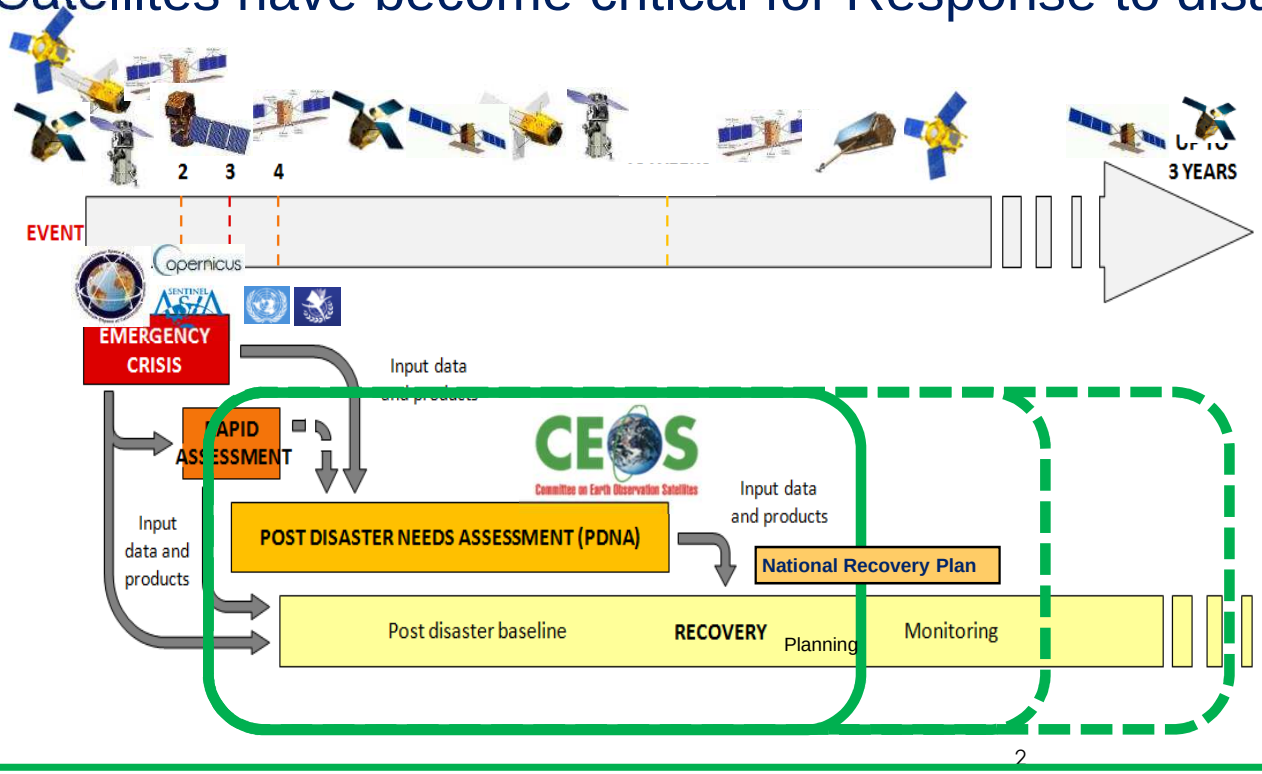
Committee on Earth Observation Satellites

