

## ARSET

Applied Remote Sensing Training

<http://arset.gsfc.nasa.gov>

 @NASAARSET

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# Overview of the Global Disaster Alert & Coordination System (GDACS)

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February 21, 2017

8:00-10:00 a.m. and 5:00-7:00 p.m. EST (UTC-8)

Amita Mehta


Guest Speaker: Luca Dell'oro (UNITAR)

# Outline

- About ARSET
- Overview of GDACS
- Overview of UNITAR-UNOSAT\*
- Demonstration of Satellite Mapping System
- Demonstration of GDACS Features for Monitoring Disasters

\* The United Nations Institute for Training and Research (UNITAR) and UNITAR Operational Satellite Application Programme (UNOSAT)



A satellite view of Earth showing a large body of water with white-capped waves on the right and a landmass with green vegetation on the left. A semi-transparent grey rectangular box is overlaid in the center, containing the title text.

# About the Applied Remote Sensing Training Program (ARSET)

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# NASA's Applied Remote Sensing Training Program (ARSET)

<http://arset.gsfc.nasa.gov/>

- Empowering the global community through remote sensing training
- Part of NASA's Applied Sciences Capacity Building Program
- Goal: increase the use of Earth Science in decision-making through training for:
  - policy makers
  - environmental managers
  - other professionals in the public and private sector
- Trainings offered focusing on applications in:



Disasters



Ecoforecasting



Health & Air Quality



Water Resources

# ARSET Training Levels



## Fundamentals

*Level 0*

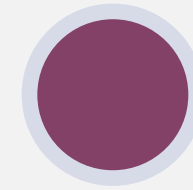
- Online only
- Assumes no prior knowledge of remote sensing
- Examples:
  - *Fundamentals of Remote Sensing*
  - *Satellites, Sensors, Data, and Tools for Land Management & Wildfire Applications*



## Basic Trainings

*Level 1*

- Online and in-person
- Requires level 0 training or equivalent knowledge
- Specific applications
- Example:
  - *Remote Sensing of Forest Cover & Change Assessment for Carbon Monitoring*



## Advanced Trainings

*Level 2*

- Online and in-person
- Requires level 1 training or equivalent knowledge
- More in-depth or focused topics
- Example:
  - *Advanced Webinar: Land Cover Classification with Satellite Data*

# ARSET Training Formats

## Online

- Offered through the internet
- Available live and recorded
- Typically 1 hr session, once per week, over 4-6 weeks
- Available at all training levels:
  - Fundamentals of Remote Sensing
  - Introductory
  - Advanced

## In-Person

- 2-7 days in length
- Held in a computer lab
- Mixture of lectures and exercises
- Locally relevant case studies
- Available levels:
  - Introductory
  - Advanced

## Train the Trainers

- Trainings and materials
- Offered online & in-person
- For organizers seeking to develop their own applied remote sensing training programs

# ARSET Trainings



8,000+  
participants



140+  
countries



1,600+  
organizations



36 online trainings



45 in-person trainings



Disasters  
7 trainings



Ecoforecasting  
10 trainings



Health & Air Quality  
48 trainings



Water Resources  
14 trainings

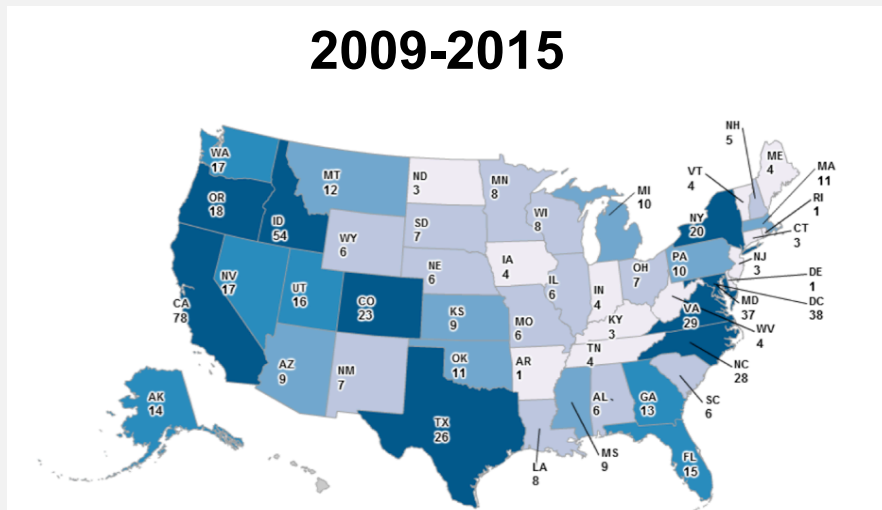


Train the Trainers  
1 training

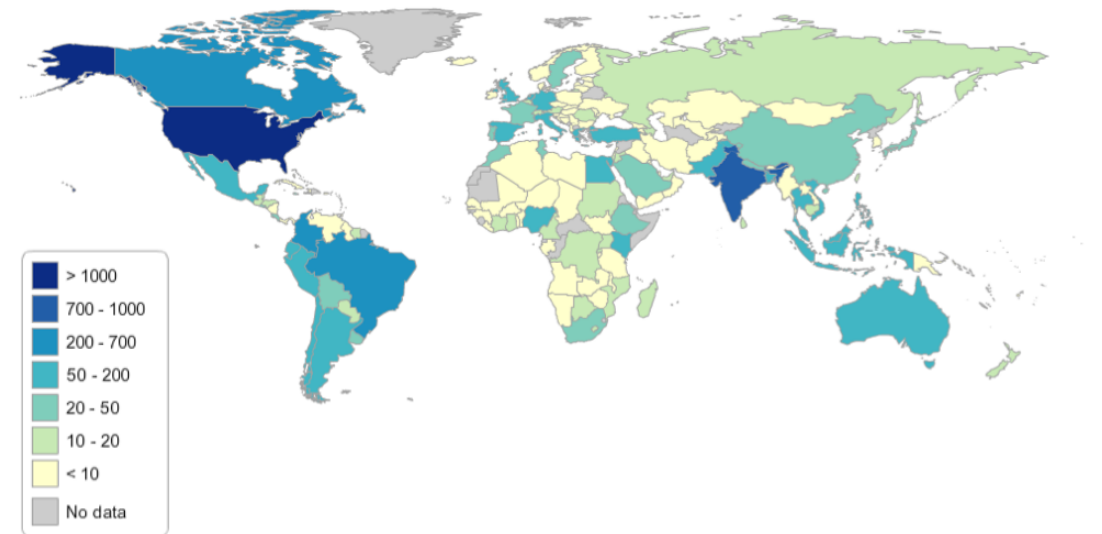


# ARSET's Global Footprint


- 81 trainings
- 8,000+ participants
- 1,600+ organizations
- 140+ countries
- All 50 U.S. States



## ARSET Participants by Country 2009 – 2016





A satellite view of Earth showing the Western Hemisphere, including North and South America, the Atlantic Ocean, and the Pacific Ocean. A semi-transparent grey rectangular box is overlaid on the center of the image, containing the title text.

# Overview of the Global Disaster Alert & Coordination System (GDACS)

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# What is GDACS?

<http://www.gdacs.org/>

- A cooperation framework between the United Nations, the European Commission and disaster managers worldwide to improve alerts, information exchange and coordination in the first phase after major sudden-onset disasters.
- Initiated in 2003/4
- Develops data tools and services that complement existing materials, including
  - International Search and Rescue Advisory Group (INSARAG) Guidelines
  - UN Disaster Assessment and Coordination (UNDAC) Field Handbook
  - International Federation of Red Cross and Red Crescent Societies (IFRC) Publications
  - Standard Operating Procedures from the European Community Mechanism for Civil Protection
  - International Humanitarian Partnership (IHP)
  - Euro Atlantic Disaster Response Coordination Centre (EADRCC)

\* *Global Disaster Alert and Coordination System Guidelines* [PDF]. (2014). GDACS.org

# GDACS Tools and Services

<http://www.gdacs.org/>

- GDACS offers the following information via its websites:
  - Disasters alerts and impact estimations after major disasters through a multi-hazard disaster impact assessment service managed by the European Commission Joint Research Centre (JRC)
  - The Virtual On-Site Operations Coordination Center (OSOCC), a password-restricted site managed by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA)
  - Maps and Satellite Imagery
  - A Science portal

# GDACS Tools and Services

<http://www.gdacs.org/>

- GDACS offers the following information:
  - Disasters alerts and impact estimations after major disasters
  - The Virtual On-Site Operations Coordination Center (OSOCC)
  - Maps and Satellite Imagery
  - A Science portal

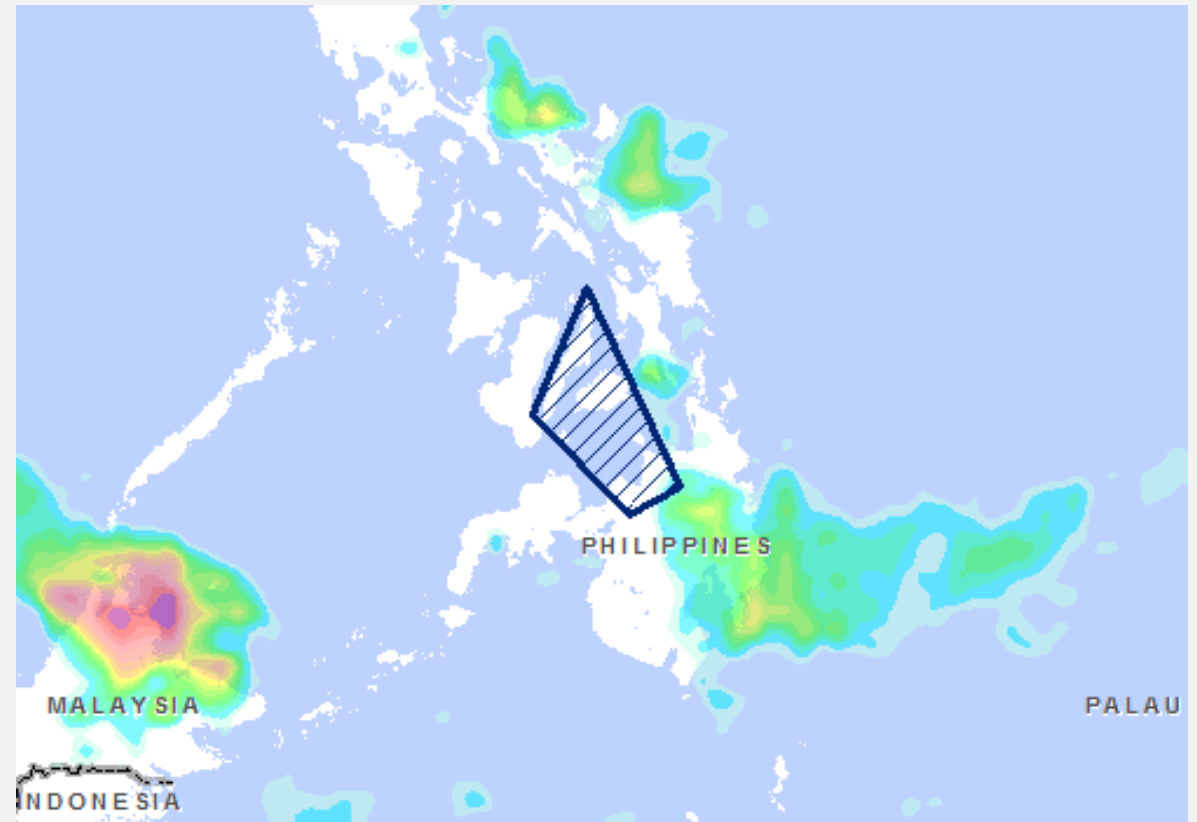


Image Credit: GDACS Event Report Summary, Flood Alert for the Philippines 16-26 Jan 2017  
<http://www.gdacs.org/report.aspx?eventtype=FL&eventid=1000038>



# GDACS Disaster Alerts

<http://www.gdacs.org/>

- **Floods**
  - inundation
  - deaths
  - displacement
- **Tropical Cyclones**
  - winds
  - heavy rain
  - storm surge
- **Earthquake and Tsunamis**
  - Intensity and magnitude
  - hypocenter depth
  - population within 100 km from the epicenter
  - vulnerability of the affected countries

Various models and data are used to obtain this information:

<http://portal.gdacs.org/Models/>

# GDACS Tools and Services

<http://www.gdacs.org/>

GDACS is a cooperation framework between the United Nations, the European Commission and disaster managers worldwide to improve alerts, information exchange and coordination in the first phase after major sudden-onset disasters.

United Nations and the European Commission

GDACS  
Global Disaster Alert and Coordination System

HOME ALERTS VIRTUAL OSOCC DATA, MAPS & SATELLITE IMAGERY SCIENCE PORTAL ABOUT GDACS

**EARTHQUAKES**

- Guam (5.5M) 24 Jan 09:38UTC
- Papua New Guinea (5.6M) 22 Jan 04:44UTC
- Papua New Guinea (7.9M) 22 Jan 04:30UTC - DTS

**FLOODS**

- French Polynesia 24 Jan 00:00UTC
- Philippines 26 Jan 00:00UTC  
FL-2017-000010-PHL

**RECENT AND OPEN EMERGENCIES**

**LATEST NEWS**

report of current and ongoing satellite mapping activities related to humanitarian disasters is available

**Tropical Cyclone Matthew: 3 reports published**

06 Oct 08:00UTC JRC published 3 reports on the Tropical Cyclone Matthew, the last one produced yesterday. The reports shows the situation and the

**LOG IN**

Username

Password

Log into

User name can be different for different services. To create an account, log in without username.

**Overview map of latest disaster alerts**

Map of disaster alerts in the past 4 days. Last 24 hours events are highlighted in yellow. Small earthquakes are shown as green boxes.

European Union, 2015. Map produced by EC-JRC. The boundaries and the names shown on this map do not imply official endorsement or acceptance by the European Union.

