United Nations Institute for Training and Research

UNOSAT

Efficient Emergency Response Using Earth Observation

Khaled Mashfiq
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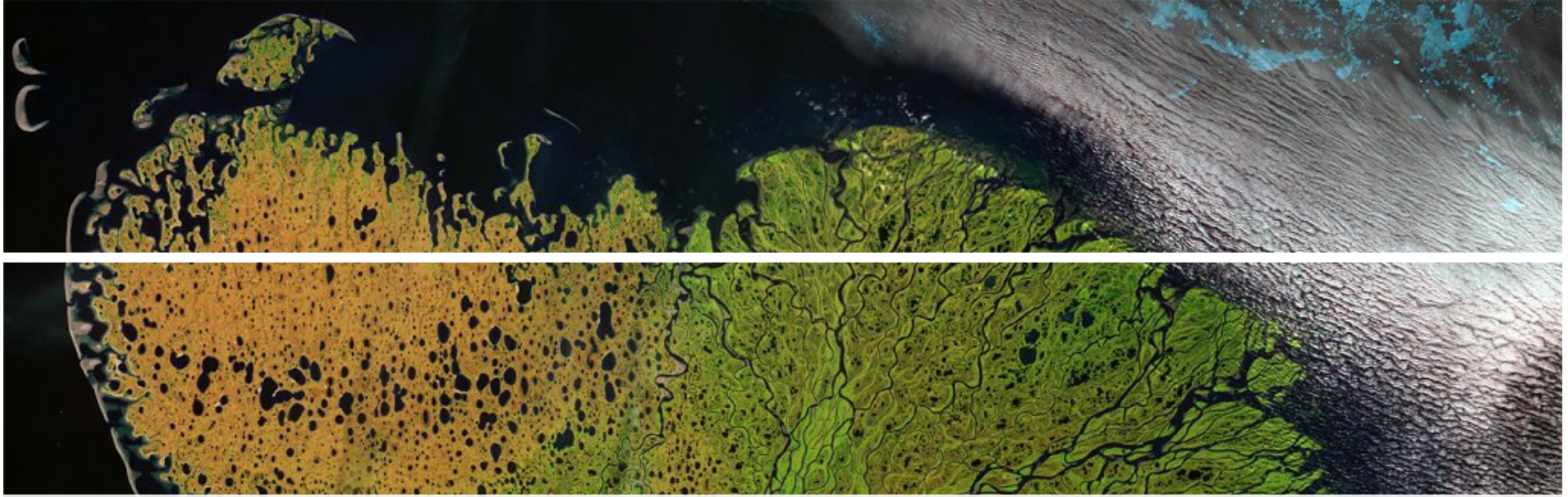
29 /September / 2016

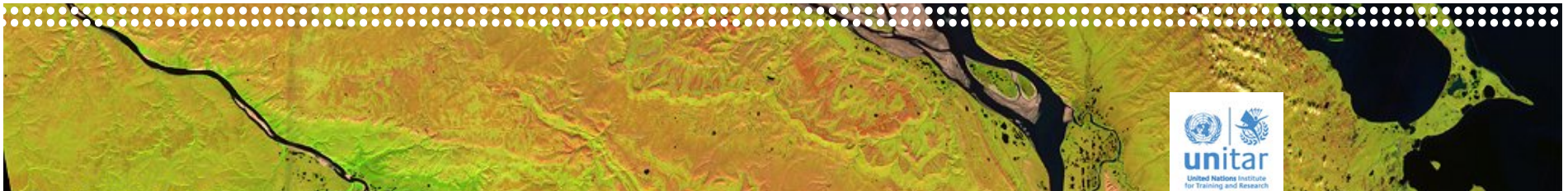
"2016 International Training Workshop on Natural Disaster Reduction"

September 26th – 30th 2016, Taipei



UNITAR's Operational Satellite Applications Programme - UNOSAT

www.unitar.org/unosat



What is UNITAR?

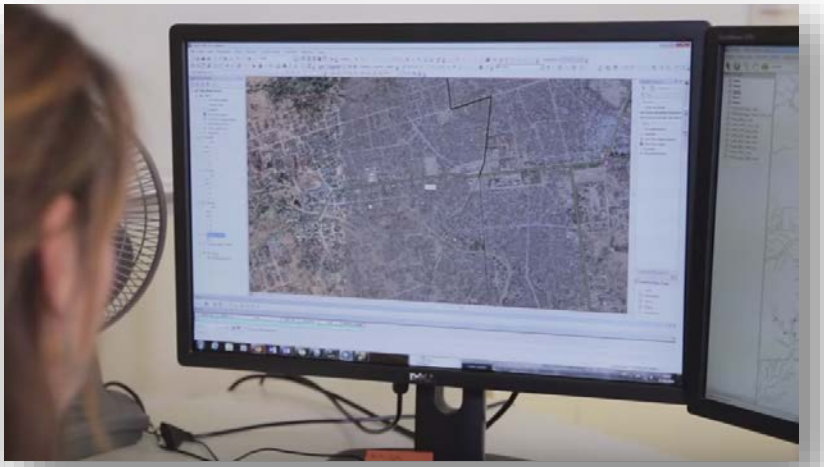
The United Nations Institute for Training and Research (UNITAR) is a principal training arm of the United Nations, working in every region of the world to empower individuals, governments and organizations through knowledge and learning to effectively overcome contemporary global challenges.

Mission

"To develop capacities to enhance global decision-making and to support translation of those decisions into action at country level"

About UNOSAT

- An operational programme of UNITAR serving 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
- Presence: Geneva (hosted at CERN), Bangkok, Nairobi, N'Djamena



UNOSAT's Main Activities

MAPPING

Analysis, Research and Innovation

TRAINING AND CAPACITY DEVELOPMENT

Hands on, National and Regional level, Technical Backstopping

Knowledge Transfer

Outline

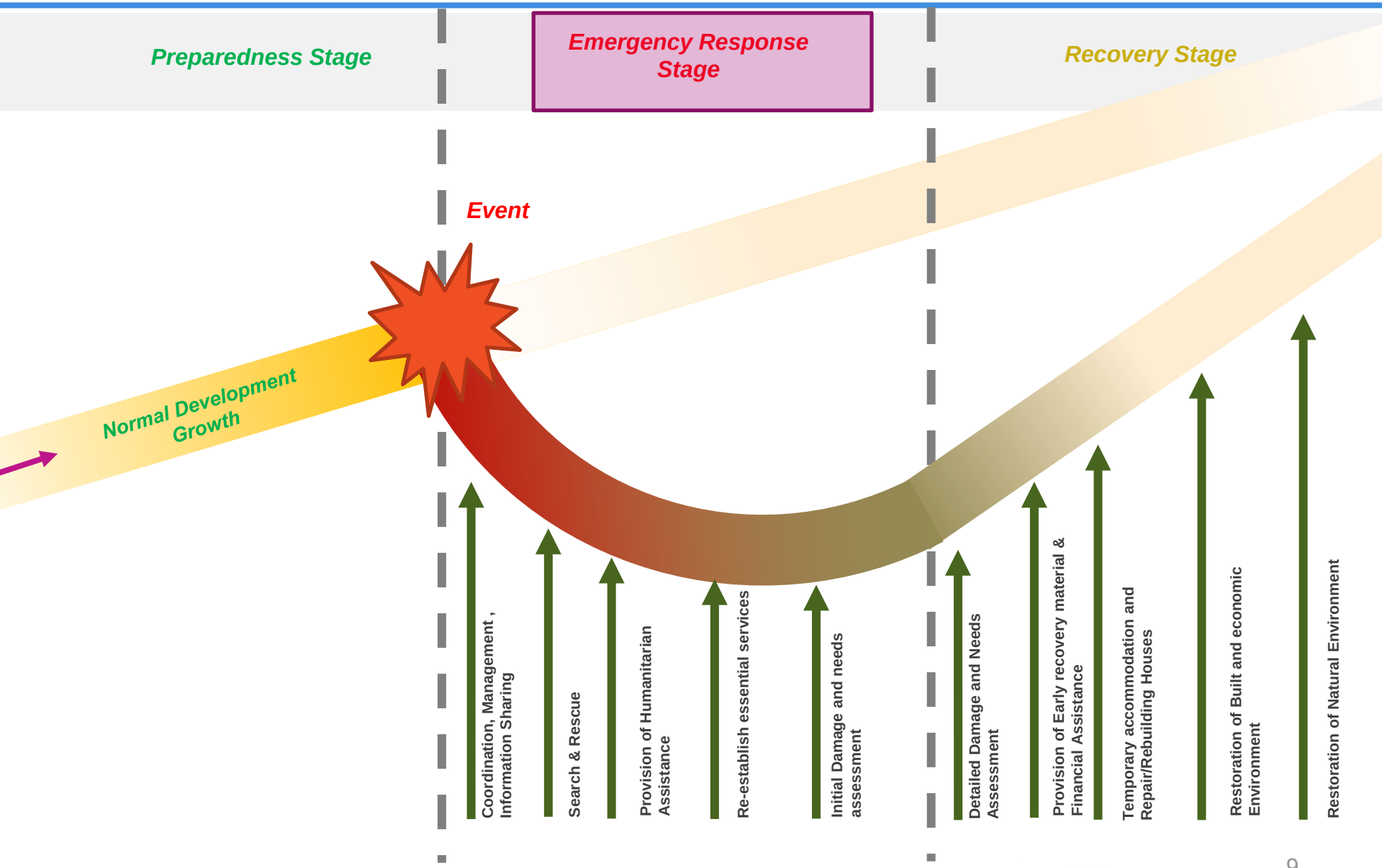
- Major Disaster & Humanitarian Framework
- Role of Geo Spatial Information in Disaster Response
- Workflow: Satellite derived analysis for emergency response
- Geospatial Information for Addressing Varying Needs for Different Phases of Disaster
- Developing Sustainable capacities

Major Disaster & Humanitarian Framework

"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**"

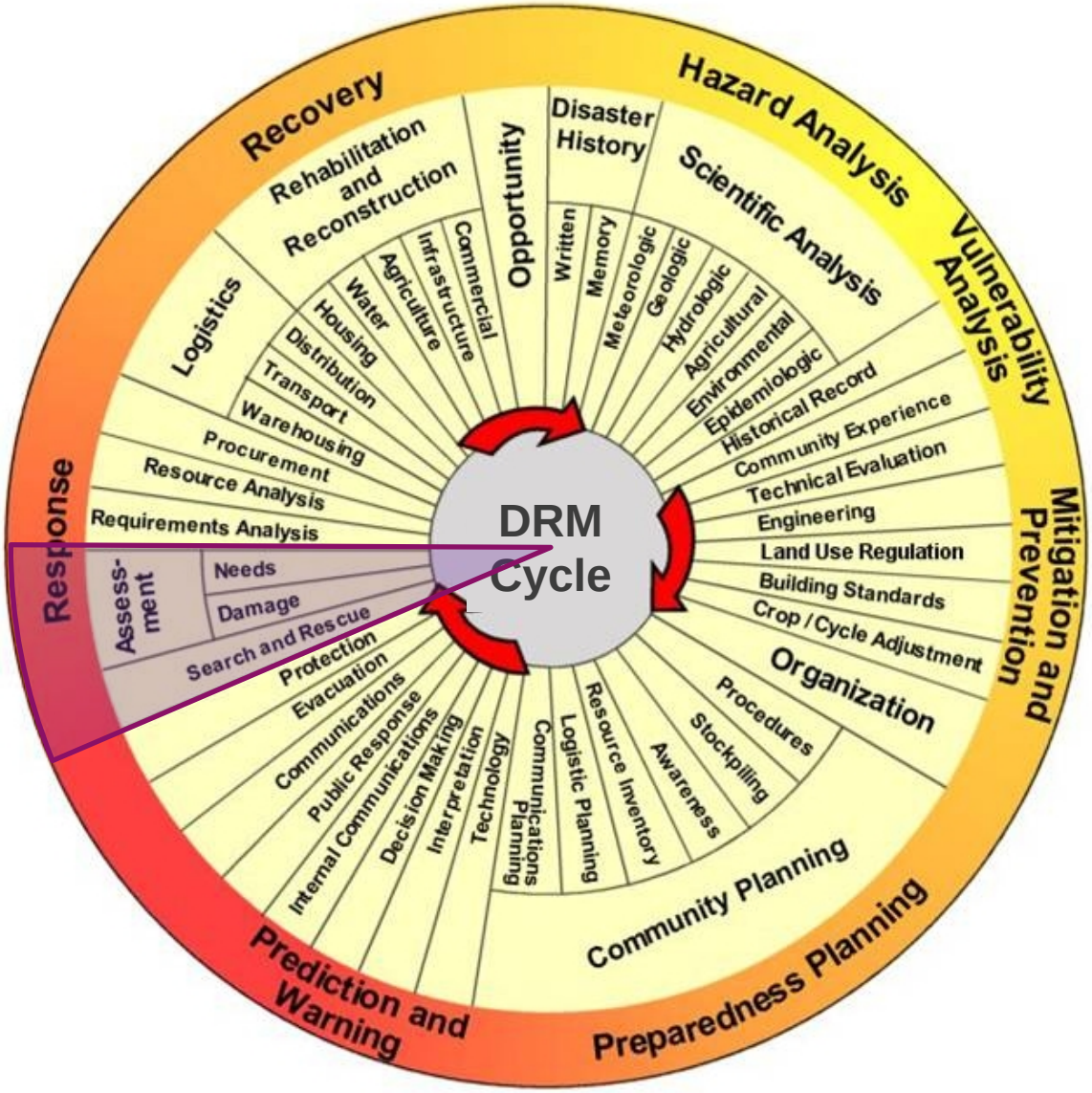
Inter-Agency Standing Committee, Dec 1994.

