



Committee on Earth Observation Satellites

# Recovery Observatory Demonstrator

**G-RO ad hoc Team**  
**Report to WGD 13 virtual meeting**  
March 11th 2020

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Ricardo Zapata-Martí, EU/Particip  
Andrew Eddy, G-RO ad hoc Team secretary



- **G-RO ad hoc Team** created September 2018
- **Members: CEOS (CNES, DLR, WGD chair), GFDRR/WB, UNDP, UNOSAT, EU.**
- **Meeting 3 December 2019** in Washington (@WB/GFDRR)
- **Advocacy Paper** completed; to be published on GFDRR website (ongoing process)
- **Proposed changes to PDNA Guidelines**, incorporating satellite data use recommendations (on going process)
- **Request for a CEOS WGD RO Demonstrator**
- **Concept Paper** to be drafted



# Overview



**RO Scope, Products, and Linkages**

**Linkages to rapid assessments/PDNA**

**Governance and Institutional Arrangements**

**Capacity Building**

**Value and Cost/Benefit**

**Demonstrator**

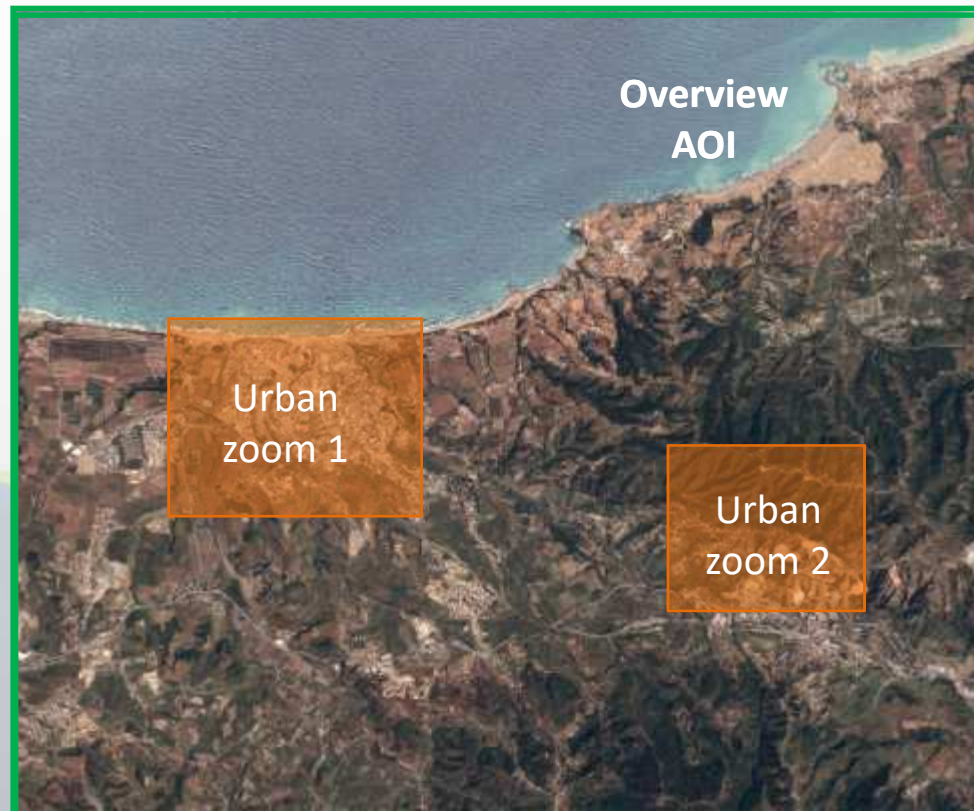
**Timeline, next steps**



# RO Concept



Collection of **satellite images and maps** at several scales during 6 months after a major disaster