Proposal to establish a pre-operational Recovery Observatory 2024-2026

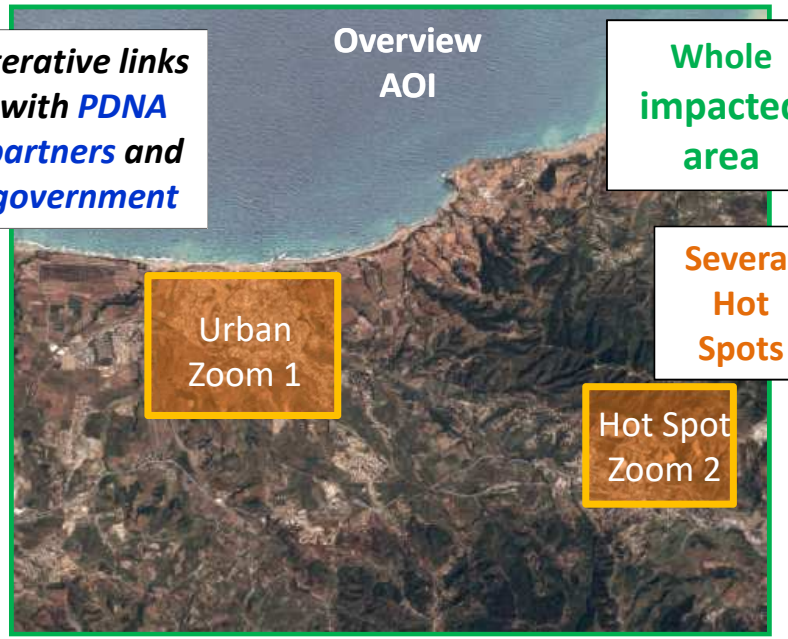
Document for approval at Plenary 2023

Recovery Observatory (RO)
A partnership between CEOS-World Bank-UNDP-EU

Satellites have become critical for Response to disasters … but what about Recovery?



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



"Recovery Observatory" : Process allowing operational use of EO for PDNA, Recovery Planning, then M&E

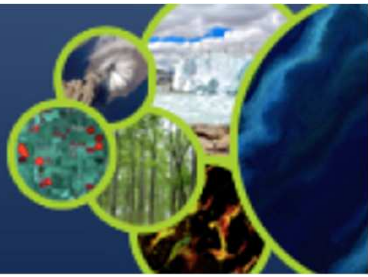
Ancillary data are indispensable: *terrain validation data, aerial and drone data, statistics, cartography, ….*

Summary of RO Demo activations

Activation	Pros	Cons	Comments
1. Beirut blaze	Synthetic update of situation	Very small area not representative of typical activation	Coordination with Copernicus but no other added CEOS value
2. Eta-Iota hurricanes	Excellent. Multinational coordination. Innovative products (e.g. interferometry Sula Valley)	Request came months after events; no direct impact on early recovery	Demonstrated need for increased tripartite coordination
3. Haiti EQ	Activation in days; results in PDNA only input for agriculture and environment	None	Excellent showcase Successful Capacity Building example
4. Pakistan floods	Excellent quality of CEOS products for two areas retained for Phase 1; strong interest in DRF products (agriculture)	Lack of coordination; evolving need analysis led to gaps in EO products; poor uptake in PDNA	Large events (Pakistan, Nepal EQ, …), pose unique coordination challenges
Turkey/Syria EQ	Strong willingness of CEOS to contribute; linkages to GSNL	Complex political situation postponed decision to activate indefinitely	No activation but support provided in determining all remote sensing data available
Myanmar Mocha hurr.	Strong technical case for quality product	Impossible to fit with timeline	Need to fast-track activation requests

5. Libya floods : activated 13th Oct. for PDNA 25th Oct. 2023

Accomplishments



- After nearly 3 years of activity, an efficient **RO Demonstrator community** working in **best effort** mode :
  - ✓ **Data providers**: ASI, CNES, ESA/Copernicus, DLR, International Charter Space & Major Disasters
  - ✓ **Value adder contributors**: Copernicus EMS, BGC, NASA, CIMA, LIST, CNIGS, ICube-SERTIT

- **Operational results :**
  - ✓ **Lebanon :** reconstruction monitoring regularly provided to **Reform, Recovery & Reconstruction Framework (3RF)**
  - ✓ **Eta-Iota :** demonstration that very complex products can be delivered and used for improved understanding of long-term recovery (interferometric SAR for mm level subsidence analysis)
  - ✓ **Haiti EQ :** first products delivered in a relative rush mode that **directly inform the PDNA with quantitative data (environmental and agricultural damage)**
  - ✓ **Pakistan :** first products delivered in rush mode; some critical areas not addressed; coordination issues with broader recovery effort; better coordination of resources could have provided more comprehensive results.

- **Various** products generated and diverse types of satellite made available

- Excellent **collaboration** between the **stakeholders** and the **RO team**; RO team responsive to the emergence of new needs. Products welcomed by the recovery community to help reconstruction and better prepare to future events

RO Cost-benefit work

- **Key to RO sustainability lies in demonstrating benefit for work of RO to DRM community, especially PDNA Tripartite Agreement partners.**
- **RO Demo team (specifically UNOSAT, SERTIT, CIMA) determined use cases and costed benefits**
- **Use case approach to be based on different balance points of coordination and value adding costs – 25k ; 50k; 80k (does not, at this time, include cost of commercial data)**