Disaster Impacts and Development

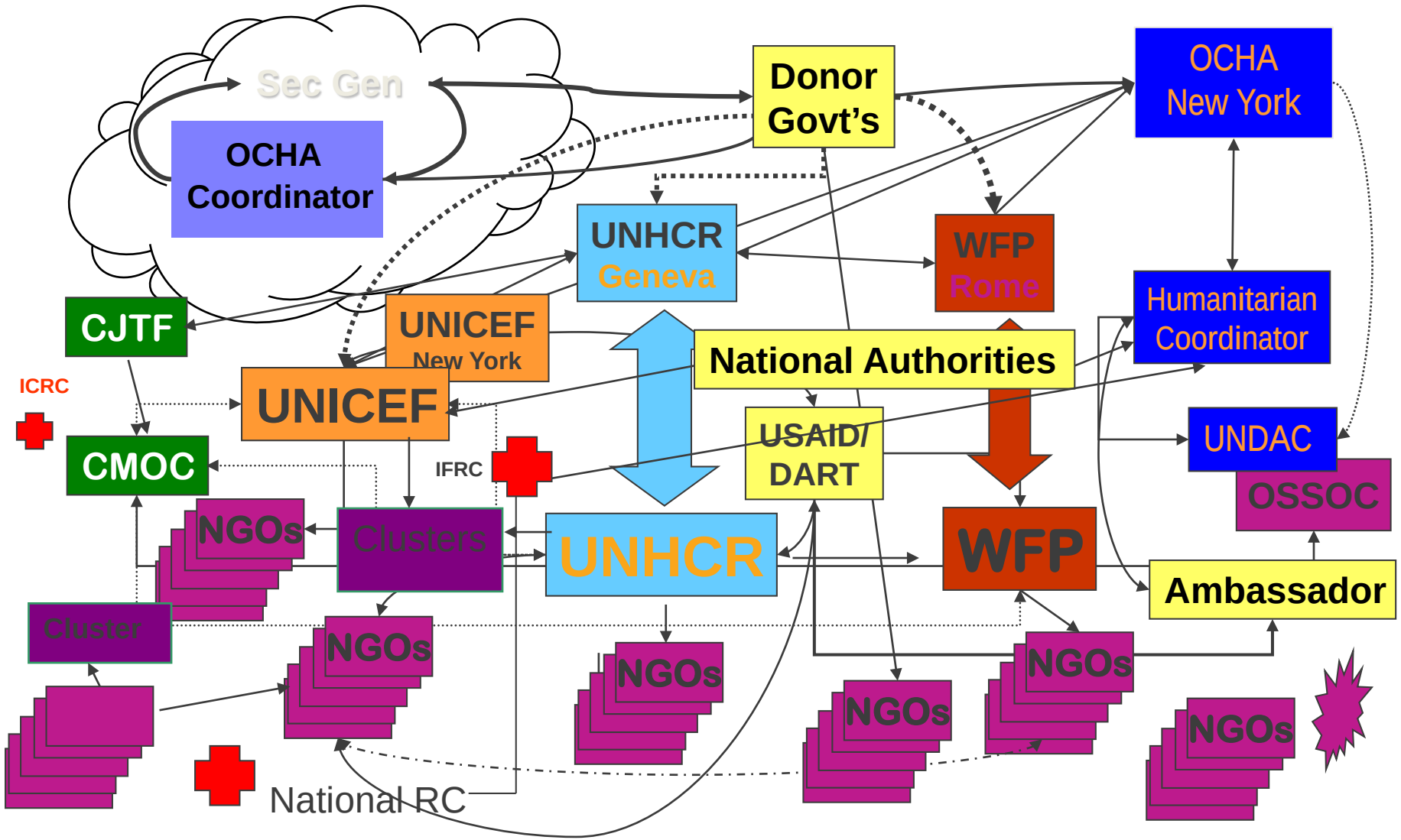


unitar

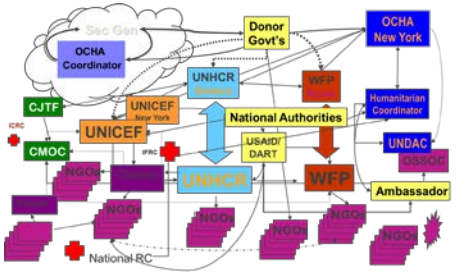
Emergency Response &Disaster management cycle



Humanitarian Actors



Disaster Cycle & Uncertainty



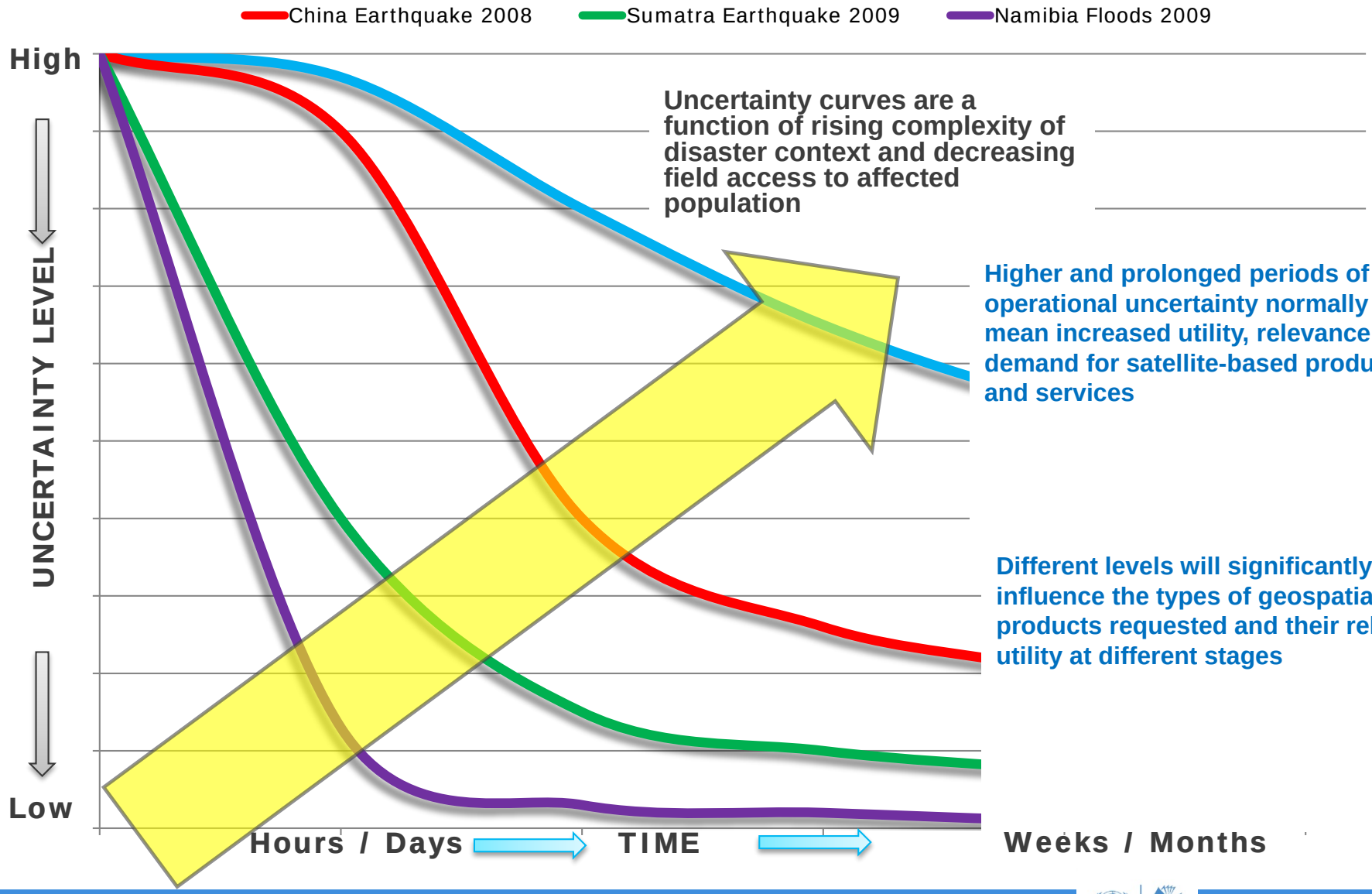
Operational uncertainty highest in early disaster response stage

Basic Definition of Operational Uncertainty in context of Humanitarian Operations

“Fog of Disaster” - Early stages of major disasters characterized by limited, incomplete and often contradictory information of unknown accuracy related to:

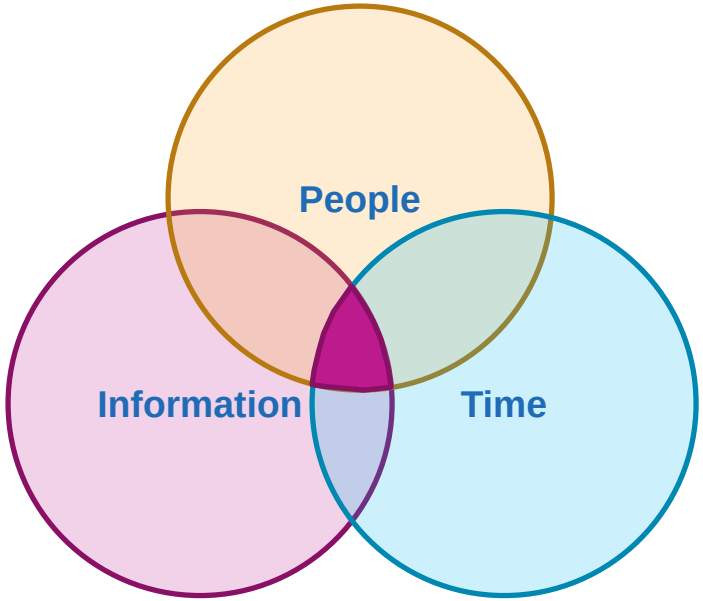
- Geographic extent of affected area(s)
- Numbers & Locations of casualties and at-risk population
- Damages to housing, infrastructure, transport facilities
- Capacity and response of local/national authorities
- Capacity and coordination of Int. humanitarian actors (3Ws Who Does What Where)

UNCERTAINLY LEVELS AS FUNCTION OF TIME & DISASTER CONTEXT (QUALITATIVE)



Role of Geo Spatial Information in Disaster Response

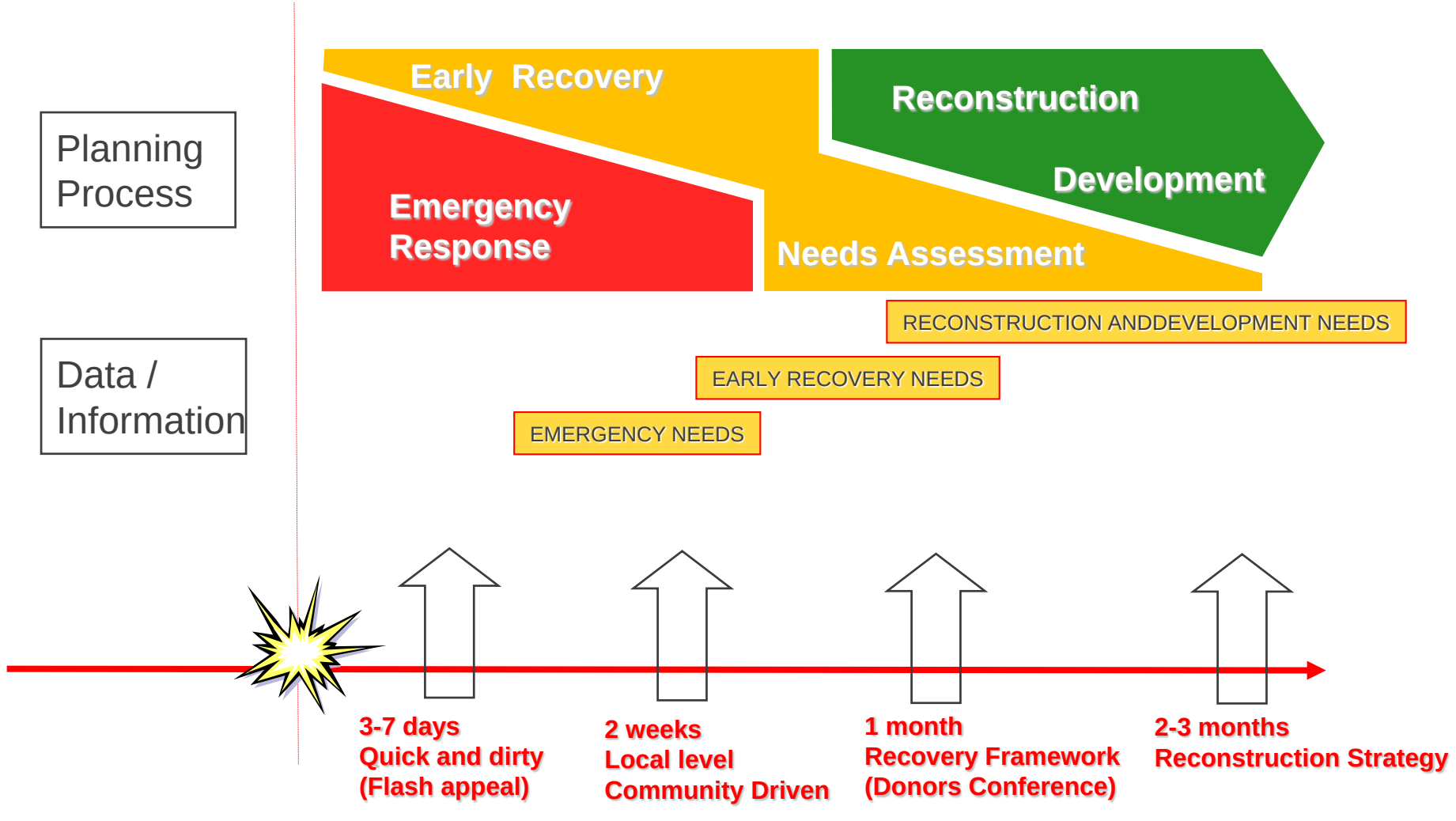
Information is the foundation on which decision-making for a coordinated and effective response is based



Objective:

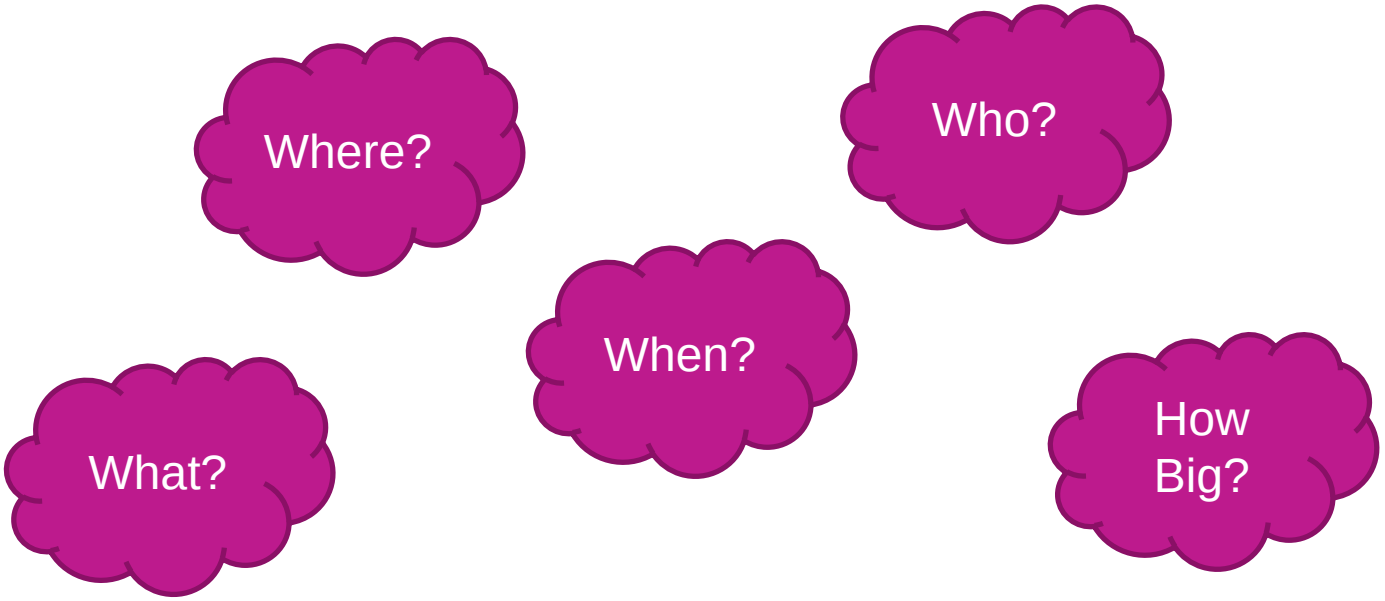
To ensure that **right information** of the humanitarian emergency is provided to the **right person** at the **right time** in a usable form to facilitate situational understanding and decision-making.