**Ancillary data remain indispensable:** terrain validation data, aerial and drone data, statistics, cartography, ....

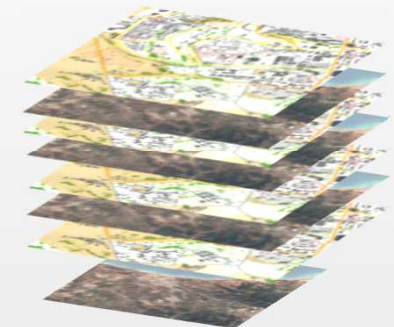
## Overview area

**Mid-scale products from Sentinel data at 10m resolution**

- Change in landcover, open spaces
- Vegetation loss or re-growth
- Agriculture

**Update frequency:**

every 10 days to 6 months



## Hot spot zooms

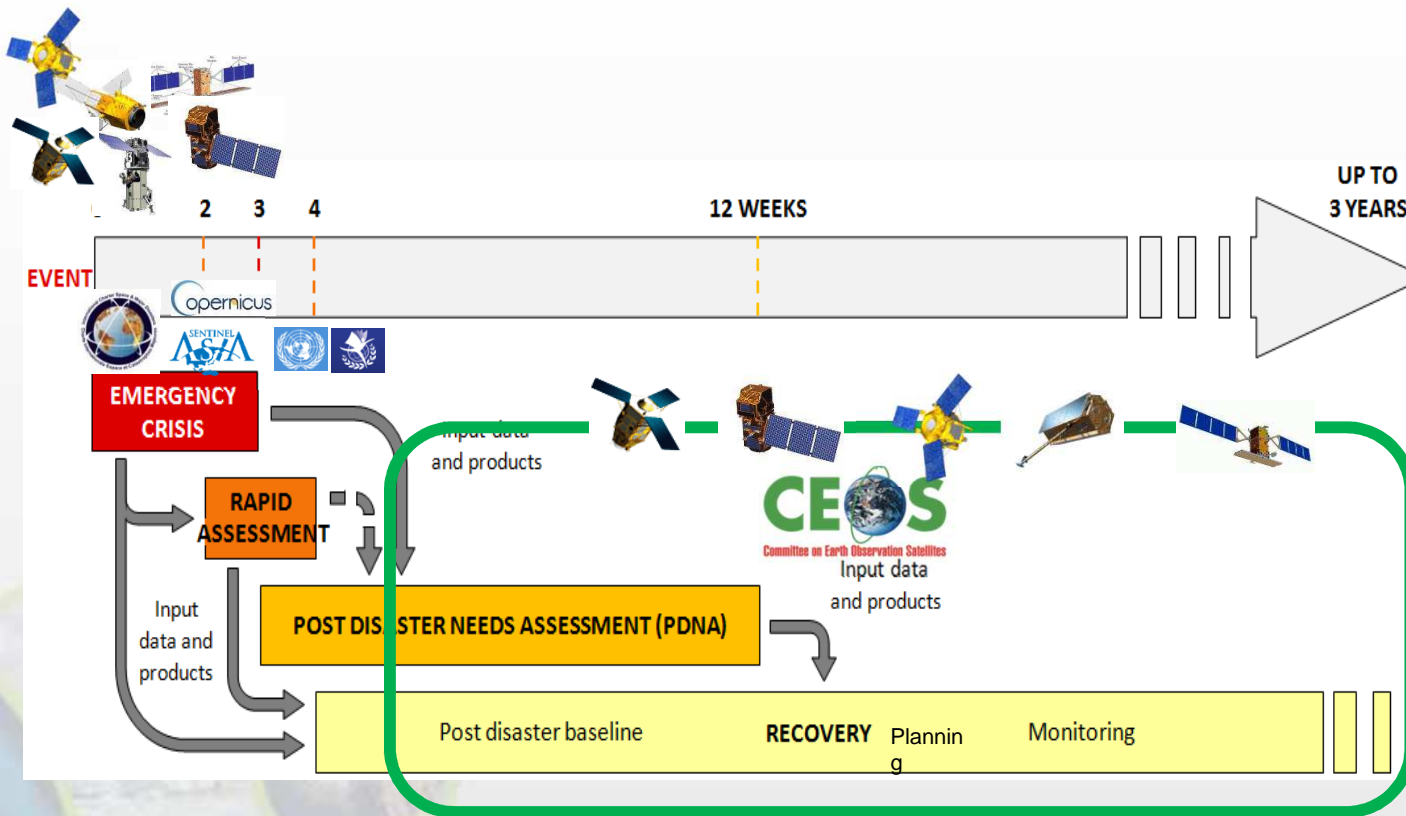
**Large scale products from very high resolution data**

- Urban areas, housing, ....
- Transport infrastructure, coastal areas, ...
- IDP camps, ...
- Specific areas of interest

**Update frequency:** every 1 to 2 months



# RO Pilot timeline



**“Recovery Observatory” Pilot** : exploratory project for helping reconstruction planning and monitoring during the whole recovery process (3 years)