ALERTS VIRTUAL OSOCC DATA, MAPS & SATELLITE IMAGERY SCIENCE PORTAL

- Interactive map with near real-time disasters alerts
- Color coded alerts
  - white: minor events
  - green: moderate events
  - orange: potential local disasters
  - red: potentially severe disasters

# GDACS Approach for Disaster Alerts: Floods

<http://www.gdacs.org/>

- Uses info from Dartmouth Flood Observatory (DFO) <http://floodobservatory.colorado.edu/> to provide alerts for individual events
- Uses DFO-GDACS Global Flood Detection System – Version 2 to map inundation from microwave radiometer data based on near-real time satellite:
  - Advanced Microwave Scanning Radiometer (AMSR-E)
  - NASA Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI)
  - NASA Global Precipitation Measurements (GPM) Microwave Imager (GMI)
- River discharge estimates produced from microwave brightness temperatures

**GDACS Global Flood Detection System - Version 2**  
An experimental system to detect and map in near-real time major river floods based on daily passive microwave satellite observations. The purpose is to identify and measure floods with potential humanitarian consequences after they occur.

Home | Current floods | Global map | Search areas | Custom areas | Regions | Download | About

### About the global flood detection system

#### Methodology

Using AMSR-E data, De Groeve et al. (2006) developed a method for detecting major floods on a global basis in a systematic, timely and impartial way appropriate for humanitarian response. [more...](#)

#### Links

- Live data in Google Earth
  - [Floods Live](#) is a KML file that will load [GDACS floods alerts](#), [GFDS animations](#), [TRMM flood potential data](#) and today's flood warnings of selected met offices.
- GFDS animations of the last 7 days for Google Earth
  - [Magnitude](#)
  - [Signal \(M/C ratio\)](#)
- Download gridded data (for 2009)
  - Brightness temperature: <http://www.gdacs.org/flooddetection/floods/tif/AvgTiffs>
  - Signal (M/C ratio): <http://www.gdacs.org/flooddetection/floods/tif/AvgSignalTiffs>
  - Magnitude: available on request
- Animations
  - Southern Africa: <http://www.gdacs.org/flooddetection/floods/Movies/Angola>

#### Publications

- De Groeve, T., Z. Kugler, G. R. Brakenridge, 2007. Near Real Time Flood Alerting for the Global Disaster Alert and Coordination System. Proceedings of the 4<sup>th</sup> International ISCRAM Conference (B. Van de Walle, P. Burghardt and C. Nieuwenhuis, eds.) Delft, the Netherlands, May 2007, pp.33-40. [Download](#)
- Brakenridge, G. R., Nghiem, S.V., Anderson, E., Mic, R. (2007) Orbital microwave measurement of river discharge and ice status, Water Resources Research, 43. [Download](#)
- Kugler, Z. and T. De Groeve, 2007. The Global Flood Detection system. Office for Official Publications of the European Communities, EUR 23303 EN. [Download](#)
- De Groeve, T., P. Riva, 2009. Early flood detection and mapping for humanitarian response. Proceedings of the 6<sup>th</sup> International ISCRAM Conference (J. Landgren, U. Nulden and B. Van de Walle, eds.) Gothenburg, Sweden, May 2009. [Download](#)
- De Groeve, T., P. Riva, 2009. Global real-time detection of major floods using passive microwave remote sensing. Proceedings of the 33<sup>rd</sup> International Symposium on Remote Sensing of Environment Stresa, Italy, May 2009. [Download](#)

Please note that the information provided on this website has no official status and does not replace local flood warnings. Please refer to the competent local hydrographic authorities for official information on the flood status in each country.

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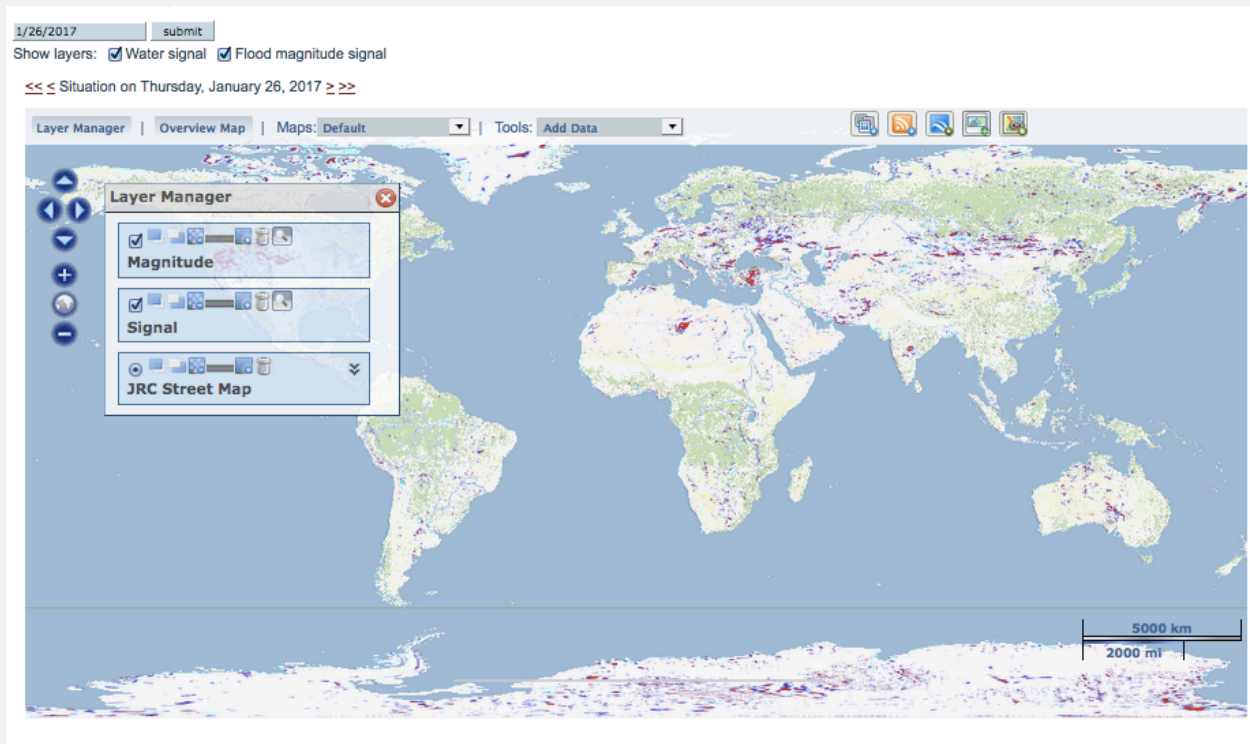
In collaboration with:

<http://www.gdacs.org/flooddetection/about.aspx>

# GDACS Approach for Disaster Alerts: Floods

<http://portal.gdacs.org/Models/>

Issues flood alerts and maps based on the satellite-based flood information from GFDS and population data



Please note that the information provided on this website has no official status and does not replace local flood warnings. Please refer to the competent local hydrographic authorities for official information in each country.

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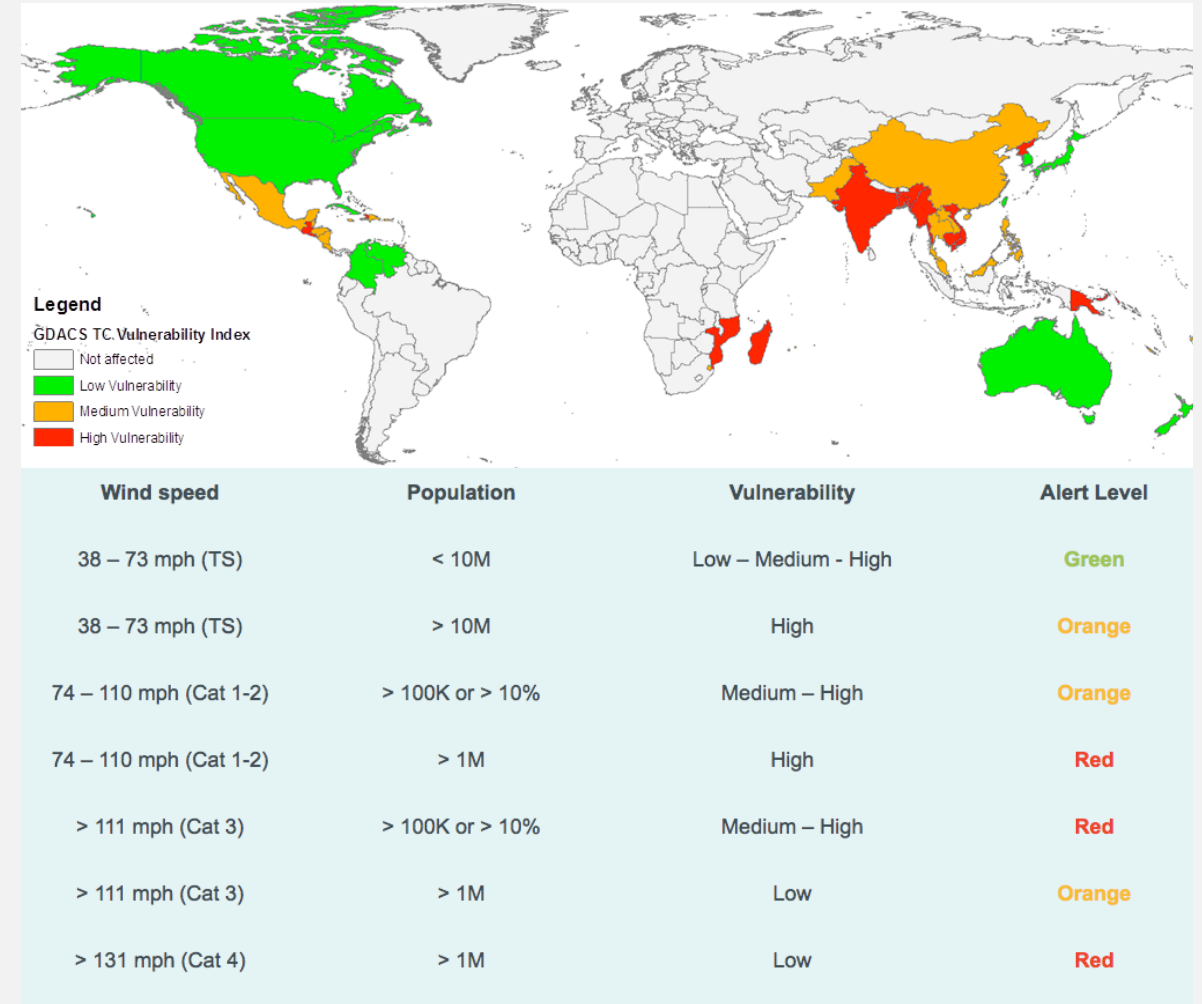
- **Red Alert**
  - more than 1,000 dead or 800,000 displaced
- **Orange Alert**
  - more than 100 dead or 80,000 displaced
- **Green Alert**
  - All other floods

Image Credit: GFDS Version 2 [http://www.gdacs.org/flooddetection/global\\_map.aspx](http://www.gdacs.org/flooddetection/global_map.aspx)

# GDACS Approach for Disasters Alerts: Tropical Cyclones

<http://portal.gdacs.org/Models/>

- Information used to issue cyclone alerts:
  - Rainfall from NOAA NESDIS
  - Winds from JRC
  - Official advisory from Pacific Disaster Center
  - Impact models based on wind speed and affected population
  - Vulnerability index based on indicators for:
    - human development
    - population
    - population in low elevation areas





# GDACS Approach for Disasters Alerts: Tropical Cyclones

<http://portal.gdacs.org/Models/>

- Storm Surge
  - Derived from a hydrodynamic shallow water equation model based on surface pressure drop and wind-water friction
  - Affected population by a storm surge is calculated
- Extreme Rainfall
  - Obtained from NOAA NESDIS, multi-satellite passive microwave remote sensing data
  - Accumulated rainfall (72 hrs) and instantaneous rain rates are used to obtain extreme rainfall potential
- Storm Surge
  - **Red Alert** > 3 m
  - **Orange Alert** > 1 m < 3 m
  - **Green Alert** < 1 m
- Total Cyclone Accumulation Alerts
  - **Red Alert** > 500 mm
  - **Orange Alert** > 200 mm < 500 mm
  - **Green Alert** < 200 mm
- Rain Rate Alerts
  - **Red Alert** > 33 mm/hr
  - **Orange Alert** > 17 mm/hr < 33 mm/hr
  - **Green Alert** < 17 mm/hr

# GDACS Approach for Disasters Alerts: Earthquakes

<http://portal.gdacs.org/Models/>

- Magnitude and depth, obtained from
  - seismological sources
- Population within 100 km from the epicenter and national vulnerability, obtained from:
  - GIS-based on epicenter location (latitude and longitude)
  - population database and index for risk management: <http://www.inform-index.org/Results/Global>
- Earthquake Alert Score is calculated as a product of
  - magnitude
  - population density within 100 km
  - vulnerability index
- **Red Alert:** magnitude > 6 (Alert Level=2)
- **Orange Alert:** depth > 70 km (Alert Level=1)
- **Green Alert:** depth < 300 km (Alert Level=0)

# GDACS Approach for Disasters Alerts: Earthquakes

<http://portal.gdacs.org/Models/>

- Calculated as a product of:
  - magnitude
  - population density within 100 km of epicenter
  - vulnerability index
- Alert Levels:
  - **Red Alert:** magnitude > 6
    - Alert Level = 2
  - **Orange Alert:** depth > 70 km
    - Alert Level = 1
  - **Green Alert:** depth < 300 km
    - Alert Level = 0
- Magnitude:
  - Obtained from seismological sources
- Population density and vulnerability index:
  - Obtained from a geographic information system (GIS) based on epicenter location, population database and index for risk management: <http://www.inform-index.org/Results/Global>

# GDACS Approach for Disasters Alerts: Tsunamis

<http://portal.gdacs.org/Models/>

- Triggered when earthquakes  $> 6.5$  magnitude occur near water
- Tsunami wave heights are calculated using earthquake magnitude and depth from the JRC tsunami database
- Tsunami Alerts
  - **Red Alert:** maximum wave height  $\geq 3$  m
  - **Orange Alert:** maximum wave height  $\geq 1$  m
  - **Green Alert:** maximum wave height  $< 1$  m

# GDACS Virtual On-Site Operations Coordination Center (OSOCC)

<http://vosocc.unocha.org>

- Real-time disaster information system portal
- User account required
- Disaster managers exchange information
- Summary reports of on-going disaster reports posted

The screenshot shows the GDACS Virtual OSOCC website. At the top, there is a navigation menu with links: HOME, ALERTS, VIRTUAL OSOCC, DATA, MAPS & SATELLITE IMAGERY, SCIENCE PORTAL, and ABOUT GDACS. Below the menu, the page title is "GDACS - Virtual OSOCC - real-time disaster coordination".