Data and Information needs during response phase



Credits: PDNA

If we need to coordinate and manage the response phase of a disaster event what are the questions that you think are relevant for planning and decision making for emergency response?



- **Right Information**
- **Right People**
- **Right Time**

A Photo is Worth a Thousand Words!!!!!

Pakistan • Monsoon Floods
Situation Report # 14
18August 2010

OCHA United Nations Office for the Coordination of Humanitarian Affairs
PARTNERSHIP FOR HUMANITY

II. Situation Overview

Government figures on the number of people directly affected by the floods remain unchanged since the previous situation report, at 15.4 million (National and Provincial Disaster Management Authorities, 18 August). Assessments to establish the degree to which affected populations are in need of immediate humanitarian assistance continue. The official death toll has risen to 1,475, with 2,052 people reported as injured. Almost 1 million houses are now reported as having been either damaged or destroyed.

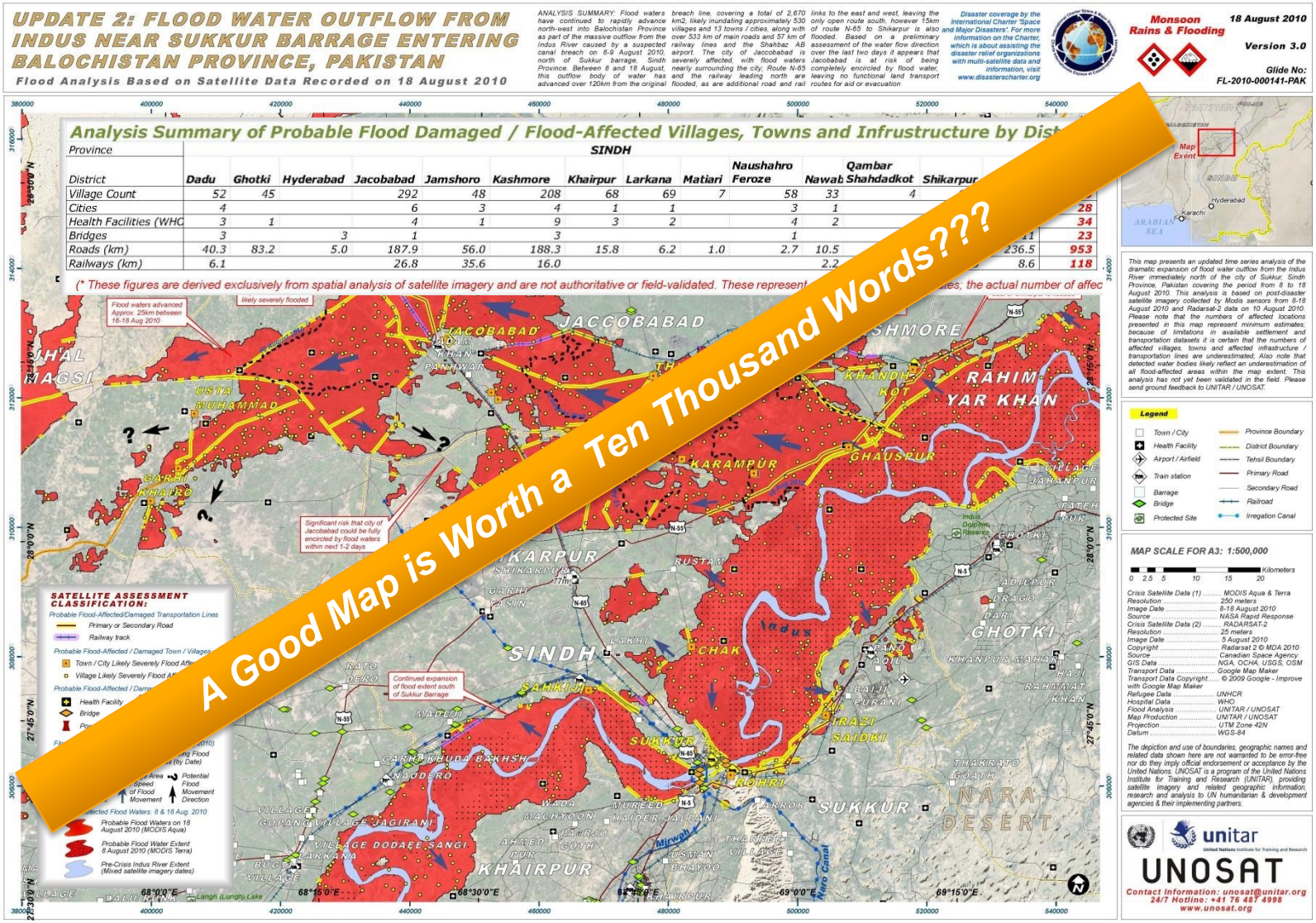
The south of the country continues to feel the impact of the second wave of floods, with a spur of the Indus River now stretching through Jacabobad district in Sindh into Jaffarabad in Balochistan. The Meteorological Department warns of a continuing risk of inundation of low-lying areas of Khairpur, Jacobabad, Ghotki, Sukkur, Larkana, Nawabshah, Hyderabad, Naushahro Feroze and Thatta districts of Sindh in the coming days. The Meteorological Department's Flood Forecasting Division reports that flood levels in the Indus are holding at "extremely high" levels at Guddu and Sukkur in northern Sindh, and rising further downriver at Kotri, as the flood wave continues to move through the province.

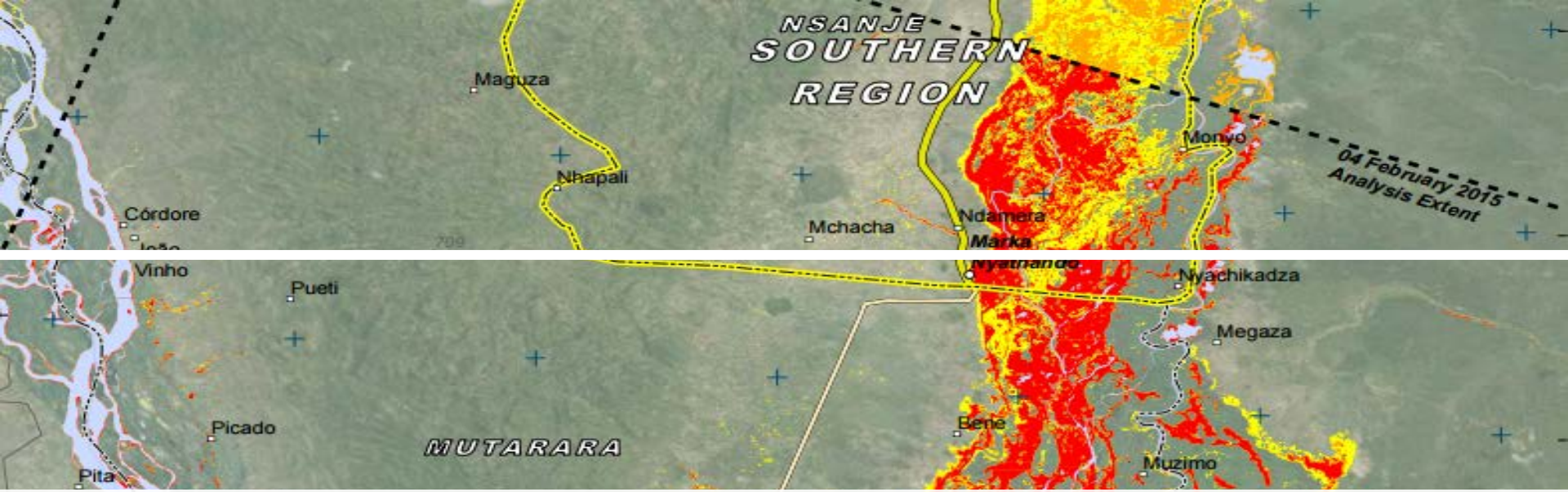
Despite the continuing efforts of the Government and the humanitarian community to assist affected populations across the country, large numbers of people are yet to be reached with the assistance they need, particularly in Sindh and Punjab. While funding levels are now improving in key sectors, the continuing threat of flooding in many areas and the manner in which populations are spread across a vast area persist as major operational challenges.

In Khyber Pakhtunkhwa province (KPK), where the response has been quicker to scale up, the Chakdara Bridge in Lower Dir district has been re-opened to light traffic as of 17 August, restoring limited road access to Upper Dir and Chitral districts. The Karakoram highway continues to be blocked, cutting off road access to Gilgit-Baltistan. The Frontier Works Organization (FWO) has indicated that at least three weeks will be required before the road can reopen.

The United Nations Department of Safety and Security (UNDSS) has deployed additional staff to Multan, Sukkur and Mingora in support of the floods response. Further deployments are planned, to cover Abbottabad

