Satellite EO for disaster risk management & international development

a viewpoint from ESA

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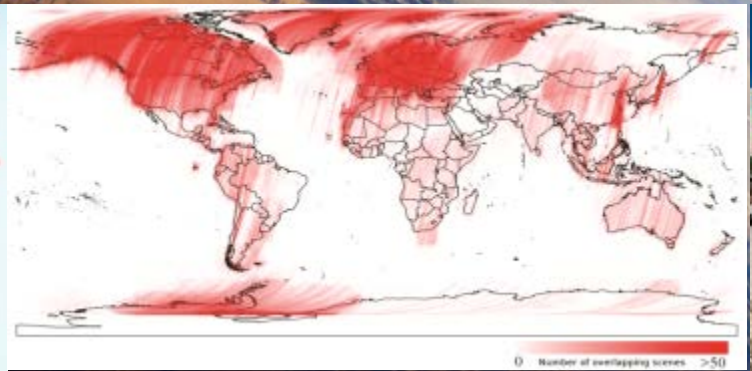
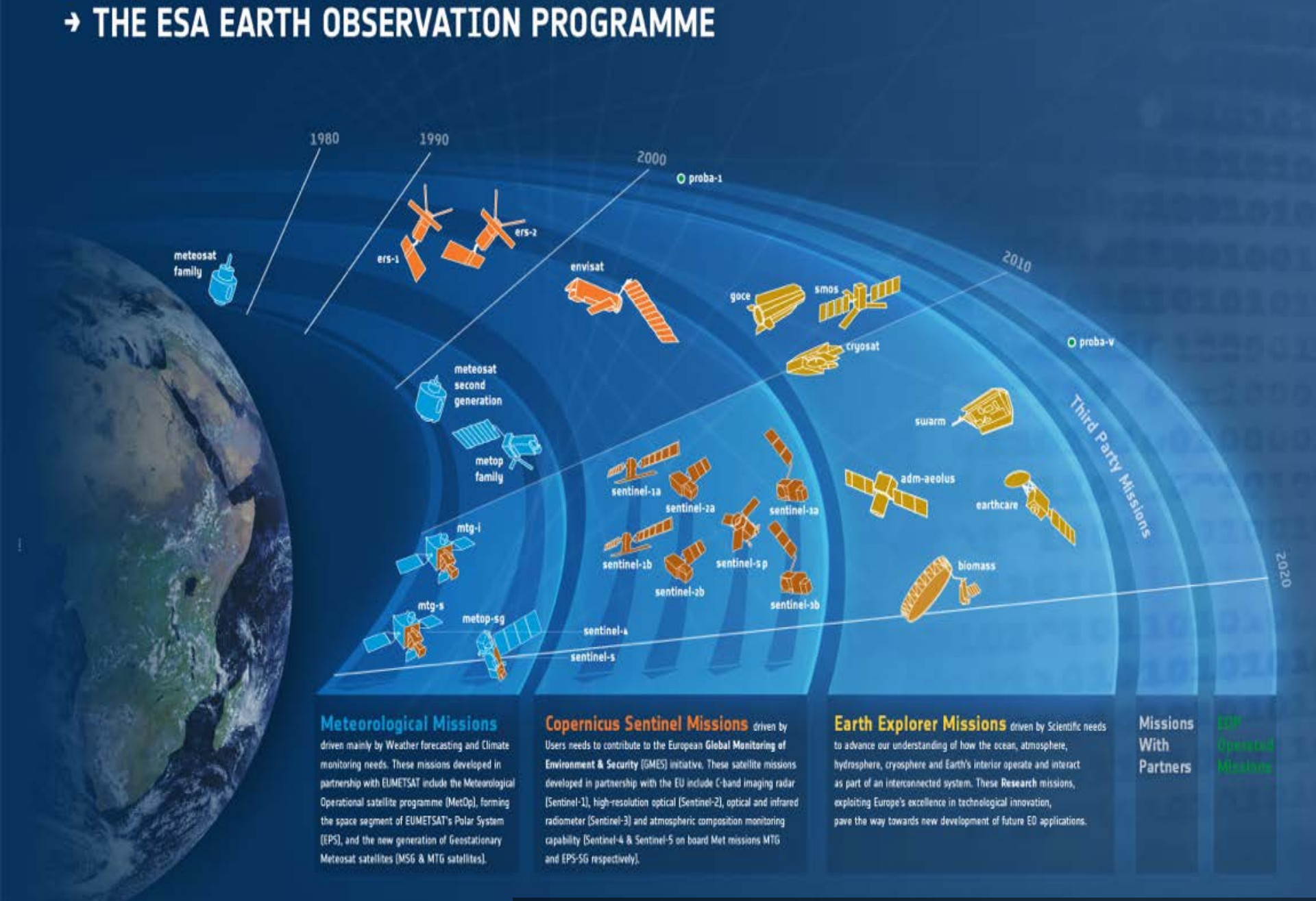




Long-term (decadal) continuous, consistent data

The Sentinel mission & DRM

Satellite EO contributes to **hazard and asset/exposure mapping.**
A new era with the advent of the **Sentinel mission:** regular provision of very large data collections in a systematic fashion to support operational applications globally.

- **Sentinel-1** provides all weather repeat observations and will, for instance, enable bi-weekly observations for millimetric precision terrain motion monitoring.
- **Sentinel-2** with its two platforms will provide global coverage of 100% land masses in Optical mode once every 5 weeks.
- complemented by **Sentinel-3, 4 & 5** that operate in different complementary domains of remote sensing.

The Sentinel mission is an element of the **Copernicus initiative** of Europe.


ESA participation to DRM activities

What can ESA provide using Earth Observation (EO) technologies ?

- ✓ Operates of satellite missions (ERS, ENVISAT, SENTINEL: tools for crisis mapping)
- ✓ Participates to the International Charter Space & Major Disasters

➢ EO data and EO based services

- ✓ has EO application development programmes (e.g. GSE feeding into EU's Copernicus)
- ✓ participate to international activities to develop EO applications

International Charter Space & Major Disasters (CHARTER)