The main content area is divided into three columns:

- Virtual OSOCC Login** (Restricted to disaster managers): Includes a login form with fields for Username and Password, a Login button, and links for "Forgot your password" and "Request an account".
- Ongoing disasters** (Virtual OSOCC latest updates): A section for disaster managers to exchange information and coordinate international assistance.
- Virtual OSOCC** (News and upcoming events): Contains sections for "SIMULATION EXERCISES" (e.g., 5/12/16 9.0M EQ Japan (Team D)), "GUIDELINES" (e.g., OSOCC Guidelines 2014, UN-CMCoord Field Handbook), "FURTHER READING" (e.g., Virtual OSOCC for UNDAC teams), and "GDACS REPORTS" (e.g., Report annual GDACS meeting 2014).

At the bottom, there is a "CURRENT GDACS ALERTS" table:

Alert	Date/Time
Green earthquake alert (Magnitude 5.8M, Depth:10km) in Southwest Indian Ridge	Sun, 29 Jan 2017 16:42:27 GMT
Green earthquake alert (Magnitude 5.7M, Depth:13.75km) in Kermadec Islands, New Zealand	Sun, 29 Jan 2017 14:59:51 GMT
Green earthquake alert (Magnitude 5.7M, Depth:10km) in Samoa	Sat, 28 Jan 2017 22:32:51 GMT
Green flood alert in Zimbabwe	Mon, 30 Jan 2017 00:00:00 GMT
Green alert for tropical cyclone THREE-17. Population affected by Category 1 (120 km/h) wind speeds or higher is 0.	Sun, 29 Jan 2017 06:00:00 GMT
Green flood alert in Peru	Mon, 30 Jan 2017 00:00:00 GMT
Orange flood alert in Philippines	Thu, 26 Jan 2017 00:00:00 GMT
Green flood alert in Mozambique	Mon, 30 Jan 2017 00:00:00 GMT

At the bottom of the page, there are logos for OCHA (Office for the Coordination of Humanitarian Affairs), JRC (European Commission), UNOSAT, and UNITAR. A footer note states: "Reproduction authorised provided the source is acknowledged, except for commercial purposes."

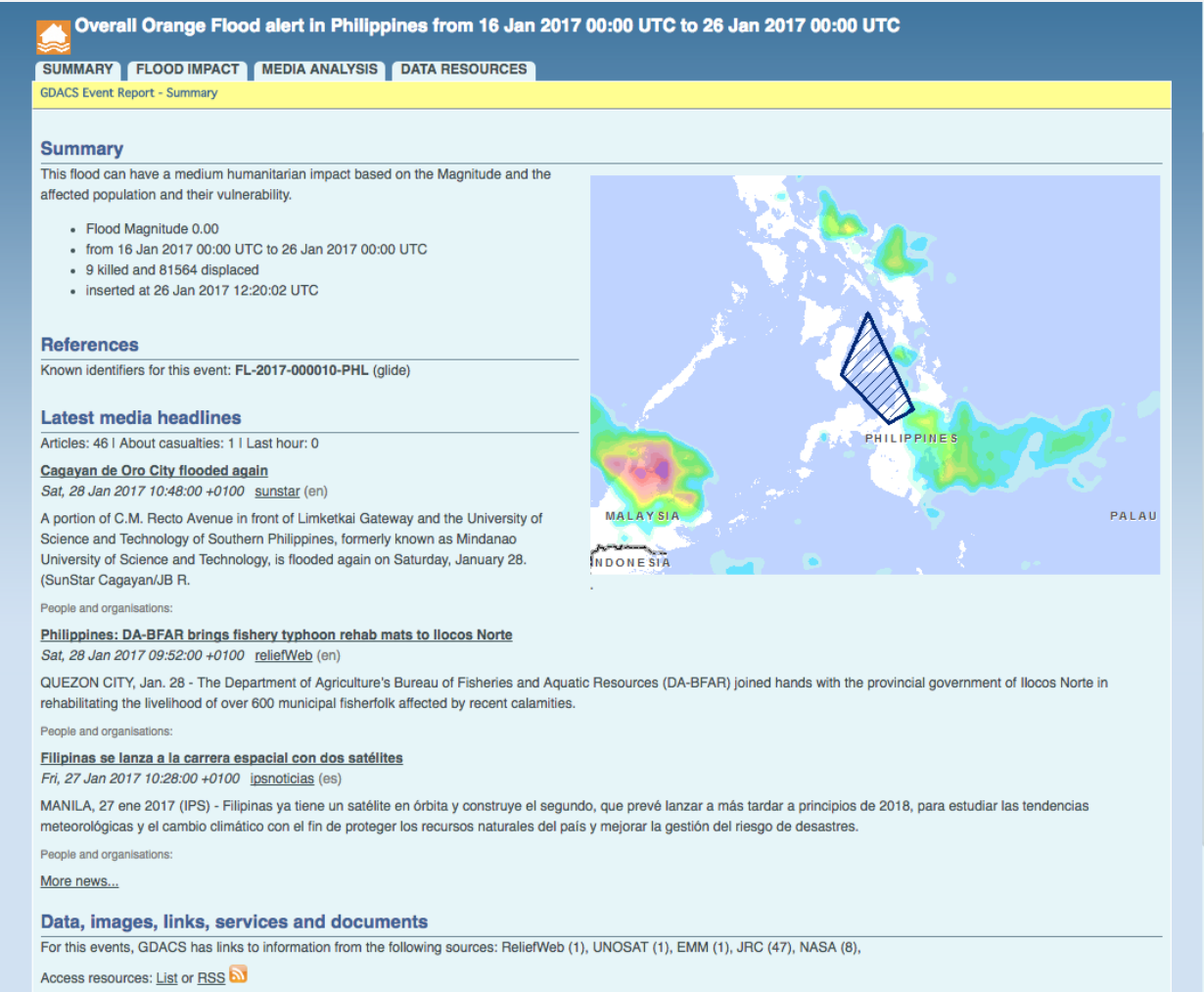


# GDACS Virtual OSOCC Disaster Information

<http://vosocc.unocha.org>

## Current Flood in the Philippines

- Summary Report: deaths, displacement
- Latest news
- Data, images, documents



**Overall Orange Flood alert in Philippines from 16 Jan 2017 00:00 UTC to 26 Jan 2017 00:00 UTC**

SUMMARY FLOOD IMPACT MEDIA ANALYSIS DATA RESOURCES

GDACS Event Report - Summary

### Summary

This flood can have a medium humanitarian impact based on the Magnitude and the affected population and their vulnerability.

- Flood Magnitude 0.00
- from 16 Jan 2017 00:00 UTC to 26 Jan 2017 00:00 UTC
- 9 killed and 81564 displaced
- inserted at 26 Jan 2017 12:20:02 UTC

### References

Known identifiers for this event: FL-2017-000010-PHL (glide)

### Latest media headlines

Articles: 46 | About casualties: 1 | Last hour: 0

**Cagayan de Oro City flooded again**  
Sat, 28 Jan 2017 10:48:00 +0100 [sunstar](#) (en)

A portion of C.M. Recto Avenue in front of Limketkai Gateway and the University of Science and Technology of Southern Philippines, formerly known as Mindanao University of Science and Technology, is flooded again on Saturday, January 28. (SunStar Cagayan/JB R.

People and organisations:

**Philippines: DA-BFAR brings fishery typhoon rehab mats to Ilocos Norte**  
Sat, 28 Jan 2017 09:52:00 +0100 [reliefWeb](#) (en)

QUEZON CITY, Jan. 28 - The Department of Agriculture's Bureau of Fisheries and Aquatic Resources (DA-BFAR) joined hands with the provincial government of Ilocos Norte in rehabilitating the livelihood of over 600 municipal fisherfolk affected by recent calamities.

People and organisations:

**Filipinas se lanza a la carrera espacial con dos satélites**  
Fri, 27 Jan 2017 10:28:00 +0100 [ipsnoticias](#) (es)

MANILA, 27 ene 2017 (IPS) - Filipinas ya tiene un satélite en órbita y construye el segundo, que prevé lanzar a más tardar a principios de 2018, para estudiar las tendencias meteorológicas y el cambio climático con el fin de proteger los recursos naturales del país y mejorar la gestión del riesgo de desastres.

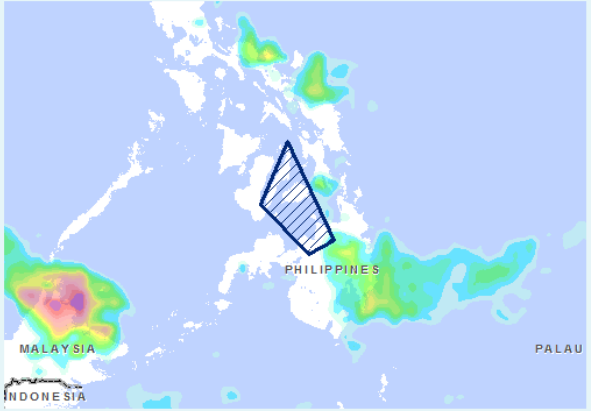
People and organisations:

[More news...](#)

### Data, images, links, services and documents

For this events, GDACS has links to information from the following sources: ReliefWeb (1), UNOSAT (1), EMM (1), JRC (47), NASA (8),

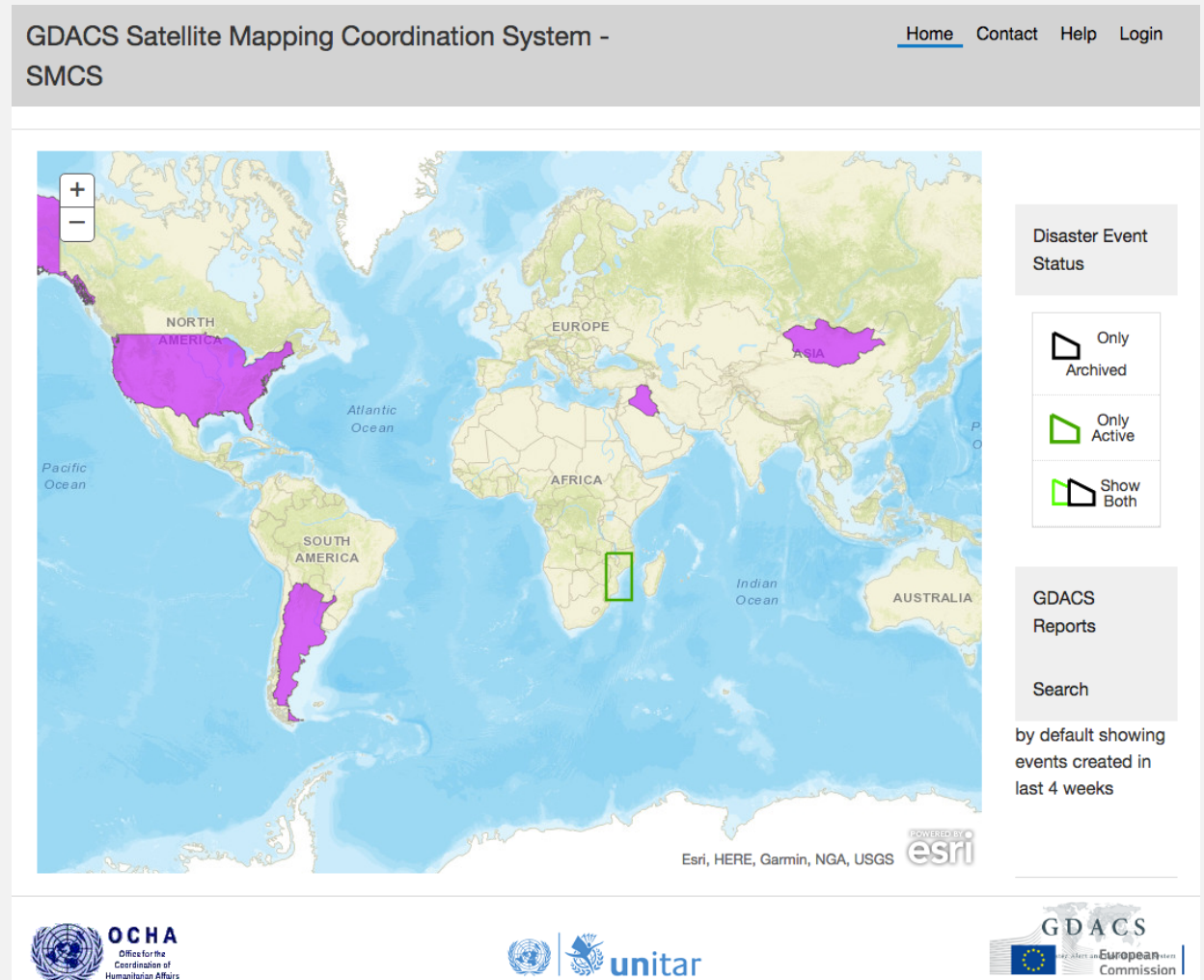
Access resources: [List](#) or [RSS](#)



# GDACS Satellite Mapping Coordinate System (SMCS)

<http://gdacs-smcs.unosat.org/>

- Led by UNITAR-UNOSAT
- Includes NASA and ESA satellite data
- A GIS-based tool of satellite imagery for specific disaster events
  - requires user registration
- Provides past and real-time imagery for an event
- Also offers:
  - baseline maps
  - situation specific maps
  - damage assessment maps
  - weather forecast maps