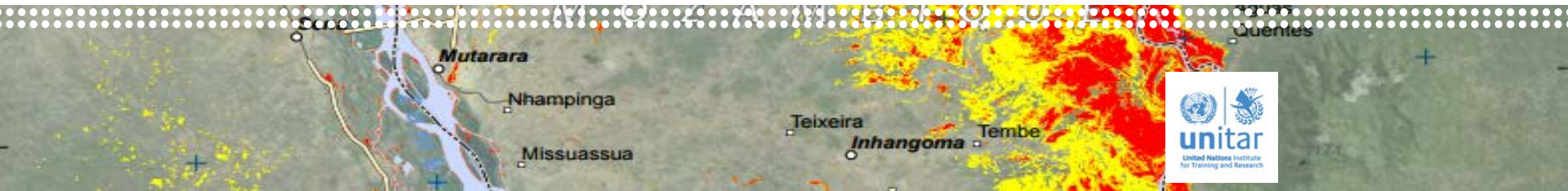
Geo-Spatial Product/ Map





Workflow: Satellite derived analysis for emergency response

www.unitar.org/unosat/rapid-mapping

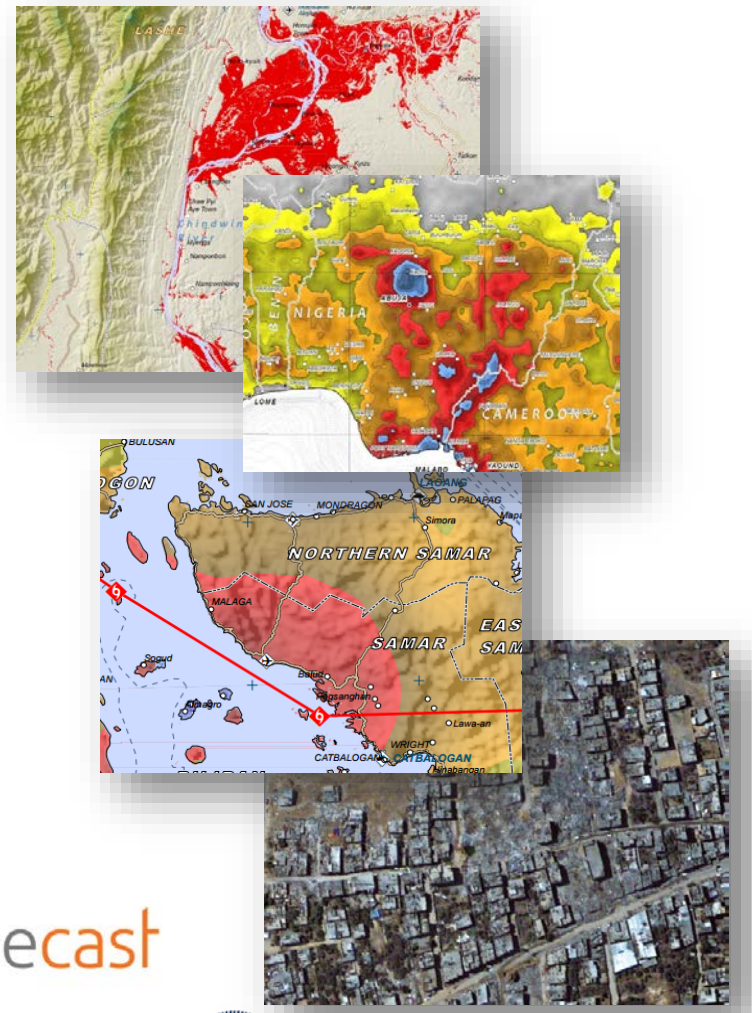


UNOSAT Rapid Mapping

https://www.youtube.com/watch?v=FkR3N5ktt4U

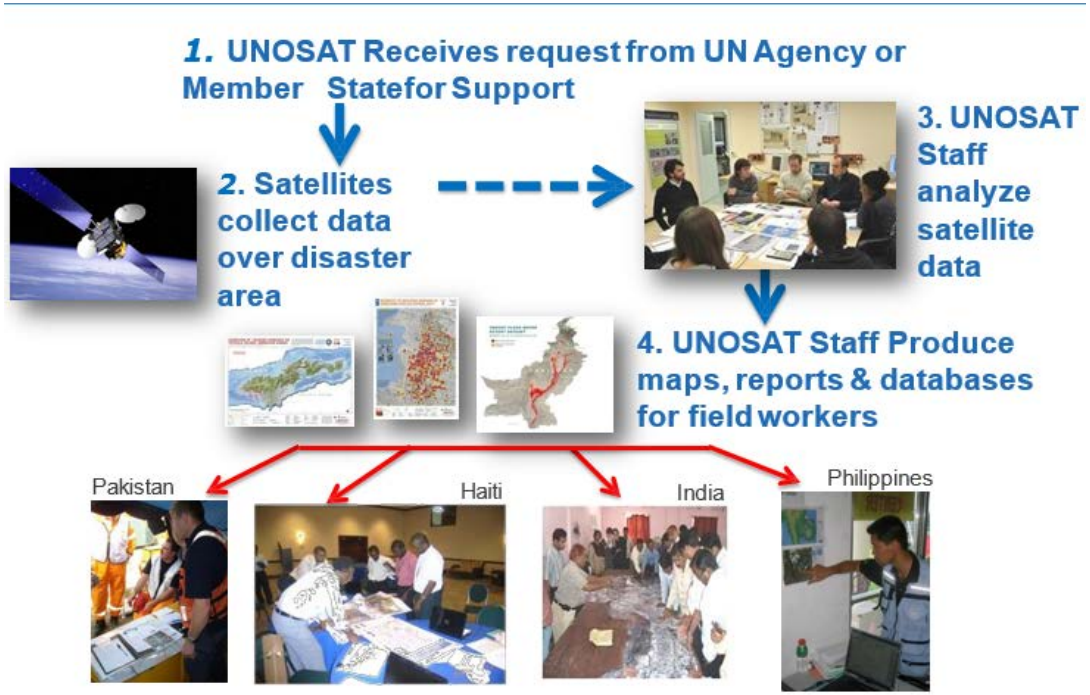
Humanitarian Rapid Mapping

- Provides satellite image analysis during humanitarian emergencies – natural disasters and conflict-situations (Maps, GIS-ready data, statistics and reports)
- Wide range of Optical and Radar satellite imagery from commercial and scientific sensors (no military data) from very high resolution (32 cm), to low resolution (1km)
- As of today approximately 25% of humanitarian activations benefit from data delivered through the Charter. For the rest of activations UNOSAT relies on in kind contributions (i.e. EnhancedView program though US State Department) as well as from imagery funds (approx. 200k per year from donors and UN sister agencies).



DigitalGlobe
EUROPEAN SPACE IMAGING
urthecast
AIRBUS DEFENCE & SPACE
KSAT KONGSBERG SATELLITE SERVICES
International Charter Space & Major Disasters
deimos IMAGING
esa
sentinel-1
unitar

UNOSAT Operational Activities: Satellite Analysis & Mapping:



UNOSAT Rapid Mapping group is available on call 365 days 24/7

24/7 365 days

+41 75 411 4998

emergencymapping@unosat.org

Floods

Earthquakes

Cyclone

Land Slides

Refugee and Internally Displaced Persons Mapping

Cultural Heritage Sites

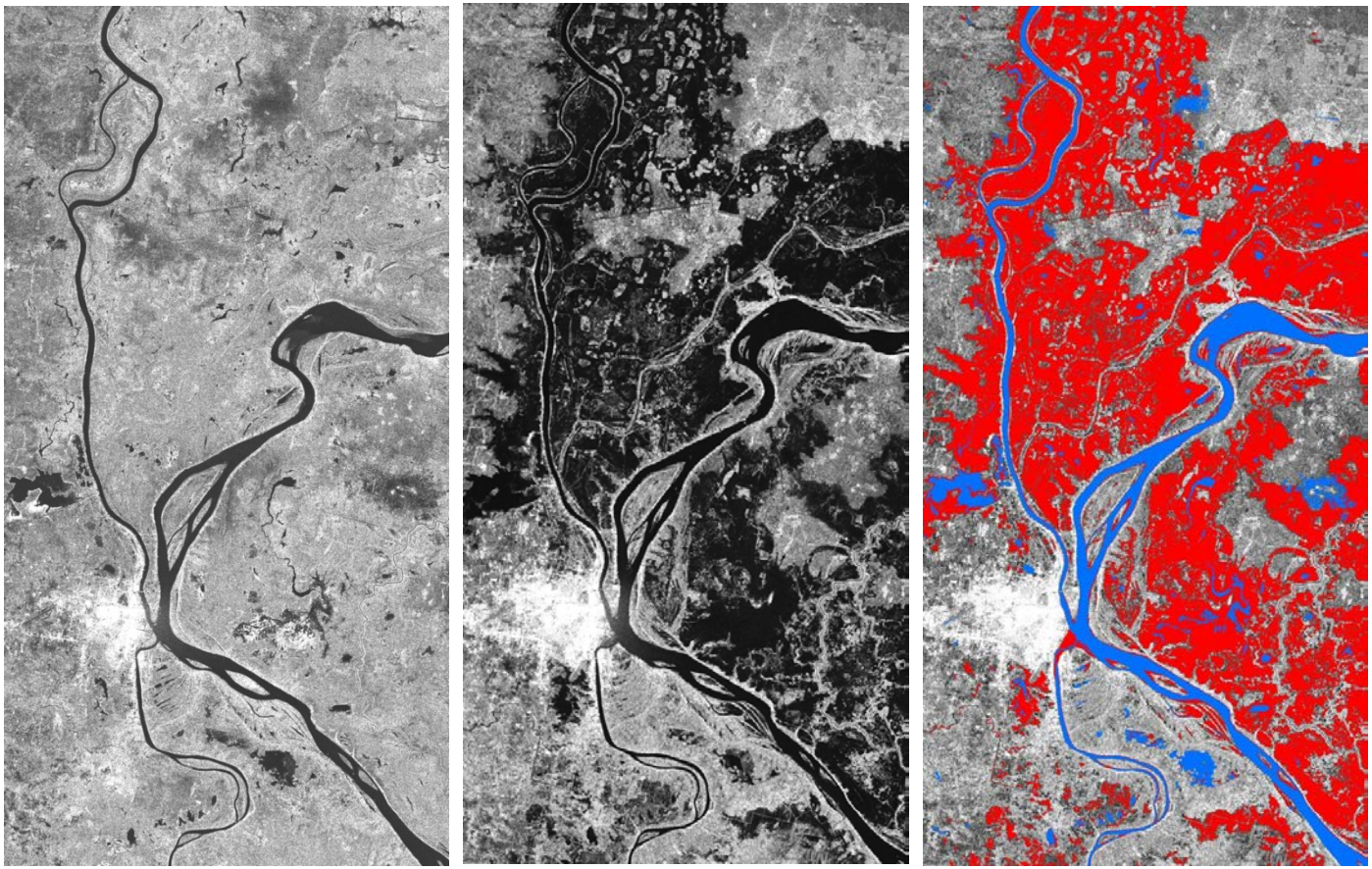
Conflict Damage Assessment

And so on…

Source: NASA Earth Observatory

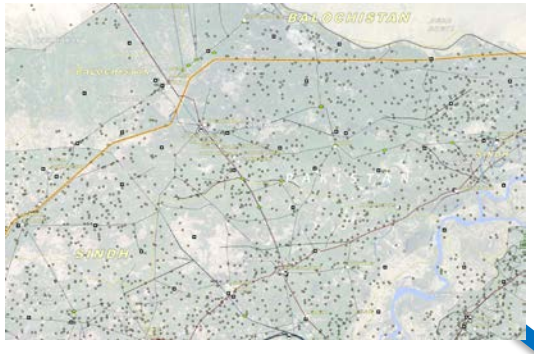
Flood Detection from RADAR Images

Mekong River (Cambodia), 2008-floods



RADARSAT

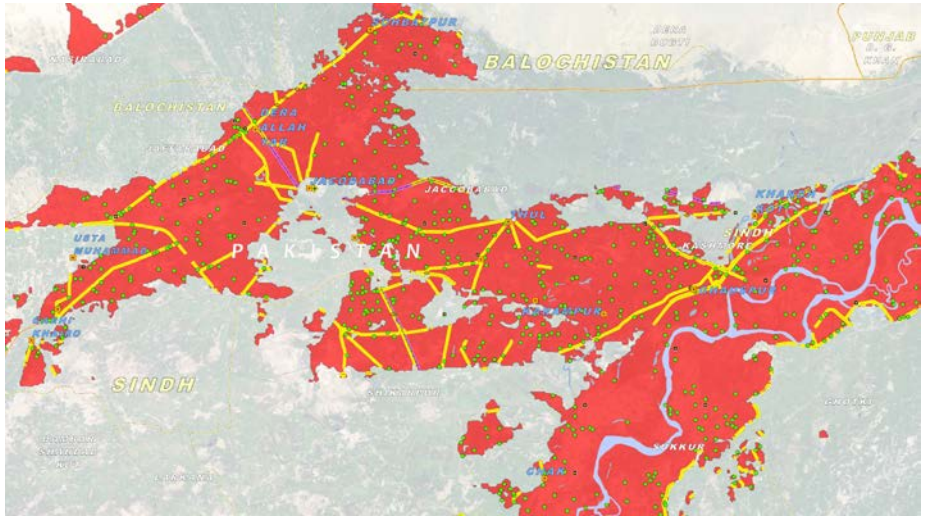
Analysis Overview of Workflow



Google Map Maker Data for Pakistan

+

UNOSAT Flood Water Analysis



Combination of data allows for detailed and comprehensive preliminary damage analysis for country of Pakistan

Summary of Flood-Affected Populated Places and Infrastructure

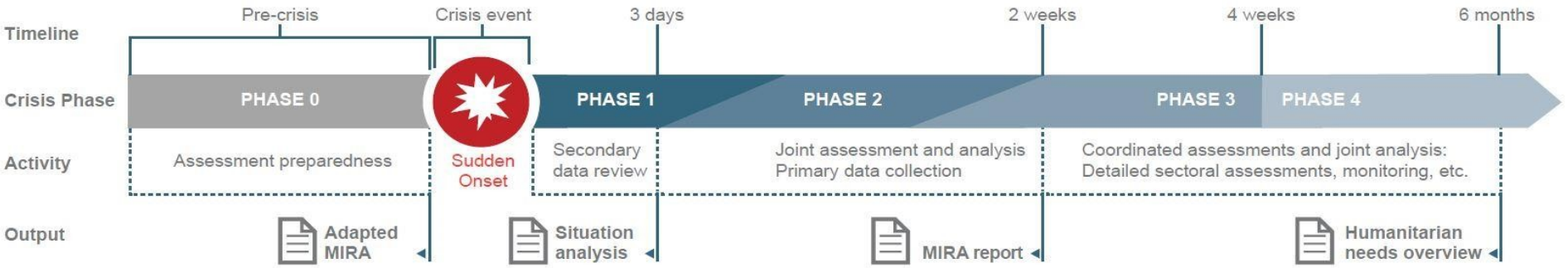
Province	BALOCHISTAN	KHYBER PAKHTUNKHWA	PUNJAB	SINDH	Others	Total
Village Count	174	808	4,037	2,463	10	7,492
Towns / Cities	6	39	54	36	0	135
Health facilities	12	20	70	88	0	190
Bridges	11	183	139	95	1	429
Roads (km)	313	772	1,613	2,331	21	5,051
Railways (km)	10	27	169	199	0	406

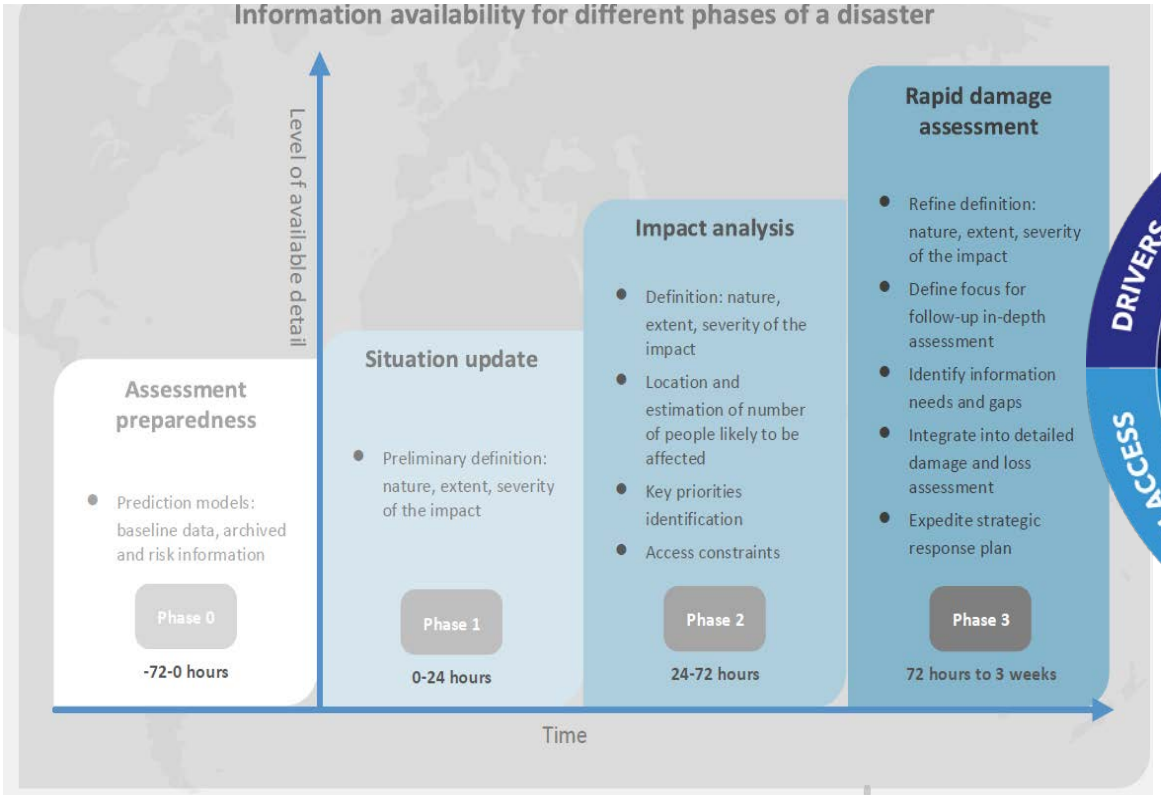
Before

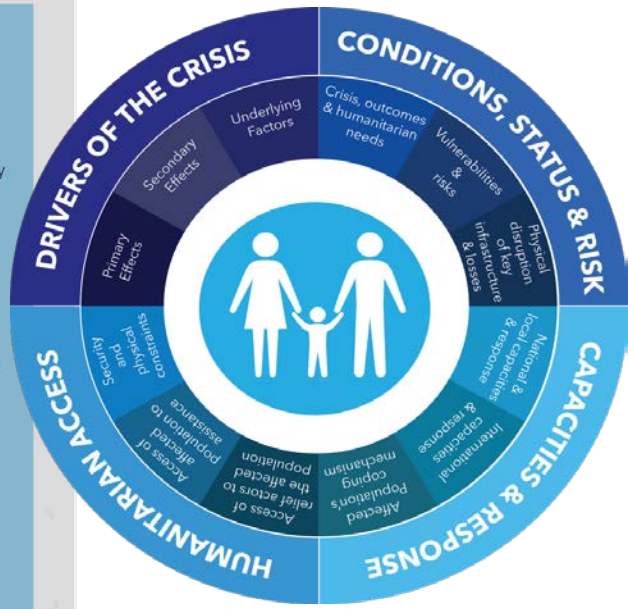
After

Geospatial Information for Addressing Varying Needs for Different Phases of Disaster