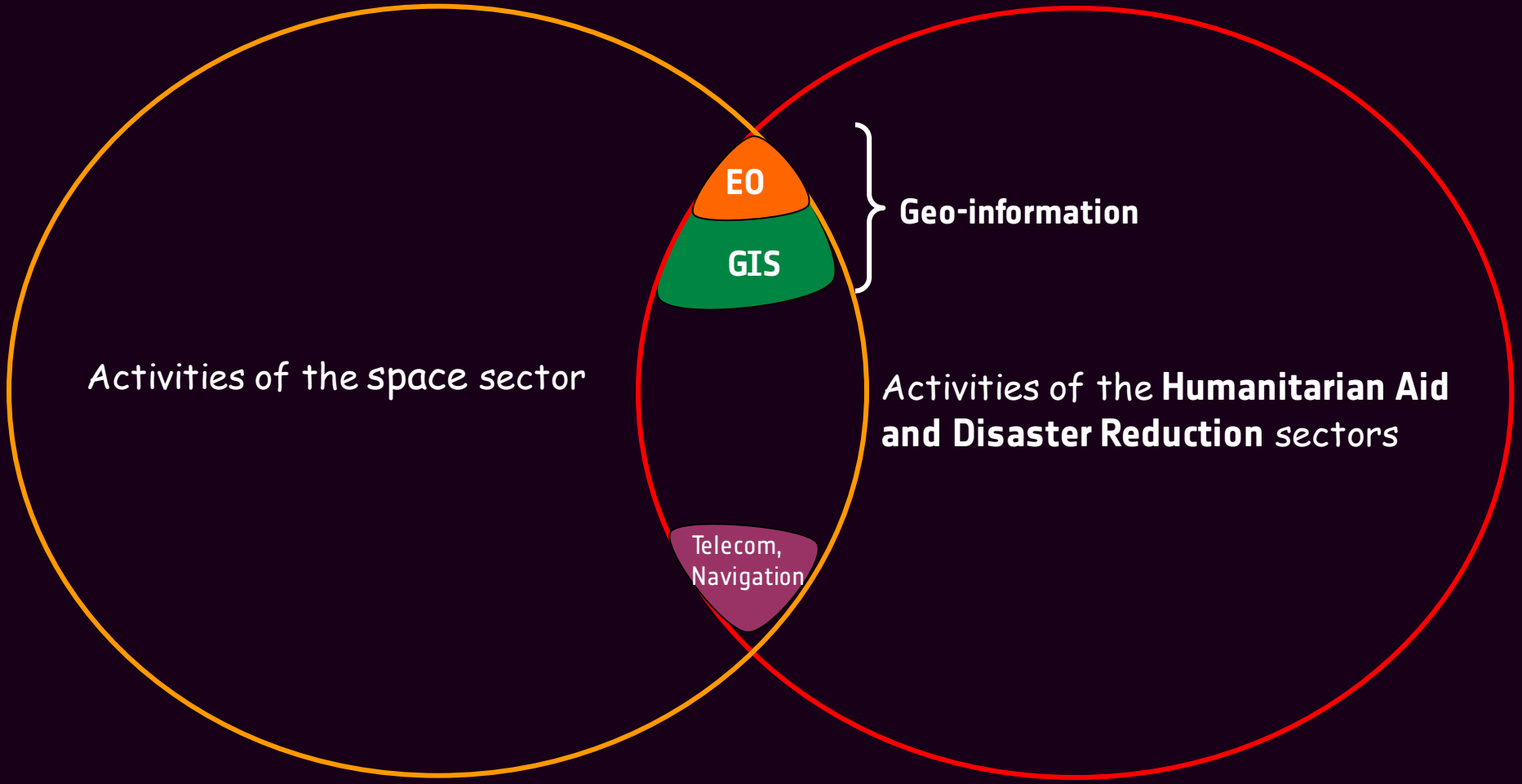
Global Earth Observing System of Systems (GEOSS)

The Copernicus programme

Collaboration with International Financing Institution (IFIs)

Importance of space Technolgies

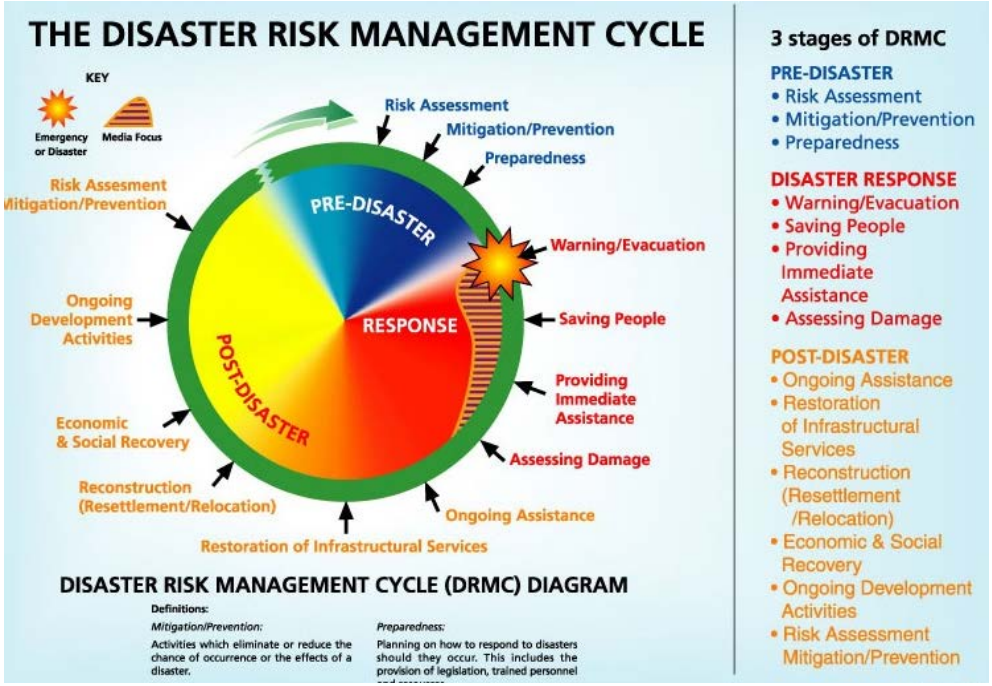
The utilisation of geo-information today only represents **a small fraction** of the activities of the **Humanitarian Aid and Disaster Reduction** sectors:



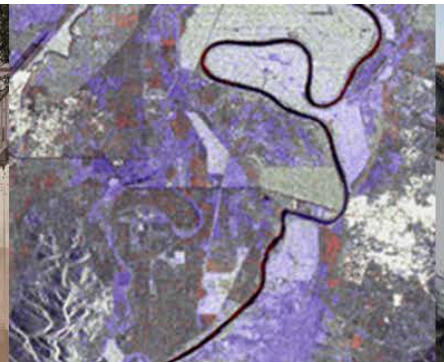
EO Services & Risk Management cycle

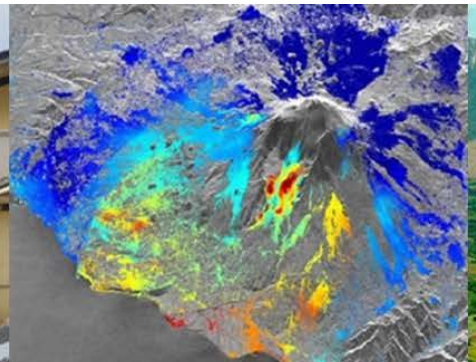
- **Emergency Response,**
  - Rapid Crisis Mapping & Damage Assessment,
  - Situation Mapping.
- Prevention, Preparedness, Recovery, Reconstruction
  - Detailed Damage Mapping,
  - Risks Assessment.

