United Nations Institute for Training and Research

UNOSAT

Overview of UNITAR-UNOSAT and GDACS Satellite Mapping Coordination System

Trainer
Luca Dell'Oro

21 Feb 2017

Applied Remote Sensing Training Program

In Partnership with the National Aeronautics and Space Administration

NASA

Outline

- **Overview of UNITAR's Operations Satellite Applications Programme (UNOSAT)**
- **UNOSAT Humanitarian Rapid Mapping Framework**
- **Operational Case Studies**
  - Natural Hazards
  - Complex Emergencies
- **UNOSAT Platforms and Tools for Data Sharing And Satellite Mapping Coordination**
  - GDACS Satellite Mapping Coordination System - SMCS
- **Questions and Answers**

Learning Objectives

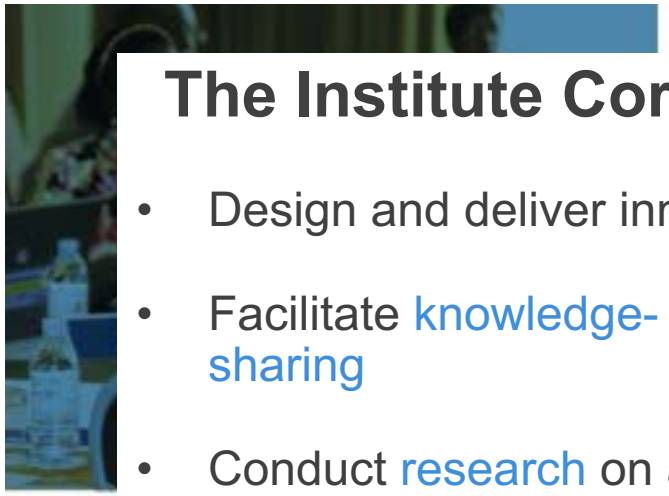
The aim of the lecture is to provide participants with an overview of the UNOSAT operational humanitarian rapid mapping service to support planning and coordination of UN agencies and UN Member States during humanitarian crises.

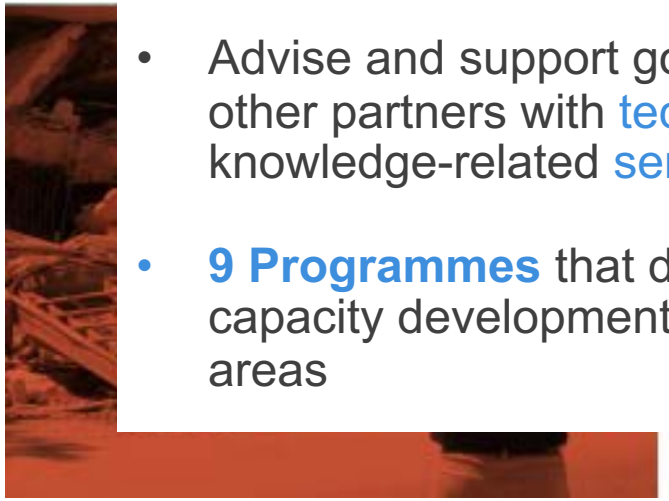
At the end of the lecture participants should be able to:

- Describe UNOSAT's operational activities including satellite derived analysis in support of international humanitarian operations.

- Describe how the GDACS-Satellite Mapping Coordination System (SMCS) supports data sharing and satellite mapping coordination during major disasters.

About the United Nations Institute for Training and Research (UNITAR)





The Institute Core Functions

- Design and deliver innovative training
- Facilitate knowledge- and experience-sharing
- Conduct research on and pilot innovative learning strategies
- Advise and support governments, UN and other partners with technology-based knowledge-related services
- **9 Programmes** that deliver training and capacity development in specific focus areas

Thematic Areas

- Capacity for the 2030 Agenda
- Strengthening multilateralism
- Advancing environmental sustainability and green development
- Improving resilience and humanitarian assistance
- Promoting sustainable peace
- Promoting economic development and social inclusion

www.unitar.org

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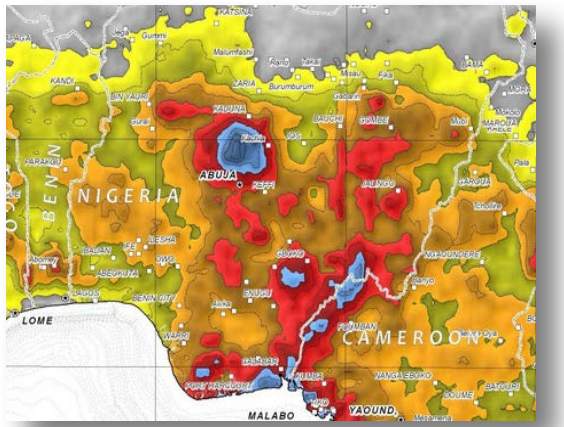
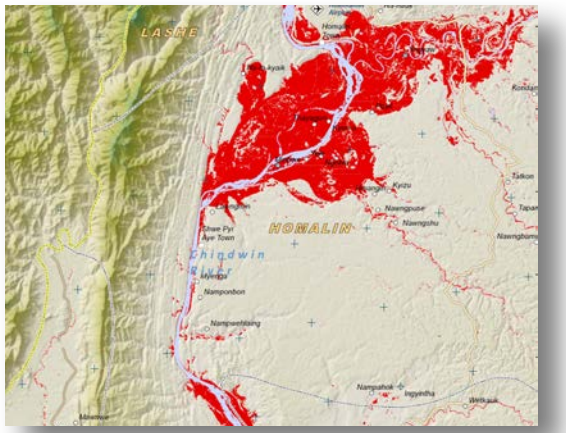
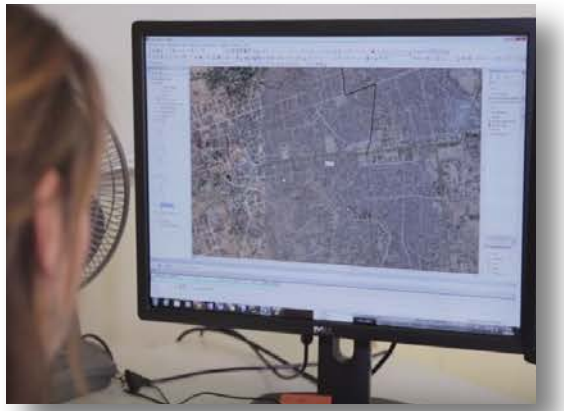
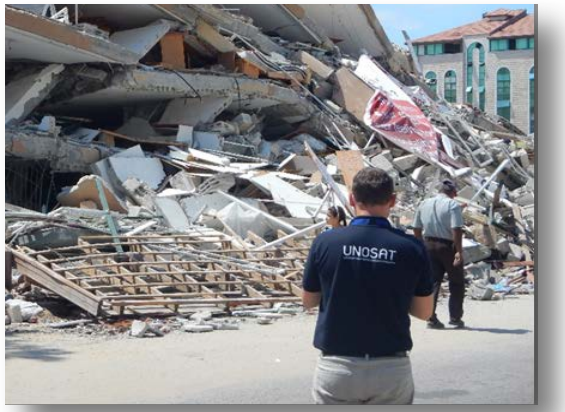
UNOSAT: UNITAR Satellite Applications Programme