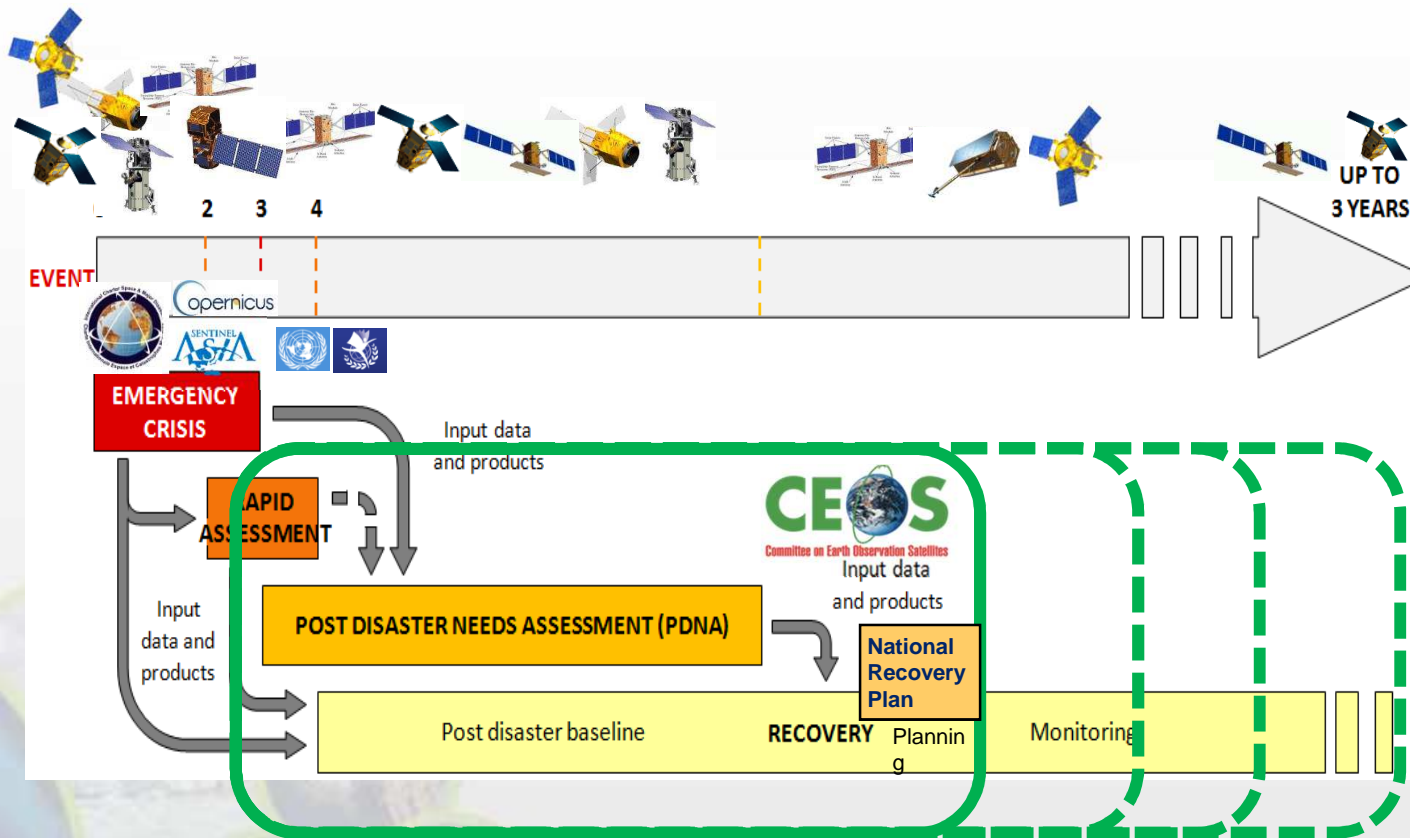
# Lessons Learned from Haiti RO Pilot



- Need for **predefined procedures** between RO, Charter / Sentinel Asia / Copernicus EMS and PDNA, and with data providers for data licensing
- Need for clear **end-to-end approach** from Event through to National Recovery Plan
- Need for **clear relay to local users** through international stakeholders
- Need to **define at outset value-adding approach** and determine level of effort (sliding scale of benefits)
- Need to **document RO product methodology** and develop **technology transfer procedure**
- Benefit of **using existing technology platforms** and **decision making** mechanisms
- Need to identify funds to ensure **local capacity development** (ad hoc)
- Need to **fast-track roll-out** and plan for **legacy strategies** at outset



# RO timeline(s)



**“Recovery Observatory”** : a concept for helping Rapid Assessments & PDNA, Recovery planning & Recovery monitoring  
**RO Demonstrators** mainly focused on PDNA / Rapid Assessment



# Face-to-face Meeting

## 3 December 2019, Washington, D.C.



### Objectives:

- Consolidate **RO Concept** by addressing main issues around improving access to satellite EO for Recovery
- Review **PDNA process** and entrance points for satellite products
- Discuss institutional hurdles and mechanisms to put in place **CEOS RO Demonstrator**
- Discuss **possible resources** to be brought to bear for RO Demonstrator
- Discuss review of **past PDNA experiences**
- Agree on **upcoming events** where ad hoc team can promote and influence – e.g. UNDP PDNA training





# RO Linkages & Scope



- **International Charter:** sharing activation products with PDNA planning mission would be 1<sup>st</sup> easy step
- **Sentinel-Asia:** same as above
- **Copernicus EMS Rapid Mapping:** same as above
- **Copernicus EMS RRM:** STD products could be triggered for PDNA support in some cases
- **ESA/EO4SD, EOclinic, future GDA :** programs targeted WB needs, that could be used for PDNA ?
- **CEOS:** program targeted satellite acquisitions post Charter and post Copernicus RMS RM
- US Commercial sat foundations?
- Contribute to **PDNA Decadal Review** recommendations:
  - « *Abbreviated joint monitoring by principle partners and government one year after disaster*»
  - « *Systematic Monitoring & Evaluation requirements*»



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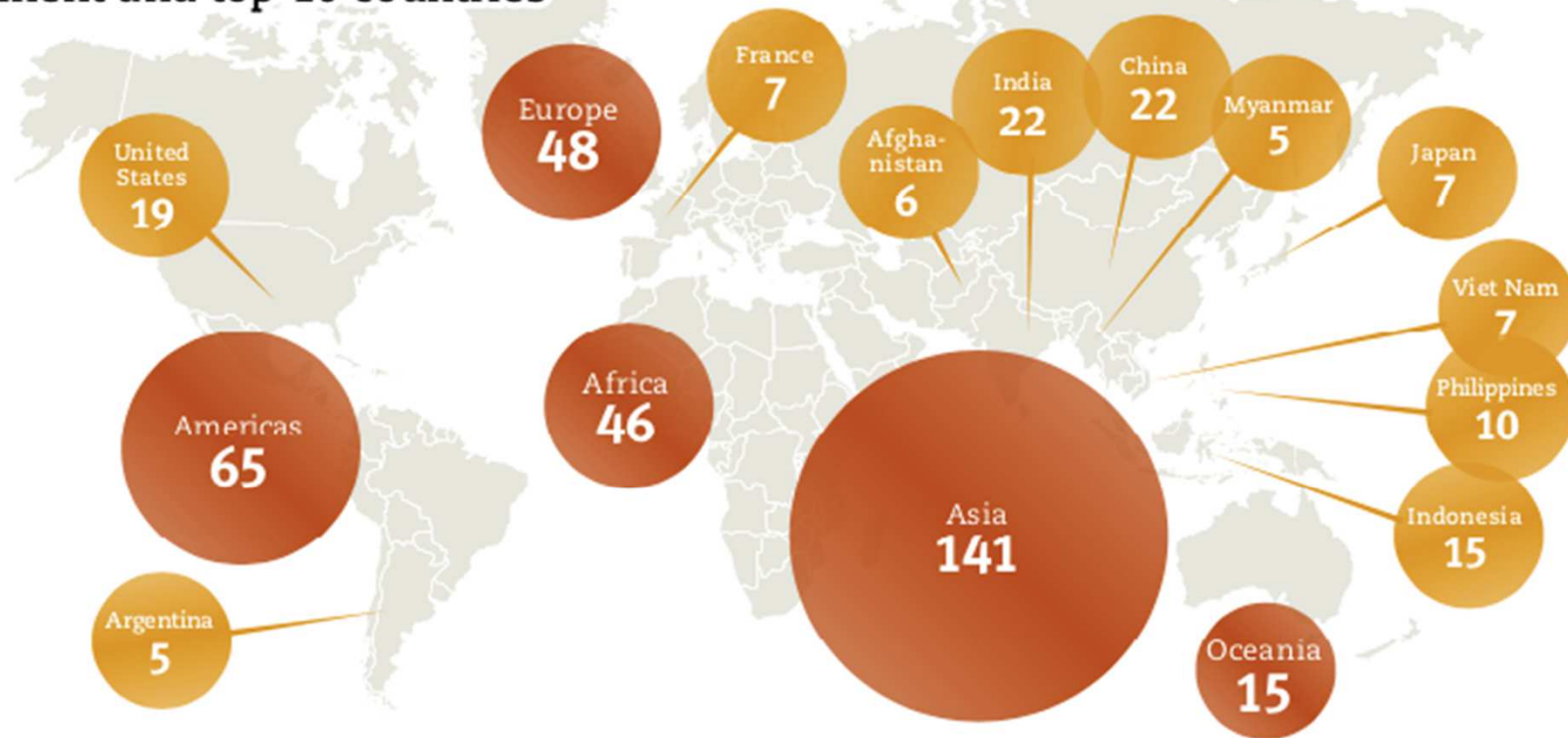
**Timeline, next steps**