  (Floods, Fires, Geo-Hazards)
- All phases
  - Reference Mapping,
  - Digital Elevation and Digital Terrain models,
  - LU/LC cover Mapping,
  - Asset Mapping.



Available Globally, Operational




The International Charter Space & Major Disasters

- Initiated in 2000 by CNES and ESA, joined by CSA, NOAA, ISRO, CONAE, JAXA, USGS, BNSC/DMCii, CNSA, ROSCOSMOS, INPE, DLR & KARI (14 members currently)
- **Unified system of space data acquisition / delivery in case of natural or human-made disasters (at no cost, best effort basis)**
- **Data delivery to civil protection agencies, emergency & rescue services;** UN cooperating body since 2003
- The only bodies authorized to request the services of the Charter are the **Authorized Users**.
- Universal Access: **nationally mandated users from all countries may apply provided simple criteria are met**
- Operational : 24/7 on-duty-operator
- **Charter activations increasing** (50 most important events/yr)
- **420+** activations in **110+ countries** since 2000.

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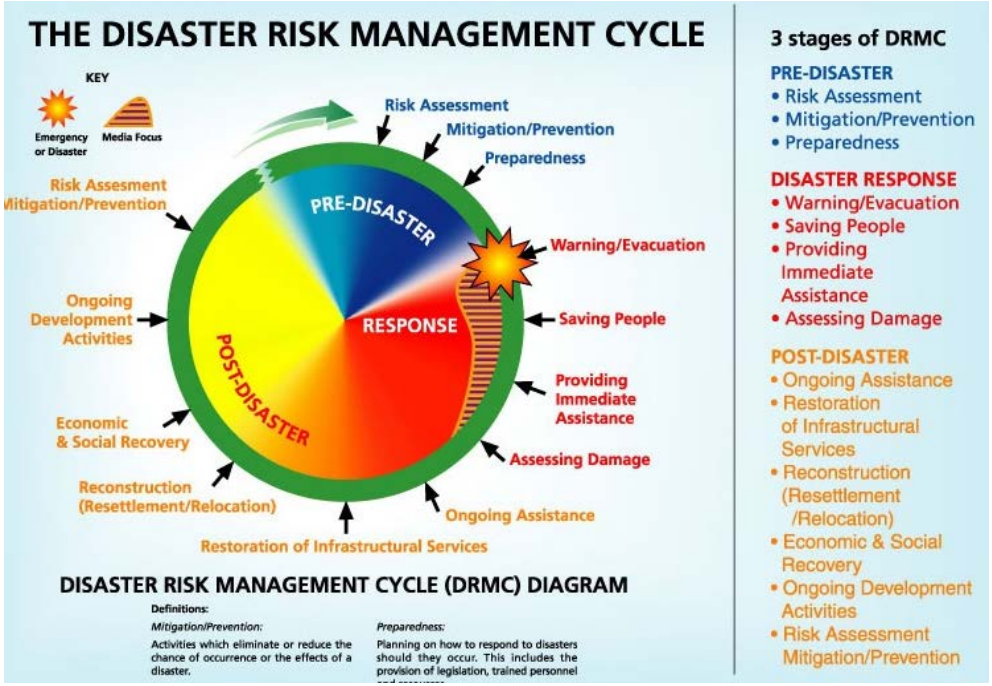

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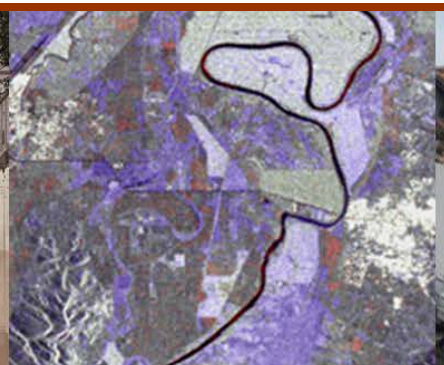
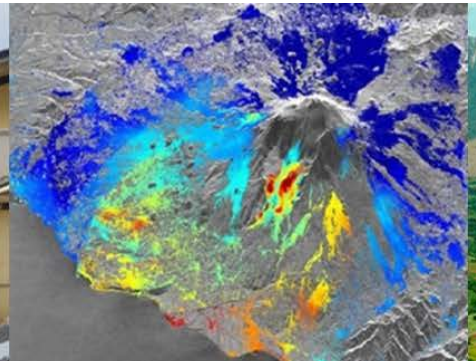
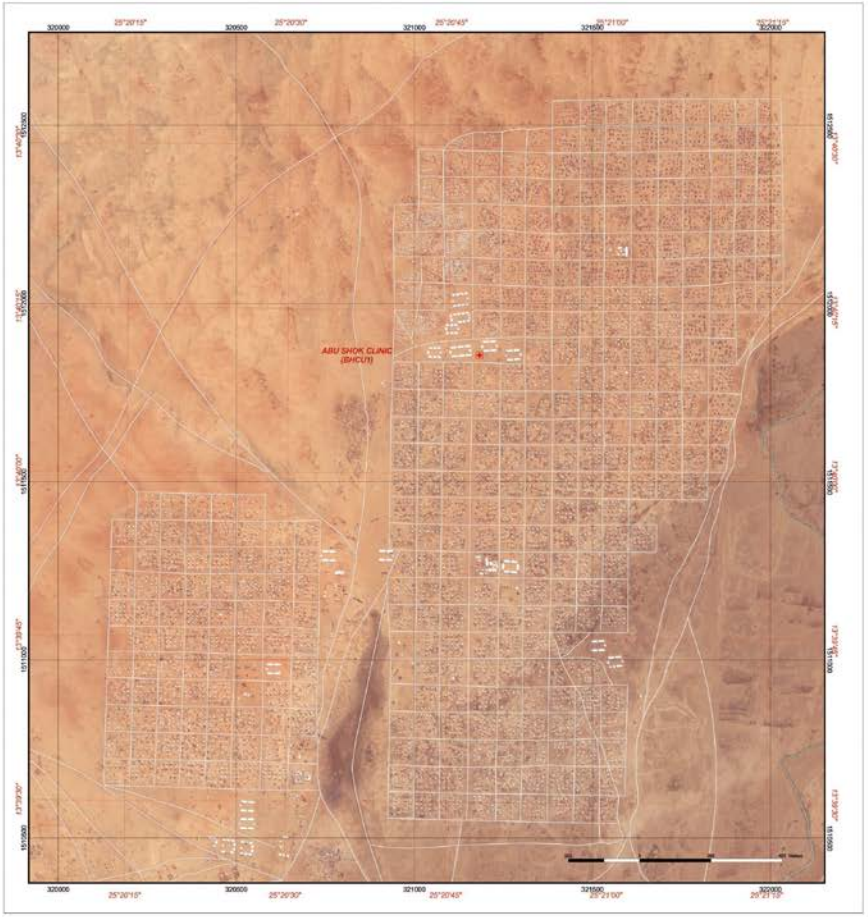
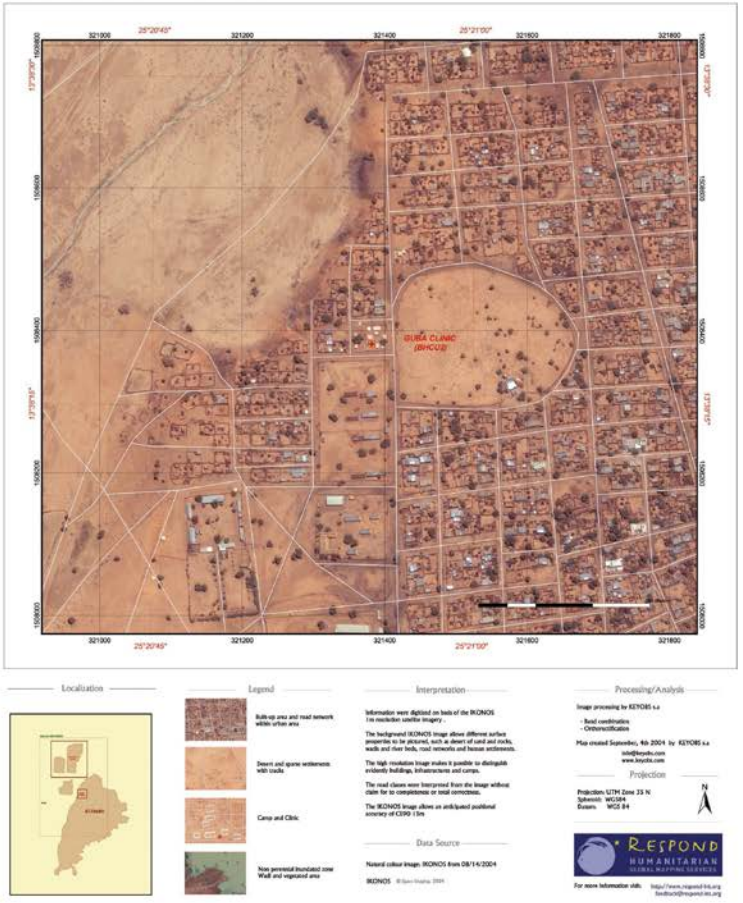