GDACS Satellite Mapping Coordination System - SMCS

Home Contact Help Login

Disaster Event Status

Only Archived

Only Active

Show Both

GDACS Reports

Search

by default showing events created in last 4 weeks

Powered by Esri, HERE, Garmin, NGA, USGS

OCHA Office for the Coordination of Humanitarian Affairs

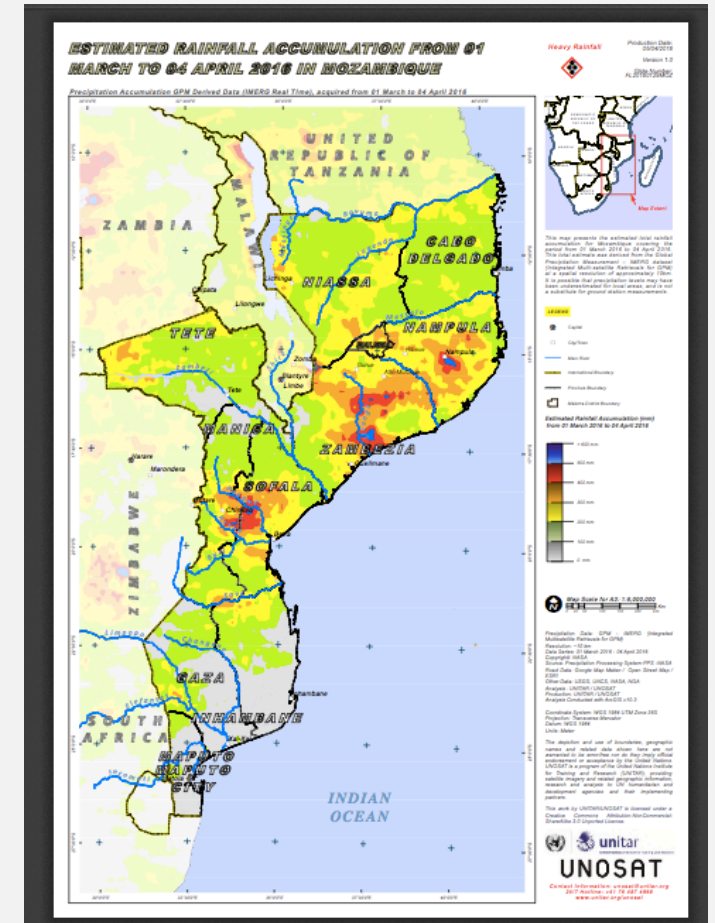
UNITAR United Nations Institute for Training and Research

GDACS European Commission

# NASA Remote Sensing Data Used by GDACS-SMCS

<http://gdacs-smcs.unosat.org/>

- Global Precipitation Measurement (GPM)
  - Rainfall Data from Integrated Multi-satellitE Retrievals for GPM (IMERG)
  - GPM Microwave Imager (GMI) used by GFDS to assess flooding
- For more details about the satellites see Fundamentals of Remote Sensing, Session 2B
  - <http://arset.gsfc.nasa.gov/webinars/fundamentals-remote-sensing#water>



Rainfall Accumulation over Mozambique from 1 March to April 4, 2016, from GPM IMERG

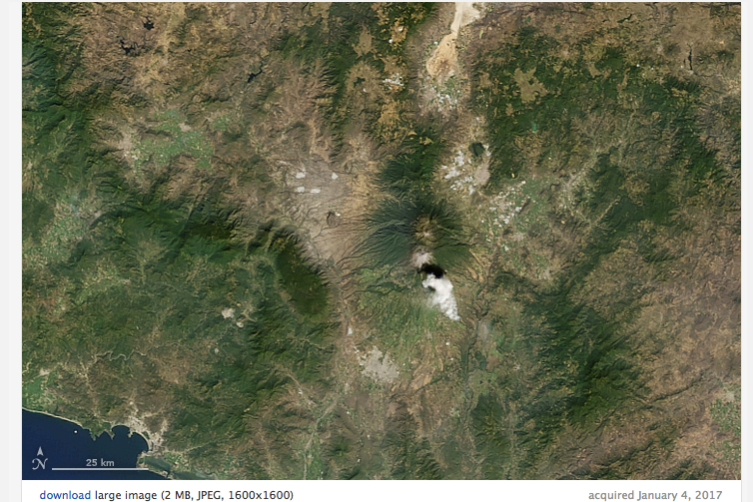
# NASA Remote Sensing Data Used by GDACS-SMCS

<http://gdacs-smcs.unosat.org/>

- Terra and Aqua: Moderate Resolution Imaging Spectroradiometer (MODIS); Landsat: Operational Land Imager (OLI)
  - Land and Snow Cover Data
  - Volcanoes
  - Wildfires
- For more details, see:  
<http://arset.gsfc.nasa.gov/webinars/fundamentals-remote-sensing#water>

Top: Terra-MODIS showing a puff of ash from the Colima Volcano in Mexico on January 4, 2017

Bottom: Landsat image collected on January 24, 2017, indicating the Mosul fires in white





A satellite view of Earth showing the Western Hemisphere, including North and South America, the Atlantic Ocean, and the Pacific Ocean. A semi-transparent grey rectangular box is overlaid on the center of the image, containing the title text.

# Overview of UNITAR-UNOSAT

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A satellite view of Earth showing the Western Hemisphere, including North and South America, the Atlantic Ocean, and the Pacific Ocean. A semi-transparent grey rectangular box is overlaid on the center of the image, containing the title text.

# Demonstration of Satellite Mapping System

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# Overview of UNITAR-UNOSAT and GDACS Satellite Mapping Coordination System

**Trainer**  
**Luca Dell'Oro**

21 Feb 2017

# 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**



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.

## The Institute Core Functions

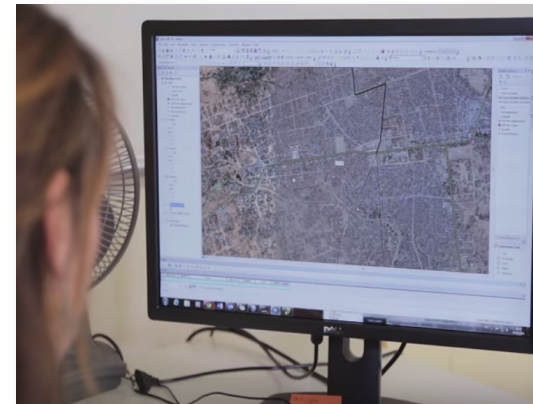
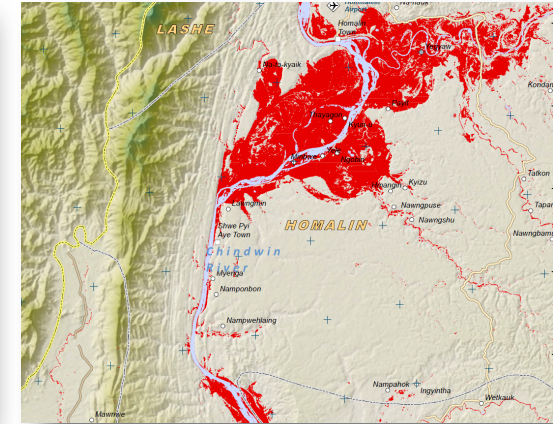
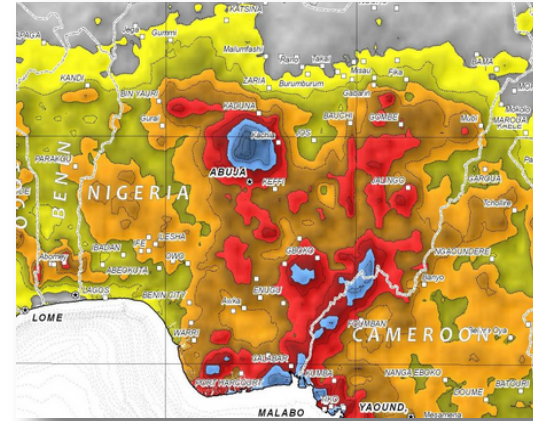
- Design and deliver innovative **training**
- Facilitate **knowledge- and experience-sharing**
- Conduct **research** on and pilot innovative learning strategies
- Advise and support governments, UN and other partners with **technology-based knowledge-related services**
- **9 Programmes** that deliver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

# 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](http://www.unitar.org/unosat)



## 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

# Training & Capacity Development Activities

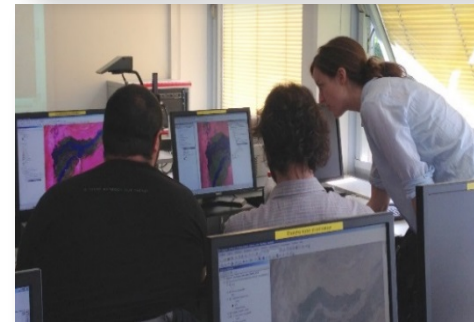
Master level courses

Basic and advanced courses

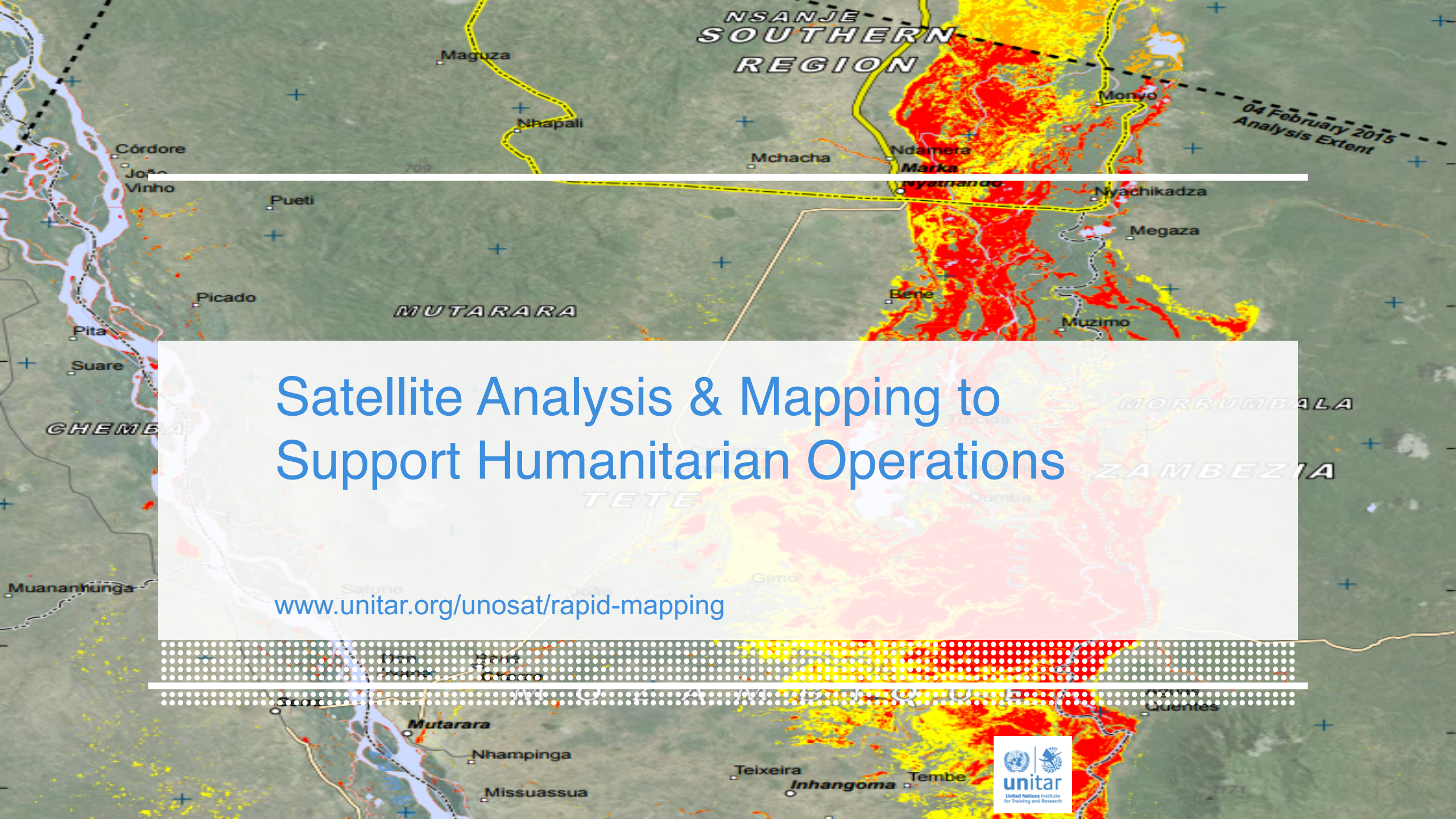
Capacity development programmes

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](http://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)

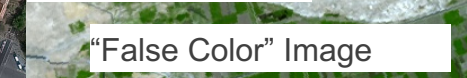
## OPTICAL:

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

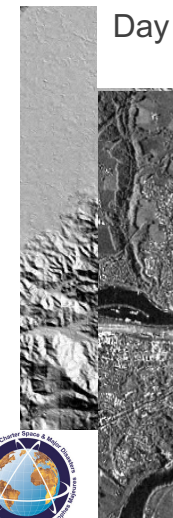
## RADAR :