RO Use Case Cost-Benefit – Riverine flood event

	25k	50k	80k
Description	Coordination across EO community and linkages to recovery teams (RO liaison); identification of free EO resources; basic products	Dedicated damage products linked to specific sectors in PDNA; dedicated recovery products tied to recovery timelines	Integrated EO-based spatialized recovery framework from event to DRF implementation
Details	Dedicated RO calls to coordinate existing EO resources; Sentinel-based products to determine maximum flood extent and changes to flood extent over periods around cresting (not daily, but probably every few days, depending on location and satellites)	Integration of dedicated SAR and VHR optical image acquisitions with lower resolution products; more detailed damage analysis (urban areas) and evolution over time (reconstruction progress) over specific hotspots	Interferometric SAR analysis of damaged infrastructure in hotspots; long-term environment and agriculture damage and recovery monitoring over large area

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RO Use Case Cost-Benefit – Windstorm (hurricane, cyclone)

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Details	Dedicated RO calls to coordinate existing EO resources; Sentinel-based products to determine land cover changes at medium resolution	Integration of dedicated SAR and VHR optical image acquisitions with lower resolution products; more detailed damage analysis (wind damage, specific crops, roof tops) and evolution over time (reconstruction progress) over specific hotspots	Ability to extend in time and area covered the VHR analysis of change – detailed monitoring of progress of DRF

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Details	RO Haiti EQ/Grace: landslide inventory, Landslide Susceptibility Index  Large flooded areas, costal erosion or fallen trees over large areas using Sentinel-1/2 images	More detailed damage analysis (wind damage, specific crops, roof tops) and evolution over time (reconstruction progress) over small specific hotspots using VHR optical images (small pre-selected priority areas (https://sertit.unistra.fr/rms/?action=655) RO Demo 2 – Eta/Iota	Ability to extend in time and area covered the VHR analysis of change – detailed monitoring of progress of DRF

RO Use Case Cost-Benefit – Earthquake

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Description	Coordination across EO community and linkages to recovery teams (RO liaison); identification of free EO resources; basic products	Dedicated damage products linked to specific sectors in PDNA; dedicated recovery products tied to recovery timelines	Integrated EO-based spatialized recovery framework from event to DRF implementation
Details	Linkages to GSNL and Seismic Demonstrator; dedicated RO calls to coordinate existing resources; use of Sentinel imagery and linkages to non-EO products	Integration of dedicated SAR and VHR optical image acquisitions with lower resolution products; more detailed damage analysis and evolution over time over specific hotspots	Large area recovery monitoring and dedicated interferometric analysis of infrastructure concerns over large area – improved understanding of evolving risk and impact of aftershocks on recovery process

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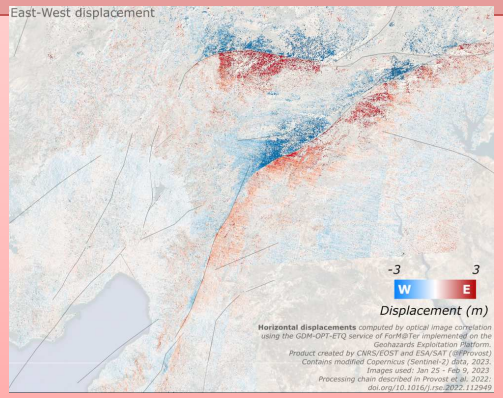
Example and potential products	 Ground deformation/movement for S1/S2 over large areas	https://disasterscharter.org/web/guest/activations/-/article/earthquake-in-turkey-activation-797- Grading maps with VHR optical images over small pre-selected priority areas https://unosat.org/products/3490 RO Demo 3 Haiti EQ	Grading maps with VHR optical images over more small pre-selected priority areas. Possibility to implement aerial, drone and/or social media sources to improve the analysis

RO Demo partner contributions

Openly available response data and products

- International Charter Space and Major Disasters
- Copernicus EMS RM
- Sentinel-Asia
- UNOSAT
- Open-source sat data (Landsat, Sentinels, DTM)
- Data bases (landcover, population,..)