Catalogue of Geospatial Products to support humanitarian Programme Cycle







Catalogues of Geospatial Products

CATALOGUE OF SATELLITE DERIVED INFORMATION: FLOOD

	Preparedness Phase 0 (Pre Disaster)	Preliminary Situation Analysis Phase 1 (24hrs)	Situation Analysis Phase 1 (72hrs)	Initial Rapid Assessme Phase 2 (2 weeks)
TIMELINE				
ANALYSIS CATEGORY	**Potential Flood Scenario**	**Precipitation Analysis** **Preliminary Flood Impact**	**Flood Impact**	**Flood Monitoring & Flood Assessment**
DERIVED INFORMATION	▪ Flood Alert / Early Warning (* Flood Finder) ▪ Simulated Flood Water Scenario (* Flood Finder) ▪ Archived Satellite Detected Flood Event ▪ Identification of river network and watershed delineation and conditioned DEMs	▪ Spatial and temporal distribution of estimated precipitation accumulation (daily / monthly / yearly) ▪ Spatial and temporal distribution of precipitation anomalies (monthly / yearly) ▪ Potentially affected population by precipitation anomalies (monthly / yearly) ▪ (*Large Scale Satellite detected flood water extent (Ha/sq. km))	▪ Regional / Local Scale Satellite detected flood water extent (Ha/sq. Km) ▪ Percentage of standing flood water by administrative unit ▪ Percentage of standing flood water by predominant landcover types (rural/urban/agriculture/vegetation, etc.) ▪ Estimated affected population living within flood affected areas by administrative units ▪ Estimated number of populated places (cities, towns, villages) within flood affected areas ▪ Estimated number of IDP sites within flood affected areas ▪ Estimated number of critical facilities & transportation network within flood areas	▪ Detailed Cumulative F Extent by administrati unit ▪ Monitoring and evolut of flood event ▪ Flood damage and risk assessment (from haz models calibrated with satellite observed floo extent)
MIRA	• Flood Preparedness • Early Warning • Contingency Planning	• Preliminary definition nature, extent, severity of the impact	• Definition nature, extent, severity of the impact • Location & Estimation of number of people Likely to be affected • Key Priorities identification • Access constraints	• Define focus for follow-up in-depth assessment • Identify information Gaps & Needs • Integrate into detailed damage & loss assessment • Expedite strategic response plan

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Floods

Earthquakes

Cyclones

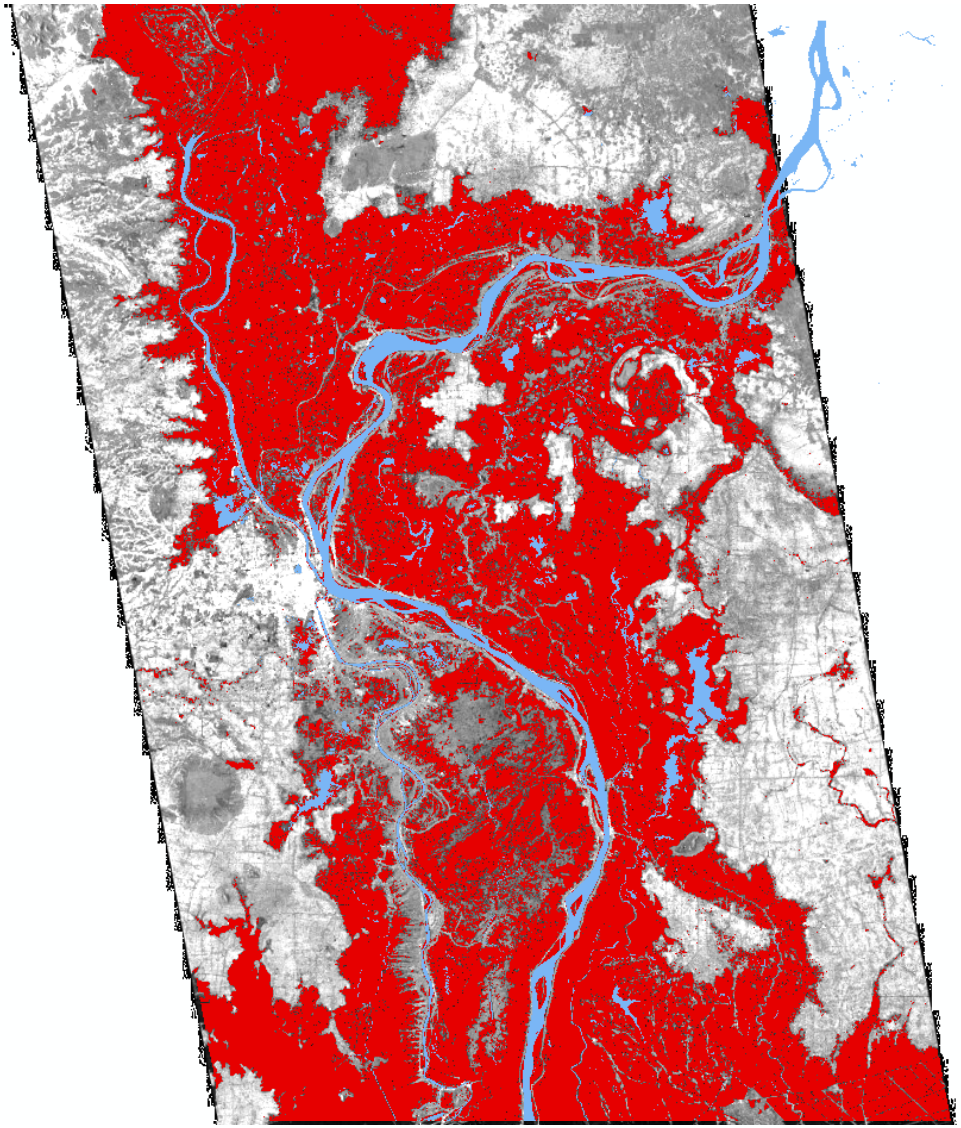
Land Slides

Refugees and Internally Displaced Persons Mapping

Cultural Heritage Sites

Conflict Damage Assessments

And so on..



Earthquake Damage Assessment

Floods

Earthquakes

Cyclones

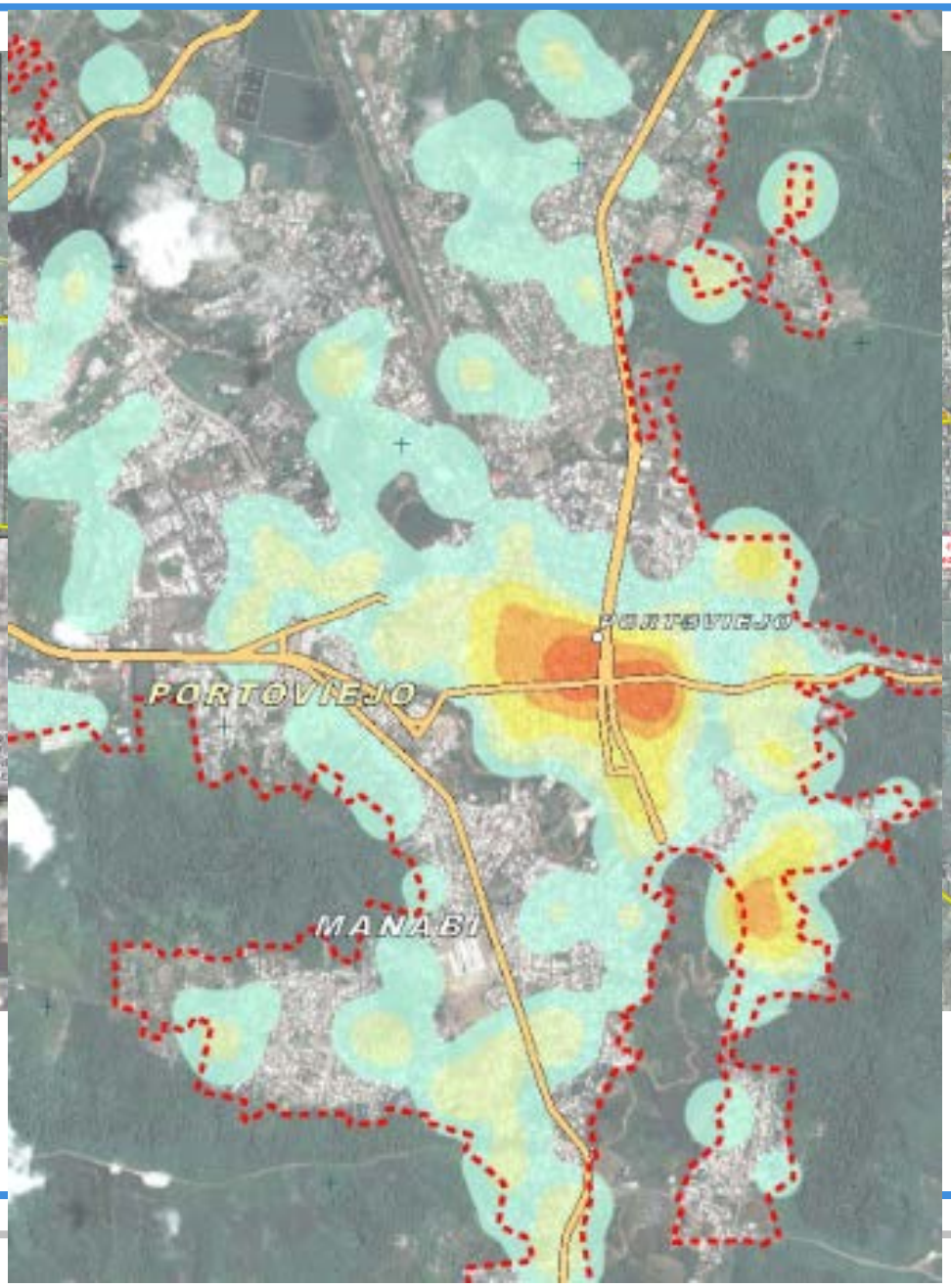
Land Slides

Refugees and Internally Displaced Persons Mapping

Cultural Heritage Sites

Conflict Damage Assessments

And so on..



Landslide

Floods

Earthquakes

Storms/Cyclones

Land Slides

Refugees and Internally Displaced Persons Mapping

Cultural Heritage Sites

Conflict Damage Assessments

And so on..

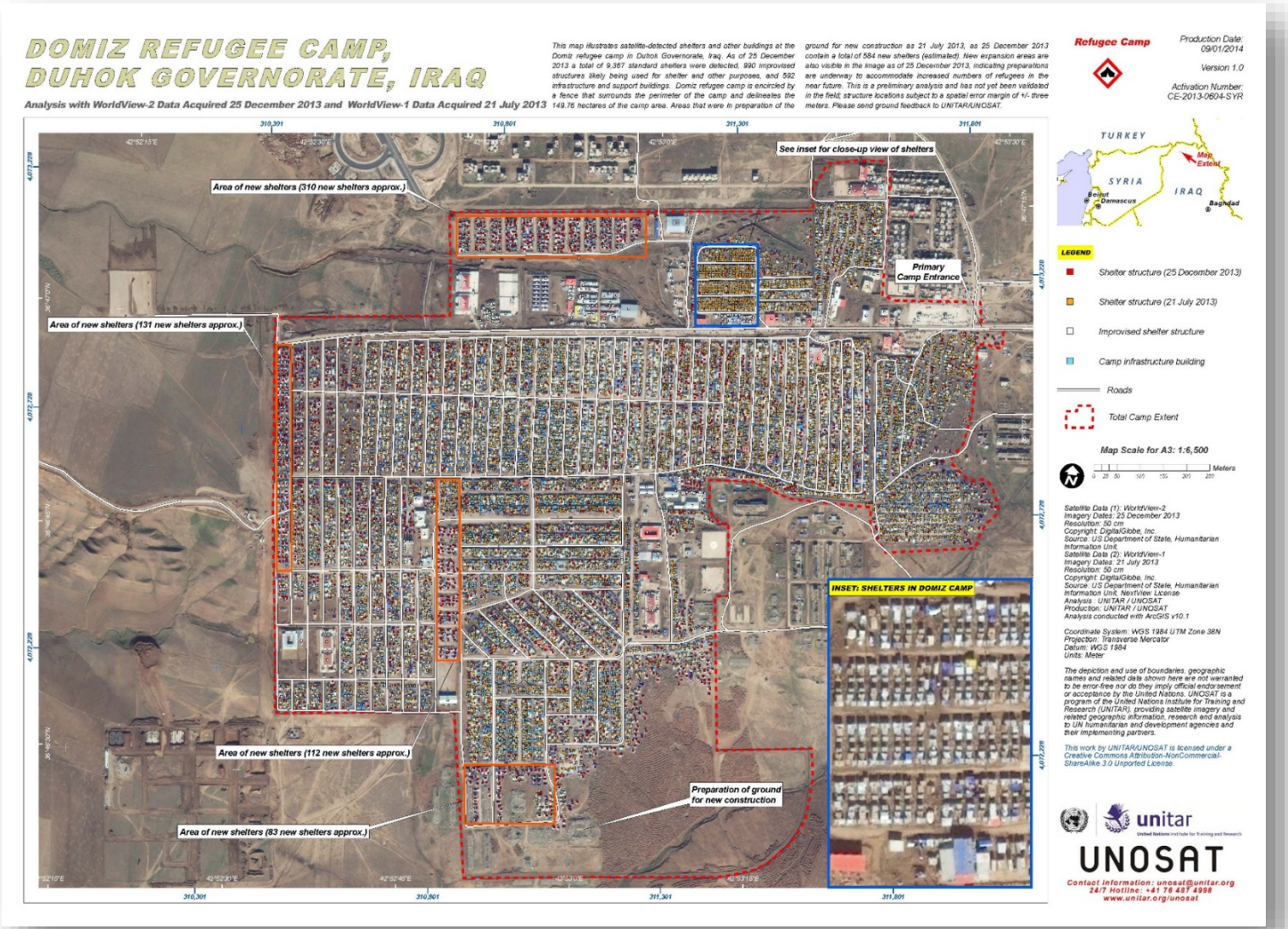
"It is an invaluable information to us and to the government departments.