Mapping of Al Fashir: Guba Clinic (1:2k) & Abu Shoc IDP camp (1:5k)





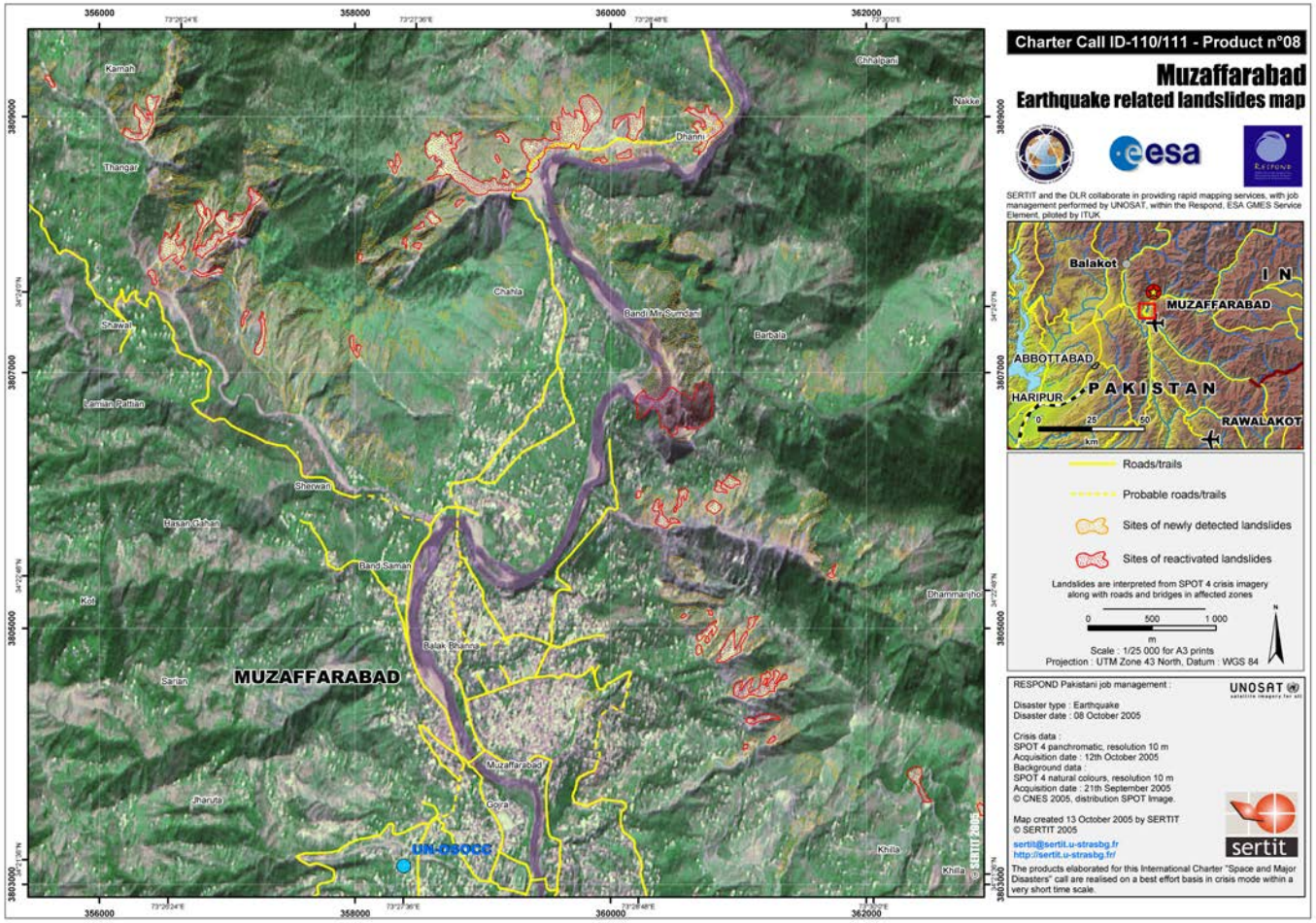
KEYOBS
Geo-Information Products and Services

Impact of Typhoon Haiyan which hit the Philippines on November 8 2013 (Charter Call 466)

Tacloban photographed on 13 Nov 2013 by a Pléiades satellite, which had captured images of the same zone on 7 Apr 2013.