# Occurrence of disasters in 2018, by location



Number of disasters by continent and top 10 countries



Source: OFDA-CRED



# Use of satellite imagery not uniform in assessments



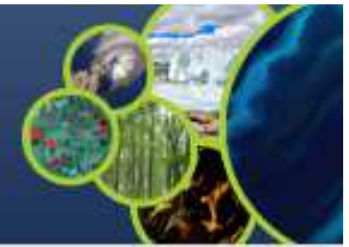
Since 2008, EU, UN, WB agreement on Post Disaster Needs Assessment (PDNA)



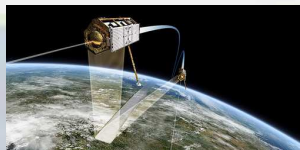
- More than 80 disaster assessments conducted with international support
- Not all are PDNAs
- WB has developed a rapid remote assessment (GRADE)
- In many instances a partial, limited PDNA or RNA is undertaken
- Not all disasters are assessed with these tools
- Few disaster recovery processes are being assessed, monitored and evaluated
- Lack of consistency in data collection being supported by remote sensing and satellite imagery



# Disaster cycle timeline: when satellites are most useful



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**EARLY WARNING AND ALERT** (storm tracking, observation of volcanic activity, soil instability, flood alerts, etc.)

**IMAGES OF DISASTER AREA** (extension and first images of damage, evolution of emergency, population displacement, useful for search and rescue and emergency response)

**PRE AND POST EVENT IMAGES** (provided pre-event images are available, to facilitate estimation of damage based on pre.event situation)

**POST EVENT RECOVERY MONITORING** (provided M&E capacity is available and images are regularly updated on disaster recovery area)

**FOLLOW UP AND RISK MONITORING** (use of periodic images to monitor known risk areas (or hot spots), such as active volcanoes, coastal areas facing risk of subduction or sea-level rise, unstable slopes, humidity levels in fire-risk areas)



# When and how satellite and remote sensing may be used



**Disaster Event**

**Post Disaster Needs Assessment**

**Disaster Recovery Framework**



Humanitarian Response: supported by satellite imagery of affected area, infrastructure and population

Assessment process supported by more focused, sector specific images of pre and post disaster situation: agriculture, environment, infrastructure, housing, connectivity networks

Continued use of selected imagery to monitor and document recovery processes 6 Months +