- An operational programme of UNITAR serving the UN, international organizations and governments
- Fully dedicated to satellite imagery analysis, applications of geospatial information technologies, training and capacity development
- Operational since 2001
- Currently 30 employees









www.unitar.org/unosat

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UNOSAT Activities

ANALYSIS & MAPPING

Satellite Analysis, Climate Service, Applied Research and Innovation

TRAINING AND CAPACITY DEVELOPMENT

Hands on, National and Regional level, Technical Backstopping

Geospatial Support services & Knowledge Transfer

Training and Capacity Development

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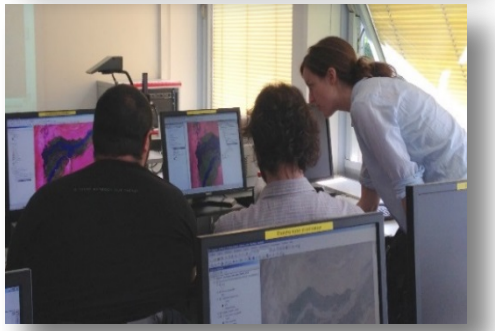
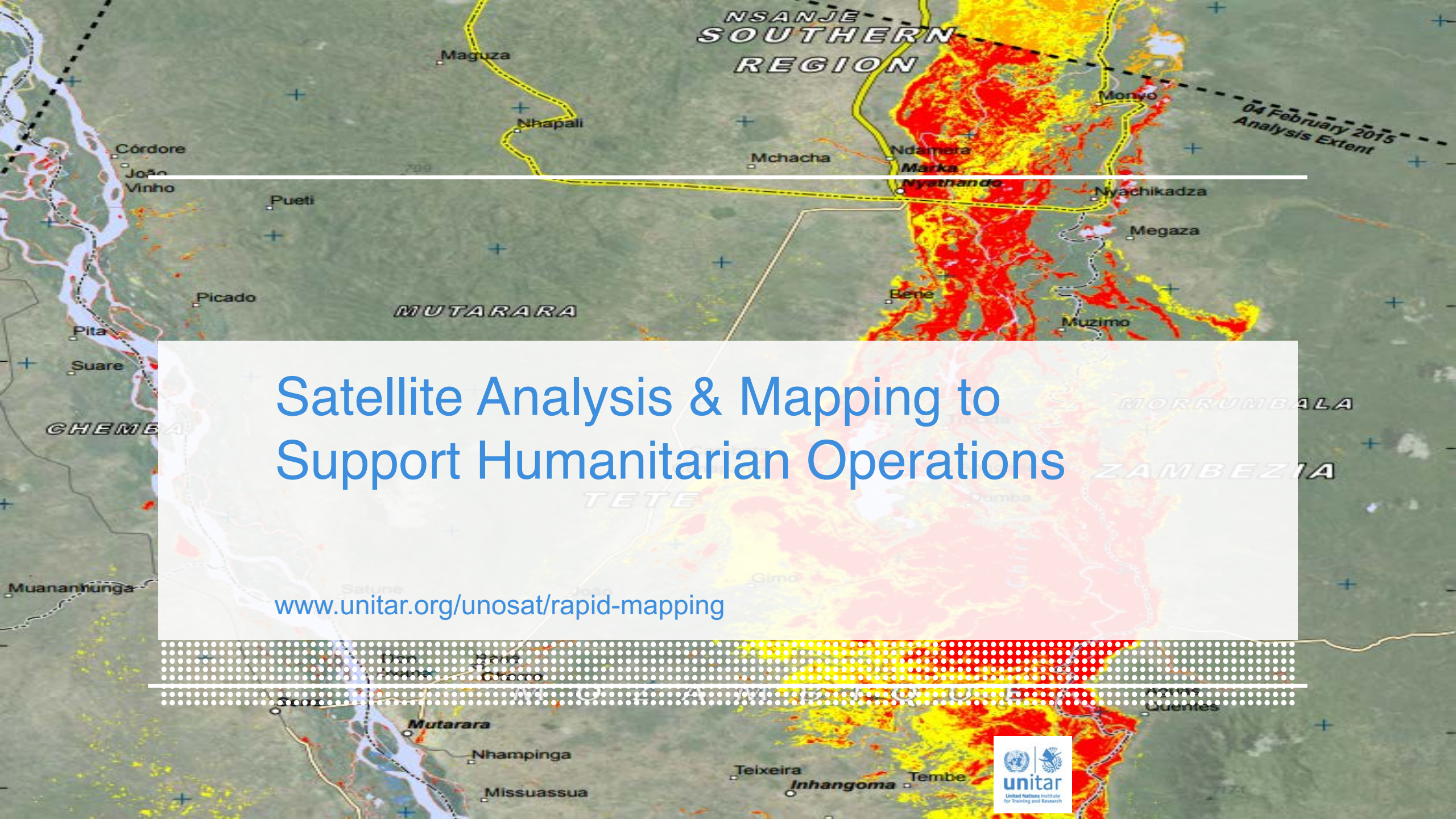
United Nations Institute for Training and Research

Training & Capacity Development Activities

- Master level courses
- Basic and advanced courses
- Capacity development programmes
- Workshops and information sharing

- We design and deliver (basic and advanced) training on the use and applications of Geospatial Information Technology (GIT) for disaster risk reduction.
- Courses are delivered face-to-face either in situ or at the headquarters in Geneva, Switzerland, and can be customized to needs.
- **Target Audience:** Professionals from:
  - National governments
  - Regional and international organizations
  - UN agencies
  - Academia
  - The private sector





Satellite Analysis & Mapping to Support Humanitarian Operations

www.unitar.org/unosat/rapid-mapping

UNOSAT's Humanitarian Rapid Mapping Service

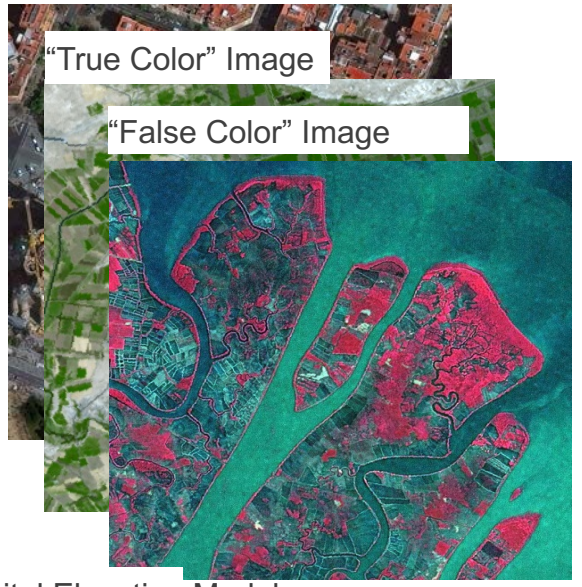
- UNOSAT provides **Satellite Imagery Analysis** during **Humanitarian Emergencies** – **Natural Disasters and Conflict-Situations** (Maps, GIS-ready data, statistics and reports).
- Several hundred-thousands sqkm of satellite images from commercial and scientific sensors are acquired and processed by UNOSAT (per year): from very high resolution (50 cm), to low resolution (1km)

OPTICAL:

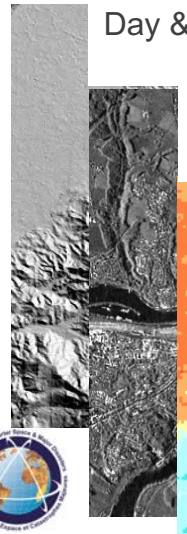
DG (Worlview-1/2/3, GeoEye) ; Pléiades ; MODIS, Landsat-8 ; Sentinel-1/2, Landsat 8, Deimos, KOMPSAT-2/3