Pléiades Satellite Images - Resolution: 50 cm;
Copyright: CNES 2013, Astrium Services - Spot Image

Rapid mapping example
The Asian EQ of 8 October 2005

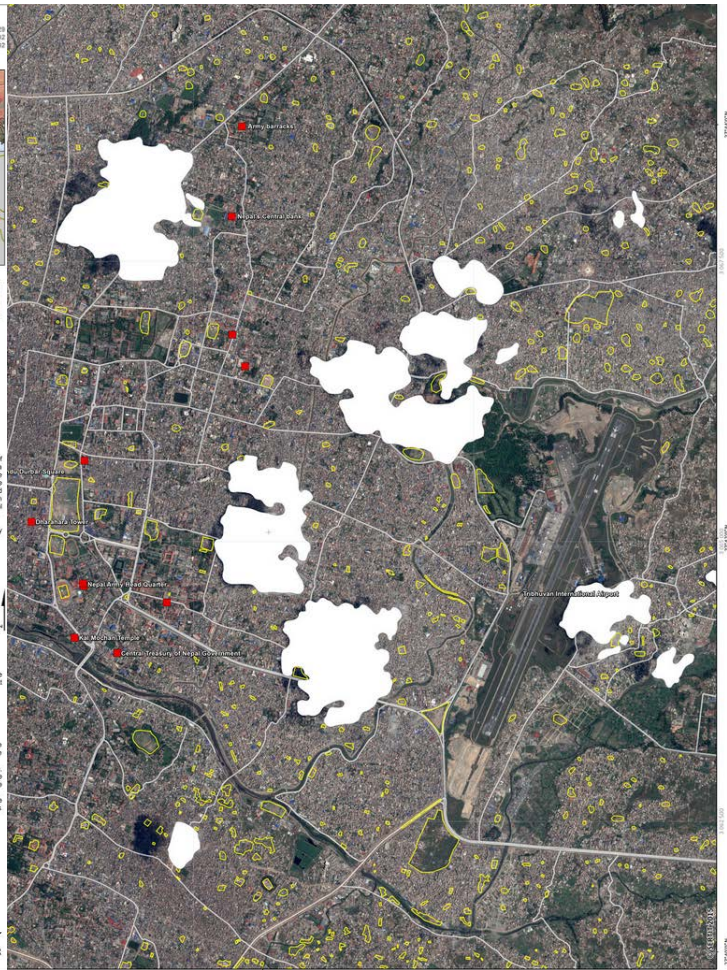


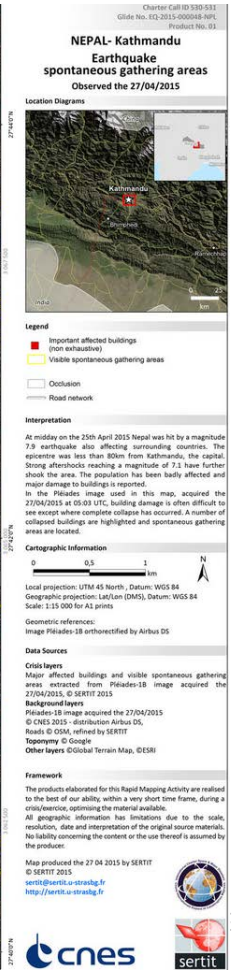
Landlsides map of Muzzafarabad (left); aid workers in the field using RESPOND maps; this Landlsides map was also given to UN Secretary General Kofi Annan & to Jan Egeland of OCHA at a donors meeting in Geneva in Nov 2005

The 25 April 2015 quake in Nepal

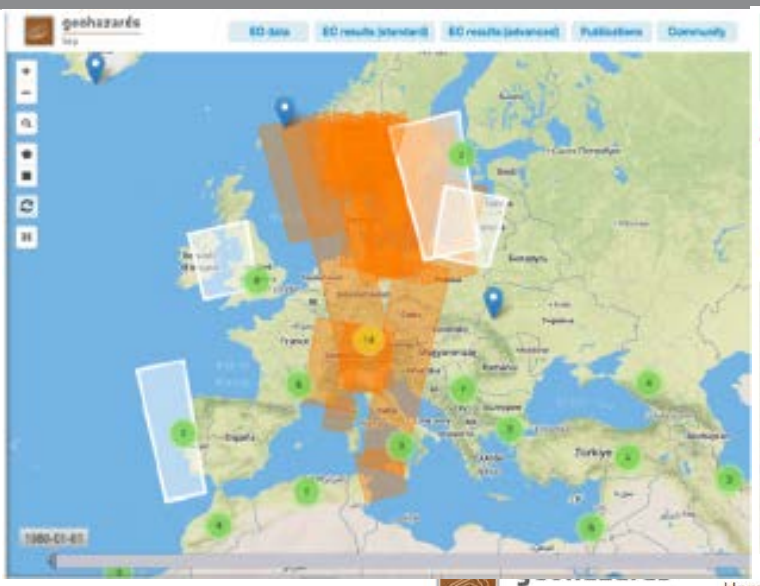
Products:

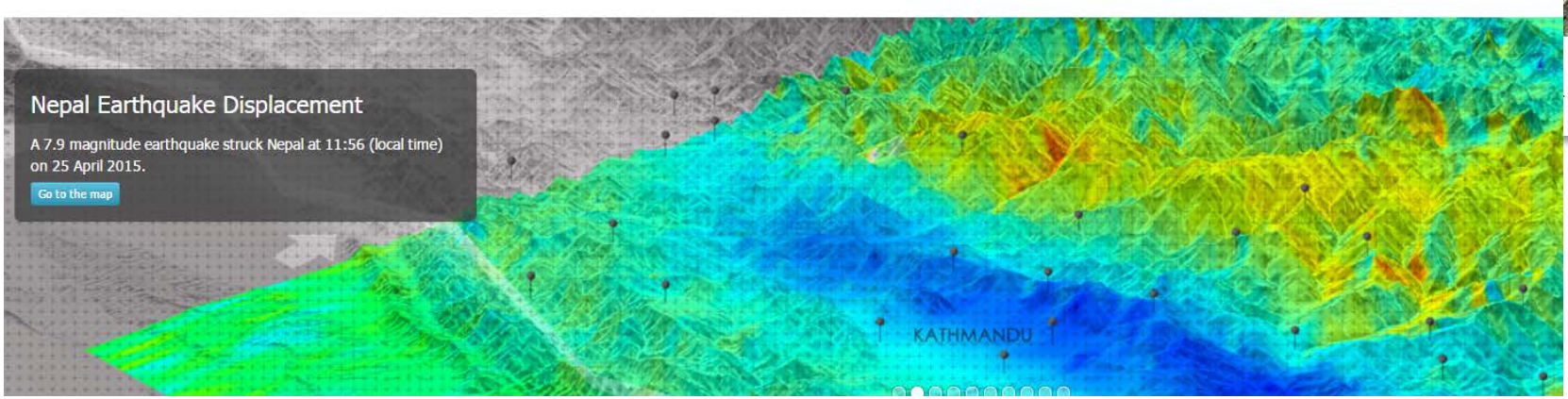
1. Background maps (up to date reference)
2. Situation maps (spontaneousgathering areas)
3. Damage maps (hazard impact, impact zonation)
4. Oher hazard impact assessment products (e.g. EQ triggered landslides, etc)





