confidence of partners in the project. More data will be required from CEOS partners as GEO-DARMA approves several more projects in the coming months. These data issues will be addressed as the projects move forward with renewed commitment from CEOS agencies.

2017-2018 Highlights

1. Adoption of regional assessments for Asia and Africa by GEO-DARMA Steering Committee January 2018
2. 1st GEO-DARMA project approved by CEOS SIT April 2018.

2019-2020 Milestones

1. 4th meeting of GEO-DARMA Steering Committee tentatively planned May 2019
2. Approval of regional assessment for Caribbean planned May 2019
3. 2nd and 3rd GEO-DARMA projects (Asia-Pacific) planned for review 3rd Q 2019
4. 1st year review of 1st GEO-DARMA project planned 3rd Q 2019
5. Approval of South American Regional Assessment planned early 2020
6. 4th GEO-DARMA project (Africa) planned for review early 2020