RADAR :

- Sentinel-1 / Radarsat-2 / TerraSAR-X / CosmoSkyMed/ RISAT, ALOS-PALSAR

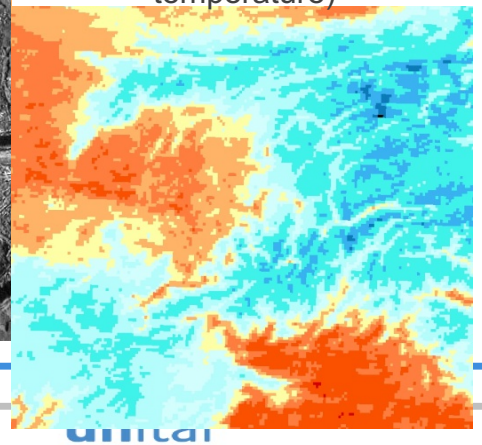


Digital Elevation Models



Day & night – Cloud free radar image

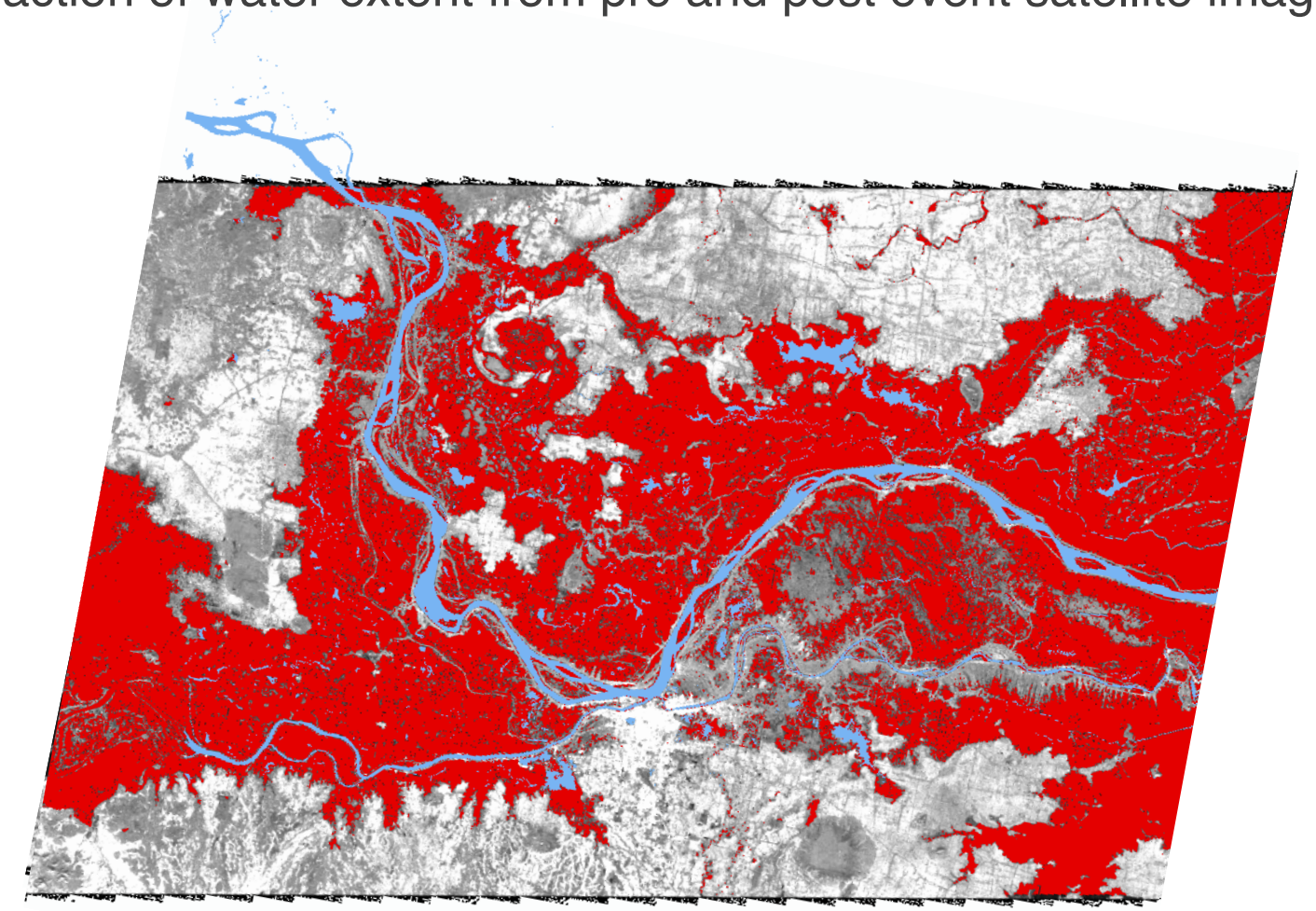
Gridded data (e.g., Precipitation, soil/water temperature)



Benefits of Satellite Imagery in Emergency Response

- Scale flexibility
  Many different optical and radar sensors orbiting the earth capable to provide evidence based information at global, regional and local scale.
- Daily to weekly imagery acquisition
  Capability to monitoring sudden/slow onset disasters as well as protracted crisis worldwide.
- Multiplicity of spectral bands
  Fine discrimination of physical and spectral characteristics of objects and features on the ground (to assess impacts and damages: buildings, infrastructures, roads, agricultural areas etc.).
- Absence of political or physical limits
  Imagery acquisition covering covering thousands of sqkm. Ideal to get information regarding remote, inaccessible or/and politically sensitive areas..
- Information-objectivity / evidence based
  Since satellites record what actually exist on the ground nobody can argue that information has been omitted or changed (common ground for stating facts and framework for negotiations)