Innovation to better support DRM:

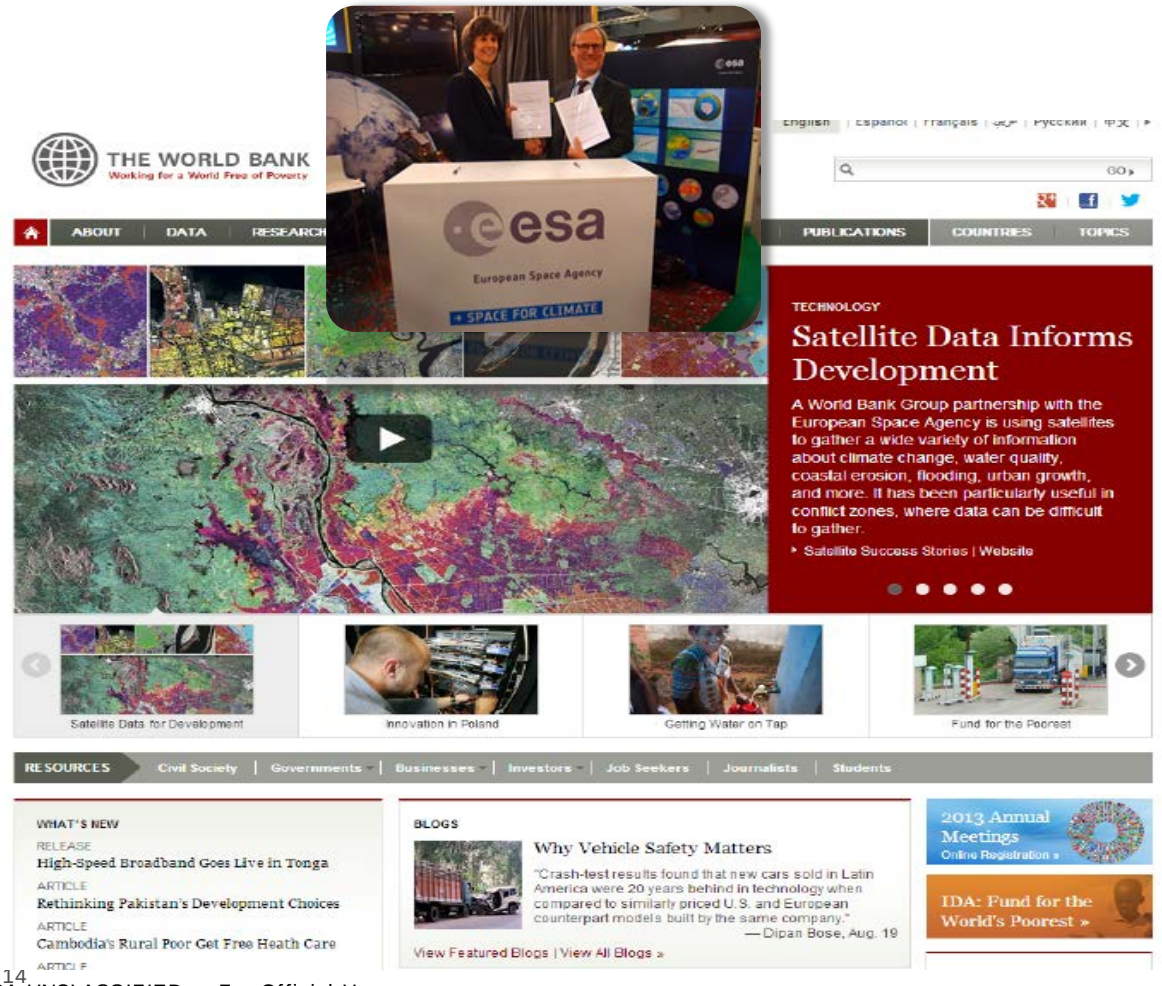


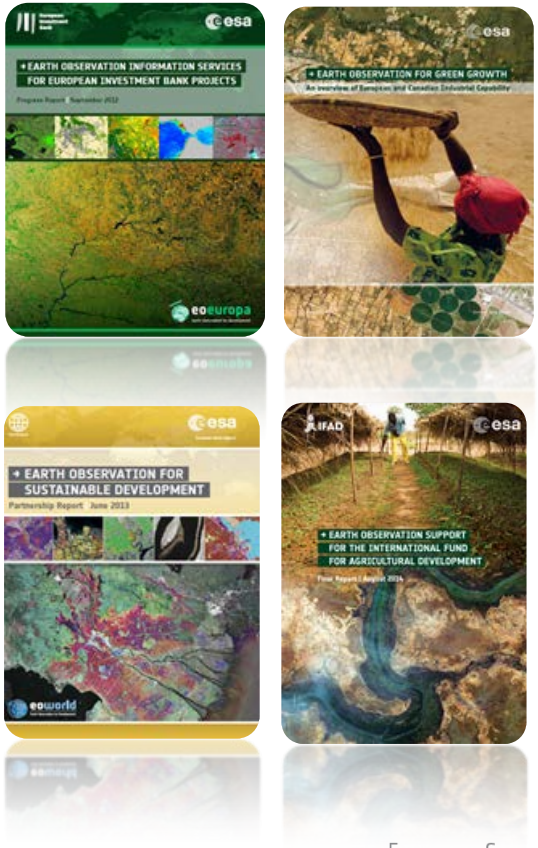


Virtualizing and federating EO processing through the Cloud: the ESA Thematic Exploitation Platforms **TEPs**.