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

Very High Resolution Image



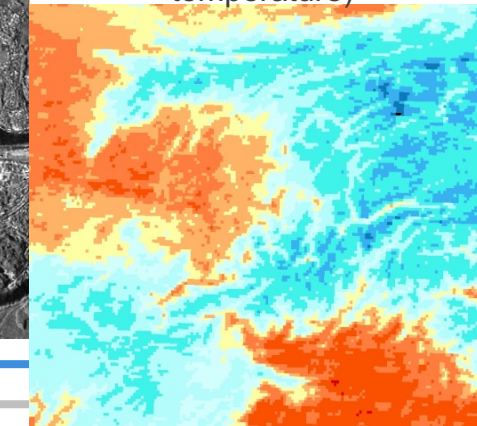
Digital Elevation Models



Day & night – Cloud free radar image



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



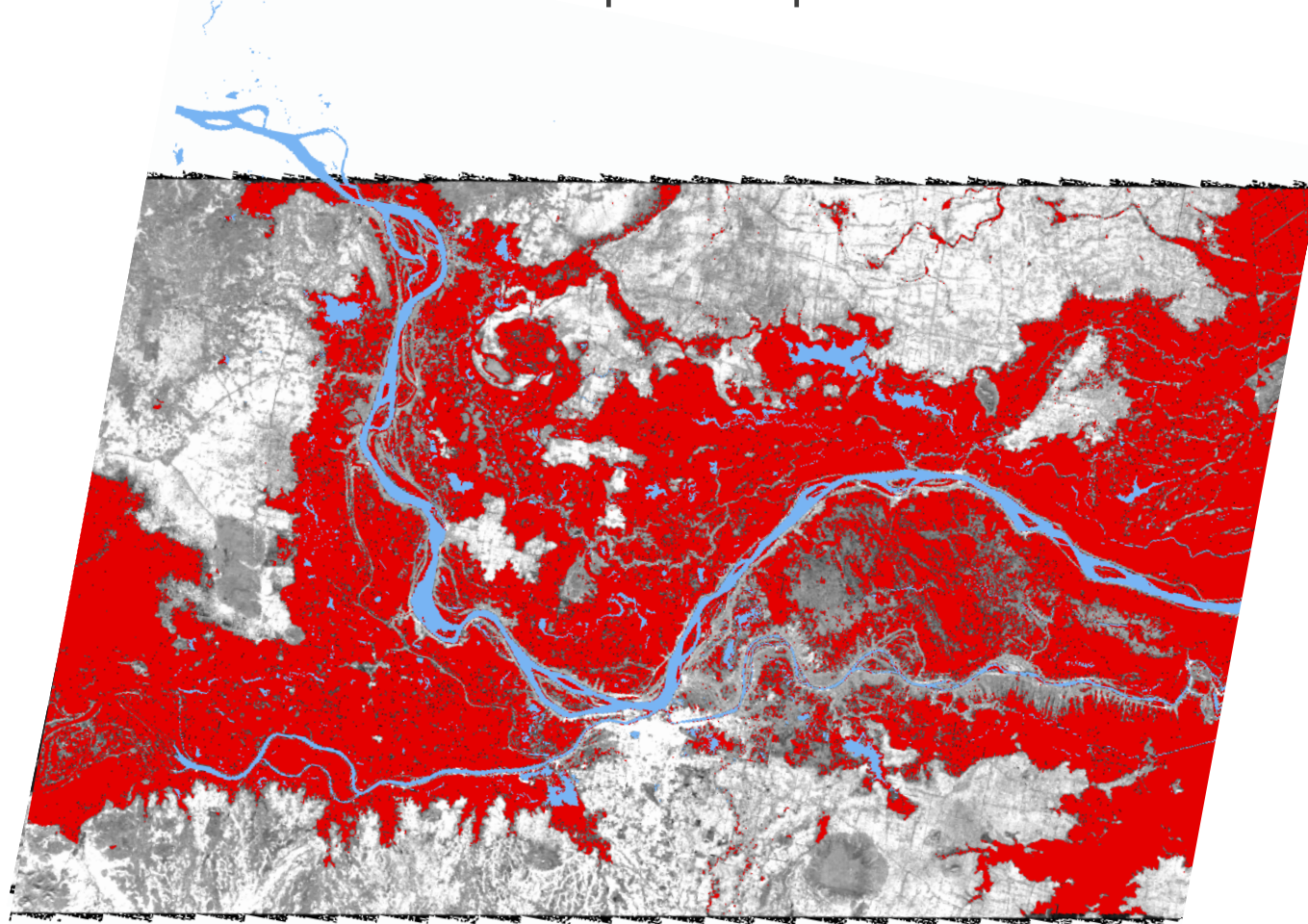


# Benefits of Satellite Imagery in Emergency Response

- **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)

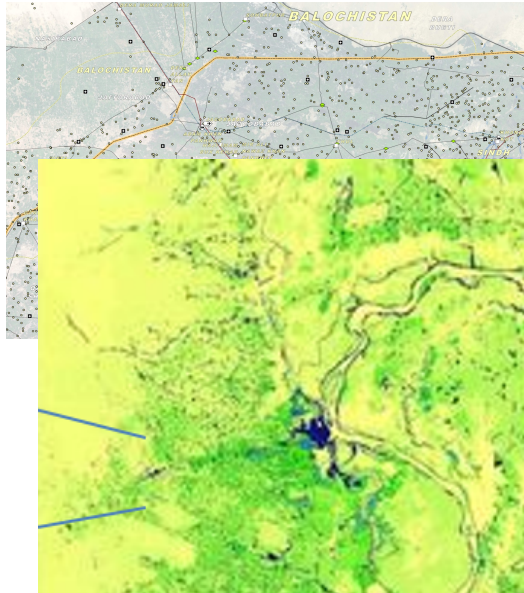


Extraction of water extent from pre and post event satellite image





## Preliminary Exposure/Impact Analysis

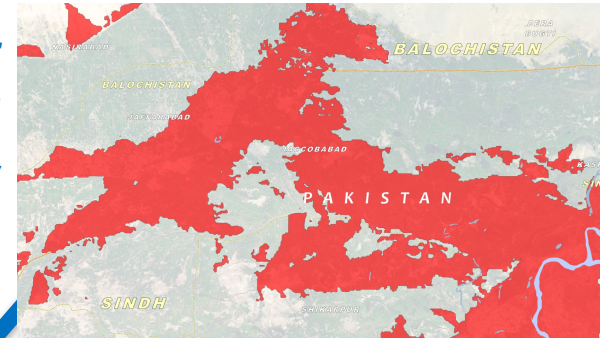


Vector  
Baseline  
Data

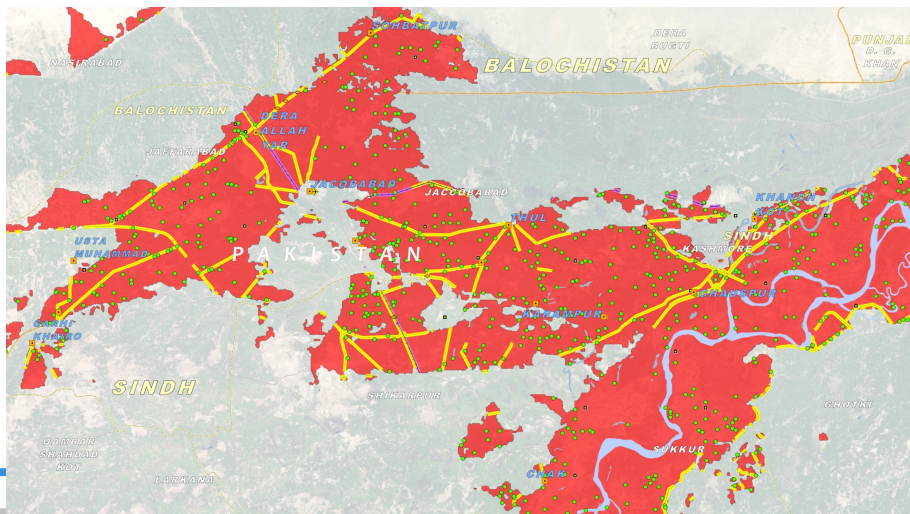
Population  
distribution



UNOSAT  
Flood  
Water  
Analysis



Combination of data allows for  
detailed and comprehensive  
preliminary exposure analysis

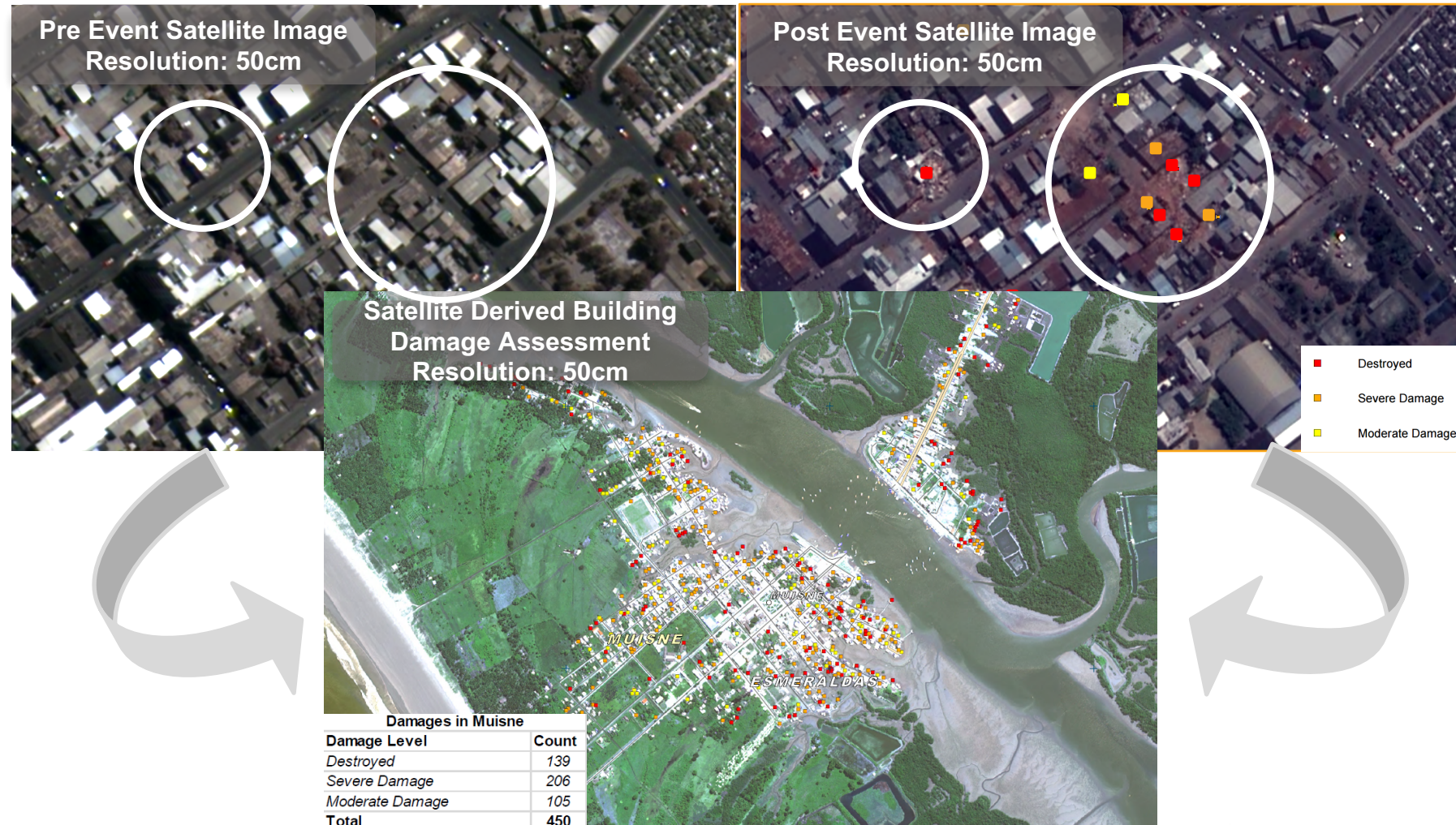


Summary of Flood-Affected Populated Places and Infrastructure

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



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



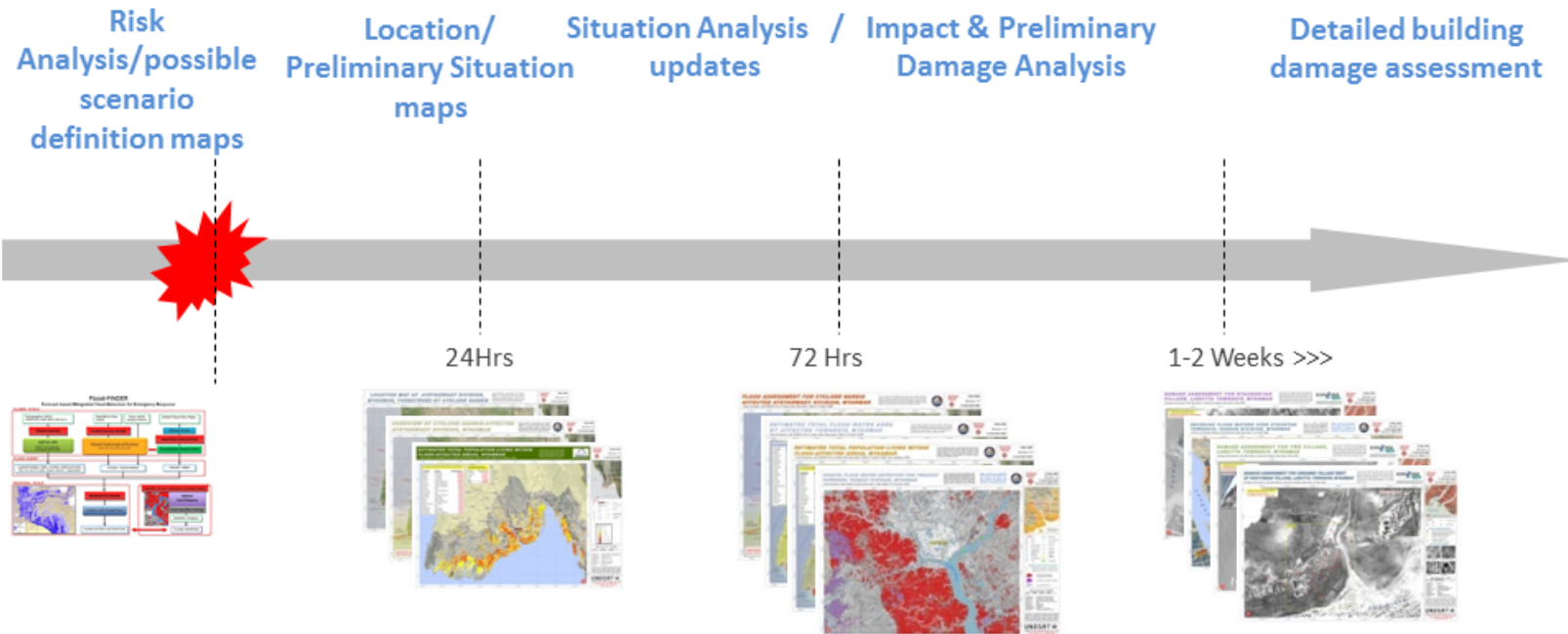
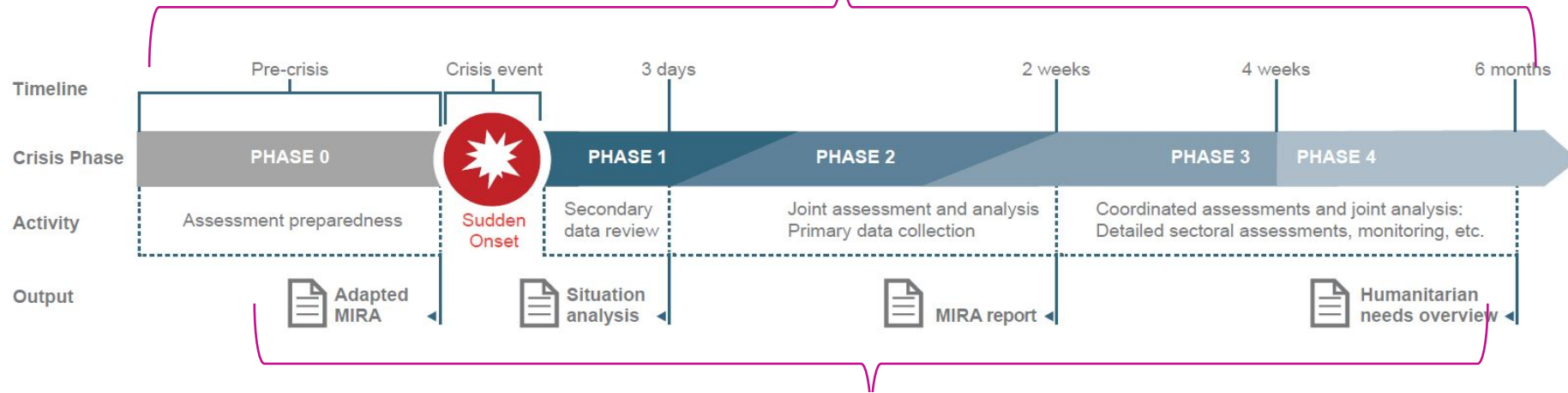