Extraction of water extent from pre and post event satellite image



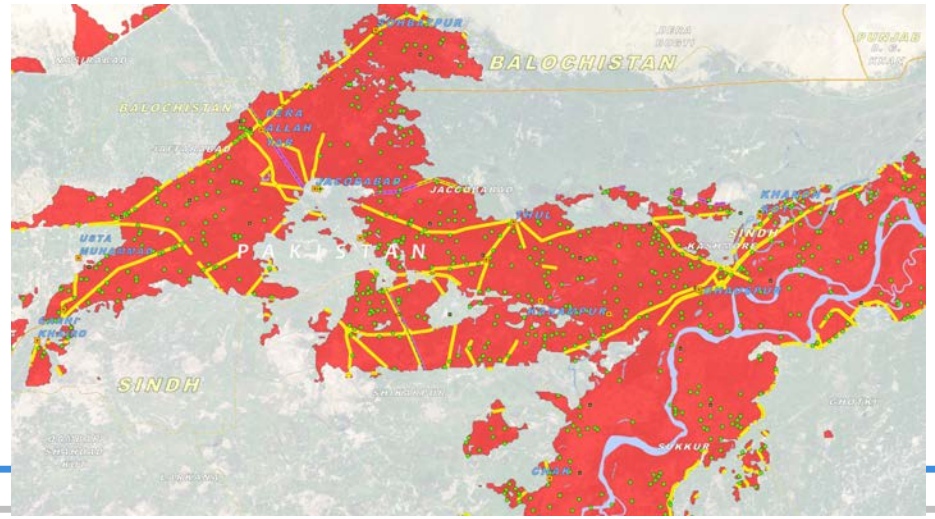
Preliminary Exposure/Impact Analysis

Vector Baseline Data

Population distribution

+

UNOSAT Flood Water Analysis



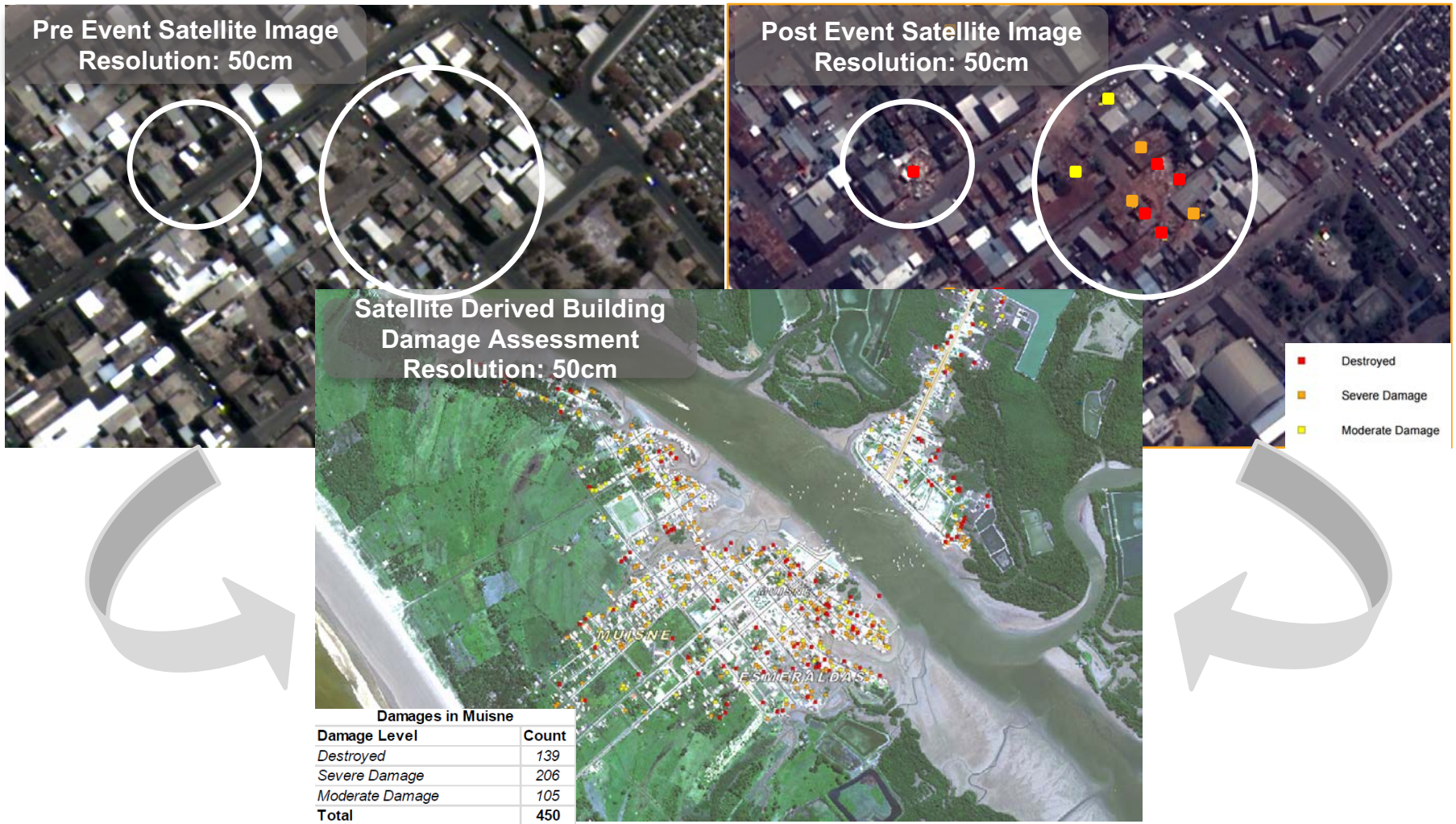
Combination of data allows for detailed and comprehensive preliminary exposure analysis

Summary of Flood-Affected Populated Places and Infrastructure

Province	BALOCHISTAN	KHYBER PAKHTUNKHWA	PUNJAB	SINDH	Others	Total
Village Count	174	808	4,037	2,463	10	**7,492**
Towns / Cities	6	39	54	36	0	**135**
Health facilities	12	20	70	88	0	**190**
Bridges	11	183	139	95	1	**429**
Roads (km)	313	772	1,613	2,331	21	**5,051**
Railways (km)	10	27	169	199	0	**406**

Satellite Analysis for exposure/impact and damage analysis

Visual Interpretation of level of building damage from Pre and Post VHR Image



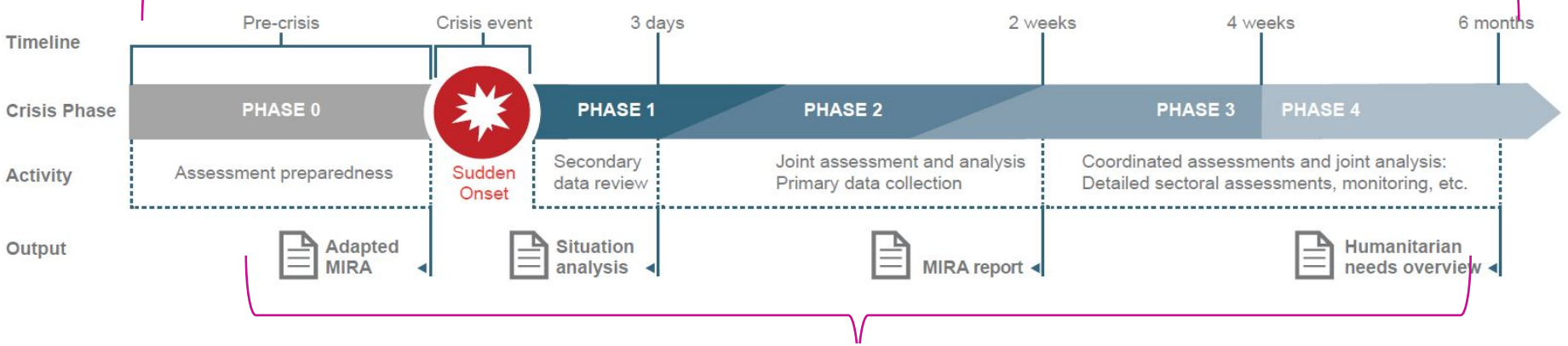
Damages in Muisne	
Damage Level	**Count**
Destroyed	*139*
Severe Damage	*206*
Moderate Damage	*105*
Total	**450**