The Ministry of Information published about it on daily news paper and now the Irrigation department has sent their team for ground survey."

UNDP Myanmar

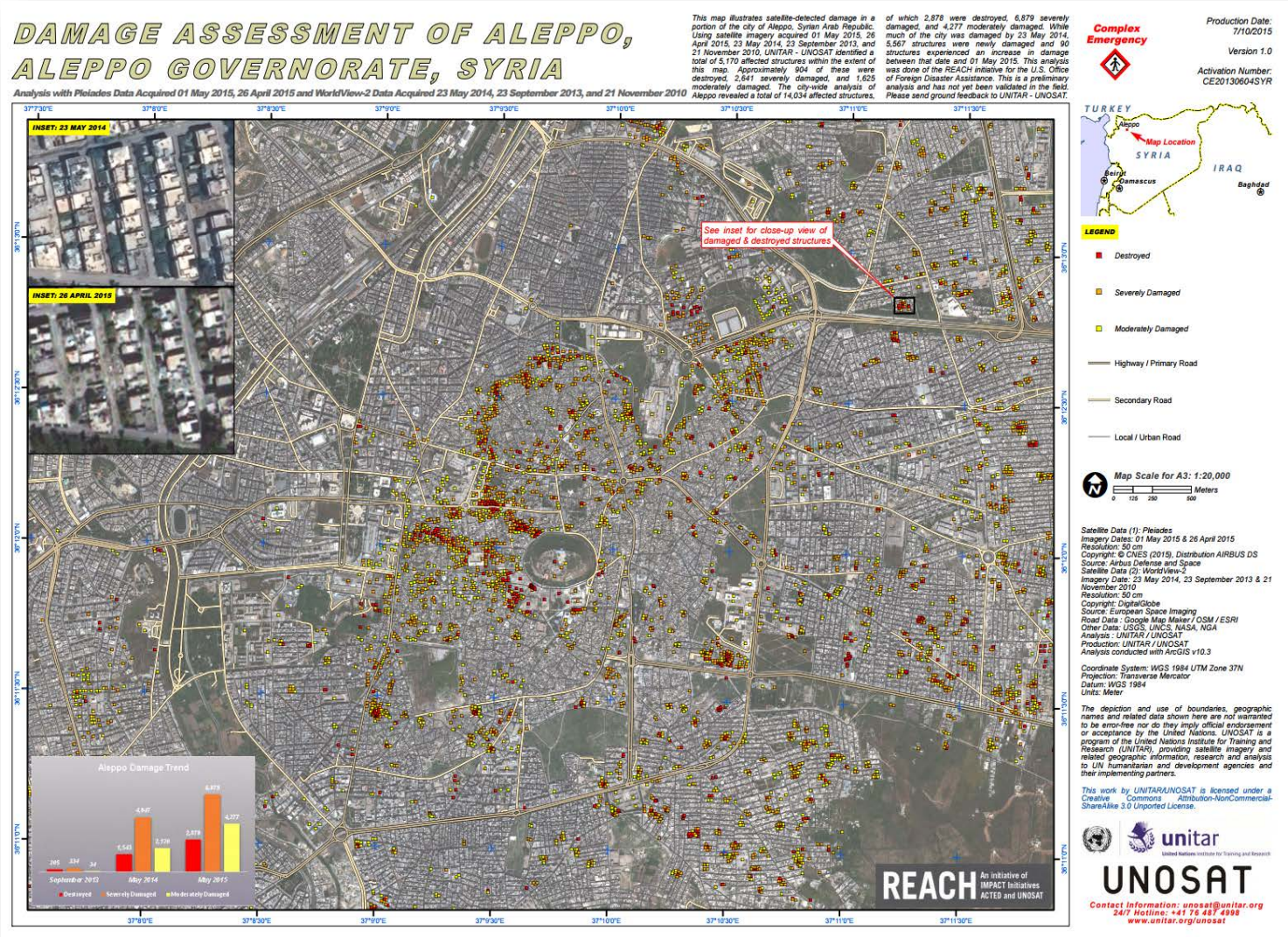
Refugee Camp – Iraq 2013

- Floods
- Earthquakes
- Storms/Cyclones
- Land Slides
- Refugees and Internally Displaced Persons Mapping
- Cultural Heritage Sites
- Conflict Damage Assessment



Damage Assessment – Syria 2015

- Floods
- Earthquakes
- Storms/Cyclones
- Land Slides
- Refugees and Internally Displaced Persons Mapping
- Cultural Heritage Sites
- Conflict Damage Assessment



UN-ASIGN

For Android Phones: For iPhone: For Windows Phones:

UN-ASIGN 1.2 for Android by AnsuR

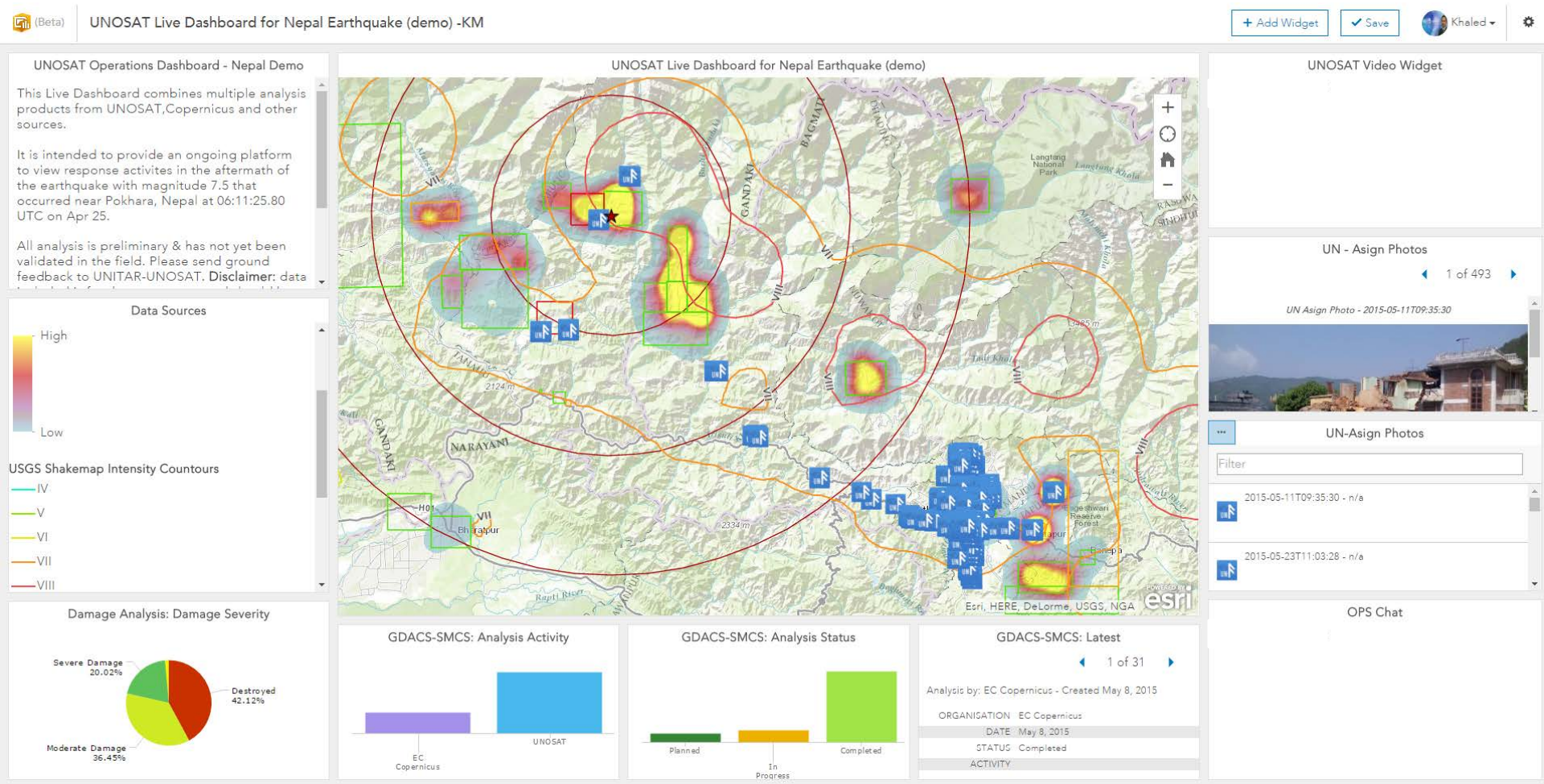
Support for off-line mode.
Press-hold an image to upload.
Delete previous version before install.

Android Market Itunes Store Windows Store

- UN-ASIGN is a free mobile app
- It is a tool for taking and sharing geo-tagged photos specifically designed to work over low bandwidth.
- Photos, messages and other data are displayed on the UNOSAT LIVE map

https://unosat.maps.arcgis.com/apps/webappviewer/index.html?id=f43d1b10e3664b8c82d06cc28e17469c

Virtual Operation Center



OBSERVE -> DECIDE -> ACT

Tropical Cyclone Winston in Fiji

(19 February 2016 – 9 March 2016)

Overview

A powerful tropical cyclone named "Winston" struck the Southern Pacific and was heading towards the coasts of Fiji. UNITAR - UNOSAT on behalf of UN OCHA activated the International Space Charter on 19 February 2016. On the 20th of February 2016, the cyclone made landfall at 06:30 UTC (18:30 local time) over the north-eastern coast of Viti Levu (Fiji), the main island of the archipelago. The cyclone tracked west across the country, causing damage in four divisions (Western, Central, Eastern and Northern) with more concerns on the Western and Central divisions.

According to FIJI Flash Appeal Tropical Cyclone Winston published by UNOCHA on 4 March 2016, 350,000 people living in the cyclone's path could have been affected (170.000 female and 180,000 male) - equivalent to 40 per cent of Fiji's population. This includes 120,000 children under the age of 18 (58,000 female and 62,000 male) and more than 3,100 people with disabilities.

Timeline of Satellite Derived Mapping Activities

Pre

0 Hrs

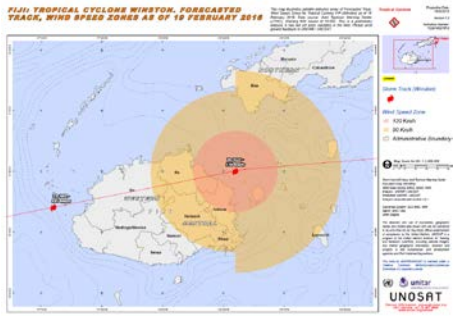
Landfall

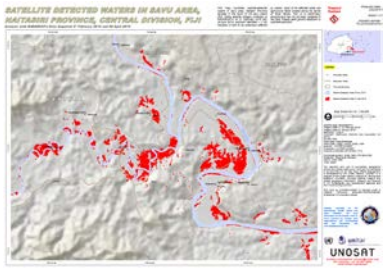
20 Feb

19 Feb

Situational Awareness Maps

Activation of International space charter





Assessment of standing waters.
Analysis done using radar data, extreme cloud cover

21 Feb

22 Feb

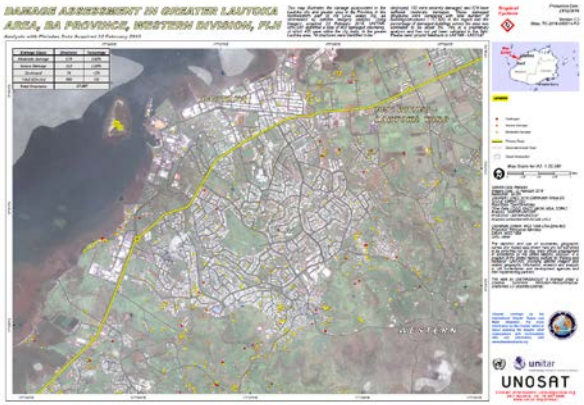
Building/Infrastructure Damage assessment products