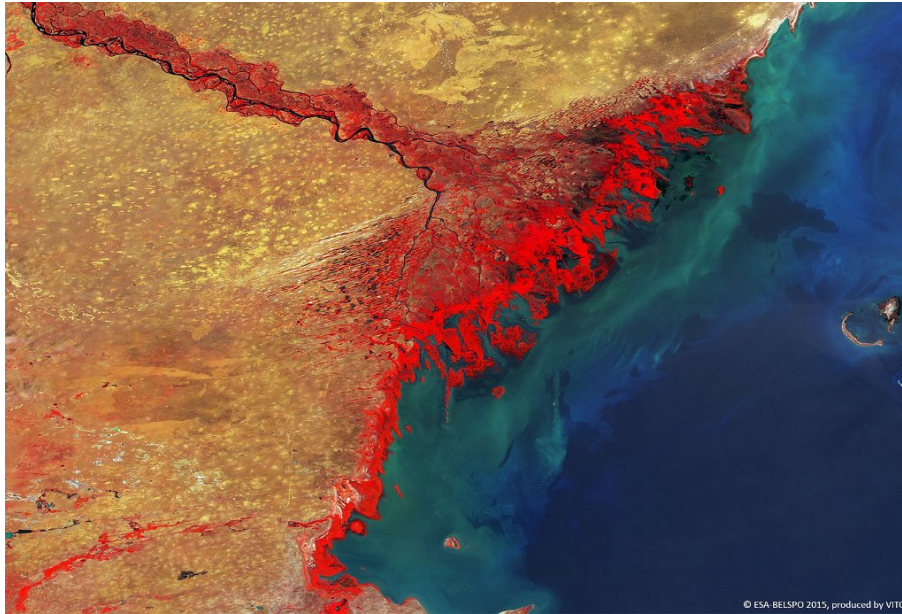
“A complex emergency or **major disaster** is a multifaceted humanitarian crisis in a country, region or society where there is total or **considerable breakdown of authority and response capacity** which requires a multi-sectoral, international response that **goes beyond the mandate or capacity of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

Inter-Agency Standing Committee, Dec 1994.



# UNOSAT'S Rapid Mapping Operational Framework





## Natural Disasters:

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

## Conflicts:

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





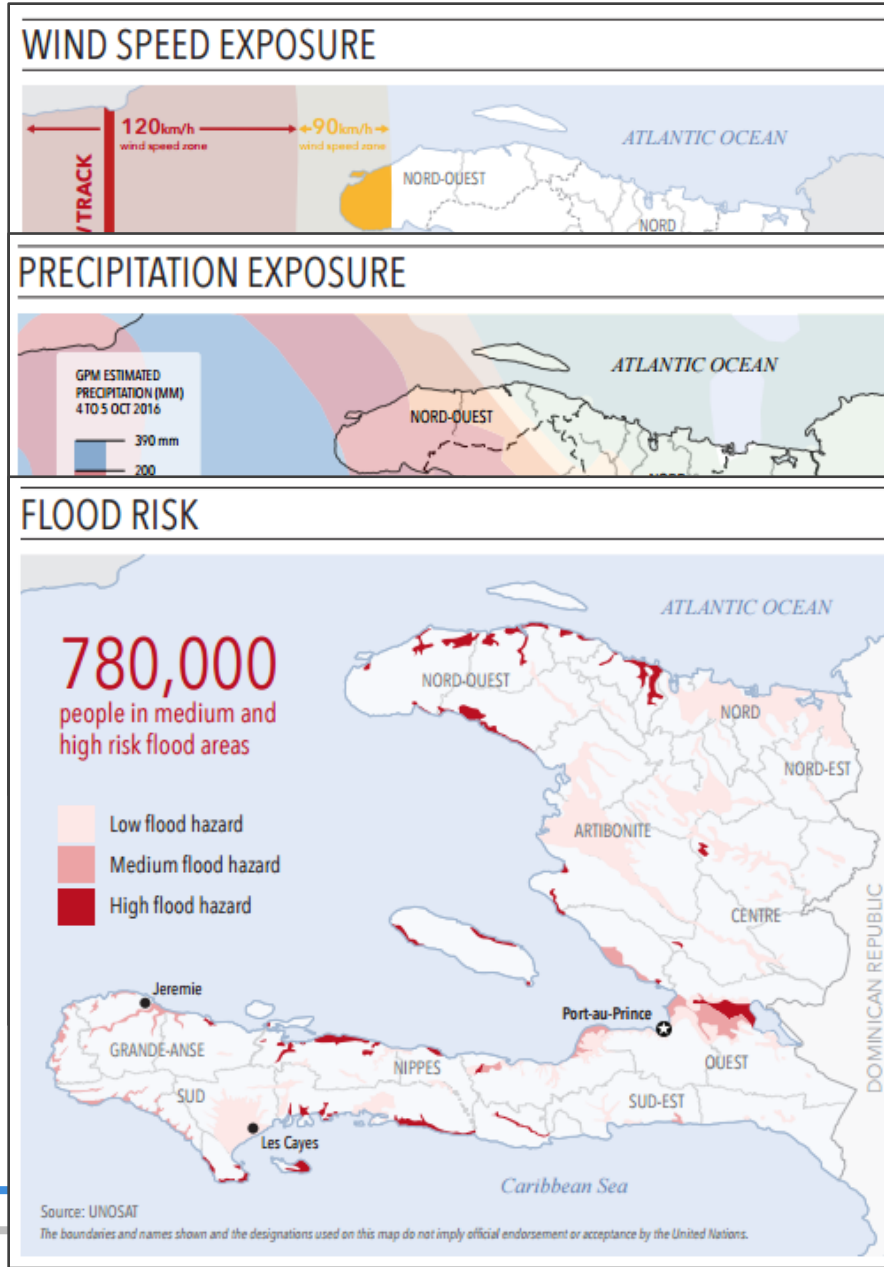
# Haiti - Hurricane Matthew 2016: Geospatial approach to estimate Population exposure / impact and damage to infrastructures (Natural Disaster)

## 2016 FLASH APPEAL

OCTOBER



**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.

## Analysis Summary: Area 1, Area 2, Area 3 & Area 4



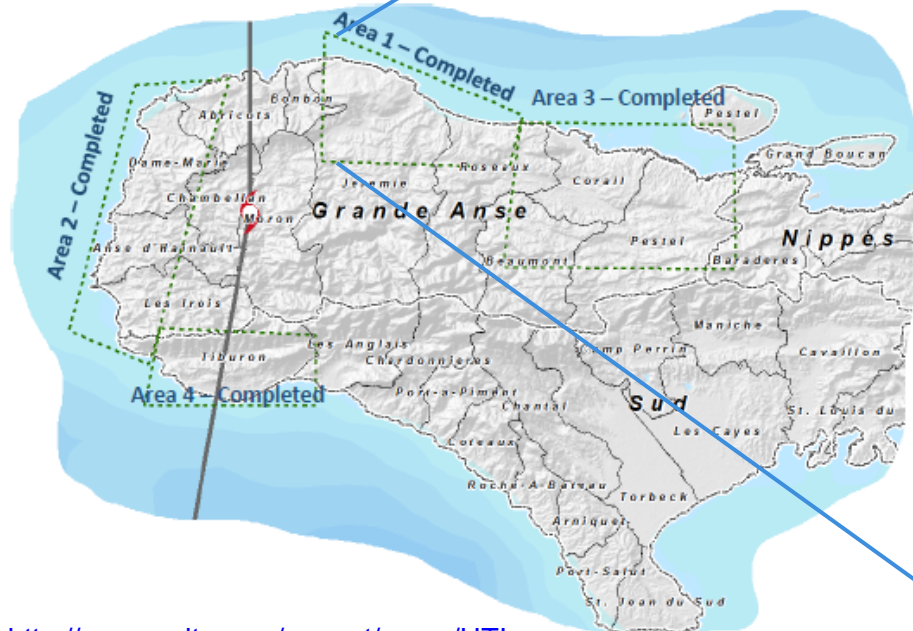
**40,696**  
Buildings/structures damages