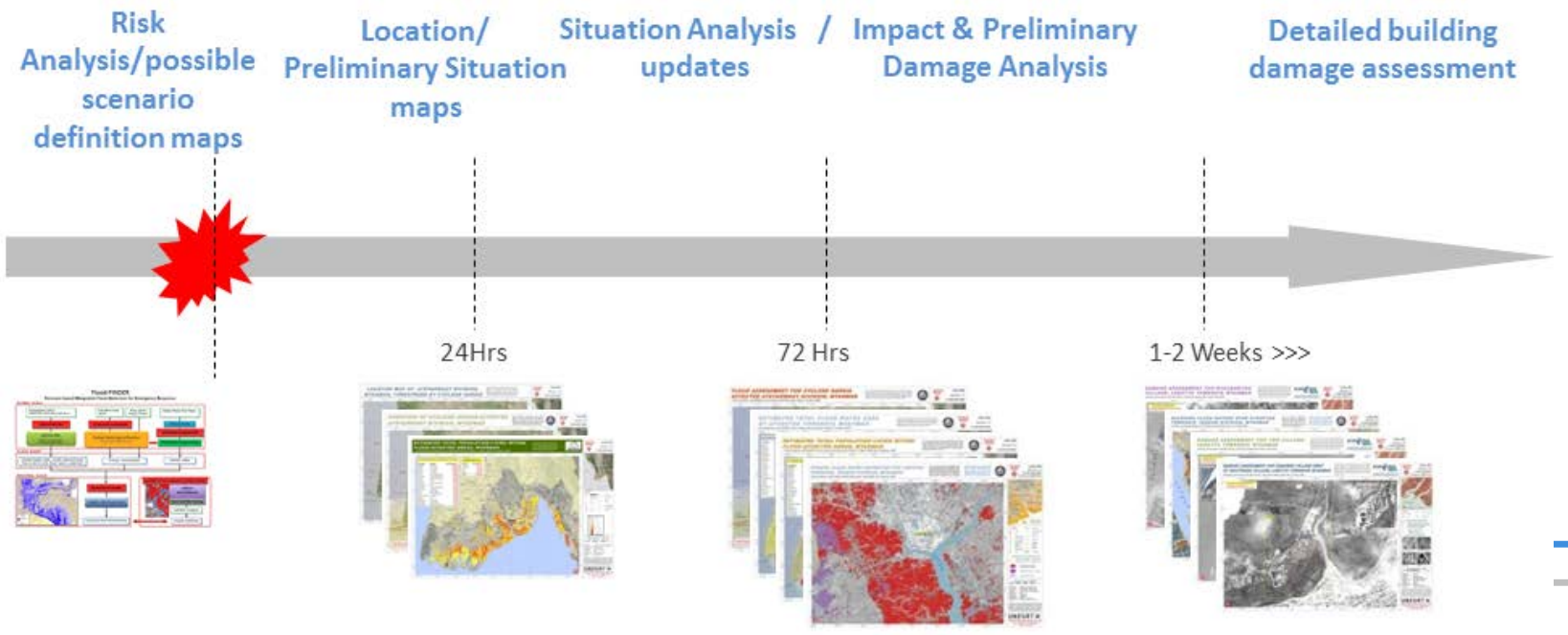
International Humanitarian Response

"A complex emergency or **major disaster** is a multifaceted humanitarian crisis in a country, region or society where there is total or **considerable breakdown of authority and response capacity** which requires a multi-sectoral, international response that **goes beyond the mandate or capacity of any single agency and/or ongoing UN country programme**"

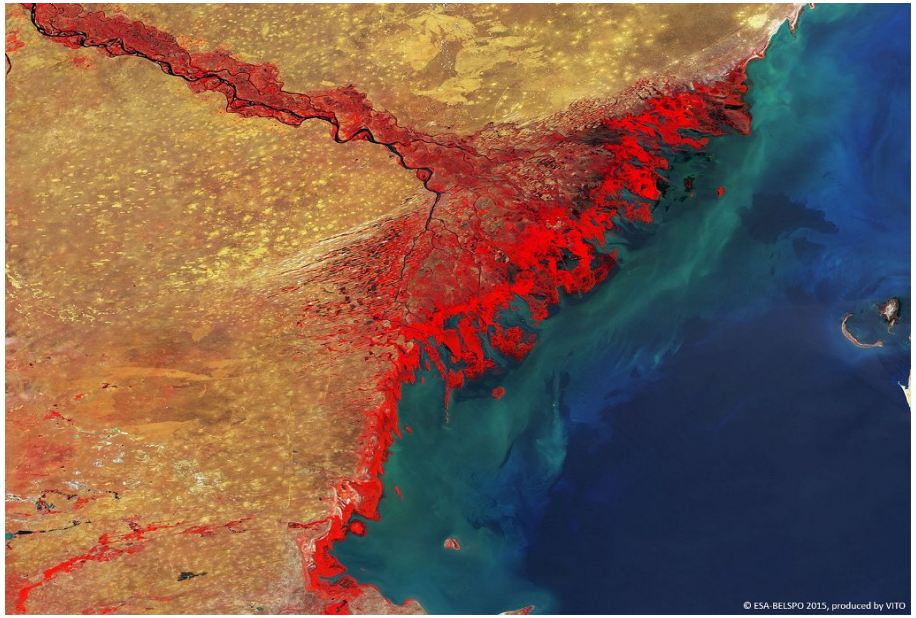
Inter-Agency Standing Committee, Dec 1994.

UNOSAT'S Rapid Mapping Operational Framework





UNOSAT Rapid Mapping: Satellite Derived Products



Natural Disasters:

- ✓ Floods
- ✓ Drought
- ✓ Cyclones
- ✓ Landslides
- ✓ Earthquakes
- ✓ Volcanic eruptions

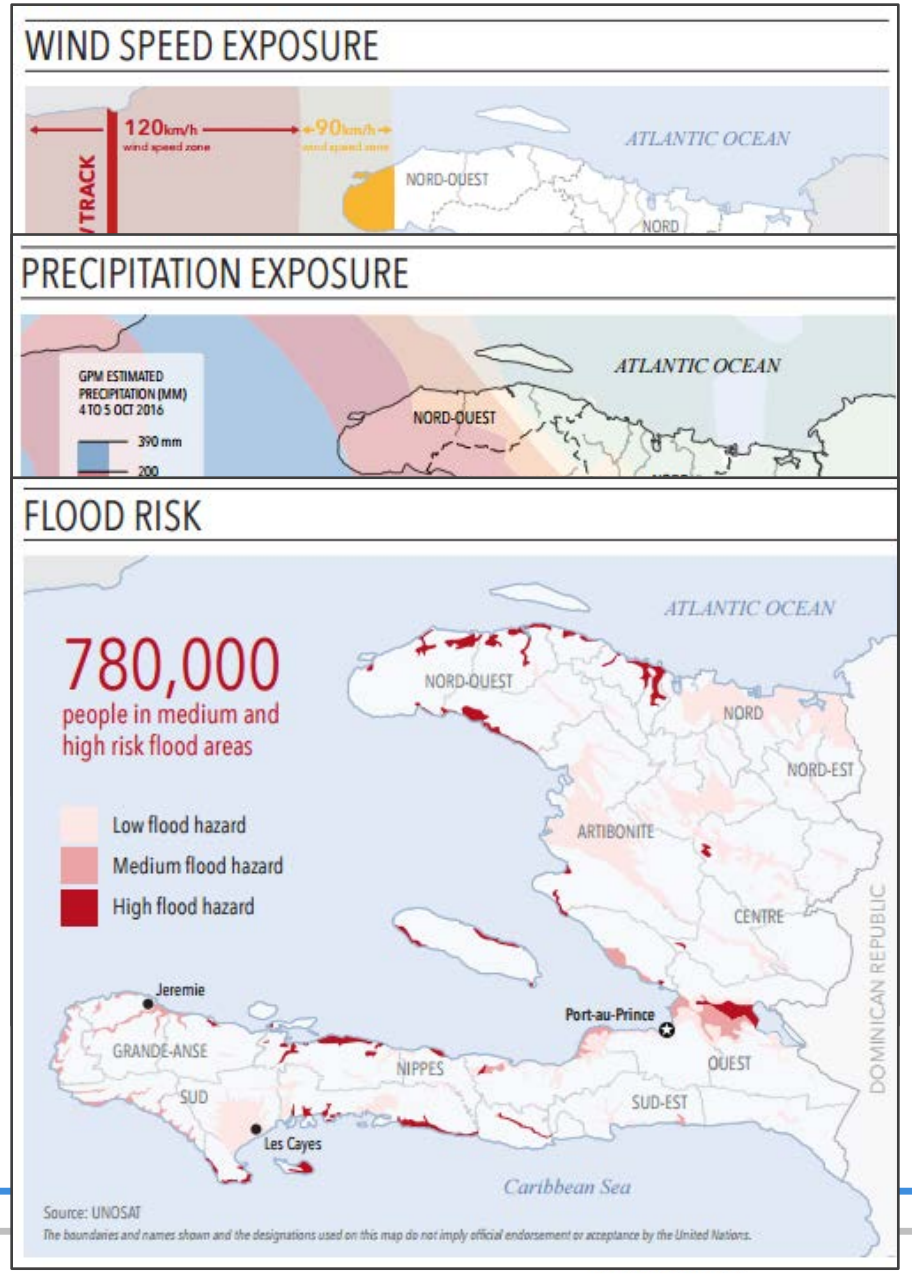
Conflicts:

- ✓ Refugee and IDPs mapping
- ✓ Conflict damage assessment
- ✓ World Heritage Sites
- ✓ And so on..

Source: NASA Earth Observatory

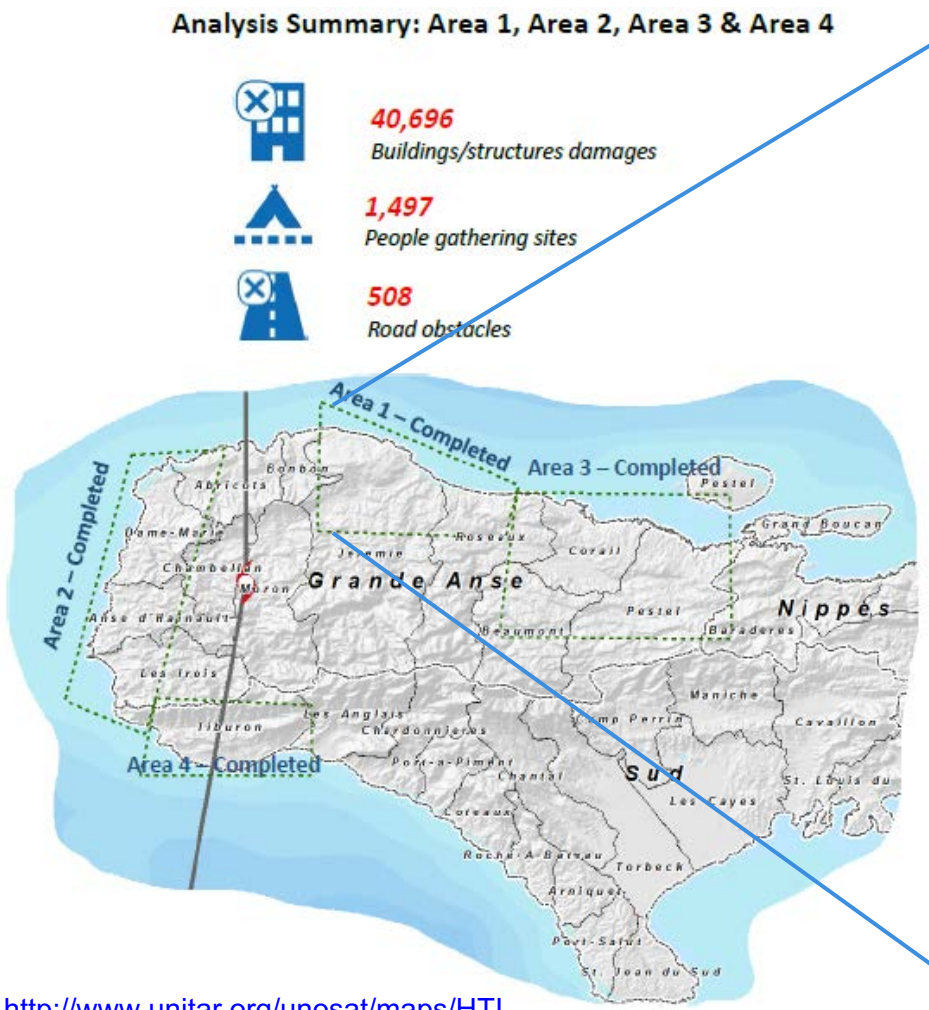
Haiti - Hurricane Matthew 2016: Geospatial approach to estimate Population exposure / impact and damage to infrastructures **(Natural Disaster)**

Hurricane Matthew, a Category 4 storm with sustained winds of 235 km/h, violently struck south-western Haiti on 4 October causing widespread damage, flooding and displacement.



Haiti - Hurricane Matthew 2016: Geospatial approach to estimate Population exposure / impact and damage to infrastructures **(Natural Disaster)**

Building damage analysis, including a rapid assessment of transportation network conditions and locations of spontaneous people gathering sites.



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

Buildings and/or structures damaged in Marfranc section Cmmunale

UNOSAT Satellite Analysis Support – SYRIA CONFLICT

Since the conflict in Syria started in March 2011, Humanitarian Community requires information to plan efficient delivery of humanitarian assistance to affected population and people in needs.

Due to accessibility constrains in conflict areas **UNITAR-UNOSAT has been requested by different humanitarian actors to monitoring conflict situation using satellite imagery and provide evidence based analysis**