Official Development Assistance (ODA):
EO as 'best-practice' environmental information

- Small-scale demonstrations of EO services in support of International Financing Institution (IFI) projects since 2008,

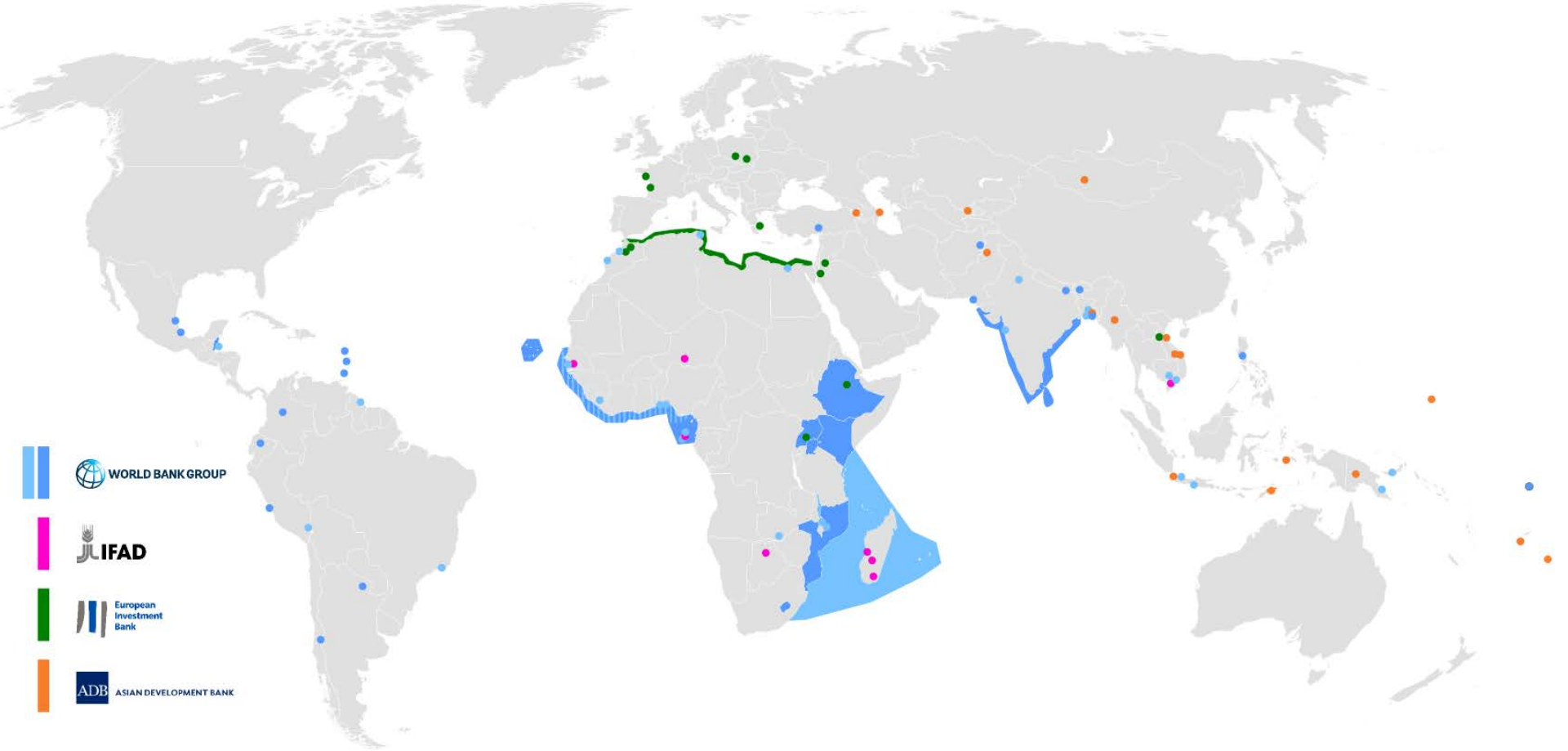




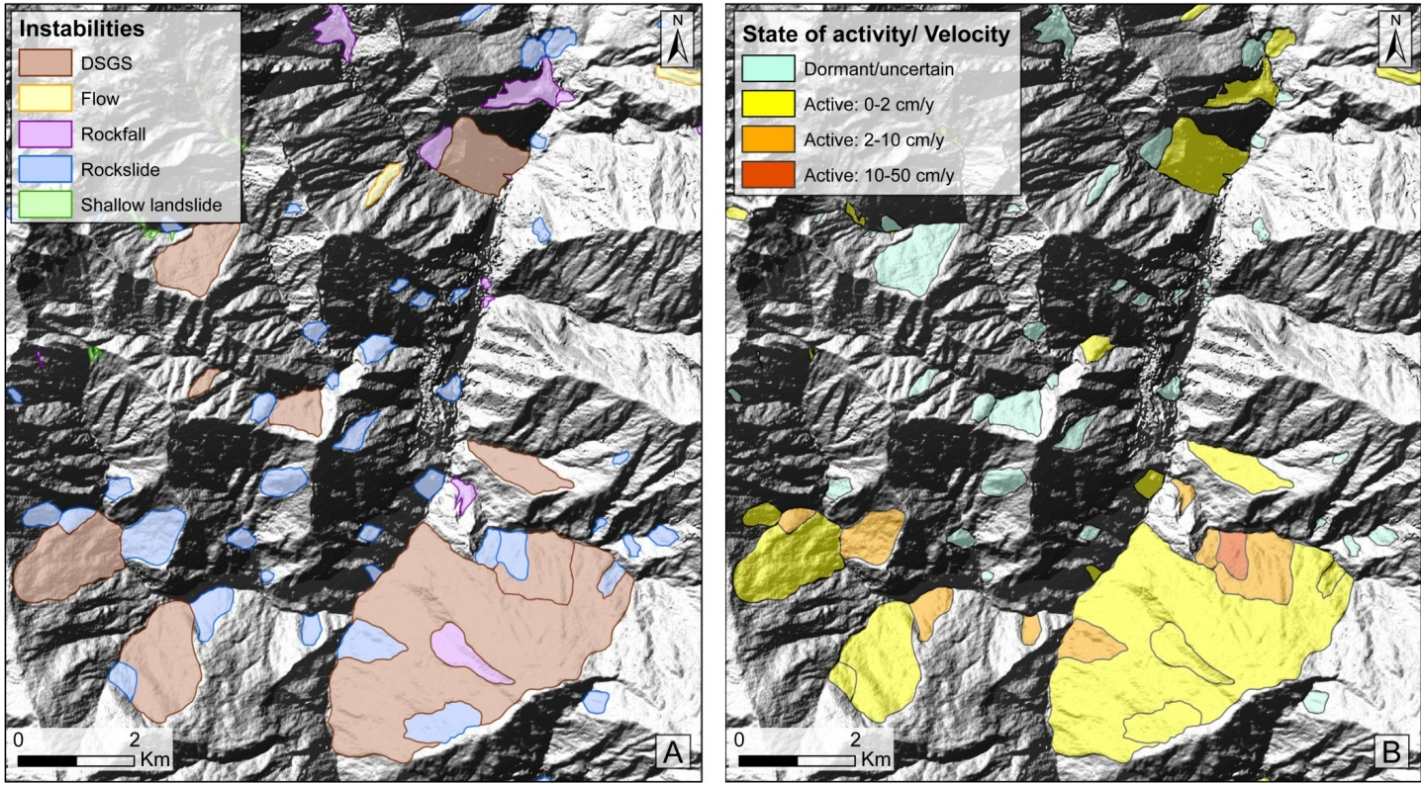
65 small-scale demonstrations :

