



The International Charter 'Space and Major Disasters'

An international mechanism providing space-based information for disaster response

Jens Danzeglocke (representing DLR in the Charter's Executive Secretariat)

Overview



- What is the Charter?
- Mechanisms to activate the Charter & “Universal Access”
- Disaster type examples
 - Floods
 - Earthquakes
 - Tsunamis
 - Tropical Storms
 - Volcanoes
 - Wildfires
- Conclusions



What is the Charter?

An International agreement among participating Agencies to provide space-based data and information in support of response efforts during emergencies caused by major disasters.

Logos of participating agencies:

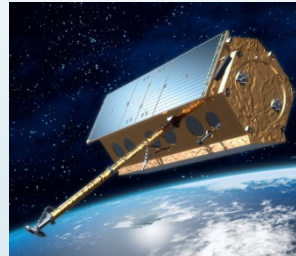
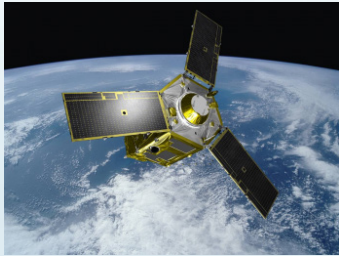
- CSA ASC
- CONAE
- INPE
- KARI
- JAXA
- CNSA
- USGS (science for a changing world)
- NOAA (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE)
- DLR
- ISRO (इसरो)
- ROSCOSMOS
- cnes
- EUMETSAT
- esa
- UK SPACE AGENCY
- dmc International Imaging

International Charter 'Space and Major Disasters'

what is the Charter?



The Charter brings together efficient space-based technologies to support disaster management.



The Charter's capacities can be activated through a **single access point** which is available 24 hours, seven days a week.

Space agencies contribute

- **Priority satellite tasking**
- Archive Retrievals
- Organisation of map production



Disaster Types Supported

Natural events

Earthquakes
Fires
Floods
Ice jams
Landslides
Tsunamis
Ocean storms
Volcanic eruptions

Man-made events

Oil spills
Industrial accidents

The Charter supports large, often sudden events with high impact in terms of lives, infrastructure, and/or environment.

(slow-onset disasters, such as droughts, are not covered by the Charter)





Limited mandate of the Charter

THE DISASTER RISK MANAGEMENT CYCLE



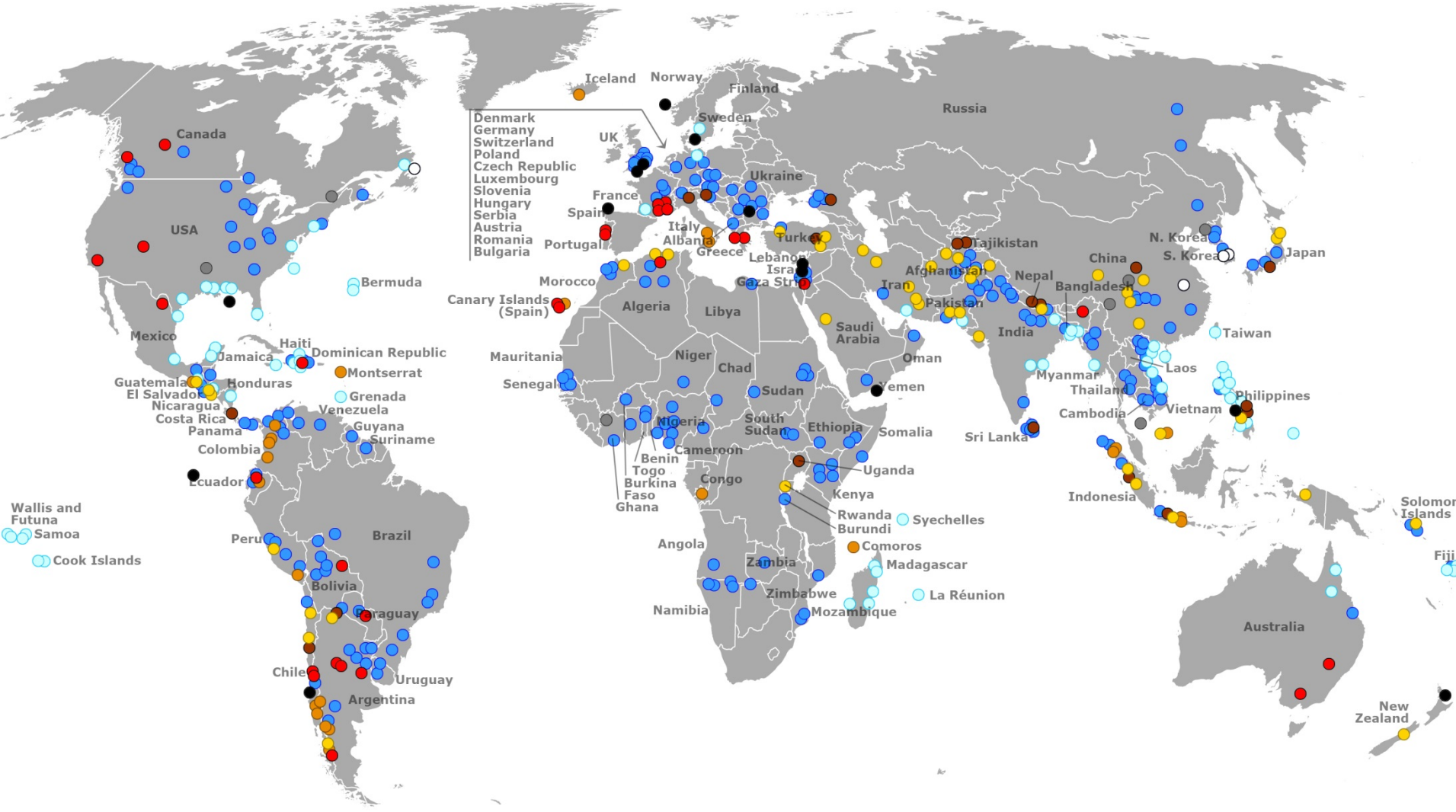
The Charter only supports the **phase of immediate response** to a disaster.