ESTABLISH A DYNAMIC HUMANITARIAN MONITORING SYSTEM

DAMAGE ASSESSMENT IN URBAN CENTERS

REFUGEE, IDP & MIGRANT MAPPING

Military presence in the outskirts of Jisr Al Shugar, Idlib Governorate

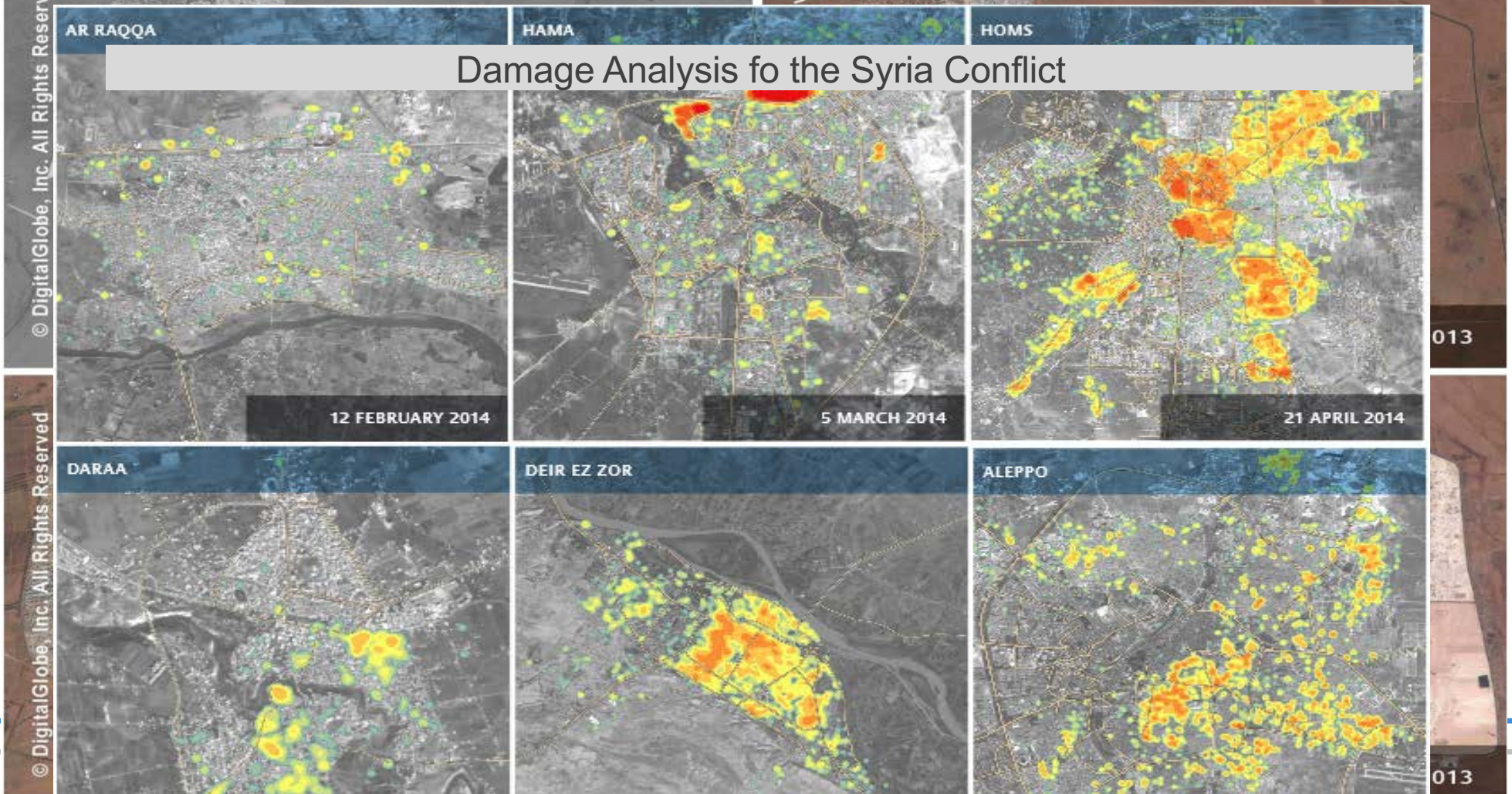
Monitoring Critical Facilities: Damage assessment to Markets

Oil Pipelines

Population Displacement

Monitoring of Refugee Camps

Damage Analysis fo the Syria Conflict



UNOSAT Platforms and Tools for data sharing and GDACS Satellite Mapping Coordination System

https://gdacs-smcs.unosat.org/

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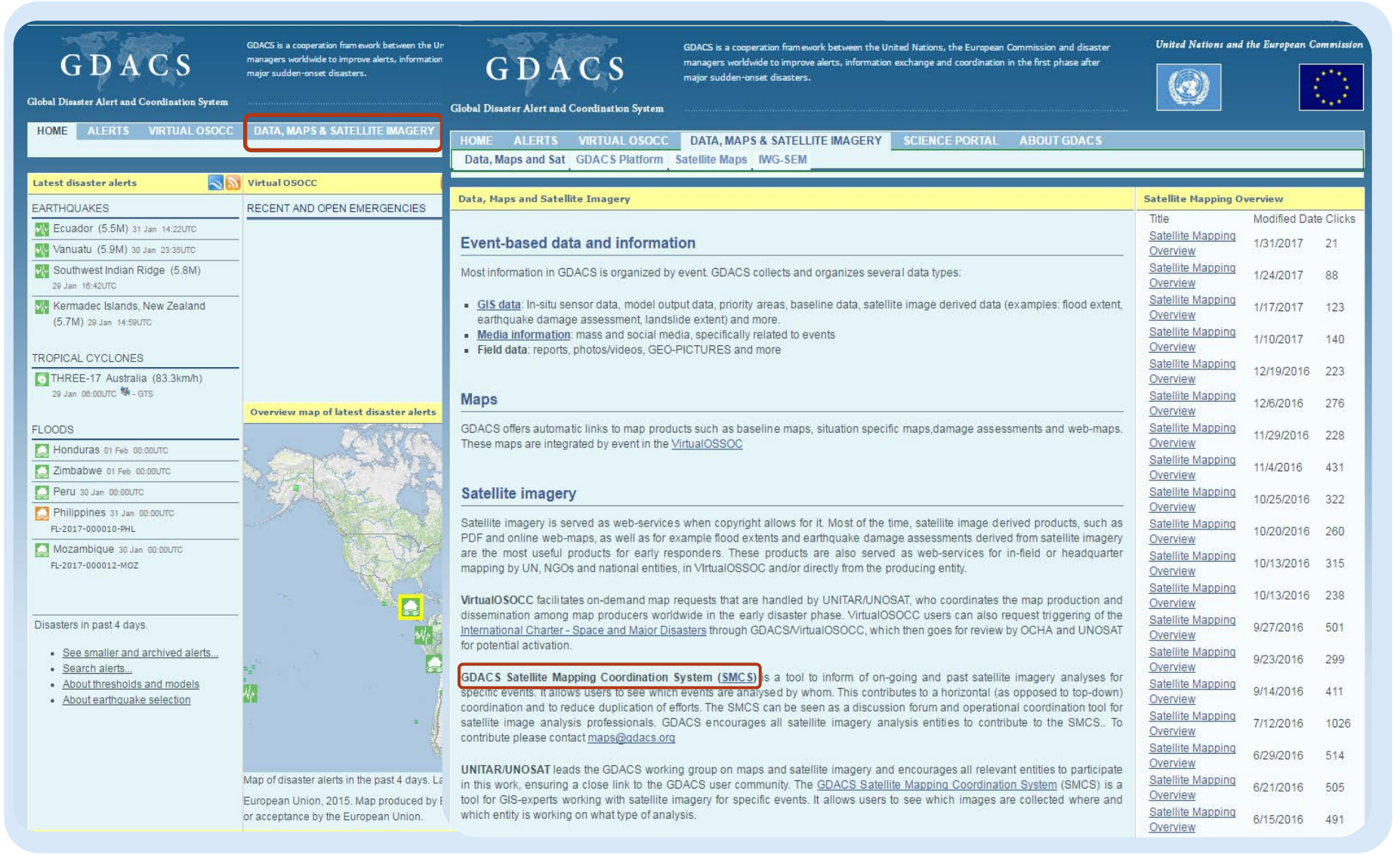
The Global Disaster Alert and Coordination System (GDACS)

The **Global Disaster Alert and Coordination System (GDACS)** was established in 2003 by the United Nations and the European Commission to fill the information gap in the immediate aftermath of sudden-onset natural disasters.

- GDACS is designed to alert the international community in the event sudden-onset disasters that might require international assistance, and to facilitate international information exchange and coordination in the first phase of a disaster.
- GDACS aims at supporting member states and relief organizations in their decision-making process through several tools and services provided in real time through the on-line platform.
- The services and tools provided by GDACS are:
  - **Automatic disaster alerts**
  - **Automatic impact estimations**
  - **Real-time coordination platform for disaster managers**
  - **Satellite Mapping Coordination System (SMCS)**
  - **A community of practice**

Global Disaster Alert and Coordination System (GDACS)



GDACS - Satellite Mapping Coordination System (SMCS)

Satellite Mapping Coordination System (SMCS)

GDCAS-SMCS is a platform for **coordinating satellite imagery analysis & mapping** following **major disaster events** for the benefit of **GDACS stakeholders** and the wider humanitarian community.