GRADE/RNA

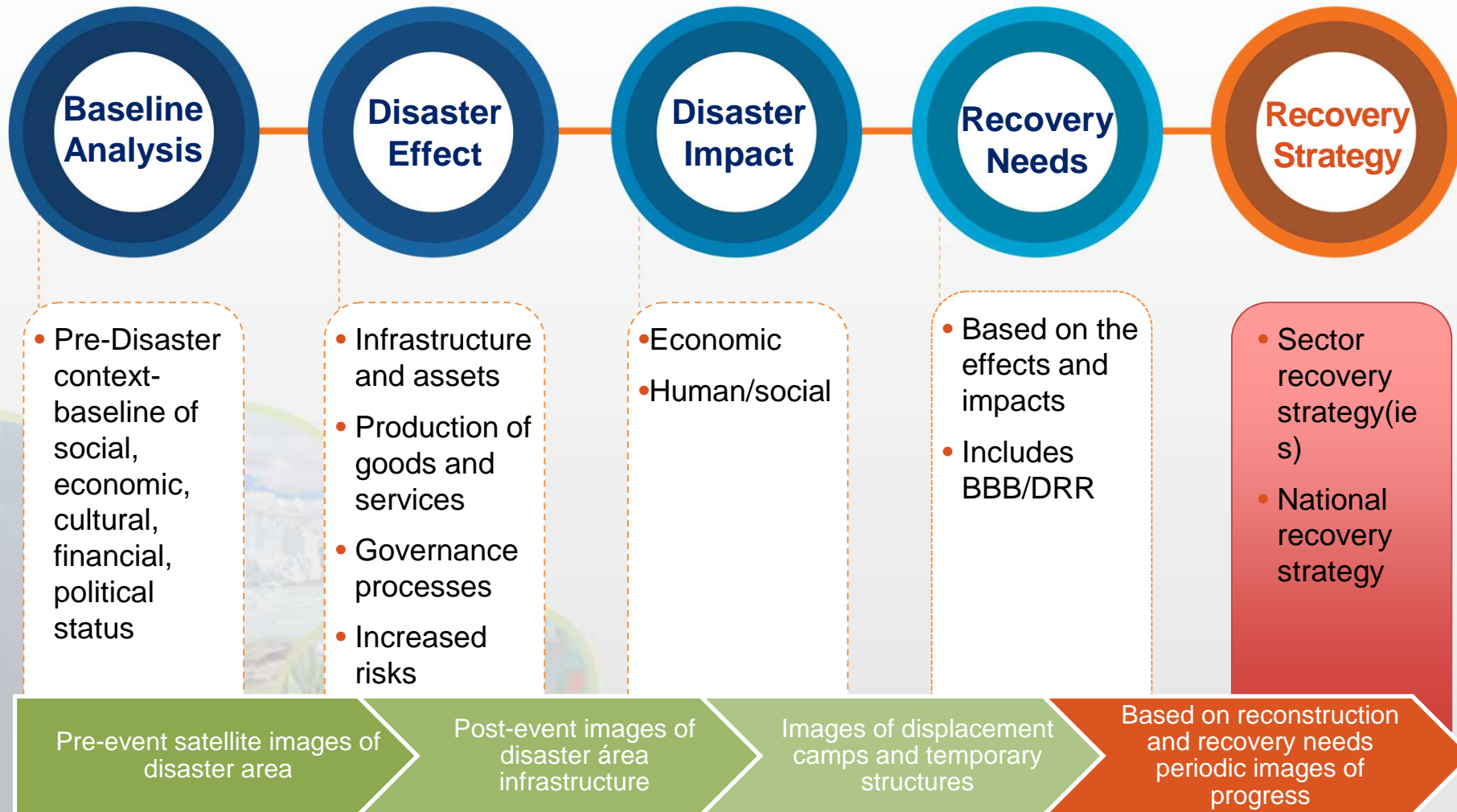
PDNA

DRF

RECOVERY M&E



# The PDNA Process: where are satellites useful





# PDNA Process Deliverables – where does satellite EO fit in?



## Four core PDNA deliverables:

- **Consolidated Assessment Report** based on sector reports, presenting the **overall effect and impact** of the disaster on each sector, the **recovery needs**, and the explicit **impact on cross cutting themes**, with a gender perspective, environmental considerations, risk reduction, and governance.
  - **Baseline information**
  - **Damage to infrastructure and physical assets**
  - Disruption of access to goods and services
  - Governance and decision-making processes
  - **Increased risks and vulnerabilities**
- **Recovery Strategy** which defines the vision for **national recovery**; provides a strategy for **recovery actions** within each sector and affected region, with clear objectives and interventions; directs it towards **expected results**; and defines the **timeframe** as well as the **cost** for the recovery process.
- Provides the **Basis for Resource Mobilization** in support of the country's recovery, including a donor conference where required.
- Provides an outline for a **Country-led Implementation Mechanism** for recovery.





# What satellite imagery may provide: indicators TBD



## PRODUCTIVE



Agriculture



Commerce



Industry



Tourism

## SOCIAL



Housing



Education



Health



Culture

## INFRASTRUCTURE



Water & Sanitation



Community infrastructure



Energy



Transport



Telecommunications

## CROSS-CUTTING

GENDER

GOVERNANCE

ENVIRONMENT

DISASTER RISK  
REDUCTION

EMPLOYMENT AND  
LIVELIHOODS

Note: The diagram above illustrates the typical sectors that are assessed in the PDNA, this can vary from country to country.



# PDNA Baselines



- Archived satellite imagery can provide information on pre-event situation and with value adding can be used to rapidly generate a **pre-event baseline**
- Rapidly tasked satellites can collect wide area coverage and detailed spotlight data on damage from event and impacted sectors (Charter, Copernicus, Sentinel-Asia) – **post event baseline**
- Satellites provide good **situational awareness** but require **ground validation** and cannot inform on some sectors
- Good baseline products require **elaboration by value-adders** (images, data, human resources)

Baseline mapping		Monitoring
Buildings, shelters	<p>Building footprint mapping</p> <p>Urban blocks with damage grading</p>	<p>Building removal and construction</p> <p>Change in urban land use, morphology and density</p>
Camps/IDP	<p>Location of spontaneous and organized gathering areas</p> <p>Location of temporary dwellings</p> <p>Possibility of camp placement</p>	<p>Camp removal and installation</p> <p>Tent removal and installation</p>
Transport	<p>Baseline transport network</p> <p><i>Accessibility analysis</i></p> <p><i>Proximity analysis</i></p>	<p>Rebuilt transport facilities</p> <p>New transport facilities</p> <p>Removal of transport facilities</p> <p><i>Accessibility analysis</i></p> <p><i>Proximity analysis</i></p>
Infrastructure	Baselines	Infrastructure change
Environment	<p>Landcover</p> <p>Baseline vegetation change (e.g. mangroves, forested areas, agriculture)</p>	<p>Change in landcover*</p> <p>Loss of vegetation*</p> <p>Vegetation re-growth*</p>
Topography/ Land use/Land	<p>DEMs,</p> <p>Land use/Land cover maps</p>	Land use/Land cover change maps*



# Copernicus EMS RRM Standard - List of Products (20)



Preparedness and /or Recovery		Copernicus EMS RRM Standard products
Prep Reco	P1	Digital Surface Model (DSM)
Prep Reco	P2	Reference dataset
Prep Reco	P3	Land Use/Land Cover dataset
<b>Reco</b>	<b>P4</b>	<b>Flood delineation</b>
Prep Reco	P5	Modelled flood extent for major events
Prep Reco	P6	Temporal analysis of occurred flood events
<b>Reco</b>	<b>P7</b>	<b>Wildfire delineation and grading</b>
<b>Reco</b>	<b>P8</b>	<b>Detailed damage assessment analyses over affected areas</b>
<b>Reco</b>	<b>P9</b>	<b>Reconstruction monitoring</b>
Prep Reco	P10	Urban sprawl analysis
Prep Reco	P11	Human footprint evaluation of cities (city lights)
Prep Reco	P12	Ground deformation analysis
Prep Reco	P13	Ready-to-print maps and map books for field campaigns
Prep Reco	P14	Impact assessment and exposure analysis on assets and populations (stats)
Prep Reco	P15	Detailed impact assessment and exposure analyses on selected aspects (stats)
Prep Reco	P16	Post disaster (Forest Fire) soil erosion risk assessment
Prep Reco	P17	Post disaster (Forest Fire) landslide risk assessment
Prep Reco	P18	Human settlements mapping (standard and informal settlements)
Prep Reco	P19	Population displacement location (IDP, informal settlements, ..)
Prep	P20	Detailed reference dataset for high importance areas