CEOS best efforts RO data and products

- Dedicated acquisitions of commercial data
- Complex satellite products (e.g. SAR interferometry)
- RO liaison officer and overall coordination
- Value adding services
- Capacity building

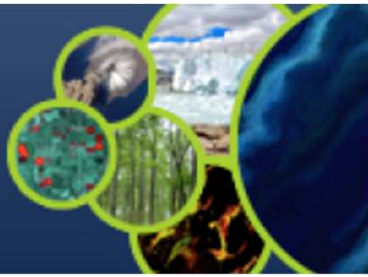
Ad hoc contributions: academia, international organizations (e.g. CEMS RRM, FAO, UN)

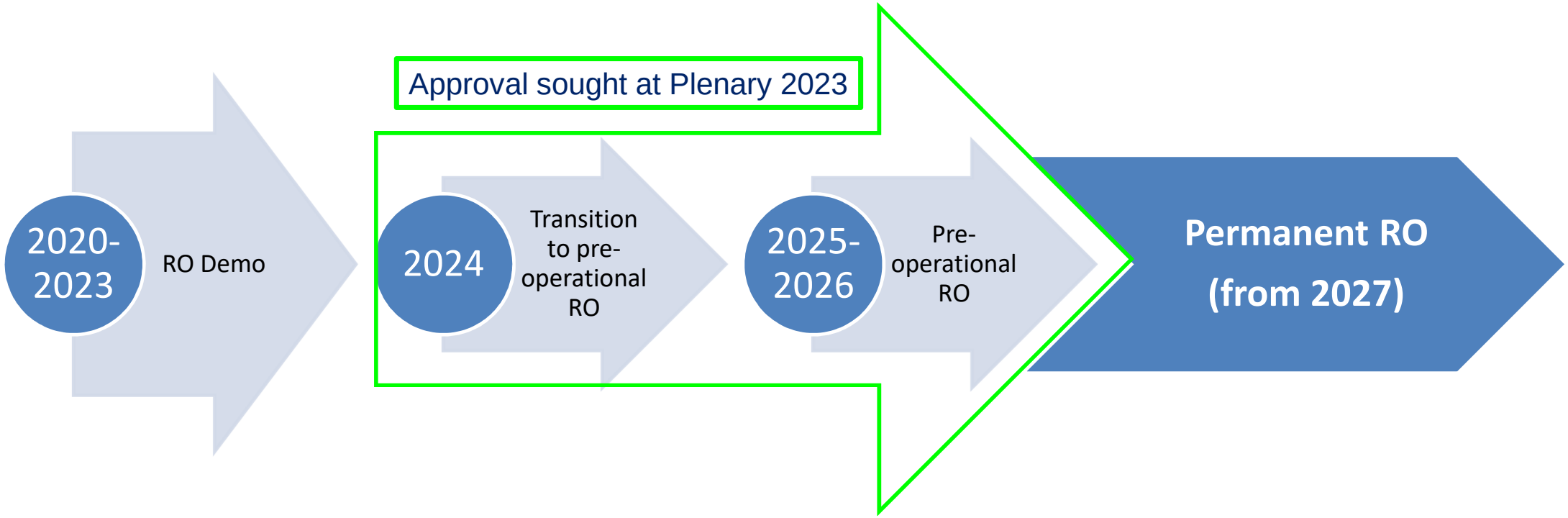
- Linkages to Copernicus Risk and Recovery Mapping
- Value adding services
- Expert analysis
- Integration of other advanced data sources (e.g. social media, drones, …)

Integrated Situational Awareness
to support recovery:

- Inform PDNA;
- Pre and post disaster baselines;
- Medium term monitoring;
- Capacity Building assessment & plan.

Establishment of Pre-operational RO Implementation Timeline





Necessary “Core” RO
Establishment of pre-Operational RO

RO Secretariat and RO Liaison functions *(transition by 2025/2026 to recovery stakeholders)*

- ***Secretariat:***
  - *Identify **dedicated RO funds** that can be activated on demand – WB/GFDRR and GDA, EU PDNA support, UNDP SOP for UNOSAT, etc*
- ***Liaison:***
  - *Document and encourage **satellite and value adding contributions** from wide array of sources*
  - *Understand needs and **coordinate tasking** of CEOS satellites*
  - *Prepare **dedicated PDNA contribution** (rapid phase 1 for each activation)*
  - *Serve as **principal PoC for satellite community** with recovery stakeholders*
- ***Capacity building:** involve local and regional technical expertise and propose reinforced capacity after each activation, in conjunction with EU Copernicus, WB, and CEOS WGCapD*