23 Feb

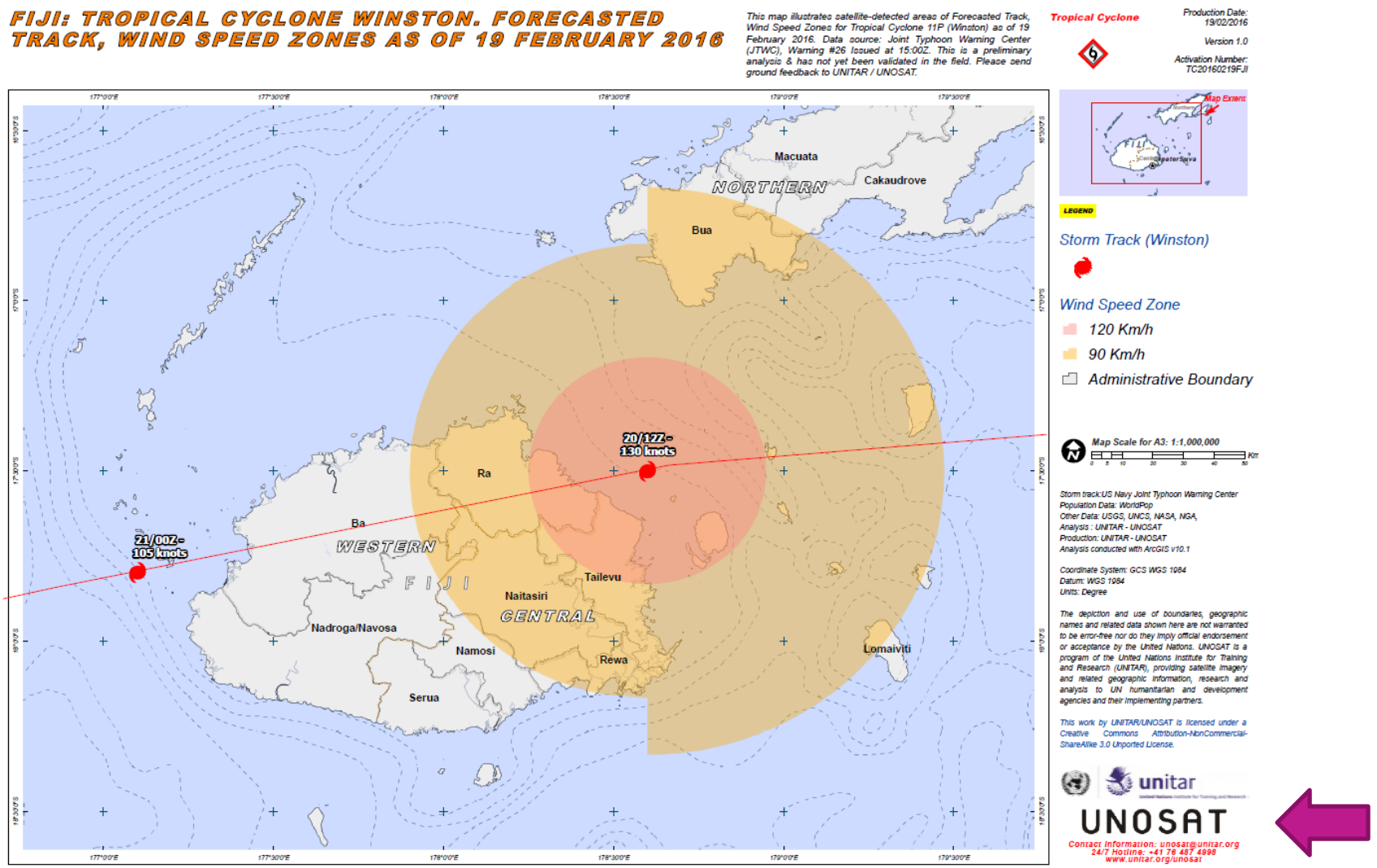
Received first suitable set of high-resolution imagery

24 Feb

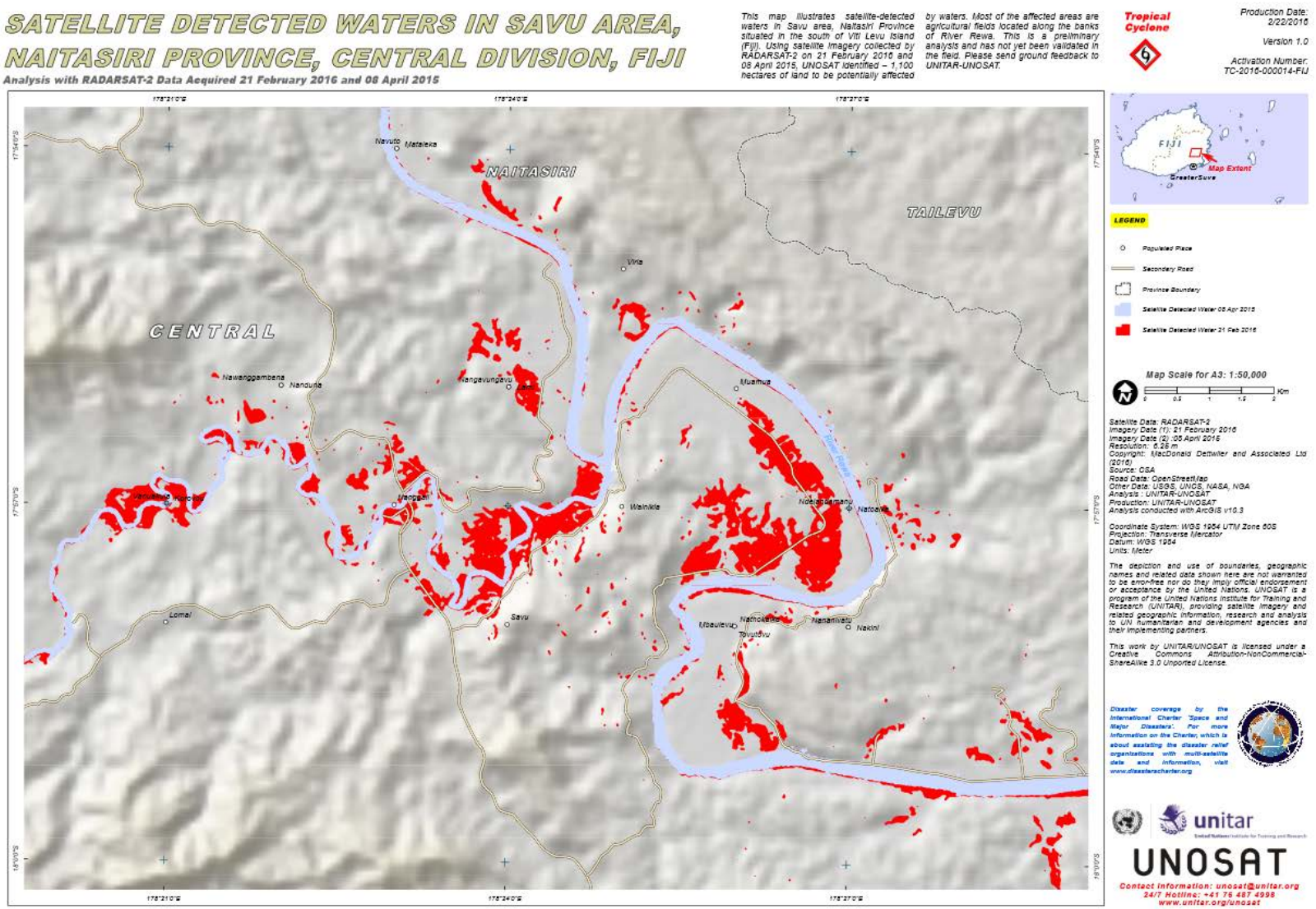
09 March



Situational awareness map: Forecasted track and probable population exposure

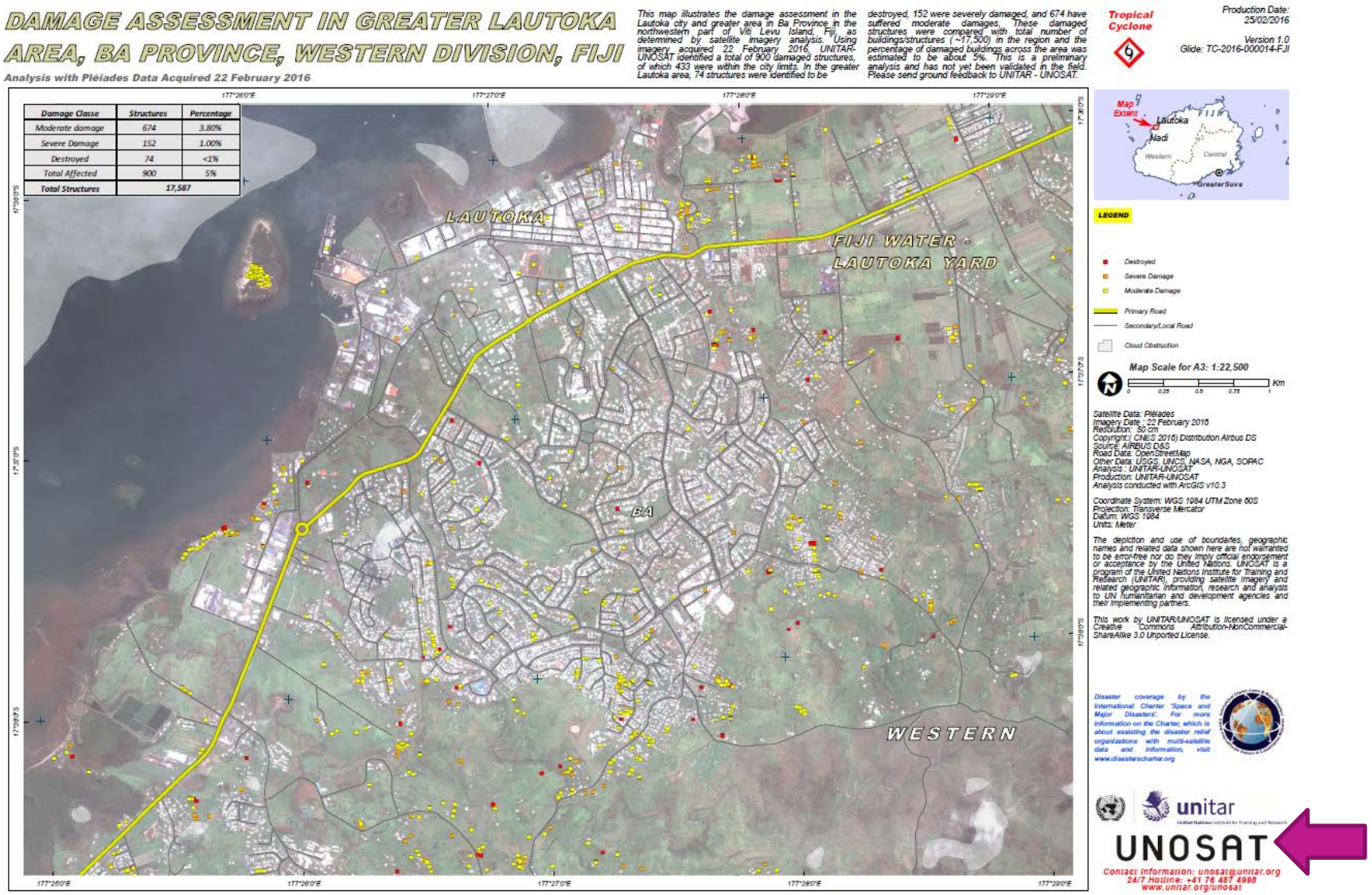


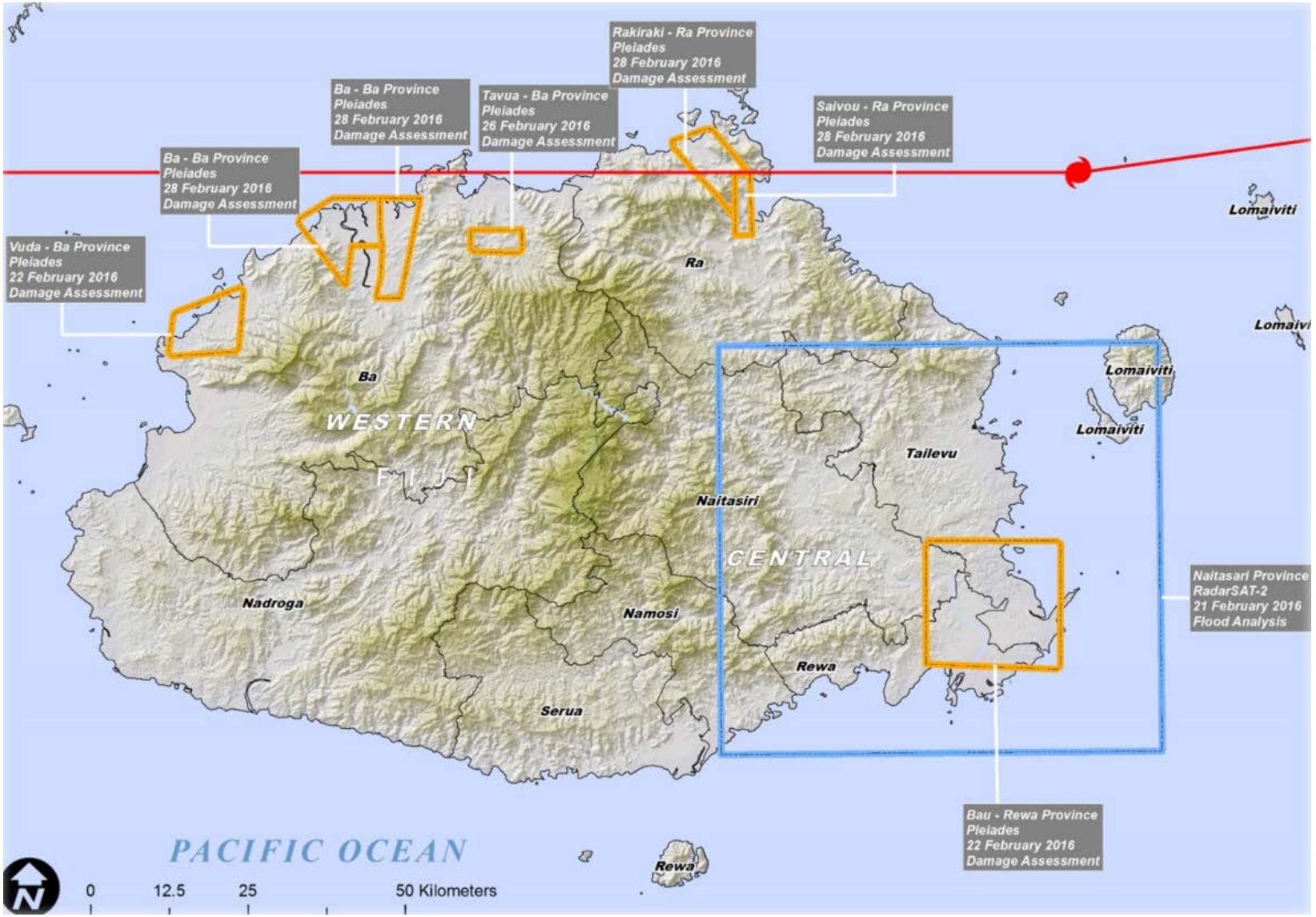
Impact assessment map: Detected standing water from radar image