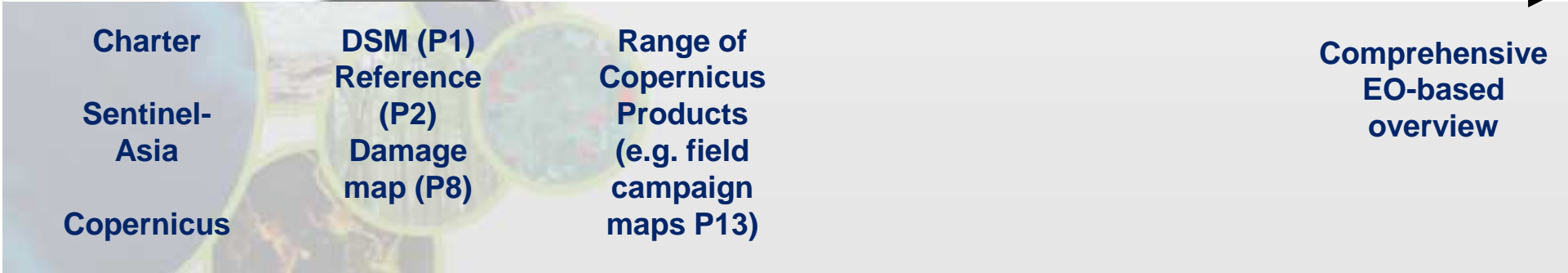
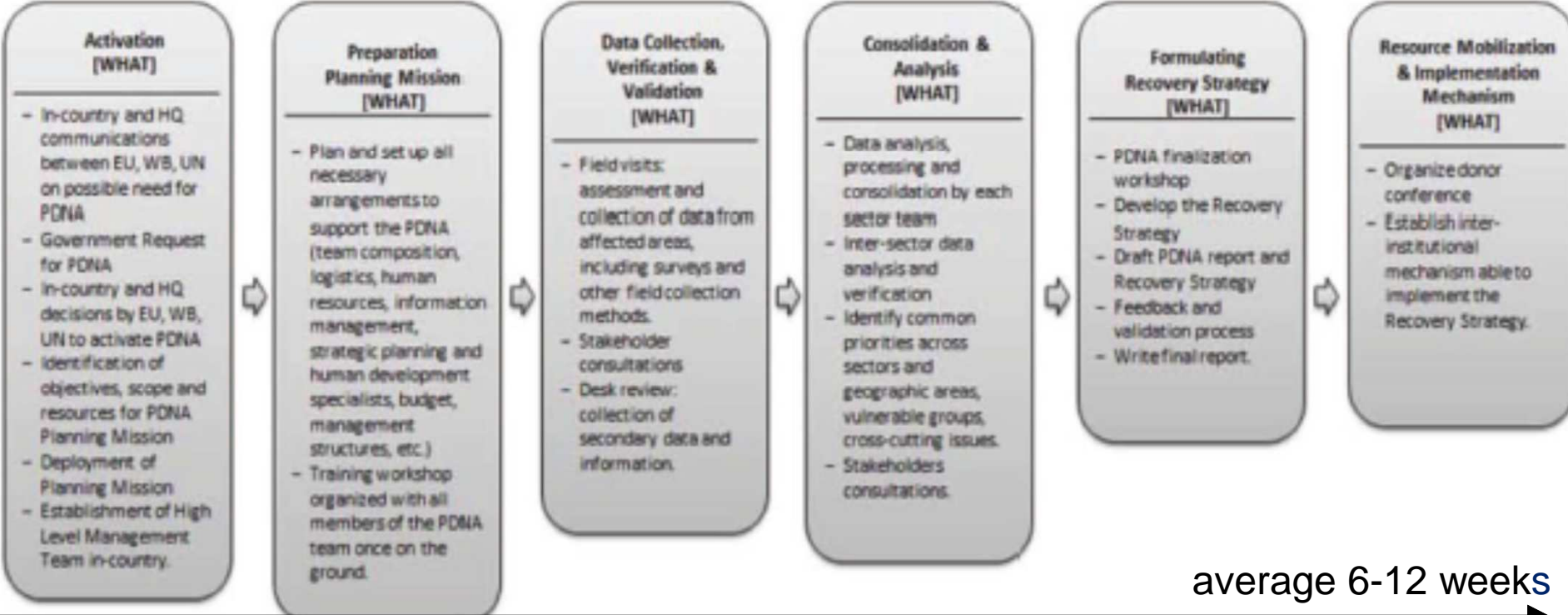




# PDNA Process from Guidelines 2013



## Post-Disaster Needs Assessment Process





# Limitations to Methodology



PDNA has a fixed timeframe which places limitations on the collection of data. Satellite imagery requires baseline geo-referenced data

Remote sensing does not replace in-depth sectorial analysis. Very useful when access is limited or dangerous (as in conflict contexts)

May facilitate the geographical location of intervention needs, and support preparation of detailed recovery projects.