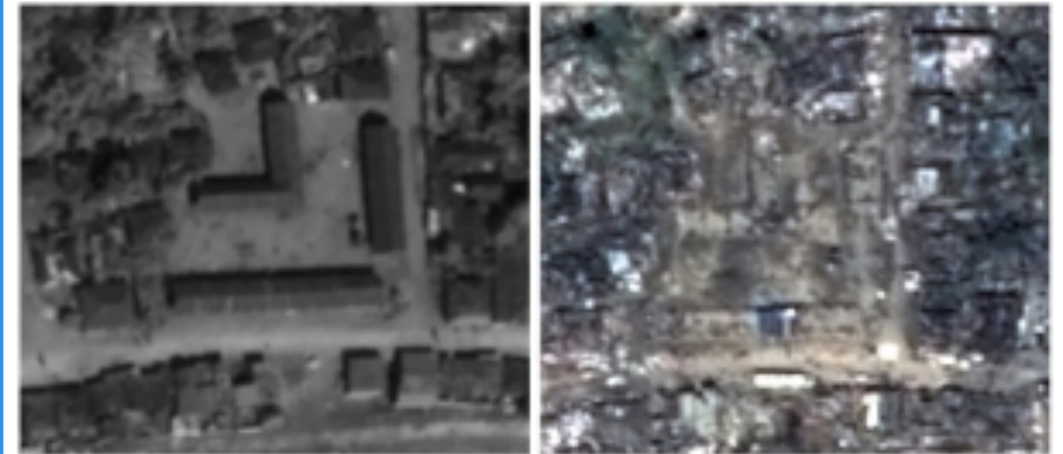
**1,497**  
People gathering sites



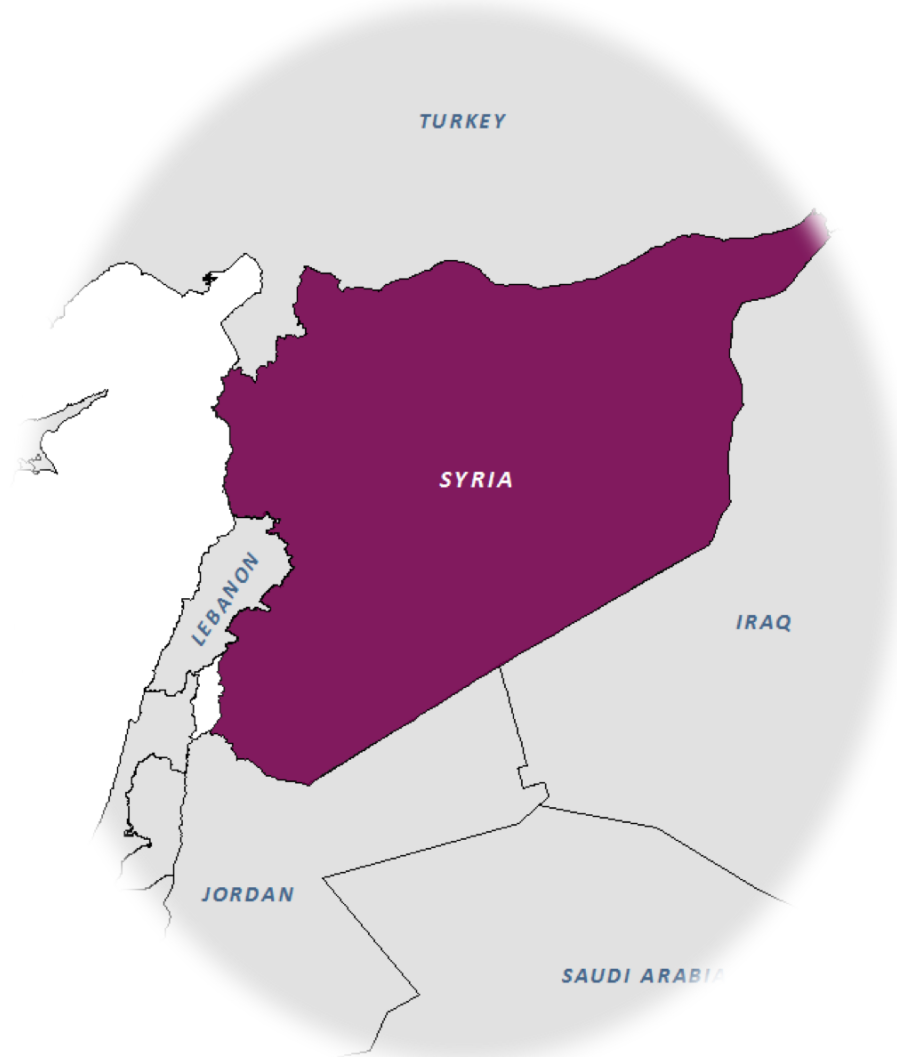
**508**  
Road obstacles



Buildings and/or structures damaged in Marfranc section Cmmunale



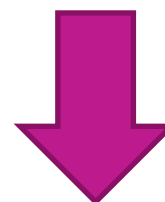
<http://www.unitar.org/unosat/maps/HTI>



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

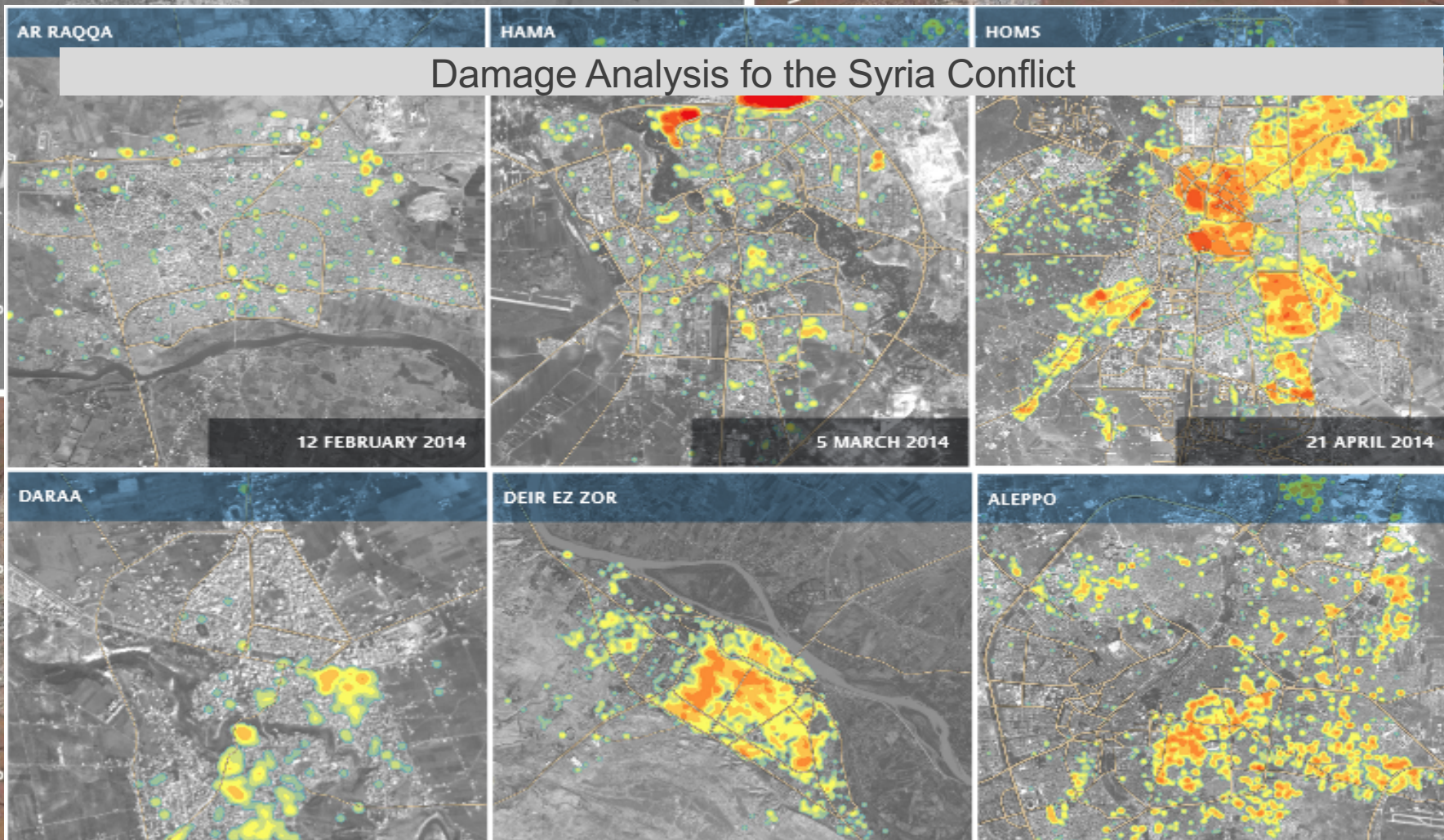
Population Displacement

Monitoring of Refugee Camps

Damage Analysis for the Syria Conflict

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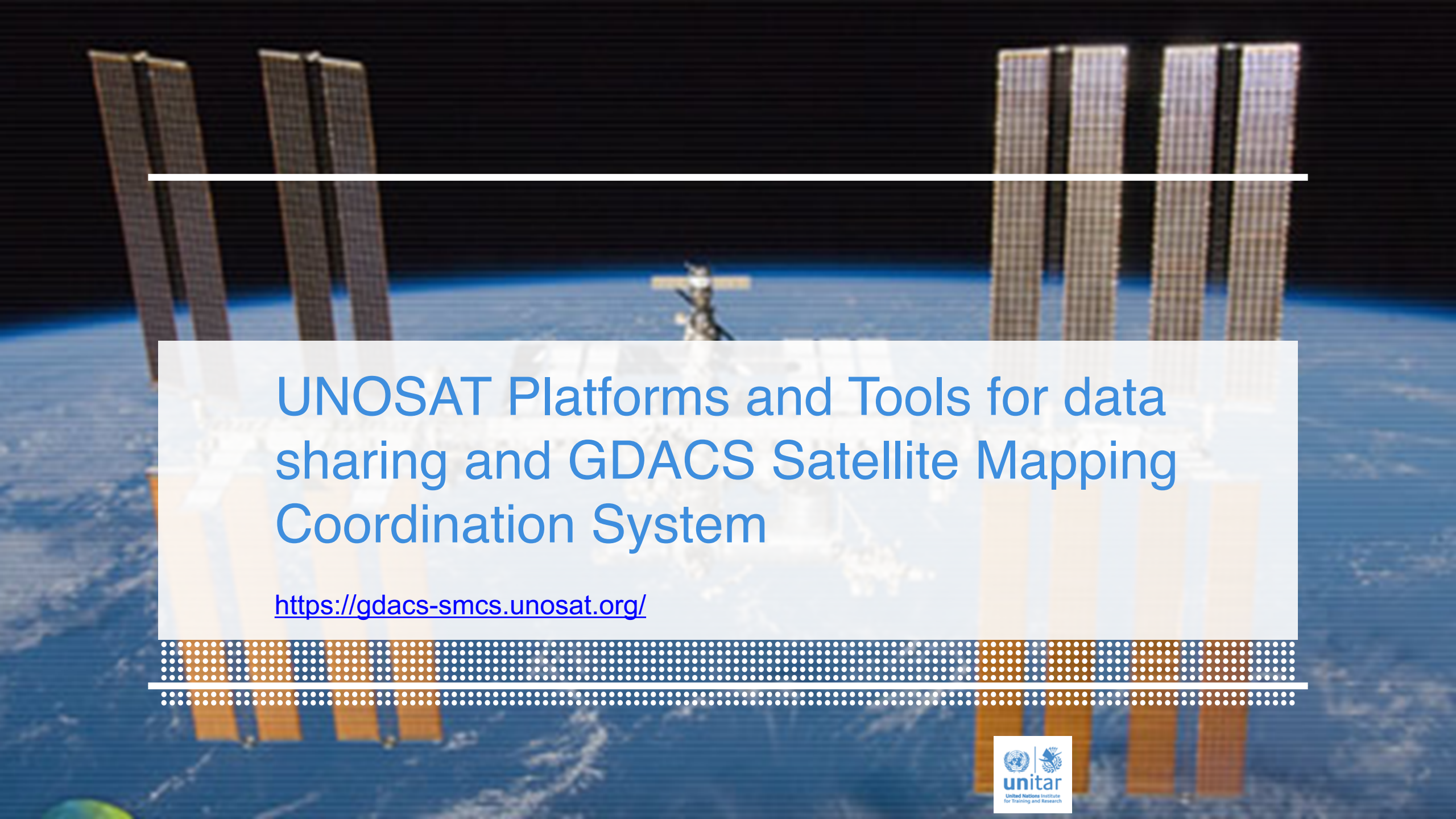
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013





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


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

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 is a cooperation framework between the UN managers worldwide to improve alerts, information major sudden-onset disasters.



GDACS is a cooperation framework between the United Nations, the European Commission and disaster managers worldwide to improve alerts, information exchange and coordination in the first phase after major sudden-onset disasters.

United Nations and the European Commission

Global Disaster Alert and Coordination System

HOME ALERTS VIRTUAL OSOCC **DATA, MAPS & SATELLITE IMAGERY**





Global Disaster Alert and Coordination System

HOME ALERTS VIRTUAL OSOCC **DATA, MAPS & SATELLITE IMAGERY** SCIENCE PORTAL ABOUT GDACS


Data, Maps and Sat GDACS Platform Satellite Maps IWG-SEM

**Latest disaster alerts**






**EARTHQUAKES**

-  Ecuador (5.5M) 31 Jan 14:22UTC
-  Vanuatu (5.9M) 30 Jan 23:35UTC
-  Southwest Indian Ridge (5.8M) 29 Jan 16:42UTC
-  Kermadec Islands, New Zealand (5.7M) 29 Jan 14:59UTC

**TROPICAL CYCLONES**

-  THREE-17 Australia (83.3km/h) 29 Jan 06:00UTC - GTS

**FLOODS**

-  Honduras 01 Feb 00:00UTC
-  Zimbabwe 01 Feb 00:00UTC
-  Peru 30 Jan 00:00UTC
-  Philippines 31 Jan 00:00UTC FL-2017-000010-PHL
-  Mozambique 30 Jan 00:00UTC FL-2017-000012-MOZ

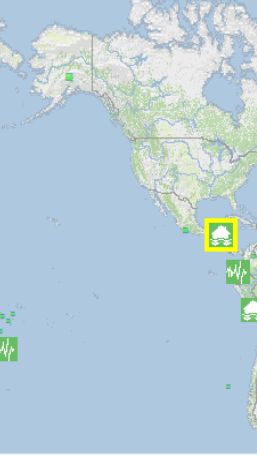
Disasters in past 4 days.

- [See smaller and archived alerts...](#)
- [Search alerts...](#)
- [About thresholds and models](#)
- [About earthquake selection](#)

**Virtual OSOCC**

RECENT AND OPEN EMERGENCIES

**Overview map of latest disaster alerts**



Map of disaster alerts in the past 4 days. Last updated: 01 Feb 2017 00:00 UTC. European Union, 2015. Map produced by ECHO and accepted by the European Union.

**Data, Maps and Satellite Imagery**

**Event-based data and information**

Most information in GDACS is organized by event. GDACS collects and organizes several data types:

- **GIS data:** In-situ sensor data, model output data, priority areas, baseline data, satellite image derived data (examples: flood extent, earthquake damage assessment, landslide extent) and more.
- **Media information:** mass and social media, specifically related to events
- **Field data:** reports, photos/videos, GEO-PICTURES and more

**Maps**

GDACS offers automatic links to map products such as baseline maps, situation specific maps, damage assessments and web-maps. These maps are integrated by event in the [VirtualOSOCC](#).

**Satellite imagery**

Satellite imagery is served as web-services when copyright allows for it. Most of the time, satellite image derived products, such as PDF and online web-maps, as well as for example flood extents and earthquake damage assessments derived from satellite imagery are the most useful products for early responders. These products are also served as web-services for in-field or headquarter mapping by UN, NGOs and national entities, in VirtualOSOCC and/or directly from the producing entity.

VirtualOSOCC facilitates on-demand map requests that are handled by UNITAR/UNOSAT, who coordinates the map production and dissemination among map producers worldwide in the early disaster phase. VirtualOSOCC users can also request triggering of the [International Charter - Space and Major Disasters](#) through GDACS/VirtualOSOCC, which then goes for review by OCHA and UNOSAT for potential activation.

**GDACS Satellite Mapping Coordination System (SMCS)** is a tool to inform of on-going and past satellite imagery analyses for specific events. It allows users to see which events are analysed by whom. This contributes to a horizontal (as opposed to top-down) coordination and to reduce duplication of efforts. The SMCS can be seen as a discussion forum and operational coordination tool for satellite image analysis professionals. GDACS encourages all satellite imagery analysis entities to contribute to the SMCS. To contribute please contact [maps@gdacs.org](mailto:maps@gdacs.org)

UNITAR/UNOSAT leads the GDACS working group on maps and satellite imagery and encourages all relevant entities to participate in this work, ensuring a close link to the GDACS user community. The [GDACS Satellite Mapping Coordination System \(SMCS\)](#) is a tool for GIS-experts working with satellite imagery for specific events. It allows users to see which images are collected where and which entity is working on what type of analysis.

**Satellite Mapping Overview**

Title	Modified Date	Clicks
<a href="#">Satellite Mapping Overview</a>	1/31/2017	21
<a href="#">Satellite Mapping Overview</a>	1/24/2017	88
<a href="#">Satellite Mapping Overview</a>	1/17/2017	123
<a href="#">Satellite Mapping Overview</a>	1/10/2017	140
<a href="#">Satellite Mapping Overview</a>	12/19/2016	223
<a href="#">Satellite Mapping Overview</a>	12/6/2016	276
<a href="#">Satellite Mapping Overview</a>	11/29/2016	228
<a href="#">Satellite Mapping Overview</a>	11/4/2016	431
<a href="#">Satellite Mapping Overview</a>	10/25/2016	322
<a href="#">Satellite Mapping Overview</a>	10/20/2016	260
<a href="#">Satellite Mapping Overview</a>	10/13/2016	315
<a href="#">Satellite Mapping Overview</a>	10/13/2016	238
<a href="#">Satellite Mapping Overview</a>	9/27/2016	501
<a href="#">Satellite Mapping Overview</a>	9/23/2016	299
<a href="#">Satellite Mapping Overview</a>	9/14/2016	411
<a href="#">Satellite Mapping Overview</a>	7/12/2016	1026
<a href="#">Satellite Mapping Overview</a>	6/29/2016	514
<a href="#">Satellite Mapping Overview</a>	6/21/2016	505
<a href="#">Satellite Mapping Overview</a>	6/15/2016	491

# GDACS - Satellite Mapping Coordination System (SMCS)

GDACS-SMCS Account Create Event View Event

Zoom to Area...

North Pacific North Atlantic South Pacific

NORTH AMERICA SOUTH AMERICA EUROPE ASIA AFRICA AUSTRALIA Indian Ocean

Satellite Mapping Coordination

Only Archived

Only Active

Show Both

Search SMCS Events...