CEOS Data Contributions
Establishment of pre-Operational RO

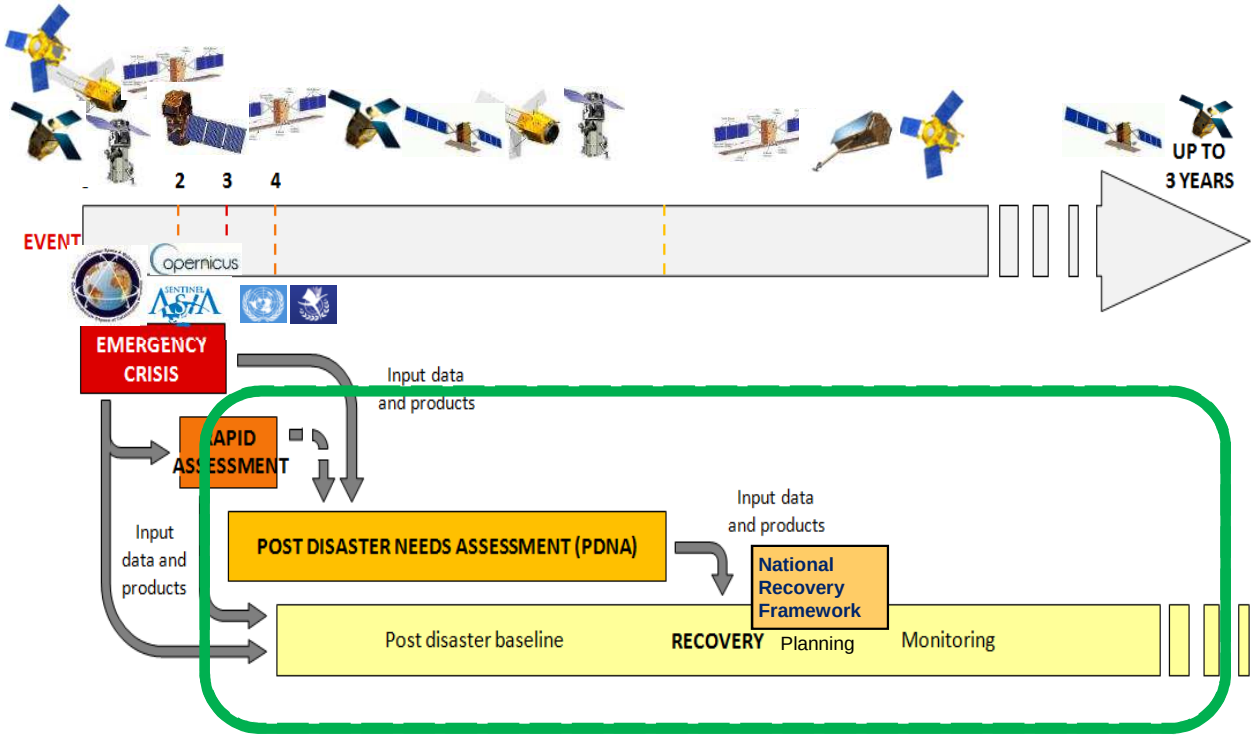
- ***Assume 2 to 4 activations per year for 2024-2026***
- ***Imagery requirements:***
  - ***VHR optical: ~2,000 sq km per activation***
  - ***X-band SAR: dedicated acquisitions to provide change detection products; hundreds of images (archived and new) per activation if interferometric analysis is useful***
  - ***L-band SAR: dedicated acquisitions to provide change detection products***
- ***Not significantly higher than existing RO Demo contribution, from same agencies (CNES, ASI, DLR, CONAE)***
- ***Transition from VHR data provided by CEOS agencies to commercial data provision after 2026***

Action Plan Proposal for 2024-2026
Establishment of pre-Operational RO

Establish a capacity to provide 2 to 4 RO / year for the next three years beginning 2024:

- ***Target :***
  - ***one event per semester in 2024;***
  - ***one event per quarter in 2025 and 2026;***
- ***Initially provide resources through ad hoc best efforts mechanisms (as in demonstrator);***
- ***Q1/Q2 2024 work with partners to establish mechanisms for private sector and intergovernmental organisation RO activation (operational Q1 2025)***
  - ***WB/GFDRR*** *mechanism to activate pre-qualified private sector support in conjunction with CB in country*
  - *Work with* ***UNDP and UNDP Crisis Bureau*** *to activate UNOSAT on regular basis for RO activations*
  - *Work with* ***EU*** *to task Copernicus EMS RRM to rapidly respond to recovery intervention requests, and to liaise with Copernicus Hubs*
  - *Work with* ***EU*** *to access existing EU framework contracts on PDNAs to ensure PDNAs benefit from satellite support*

Outcome:
RO integrated into Recovery process



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