Recovery strategy M&E, backed by other auditing and accountability processes

Some drawbacks may be:

- Timeliness and availability (cloud cover, lack of coverage by regular satellites, etc.)
- Cost to national authorities (of more detailed and granular imagery)
- Capacity to analyze and interpret images
- Appropriate baseline geo-referenced data
- Lack of knowledge of availability by affected countries / institutions

## Diapositive 22

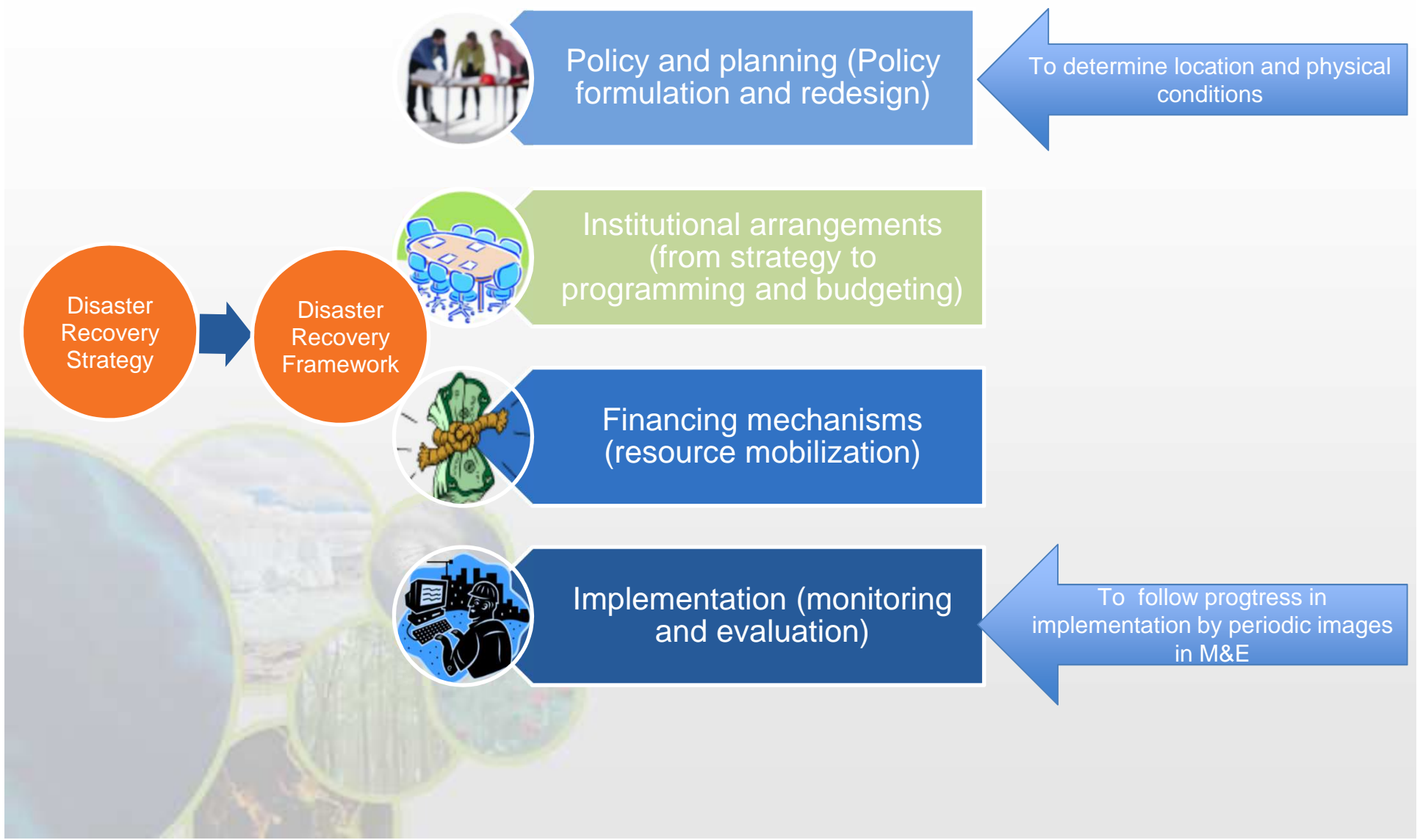
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**RZ1**

Ricardo Zapata; 29/11/2019



# From DRS to DRF: satellites facilitate implementation M&E







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**Timeline, next steps**



# Governance : issues addressed 1/2



- Continue as **informal effort** between satellite EO community, DRM / Recovery international stakeholders
- **PDNA Guidelines**: our effort should contribute to drafting “satellite input to PDNA guidelines” (& other assessments guidelines such as GRADE);
- **Demonstrator**: access to satellite imagery and value adding services through CEOS RO Demonstrator ? What is required ? What is benefit?
- Linkages to **NGOs, private sector** to be defined
- Changing “**RO users**” – humanitarian relief is not recovery, recovery is not development... evolution of users over timeline



## Governance : issues addressed 2/2



- Seek **Agreement with Charter & Sentinel Asia** on data access (visibility of acquisitions and products)
- Seek **Agreements with Copernicus RMS** on possible data access (?) – Access to value added products on the web portal
- Seek **Agreement with Copernicus RRM** on triggering “Standard” (STD) Risk and Recovery Mapping service

Conclusion: ***ad hoc Demonstrator without any legal or formal structure would allow to confirm value proposition***



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# Capacity Building



- Capacity Building is **systematically** part of international stakeholders activities in a country.
- Should **existing capacity** be a requirement for triggering RO, or variety of scenarios and adopt an **ad hoc approach** ?
- **Proposed strategy**: identify local node of expertise; evaluate capacity; make linkages to existing data streams and value-adding sources; develop ad hoc CB plan; hand-off.
- Capacity Building is critical but requires **long-term commitment**. RO activity can initialize CB plan and set wheels in motion.
- Capacity Building should **focus on Recovery monitoring phase** rather than early recovery, so is mostly outside scope of RO Demonstrator.