25 Feb 2016: Damage Assessment

Damage assessment map: Detected from high resolution cloud-free satellite image




Rakiraki - Ra Province
Pleiades
28 February 2016
Damage Assessment
Ba - Ba Province
Pleiades
28 February 2016
Damage Assessment
Tavua - Ba Province
Pleiades
26 February 2016
Damage Assessment
Saivou - Ra Province
Pleiades
28 February 2016
Damage Assessment
Ba - Ba Province
Pleiades
28 February 2016
Damage Assessment
Vuda - Ba Province
Pleiades
22 February 2016
Damage Assessment
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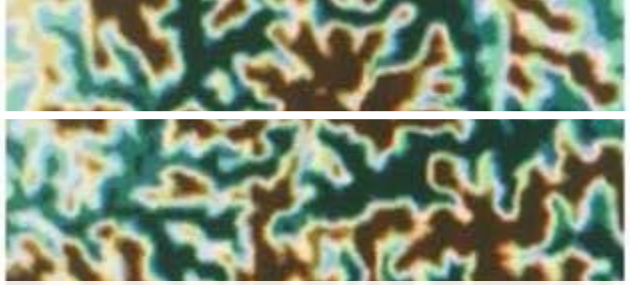
Lomaiviti
Lomaiviti
Lomaiviti
Tailevu
Naitasiri
CENTRAL
Naitasari Province
RadarSAT-2
21 February 2016
Flood Analysis
Nadroga
Namosi
Rewa
Serua
Bau - Rewa Province
Pleiades
22 February 2016
Damage Assessment
PACIFIC OCEAN
Rewa
0
12.5
25
50 Kilometers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United Nations Institute for Training and Research

Developing Tangible Capacities in Geospatial Information technology for Disaster Risk Reduction

Asia Capacity Development



Training & Capacity Development Activities

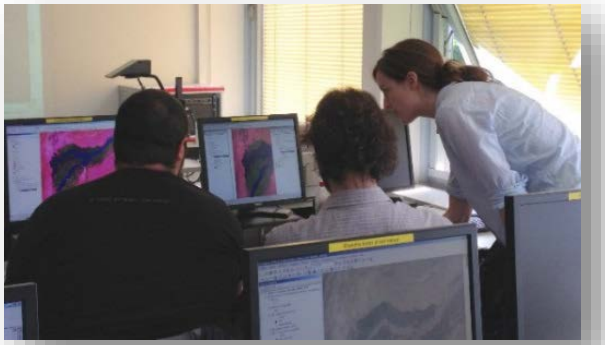
- Master level courses
- Basic and advanced courses
- Capacity development programmes
- Workshops and information sharing

UNOSAT is implanting capacity development projects in collaboration with:

- Intergovernmental Authority on Development (IGAD) (Horn of Africa)
- the Asian Disaster Preparedness Centre (ADPC) (South East Asia)
- Government of Chad (Reseau Project)

Target Audience

- Decision makers and professionals from national and international organizations



New Model

UNOSAT offered an innovative capacity development approach that enables participants to master and adopt the different tools and techniques of GIT in their workflows. Following are the chronological order of activities:

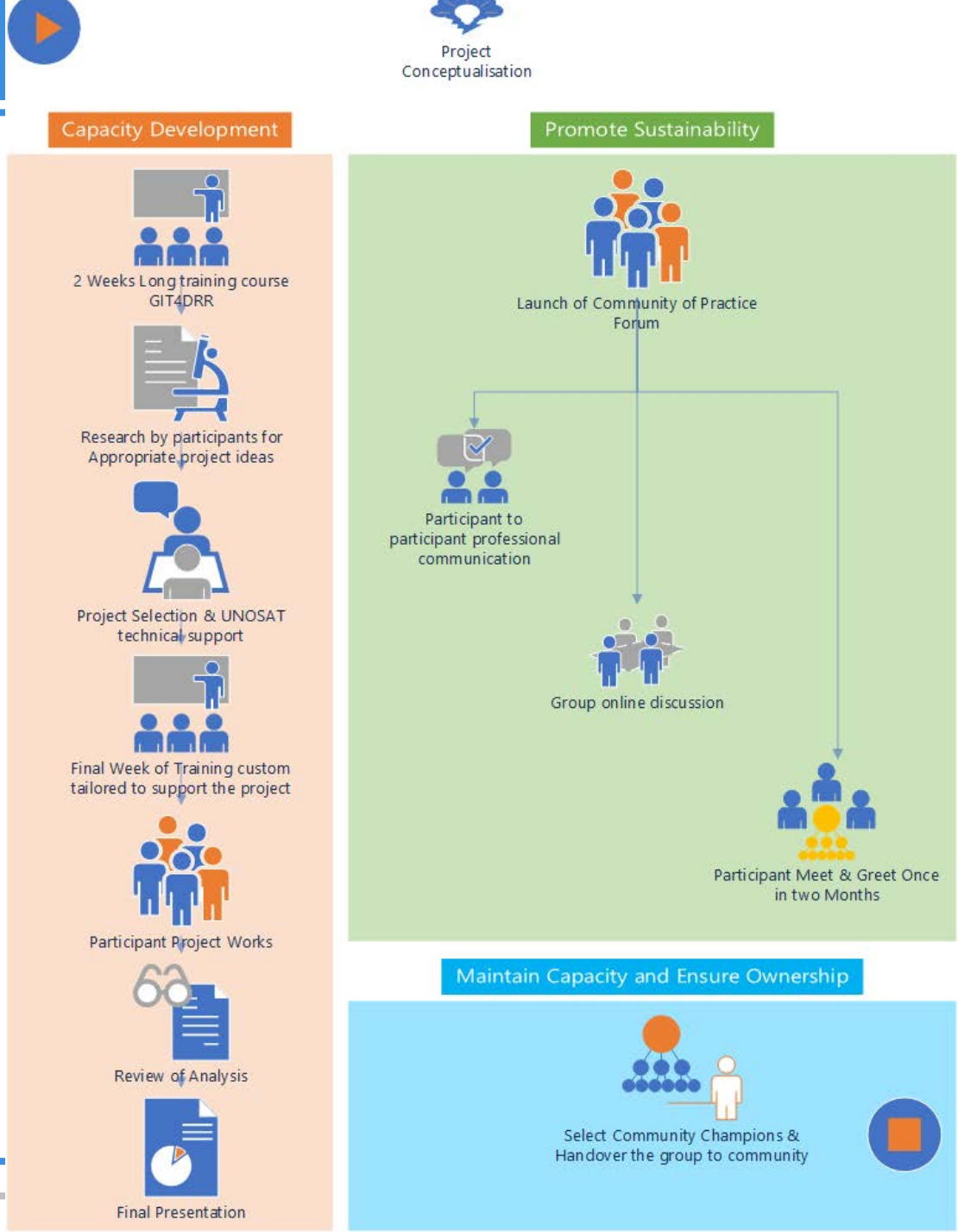
A. First Technical Training

B. Selection Of A Relevant Geo-spatial Assessment Project By Participants

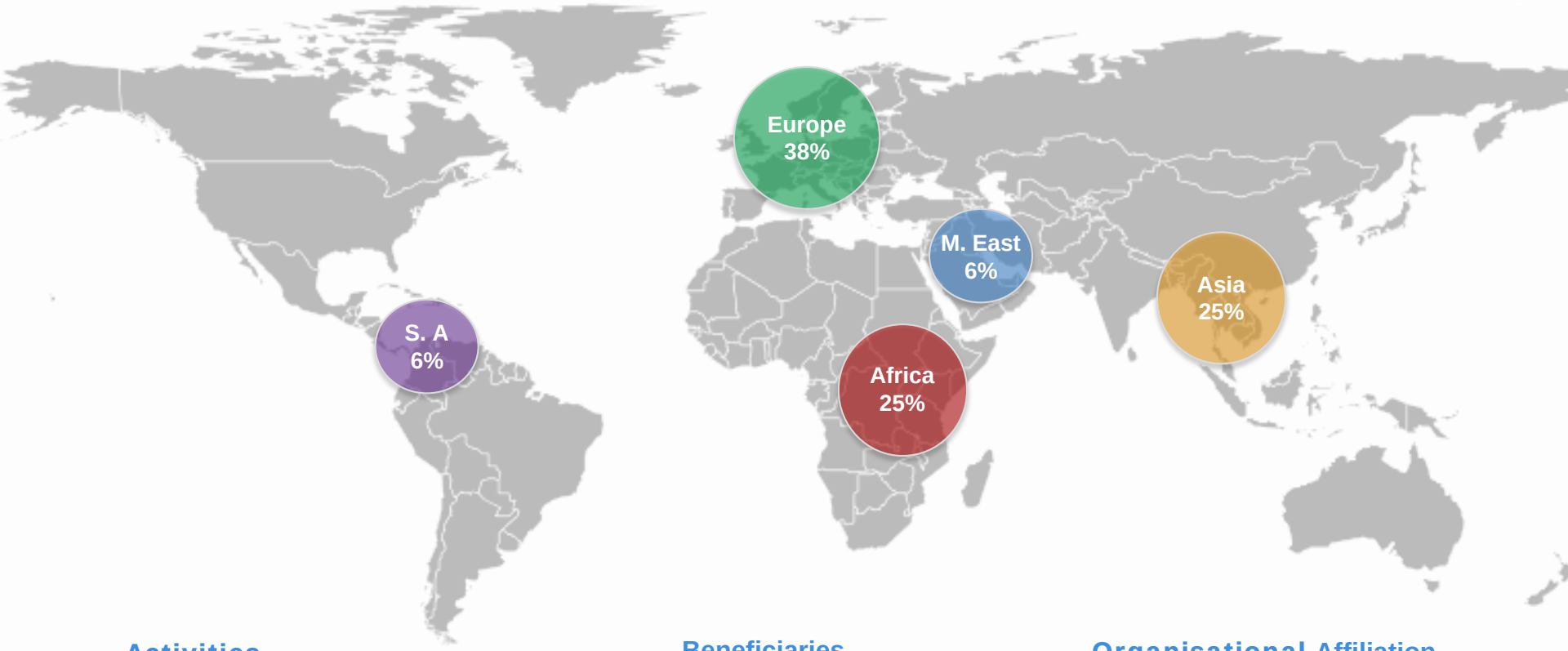
C. Launch Of Community Of Practice Forum

D. Final Week Of Advanced Training And Presentation Of Project

E. Handover The Community To The Participants



UNOSAT Training and Capacity Building Beneficiaries (2006 – 2015)



Activities

Master level training
Basic & advanced courses
In-country capacity building programmes
Workshops and information sharing

Beneficiaries

854 Learning events

28% 72%

8000+ Knowledge sharing events

Organisational Affiliation

47%	National authorities
23%	Academic
15%	NGOs
8%	Regional organisations
7%	UN system

Activating UNOSAT

- Provides satellite image analysis during humanitarian emergencies – natural disasters and conflict-situations

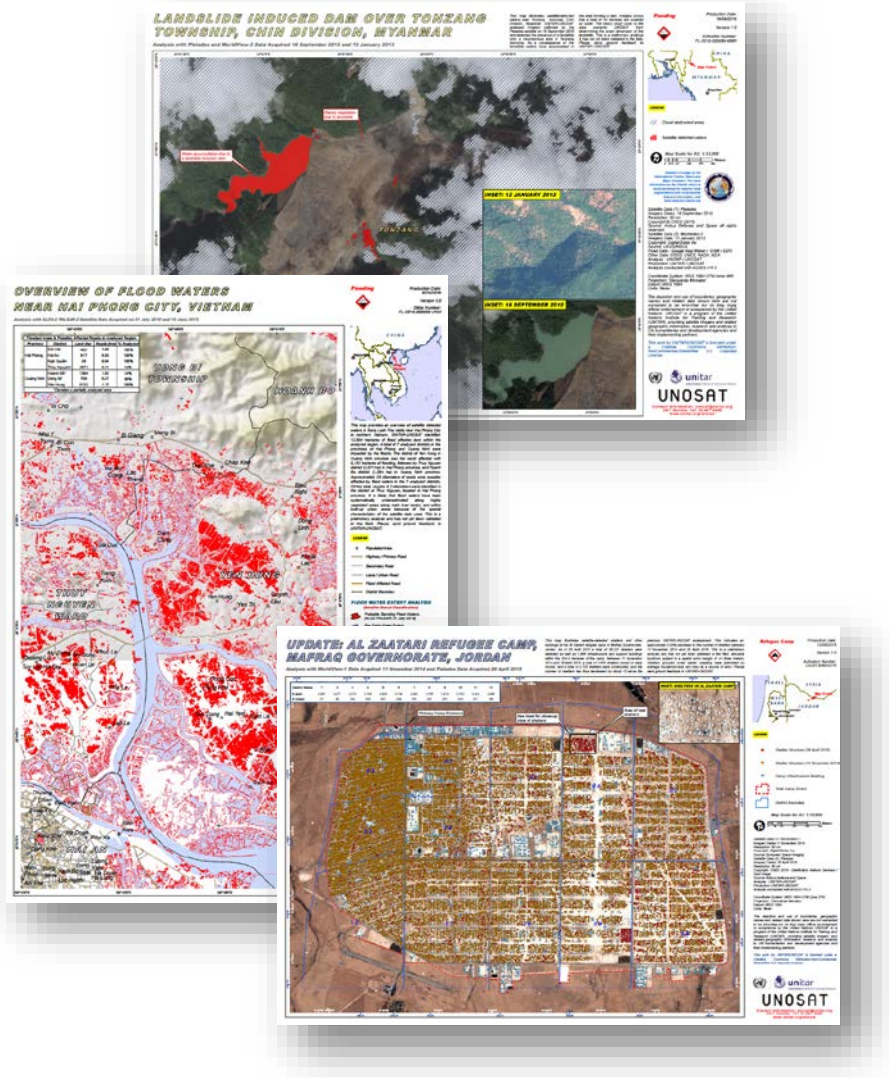
- Maps, GIS-ready data, statistics and reports

https://www.unitar.org/unosat/maps

- On call 24/7

- Phone: +41 76 487 4998

- Email: emergencymapping@unosat.org



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Questions???

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