Charter activations generally last for about **1-4 weeks**.

If needed, the Charter can be activated **in advance (1-2 days)**.



Activation Distribution



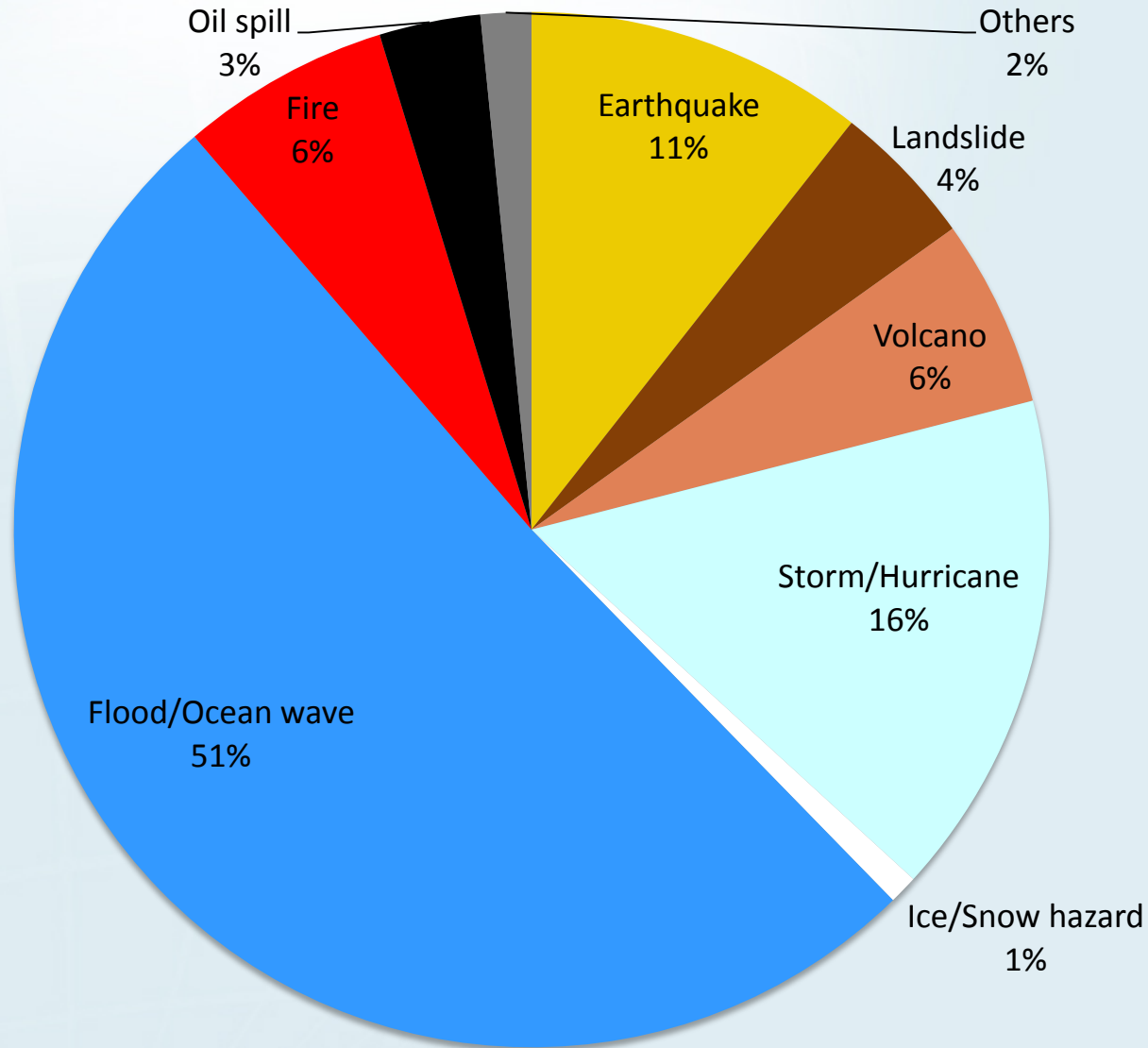
- Denmark
- Germany
- Switzerland
- Poland
- Czech Republic
- Luxembourg
- Slovenia
- Hungary
- Serbia
- Austria
- Romania
- Bulgaria

Legend: ● Earthquake ● Landslide ● Volcano ● Storm/hurricane ● Flood/ocean wave ○ Ice/snow hazard ● Fire ● Oil spill ● Other