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# Meeting Early Recovery Needs with Satellite Imagery



- **Early recovery** begins **immediately after** the event, during the **damage assessment phase**, including:
  - Rapid and more detailed **assessments** (GRADE, PDNAs);
  - Elaboration of **recovery planning** (National Recovery Plans).
- The **main challenges** to accessing satellite EO are **awareness** and **cost**.
  - **Recovery managers are not familiar** with :
    - the range of satellite EO options and performance (providing data)
    - the range of EO-derived services (providing information products)
    - how to access relevant data and information products.
  - There is **no dedicated satellite imagery budget** within the current PDNA process that would allow for the purchase of specific data sets or pay for value-adding services.
  - Recovery managers are not familiar with what is **available for free** and what **requires a dedicated budget**.

- Several **public good services** provide information dedicated to civil protection teams such as reference maps of area before the event, maps of area affected and high-resolution “hotspots” showing specific damage.
- **Charter** products produced on a best efforts basis by a designated Project Manager and are tailor-made, typically available within one or a few days. **Sentinel Asia** provides similar service at regional scale. Activation for Charter or Sentinel Asia generally ends after one to two weeks.
- **Copernicus EMS RMS** products are generated by European commercial companies working in rush mode under a standing offer for the European Commission. Activation for EMS RMS also ends quickly, but may be extended via the Risk and Recovery Mapping services (**EMS RRM**).
- **Commercial on-demand products** may also be acquired through a range of commercial providers.

***Satellite EO provide a rapid, synoptic overview and is a useful complement to field information during Emergency Response. **These products are available to Recovery community now (awareness required)!*****





## In the weeks following an event (**Early Recovery**)



- Since 2012, Copernicus EMS offers a **Risk & Recovery Mapping (RRM) service** that can be activated through Authorized Users (including EU delegations). Activations last for ~ 40 days but may be renewed. Since January 2020, this service offers :
  - a range of “**standard recovery products**” available very quickly after a disaster (STD RRM),
  - as well as the previously available longer-term “**flexible recovery products**” (FLEX RRM).
- **Basic data sets**, optical and radar, are available through Landsat and Sentinels at 20m resolution; can be used to track recovery of vegetation, impact to agriculture, and rehabilitation of major infrastructure.
- More detailed assessment of damage to roofs or urban areas requires **much higher resolution** data.
- There are **intermediary data sets** which offer useful information about affected vegetation / agriculture.

*Only satellite data offers a holistic view of the entire affected area, but it requires **local expertise** and **field validation** to understand.*

*Some information is not available through satellites (e.g. building damage vs roof damage, urban damage at detailed level, crop types, etc.)*



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**In a nutshell (summary) – timeline, next steps**



# CEOS RO Demonstrator



- Proposal for a **3-year RO Demonstrator** to validate technical model
- Strong **expression of interest from UNDP, GFDRR/WB, and EU.**
- **In-kind contributions** under review from **Recovery partners: GFDRR** EO Clinic activation (through ESA partnership), small UNDP value-adding budget, EU consultancy, and linkages to Copernicus EMS RRM.
- Other contributions under review **from CEOS partners** (data and value-adding resources) : ASI, CNES, CSA, CSA, ...
- **1<sup>st</sup> demonstrator test late 2020/early 2021**; 3-5 demonstrations over 2021-2023 (approximately 3 years)
- **Standard duration** of observatories to be **three to six months** with strong emphasis on early observations; possibility of extension with outside support for longer-term monitoring
- **2023: report to CEOS Plenary** and to other partners on lessons learned and make recommendations for next steps

***RO Demonstrator seeks approval in principle of WGD #13 mtg  
and presentation by WG Chair to 2020 SIT.  
Implementation Plan to be presented fall 2020.***



# CEOS RO Demonstrator Possible triggering



- Definition of possible RO demonstrator **triggering mechanism** (1 week process):
  - PDNA team makes request for demo;
  - Relay by ad hoc team to CEOS RO team (yes or no);
  - If RO activated, possible urgent request (image type, volume, value-adding) may be sent to CEOS **Data Coordination Team** (yes or no).
- **RO implementation:**
  - If Yes, DCT designates **CEOS PDNA liaison** (volunteer agency or agency designate) to lead RO contribution.
  - CEOS liaison identifies **PDNA team needs** & defines acquisitions strategy, delivery dates for imagery and products, information to be extracted. CEOS liaison ensures regular update of users' needs assessment, that may evolve.
- **RO Team of global coordinators** to support coordination, review results and report on Demonstrator



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# G-RO Concept Paper



## Activity performed by G-RO ad hoc group

### Objectives:

- Articulate critical linkages and governance scenarios for further Recovery collaboration
- Propose ideas for future WGD demonstrator(s)
- Develop a clear baseline for partner contributions to the future demonstrator(s)

### Status:

- Consensus achieved (UNDP/WB/GFDRR/EU/CEOS) on structure and objectives of Concept Paper, and philosophy behind demonstrator(s)
- Paper to be drafted this spring



# RO Demonstrator & G-RO Plans for 2020



## Promotion and advocacy

- Promotion of e-version of **Advocacy Paper**
- Finalization and e-publication of **Concept Paper**

## CEOS Demonstrator

- Development and presentation of **RO Demonstrator** proposal for **CEOS SIT April 2020**
- Demonstrator to build on **case study of recent PDNAs** and survey of past PDNA leaders
- Demonstrator will be **triggered by PDNA planning teams** who will propose events for support
- Foster linkages with other programs and resources (e.g. Charter, Sentinel-Asia, Copernicus EMS, EO Clinic, ESA/GDA, Foundations, etc.)

## Guidelines

- Draft guidelines for satellite contributions to PDNAs and DRF



**Thanks for you attention**