Responding to specific geospatial information needs

- **Land** Urban Infrastructure, Land Cover, Forest, Crops, Soil erosion, In-land Water,
- **Marine** Oil-spill, Fishing, Coral Reef, Coastal Change, Sea-level Height, Ocean Currents,
- **Risk** Floods, Land Motion Histories for subsidence, landslides, seismic,

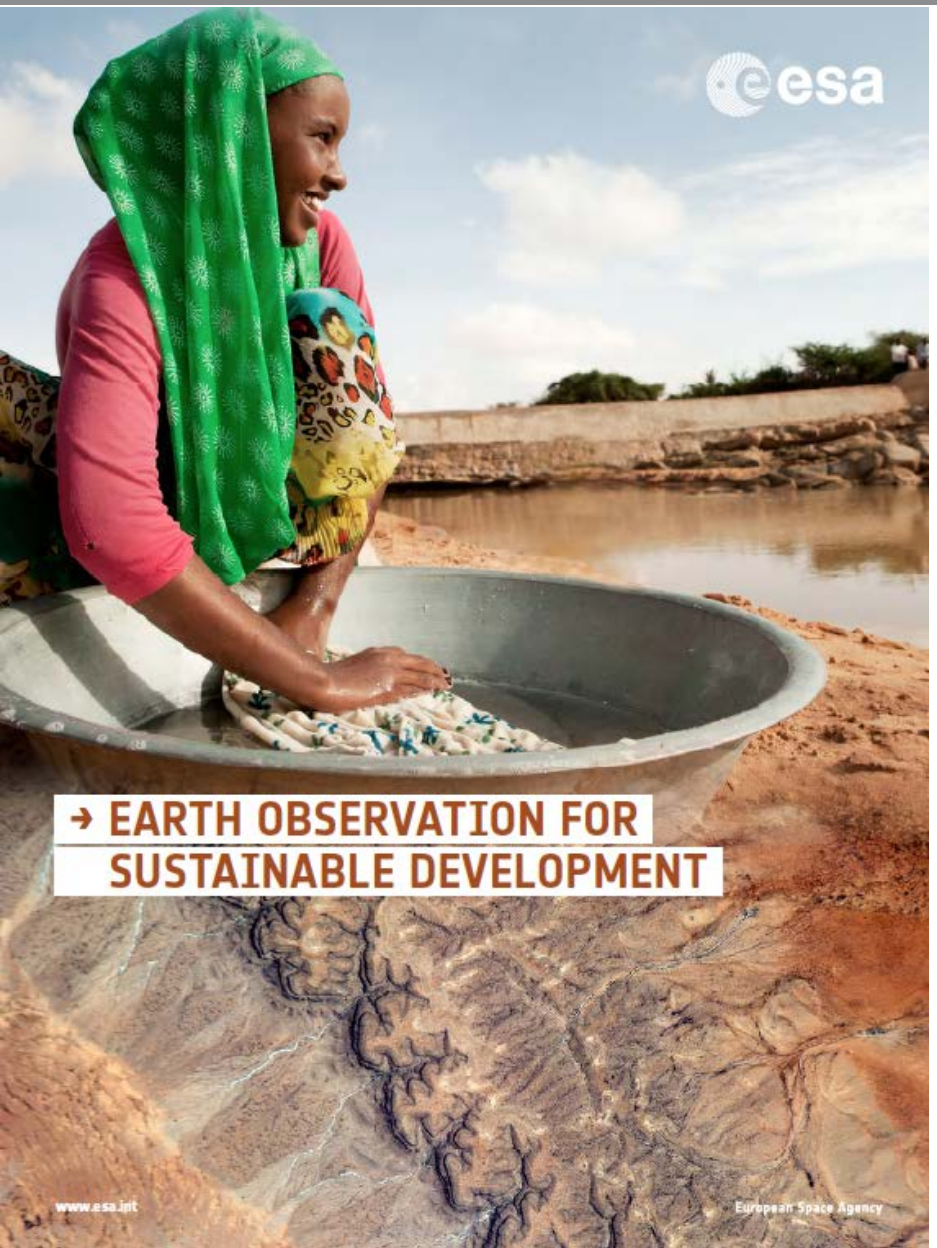


Example : A Disaster Risk Reduction pilot with WB in Nepal and Bhutan



Landslide mapping example in Lukla, Nepal. The compilation of **landslide inventory maps** (left) was based on the interpretation of satellite optical and stereo images (VHRO KOMPSAT-2, and HRO RapidEye and, Google Earth images) and the TanDEM-X 10 resolution DEM. The state of activity (right) was based on **precise terrain motion measurements** derived from SAR interferometry as illustrated in Figure 2. *Credits: MFB-Geo Consulting GmbH, Gamma Remote Sensing AG & SUPSI-IST for ESA/World Bank*.

Longer-Term Vision



- **Mainstream & Transfer EO** into operational working processes of international development – in countries & Multi-lateral Development Banks

- **EO As 'best-practice' source of environmental information** in Environmental Impact Assessment (EIA), Monitoring & Evaluation (M&E) methodologies

- **Priority thematic areas :**

  Urban, Marine, Agriculture, Risk Management, Energy, Water, Forest, Ecosystems, Fragile States, Climate Resilience & Proofing.

Take home messages:

Supply

- **Satellites :** A large number of satellites with a wide range of capabilities are becoming available; (VHR, high re-visit, wide coverage, systematic acquisition), Long-term continuity of these sources and types of data is assured,
- **Services :** EO is moving from an R&D technology to a basis for provision of operational geo-information services, Different EO services for DRM are developed and validated. Technical specs, accuracies, limitations, constraints, costs are all documented, World-wide providers and practitioners exist with advanced capacities to exploit EO for geohazards (US, Canada, Japan, China, etc).

Demand

- **Disaster Response**: the International Charter and the Copernicus EMS are growing; more users (both Civil protections and the International Humanitarian community), increased performance, rapid mapping methods are adopted by more and more end users
- **Prevention / preparedness** (risk assessment): more EO based risk information used by mandated organisations (But in many countries of the world users are *not aware or cannot afford EO based solutions).*

Earth Observation
A Necessity