As of January 2, 2015 – 443 Activations



Activations by Disaster Type

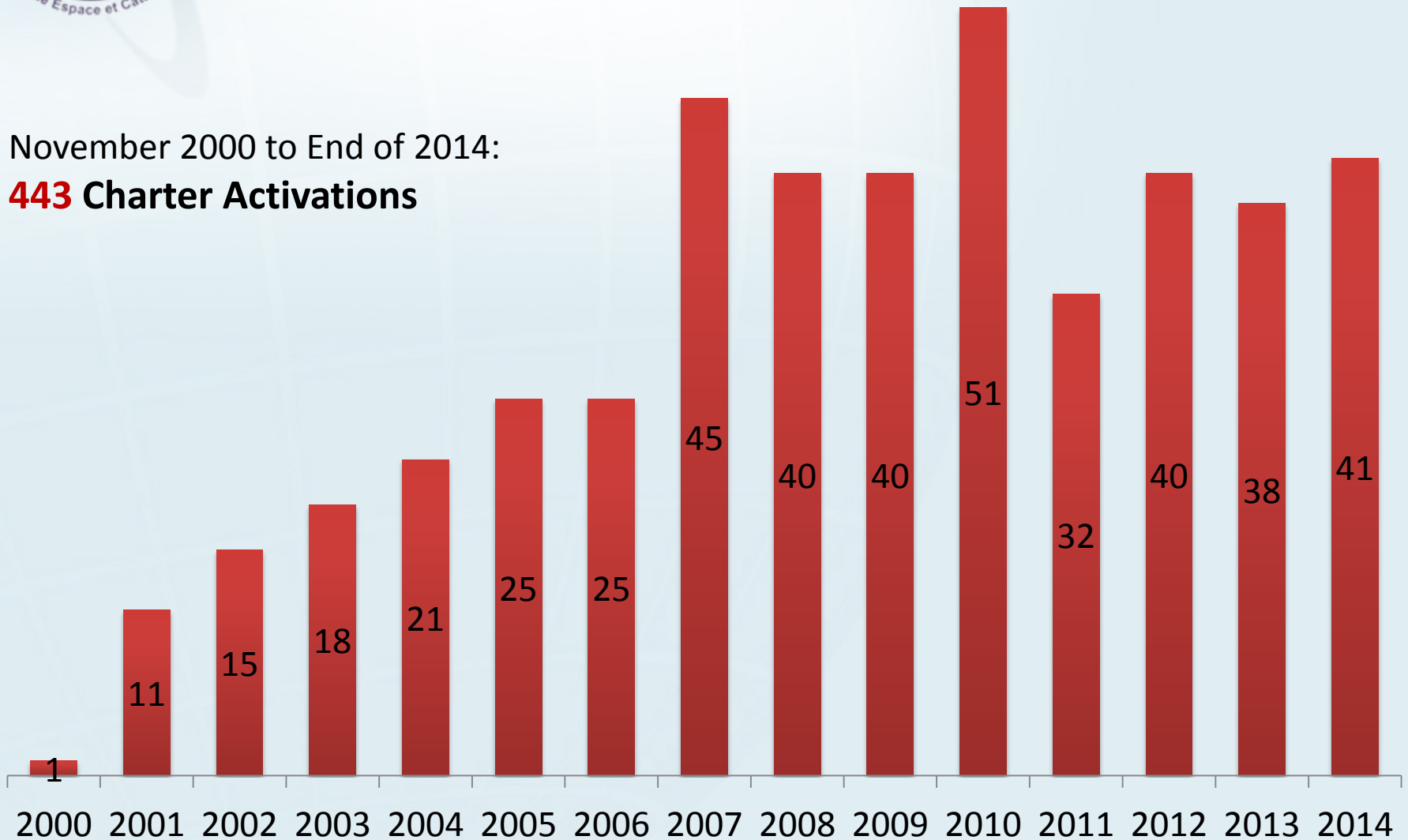




Number of Activations

November 2000 to End of 2014:

443 Charter Activations



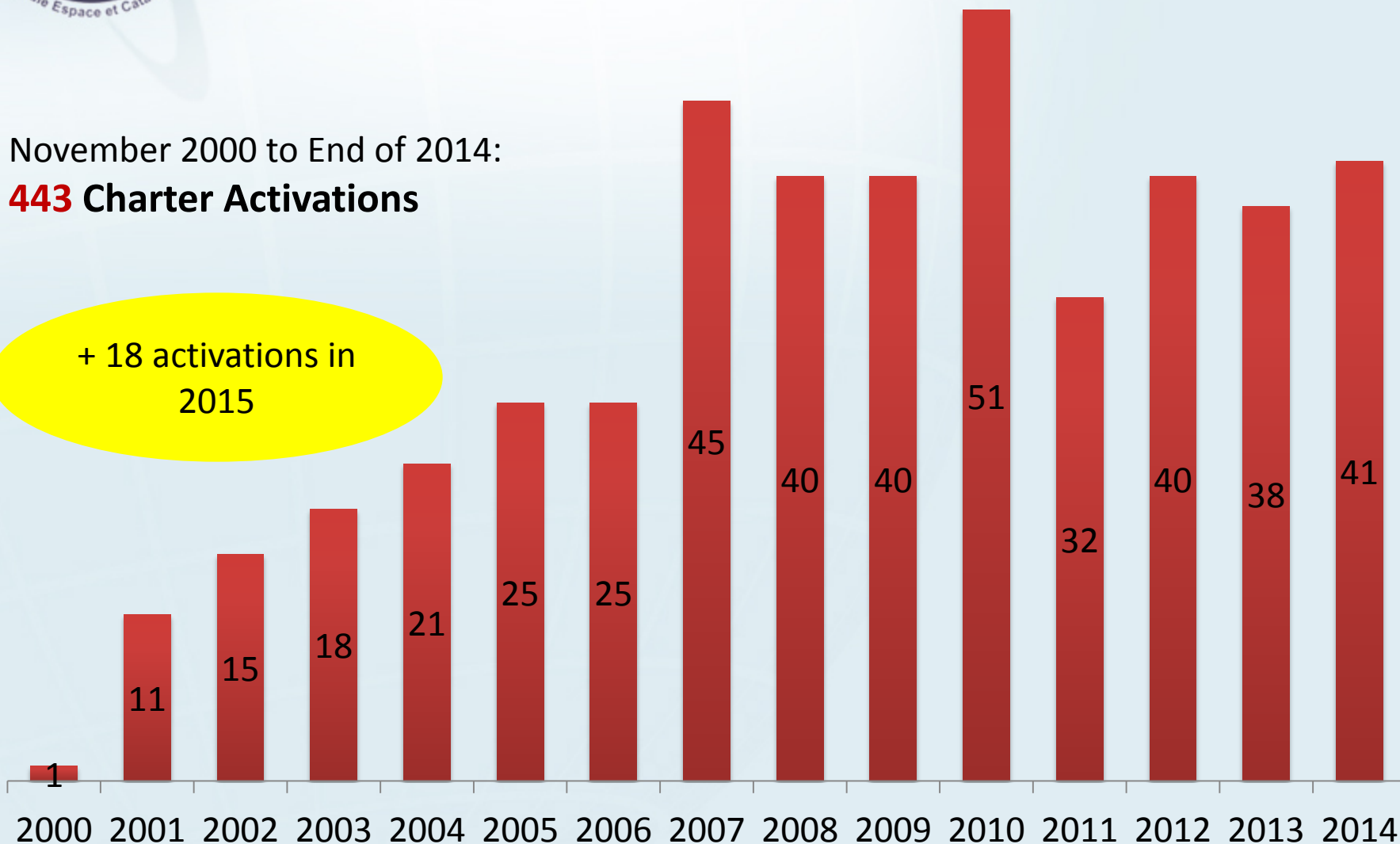


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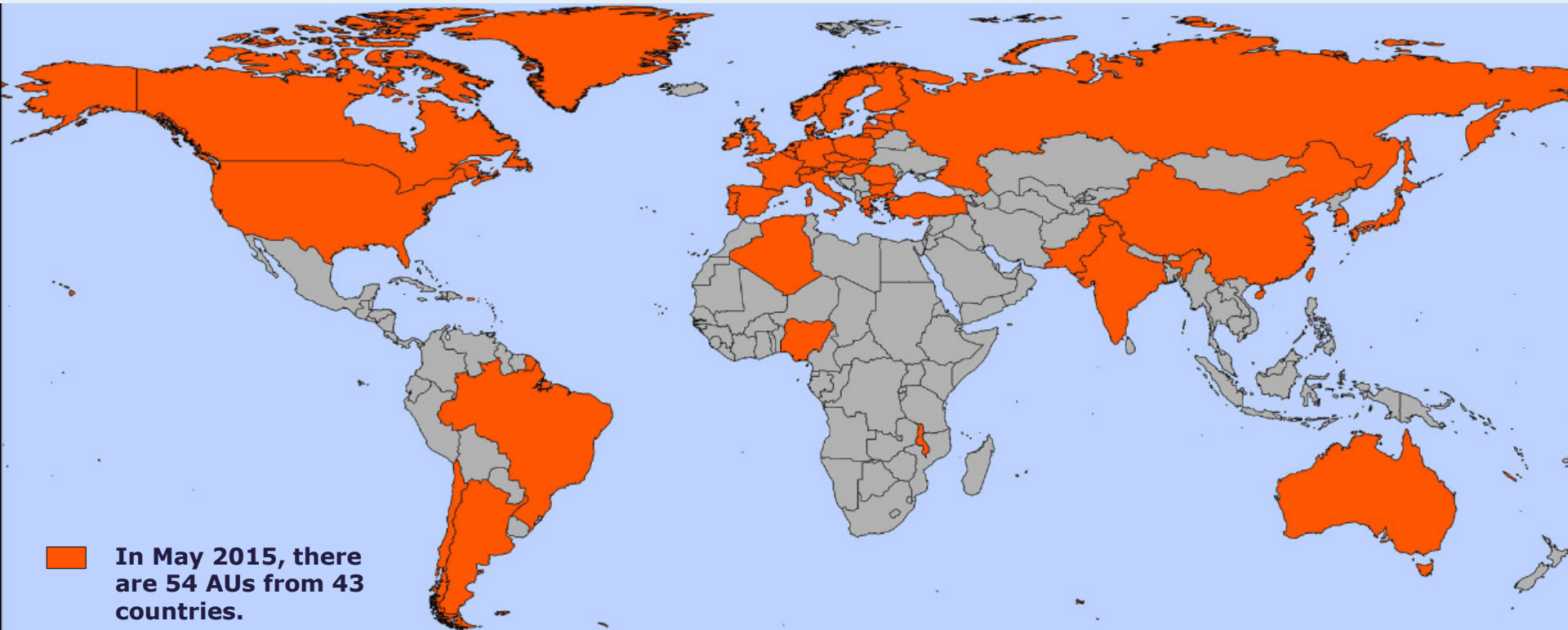
+ 18 activations in
2015





Mechanism to Activate the Charter

- **Direct activation:** The only bodies authorized to directly request the Charter to be activated for a disaster occurring in their country are the **'Authorized Users' (AUs)**. They are typically civil protection agencies, or other authorities with a national mandate related to disaster management.