Satellite Mapping Overview Reports

Live Maps

The GDACS Satellite Mapping and Coordination system provides a communication and coordination platform where organisations may monitor and inform stakeholders of their completed, current and future mapping activities for ongoing emergencies. There are three main parts of the GDACS-SMCS:

**Satellite mapping coordination**

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Request satellite analysis

Upload field assessments

Contribute mapping information

**Satellite mapping overview reports**

This service summarizes current satellite mapping activities of interest to GDACS stakeholders. It is issued weekly by UNOSAT and based on contributions from map-producing entities and GDACS partners.

View latest reports

**Live maps**

UNOSAT Live maps provide an up to date overview of an emergency, bringing together imagery, analysis from different organisations into a single place allowing for a more holistic view of an emergency event

View Latest Maps

OCHA Office for the Coordination of Humanitarian Affairs

European Commission

GDACS Global Disaster Alert and Coordination System

unitar United Nations Institute for Training and Research

## Satellite Mapping Coordination System (SMCS)

GDACS-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. Satellite Mapping Coordination
2. Satellite Mapping Overview Reports
3. Live Maps

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

# Satellite Mapping Coordination – Overview 2016

11 Emergencies  
1 Simulation

6  5  1 

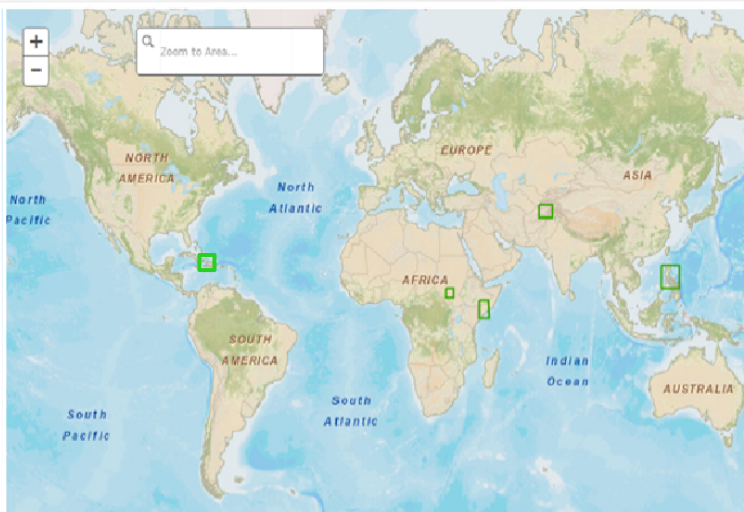
75% Requested  
by UNOCHA





# GDACS - Satellite Mapping Coordination

GDACS-SMCS
Account
Create Event
View Event ▾



**Satellite Mapping Coordination**

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Only Active

Show Both

Search SMCS Events...

**Satellite Mapping Overview Reports**

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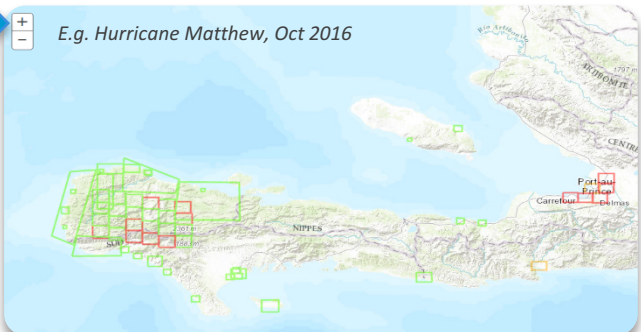
## Satellite Mapping Coordination

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

+

-

*E.g. Hurricane Matthew, Oct 2016*



**Analysed by UNOSAT**

**Current Status:** Completed

**Activity:** Satellite Detected Waters

**Sensor:**Radarsat-2

**Date :**08/10/2016

**Activity2:**Damage Assessment

**Sensor1:**Pleiades

**Date :**09/11/2016

**Sensor2:**Worldview-2

**Date:**14/10/2016

**Location:**Grande Anse

**Imagery Analysis status**

Planned

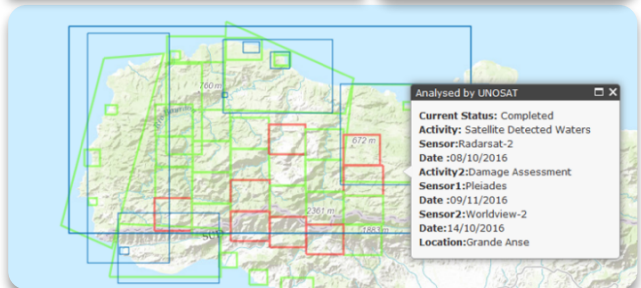
In Progress

Completed

All Activities

**Published map products**

UNITAR-UNOSAT Maps



**Analysed by UNOSAT**

**Current Status:** Completed

**Activity:** Satellite Detected Waters

**Sensor:**Radarsat-2

**Date :**08/10/2016

**Activity2:**Damage Assessment

**Sensor1:**Pleiades

**Date :**09/11/2016

**Sensor2:**Worldview-2

**Date:**14/10/2016

**Location:**Grande Anse

# GDACS - Satellite Mapping Overview Report

GDACS-SMCS Account Create Event View Event

Zoom to Asia...

**Satellite Mapping Coordination**

- Only Archived
- Only Active
- Show Both

Search SMCS Events...

**Satellite Mapping Overview Reports**

**Live Maps**

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- Request satellite analysis >
- Upload field assessments >
- Contribute mapping information >

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[View latest reports >](#)

## Live maps

UNOSAT Live maps provide an up to date overview of an emergency, bringing together imagery, analysis from different organisations into a single place allowing for a more holistic view of an emergency event

[View Latest Maps >](#)



## Satellite Mapping Overview Reports

- Narrative overview & summary of ongoing satellite mapping emergencies

*E.g. Hurricane Matthew, Oct 2016*

**GDACS Report for Haiti**

Title: Haiti tropical cyclone  
As of: 2016-10-24  
Glide: TC-2016-000106-HTI  
Text: Tropical cyclone Matthew made landfall over the west coast of Haiti on 04 October 2016. The International Charter on Space and Major Disasters was activated on 03 October 2016 by the USGS on behalf of the Pacific Disaster Center, UNITAR-UNOSAT and the Copernicus Emergency Management Service published new products related to the event. UNITAR-UNOSAT recently released an updated satellite based damage assessment report for the Grand South

[Zoom to](#)

**GDACS Report for Haiti**

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[Zoom to](#)

**GDACS**

This service summarizes current satellite mapping activities of interest to GDACS stakeholders. It is issued weekly and based on contributions from map-producing entities and GDACS partners.

**Satellite mapping overview**  
As of 24 October 2016

Asia


Philippines tropical cyclone - GLIDE number: TC-2016-000118-PHL  
On 15 October 2016, tropical cyclone Yaman marks the Philippines and impacted more than 100,000 people. The storm struck only four days after tropical cyclone Yaku made landfall over the country. The NASA Earth Observatory acquired 18 October 2016 satellite imagery of the situation in the region and created an overview map. All of the data frames was visible approaching the Philippines from the west as a category 4 storm, with maximum sustained winds of approximately 240 kilometers per hour. Around the same time, tropical cyclone Yaku could be seen tracking over China's Hainan Island, where it made landfall that day. After hitting the Philippines, Yaman also tracked to China where it ultimately affected the southern part of the country, particularly Hong Kong. This map product is available for online viewing or download in GeoTIFF and JPEG format on the NASA Earth Observatory website.  
Source: NASA Earth Observatory  
URL: <http://theearthobservatory.nasa.gov/earthimage/imagery/20161024-20161024-000118-PHL>

Caribbean

Cuba tropical cyclone - GLIDE number: TC-2016-000106-CUB  
Cuba was hit with heavy rainfall and strong winds on 04 October 2016 as tropical cyclone Matthew struck the northeast coast of the country. The International Charter on Space and Major Disasters was activated on 03 October 2016 by UNOSAT/UNOSAT and project management was assumed by the European Space Agency. UNITAR-UNOSAT published a preliminary satellite based damage assessment report of its findings in Copernicus Emergency Management Service on 11 October 2016. UNITAR-UNOSAT identified a total of 1437 damaged buildings in the Spanish, Capahate, Matiz and large areas of Guantánamo Province. New maps indicate 5,147 of these damaged structures were found in Guantánamo and 492 were observed in the Capahate area. Products are available for download in PDF and JPEG format on the International Charter on Space and Major Disasters and UNITAR-UNOSAT website. Accompanying data is also available in GeoTIFF and 15M geotiff format on the UNITAR-UNOSAT website.  
Sources: International Charter on Space and Major Disasters, UNITAR/UNOSAT  
URL: <http://www.theearthobservatory.com/earthimage/imagery/20161024-20161024-000106-CUB>



GDACS-SMCS
Account
Create Event
View Event ▾



**Satellite Mapping Coordination**

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Input from the field assessments is also made available to help prioritize areas needing further analysis and make available current information to help with decision making

Request satellite analysis »

Upload field assessments »

Contribute mapping information »

**Satellite mapping overview reports**


This service summarizes current satellite mapping activities of interest to GDACS stakeholders. It is issued weekly by UNOSAT and based on contributions from map-producing entities and GDACS partners.

View latest reports »


**Live maps**

UNOSAT Live maps provide an up to date overview of an emergency, bringing together imagery, analysis from different organisations into a single place allowing for a more holistic view of an emergency event


View Latest Maps »




OCHA  
Office for the  
Coordination of  
Humanitarian Affairs



European  
Commission



GDACS  
Global Disaster Alert and Coordination System

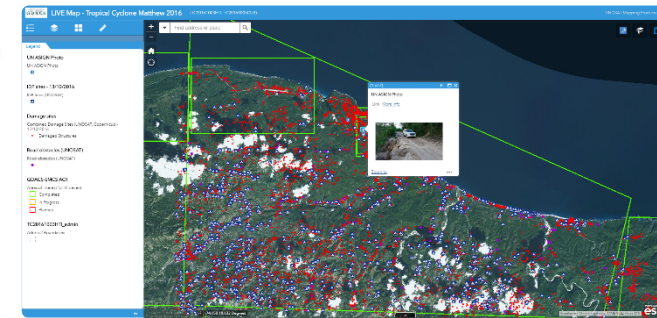


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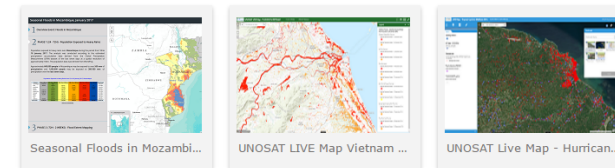
## Live Maps

- **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

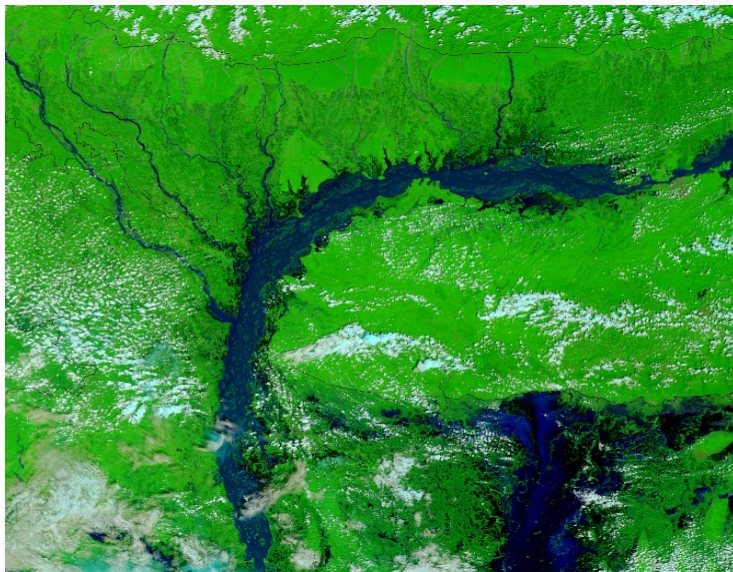
*E.g. Hurricane Matthew, Oct 2016*



Latest UNOSAT Live Maps







UNITAR	<a href="https://www.youtube.com/watch?v=48bSEKW4W3w&amp;feature">https://www.youtube.com/watch?v=48bSEKW4W3w&amp;feature</a>
UNOSAT's Rapid Mapping	<a href="https://www.youtube.com/watch?v=FkR3N5ktt4U">https://www.youtube.com/watch?v=FkR3N5ktt4U</a>
Master level training course with University of Copenhagen	<a href="https://www.youtube.com/watch?v=oXe4aACkvzk">https://www.youtube.com/watch?v=oXe4aACkvzk</a>
Unmanned Aerial Systems for Rapid Mapping	<a href="https://www.youtube.com/watch?v=3IU0-KqGqkg">https://www.youtube.com/watch?v=3IU0-KqGqkg</a>
Growth of AlZaatari Refugee Camp	<a href="https://www.youtube.com/watch?v=g2h-UEdgiQs">https://www.youtube.com/watch?v=g2h-UEdgiQs</a>
UNOSAT at TEDx: There is nothing natural about disasters	<a href="https://www.youtube.com/watch?v=h7fbZxoWIY">https://www.youtube.com/watch?v=h7fbZxoWIY</a>
Introduction to International Charter Space and Major Disasters	<a href="https://www.youtube.com/watch?v=dRN1dkHqIPM">https://www.youtube.com/watch?v=dRN1dkHqIPM</a>
NASA Earth Observatory:	<a href="http://earthobservatory.nasa.gov/">http://earthobservatory.nasa.gov/</a>
Advantages and challenges of satellite based response:	<a href="http://www.sciencedirect.com/science/article/pii/S1877042814016449">http://www.sciencedirect.com/science/article/pii/S1877042814016449</a>





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# Questions and Answers

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Организации Объединенных Наций  
معهد الأمم المتحدة للتدريب والبحث  
联合国训练研究所



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](http://www.unitar.org)



A satellite view of Earth showing a large-scale weather system, possibly a cyclone or hurricane, with a prominent eye and spiral cloud bands. The image is partially obscured by a semi-transparent grey rectangular box in the center. Inside the box, the text "Demonstration of GDACS Features for Monitoring Disasters" is displayed in a bold, black, sans-serif font. A thin black horizontal line is positioned below the text.

# Demonstration of GDACS Features for Monitoring Disasters

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