The SMCS is a tool used by users working with satellite imagery for specific events that allows to see which images have been collected, their coverage and which entity is working on what type of analysis. In addition to being an operational coordination tool for satellite image analysis professionals, SMCS is also a metadata archive for past events, and a discussion forum.

1. **S**atellite **M**apping **C**oordination
2. **S**atellite **M**apping Overview **R**eports
3. **L**ive **M**aps

https://gdacs-smcs.unosat.org/

Satellite Mapping Coordination – Overview 2016

11 Emergencies
1 Simulation

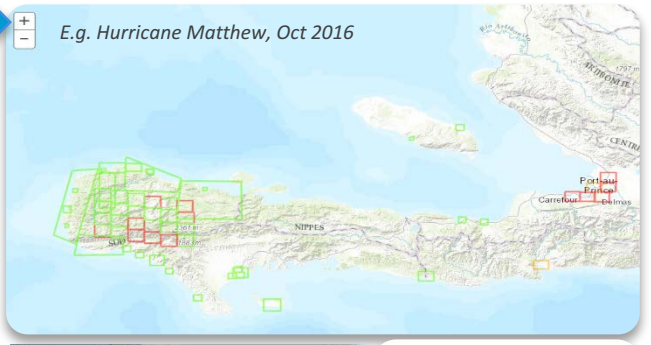
6 5 1

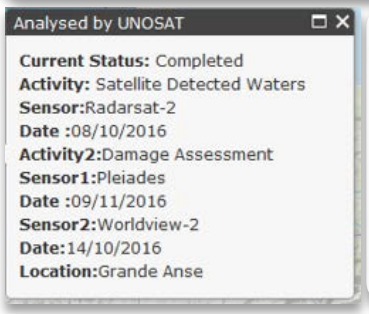
75% Requested by UNOCHA

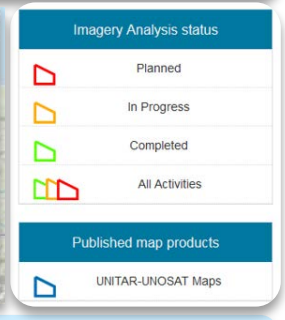
GDACS - Satellite Mapping Coordination

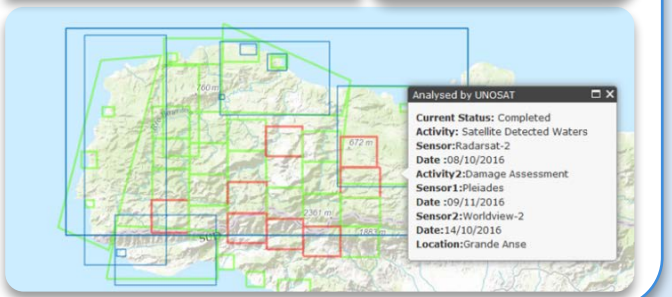
Satellite Mapping Coordination

- **Who does What, Where in terms of Satellite Analysis & Mapping?**





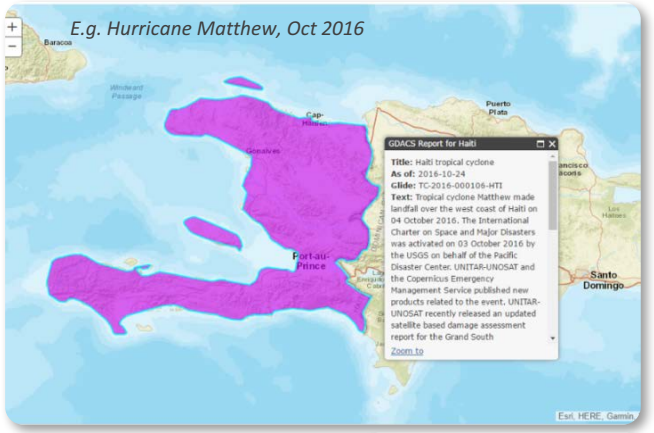


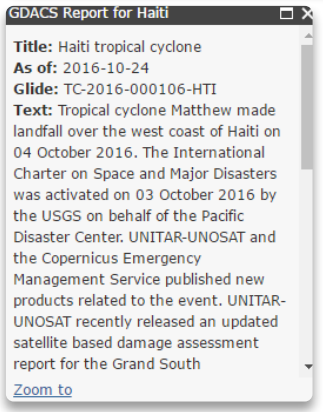


GDACS - Satellite Mapping Overview Report

Satellite Mapping Overview Reports

- **Narrative overview & summary of ongoing satellite mapping emergencies**



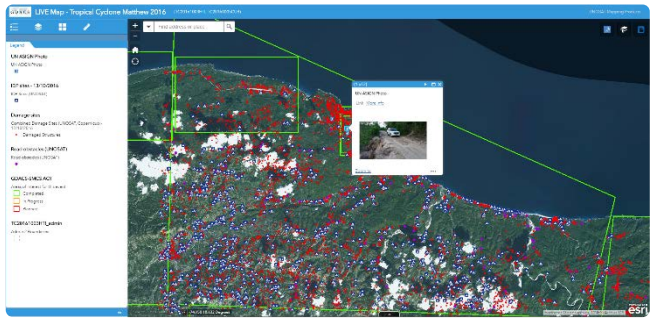


GDACS - Live Maps

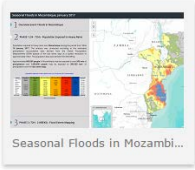
Live Maps

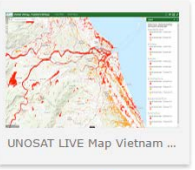
- **UNOSAT LIVE MAP** allows users to interact with satellite imagery analysis in an intuitive and eye-catching manner, allowing easy visualisation of the affected areas, and allowing users to focus on what interests them most, giving a better local understanding of the situation. These maps are updated as new data is available over the course of an event

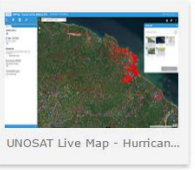
E.g. Hurricane Matthew, Oct 2016



Latest UNOSAT Live Maps


Seasonal Floods in Mozambi...


UNOSAT LIVE Map Vietnam ...


UNOSAT Live Map - Hurrican...

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Resources for Reference

UNITAR	https://www.youtube.com/watch?v=48bSEKW4W3w&feature
UNOSAT's Rapid Mapping	https://www.youtube.com/watch?v=FkR3N5ktt4U
Master level training course with University of Copenhagen	https://www.youtube.com/watch?v=oXe4aACkvzk
Unmanned Aerial Systems for Rapid Mapping	https://www.youtube.com/watch?v=3lU0-KqGqkg
Growth of AlZaatari Refugee Camp	https://www.youtube.com/watch?v=g2h-UEdgiQs
UNOSAT at TEDx: There is nothing natural about disasters	https://www.youtube.com/watch?v=h7fbfZxoWIY
Introduction to International Charter Space and Major Disasters	https://www.youtube.com/watch?v=dRN1dkHqIPM
NASA Earth Observatory:	http://earthobservatory.nasa.gov/
Advantages and challenges of satellite based response:	http://www.sciencedirect.com/science/article/pii/S1877042814016449

Questions and Answers

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UNITAR
International Environment House
Chemin des Anémones 11-13,
CH-1219 Châtelaine,
Geneva - Switzerland
T +41 22 917 8400
F +41 22 917 8047
www.unitar.org

Applied Remote Sensing Training Program

In Partnership with the National Aeronautics and Space Administration