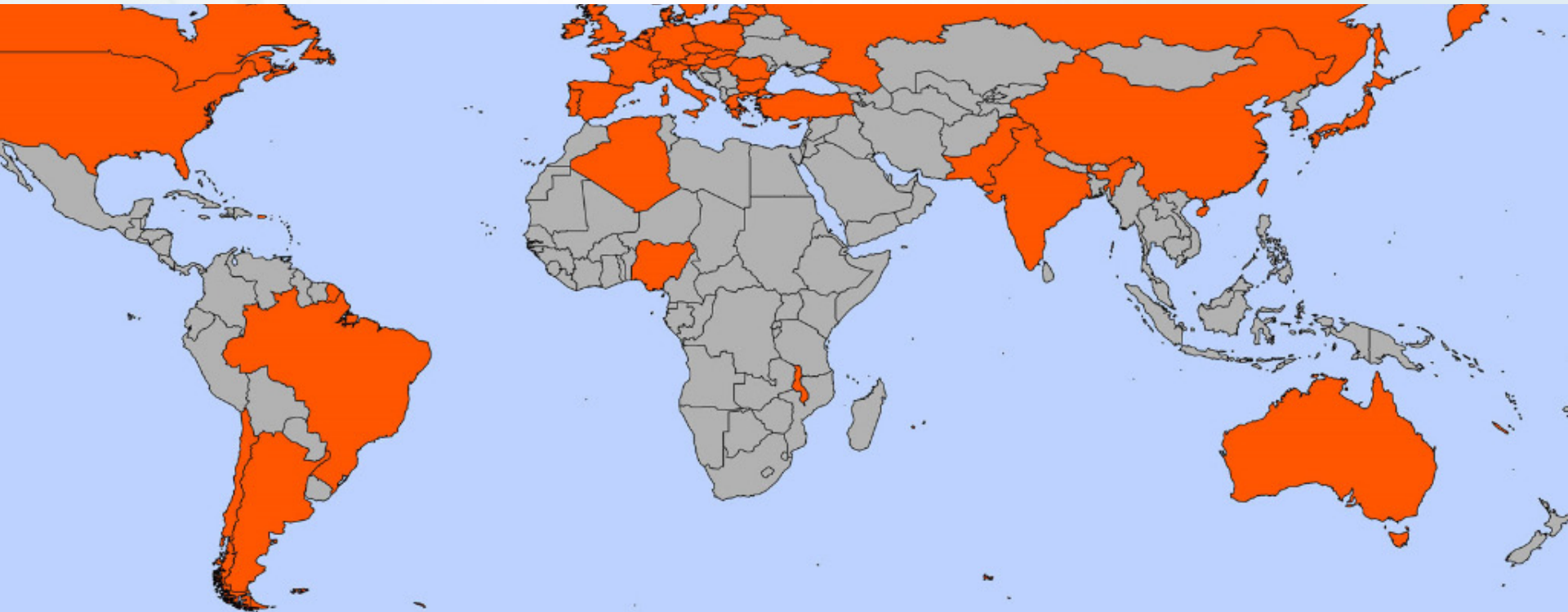
Additional mechanisms to Activate the Charter



- **Activation via an Authorized User on behalf of a user from another country without AU:** Authorized Users can access the Charter to request support for a disaster in another country with which they cooperate for relief purposes.
- **Activation via the UN for UN users:** The Charter has agreements with [UNOOSA](#) (Vienna) and [UNITAR/UNOSAT](#) (Geneva) to provide [support to UN agencies](#). UNOOSA and UNOSAT may submit requests on behalf of users from the United Nations.
- **Activation for Asia Pacific users via Sentinel Asia:** Sentinel Asia is a regional collaboration for satellite based emergency response in Asia Pacific. Since 2009 the Charter has granted the Asian Disaster Reduction Centre the right [to submit activation requests on behalf of national users of Sentinel Asia](#).



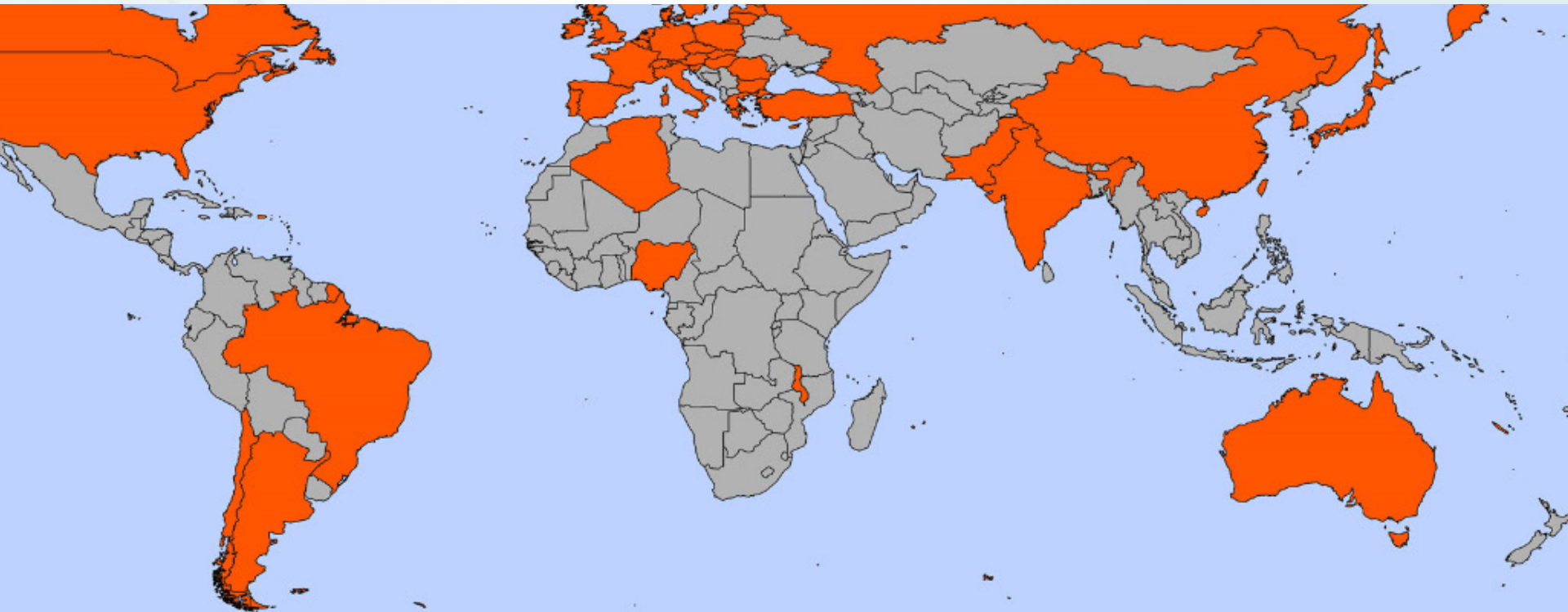
Universal Access



Many countries highly prone to natural disasters do not have a Charter Authorised User yet!



Universal Access

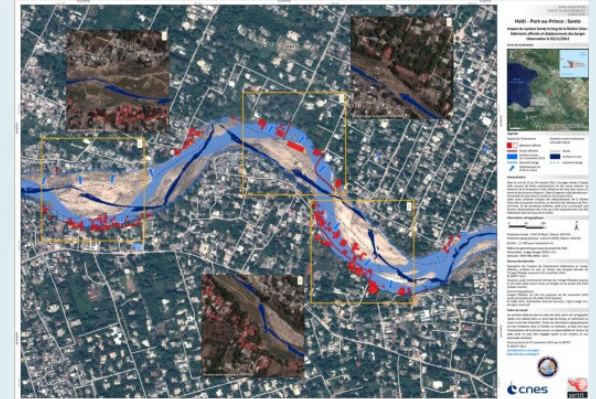


Since September 2012, any national disaster management authority can become an Authorized User, if it meets few basic criteria!

Conditions for becoming an Authorised User



1. be a **national disaster management authority** or its delegated agency in that country
2. have the **capacity to download and use maps**
3. be able to **submit and pursue an activation request in English**





Registration

A **Registration Form*** is available to express interest in becoming a Charter Authorised User.

1. The candidate fills in the questionnaire providing all required information.
2. The questionnaire, *with an official cover letter from the organisation*, must be sent to:
ExecutiveSecretariat@disasterscharter.org
3. The request is assessed by the Charter members.
4. A training and an activation exercise is conducted.



*The form and a **Universal Access Information brochure** is available on the Charter website:

<https://www.disasterscharter.org/web/guest/activating-the-charter>

The Charter's response to plain flood disasters



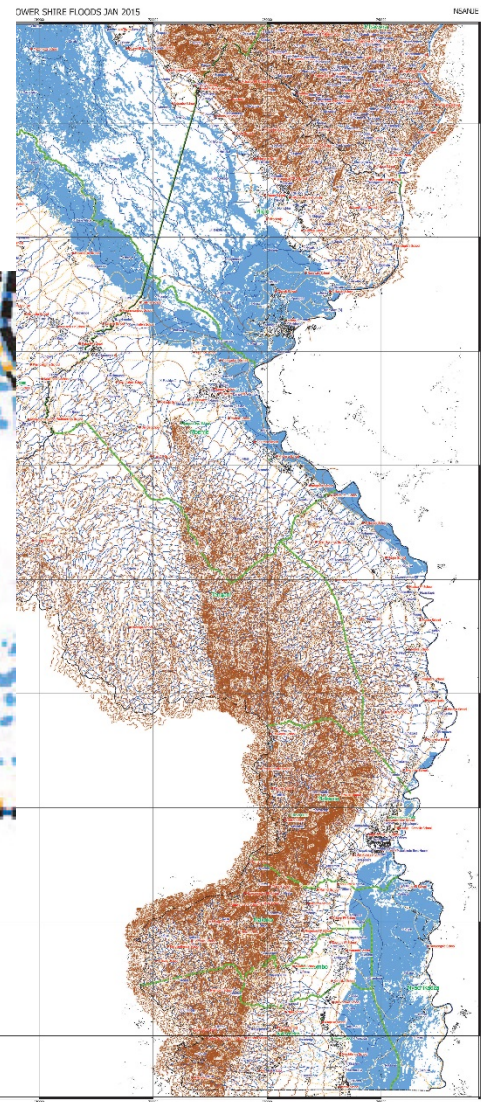
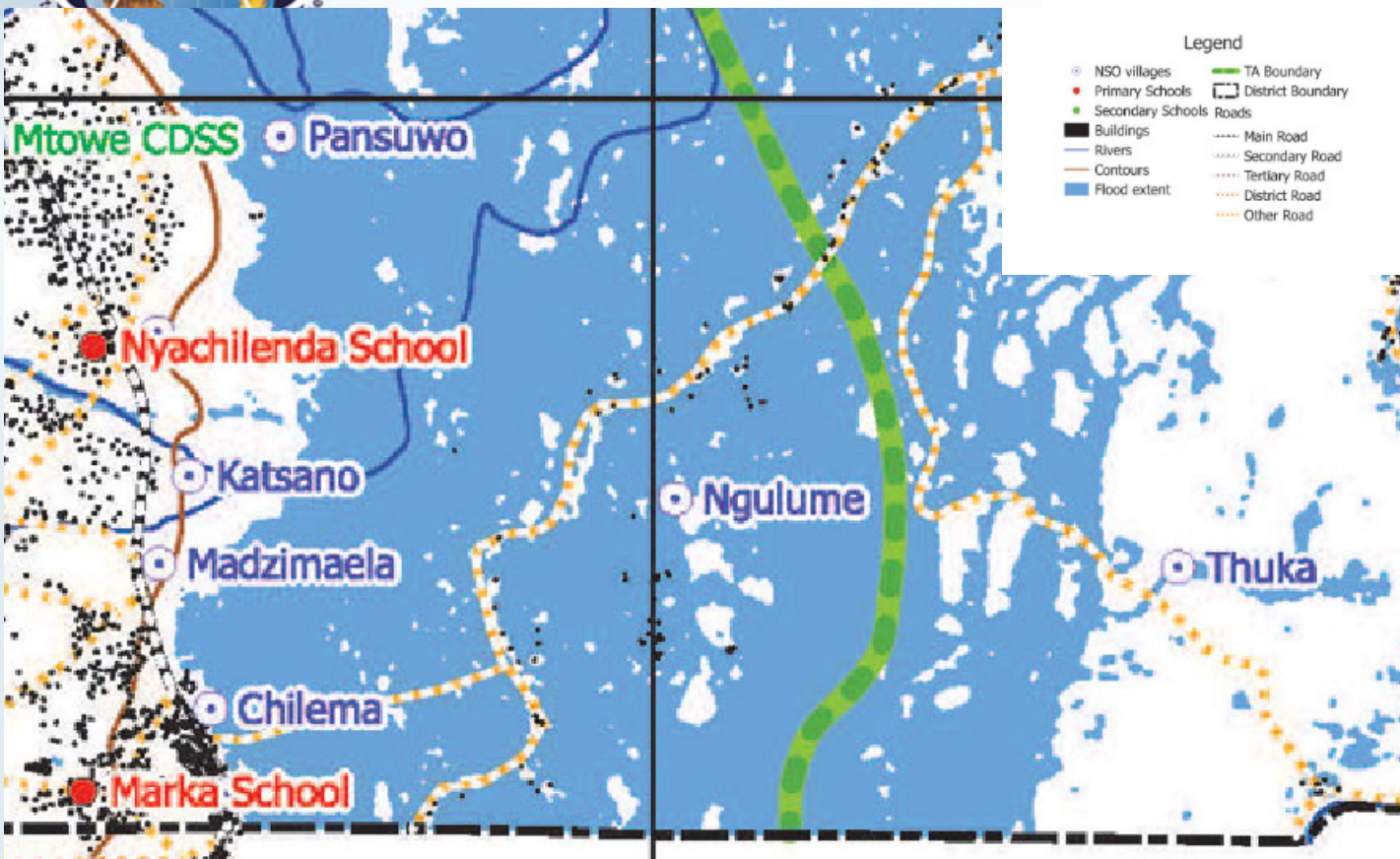
Issues:

- Flooded areas frequently under cloud cover
- Sometimes huge areas affected

Solution:

- Radar satellite data allows mapping of inundated areas independent from daylight and weather conditions.

Flood disaster example: Malawi 2015



Inundation in the South of Malawi – map prepared by Malawi Department of Surveys, Ministry of Lands, based on Radarsat-2 data.



The Charter's response to earthquake disasters

Issues:

- Different damage types may occur in combination: direct damage, landslides in mountainous areas, technological disasters...

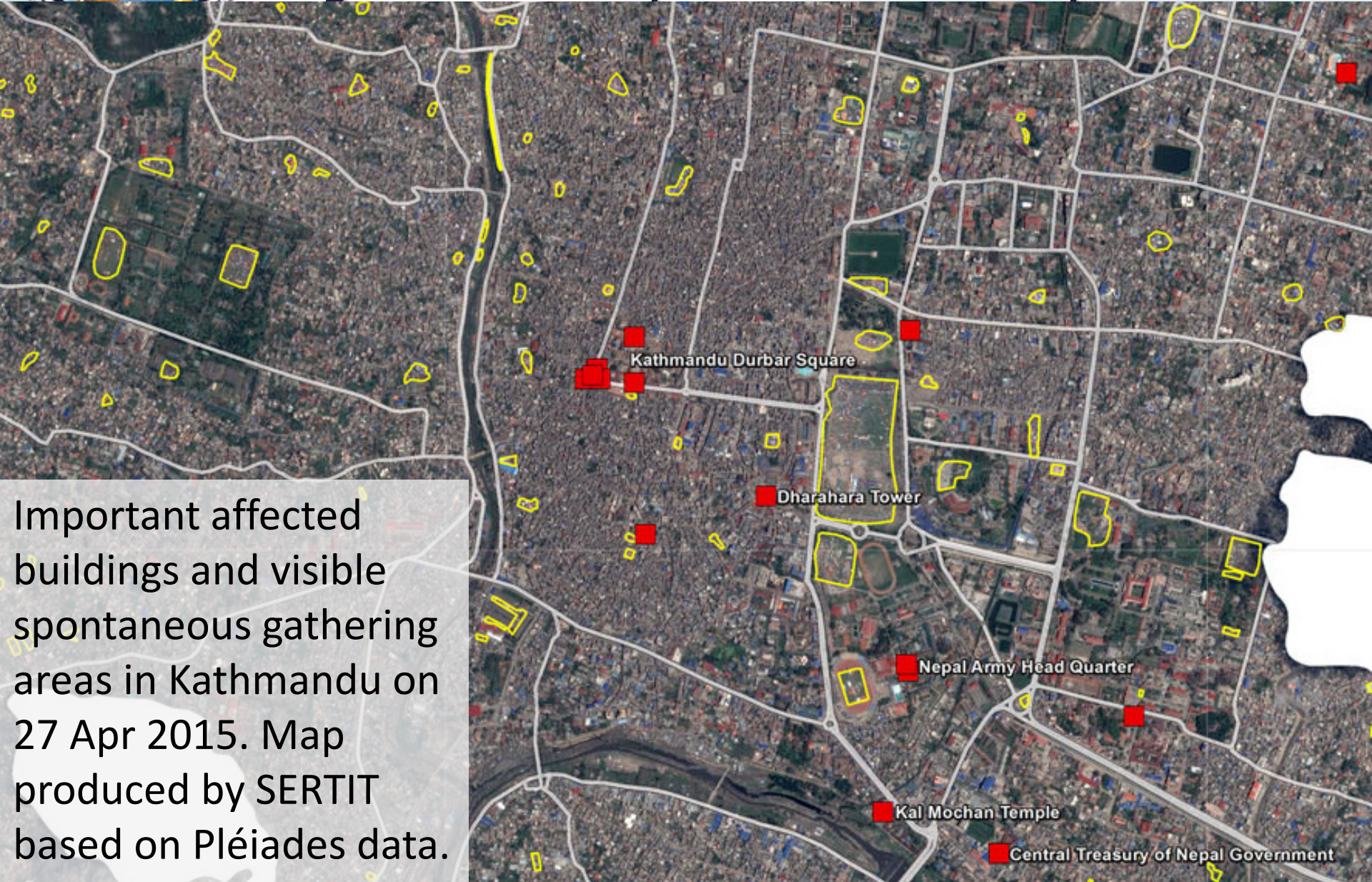
Solution:

- Damage assessment and detection of gathering places based on very high resolution optical data
- Radar-based change detection possible only if pre-event data is available

(Interferometric analyses are not supported by the Charter)



Example: Kathmandu after the major earthquake on 25 Apr 2015



Kathmandu Durbar Square

Dharahara Tower

Nepal Army Head Quarter

Kal Mochan Temple

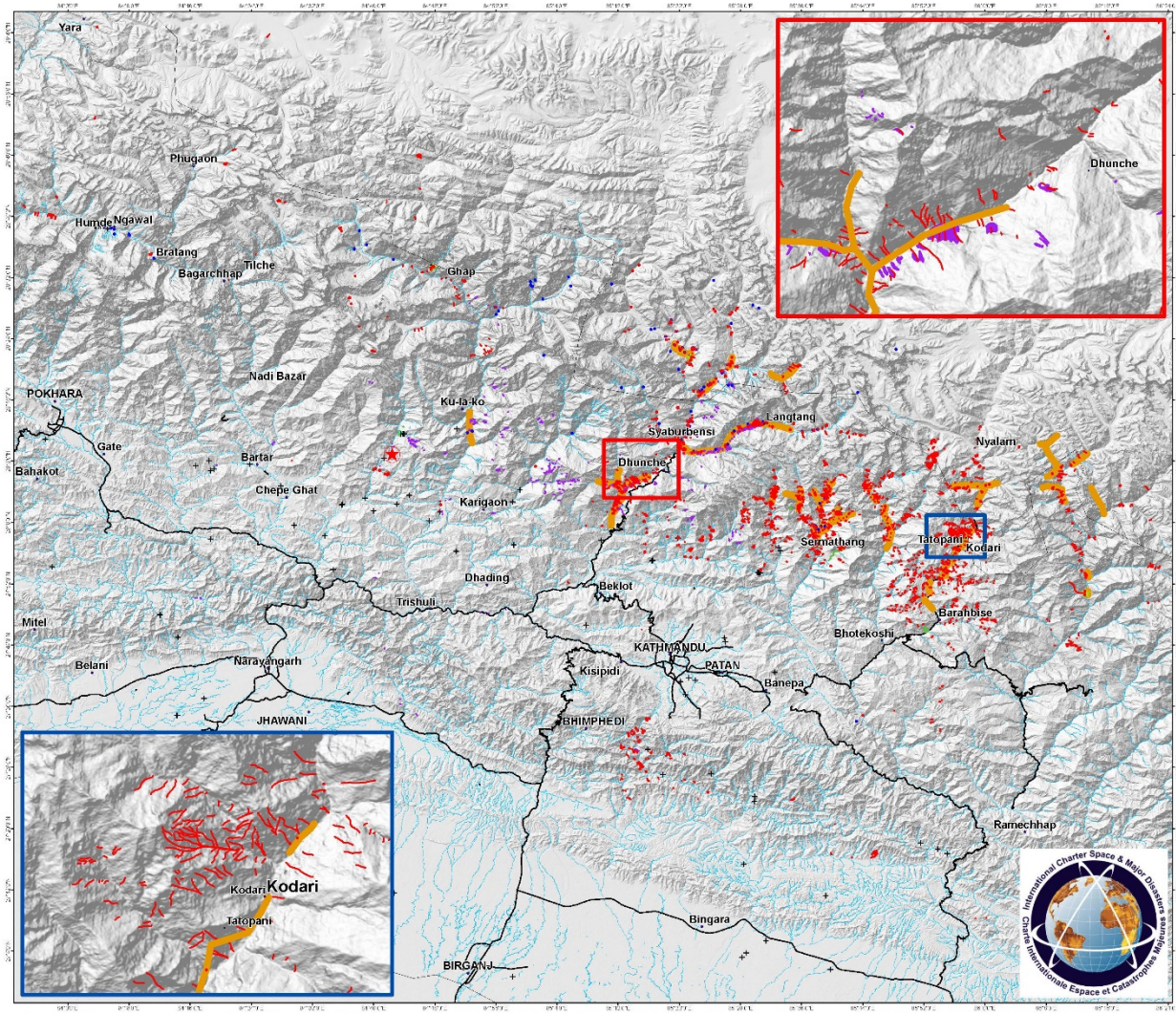
Central Treasury of Nepal Government

Important affected buildings and visible spontaneous gathering areas in Kathmandu on 27 Apr 2015. Map produced by SERTIT based on Pléiades data.



Example: Nepal earthquake landslide inventory

Preliminary Landslide Inventory Following 25 April 2015 Nepal Earthquake



Legend

- Cities and towns
 - Main roads
 - Rivers
 - Country boundaries
 - ★ Epicenter
 - + Damaged roads/bridges (Tomnod.com)
- Landslides active since 25/04/2015**
- Landslides (BGS & Durham)
 - Landslides (ICIMOD)
 - Landslides (MDA)
 - Landslides (NGA)
 - ★ Valley blocking
 - Valleys with numerous landslides

Interpretation

This satellite image interpretation map shows the combined landslide maps produced by an international team including British Geological Survey, Durham University, ICIMOD, MDA and NGA. The scale of mapping was between 1:5,000 and 1:10,000 and the satellite image resolution is between 2.5 m and 22.5 m.

More than 3000 new landslides were mapped (by the publication date). Geolocation of landslides may not be accurate.

Insets show detailed mapping.

Vector data:
 Cities, Roads, Rivers, Country boundaries © OpenStreetMap
 Damaged roads/bridges Tomnod.com © DigitalGlobe

Framework
 International Charter Disaster Activation 530/531.
 This inventory was prepared in rapid mapping mode using a combination of satellite image interpretation and sourcing information from news reports and crowdsourcing.
 No liability concerning the content or use thereof is assumed by the producer. Product published 8 May 2015 and designed for viewing at A0 paper size.

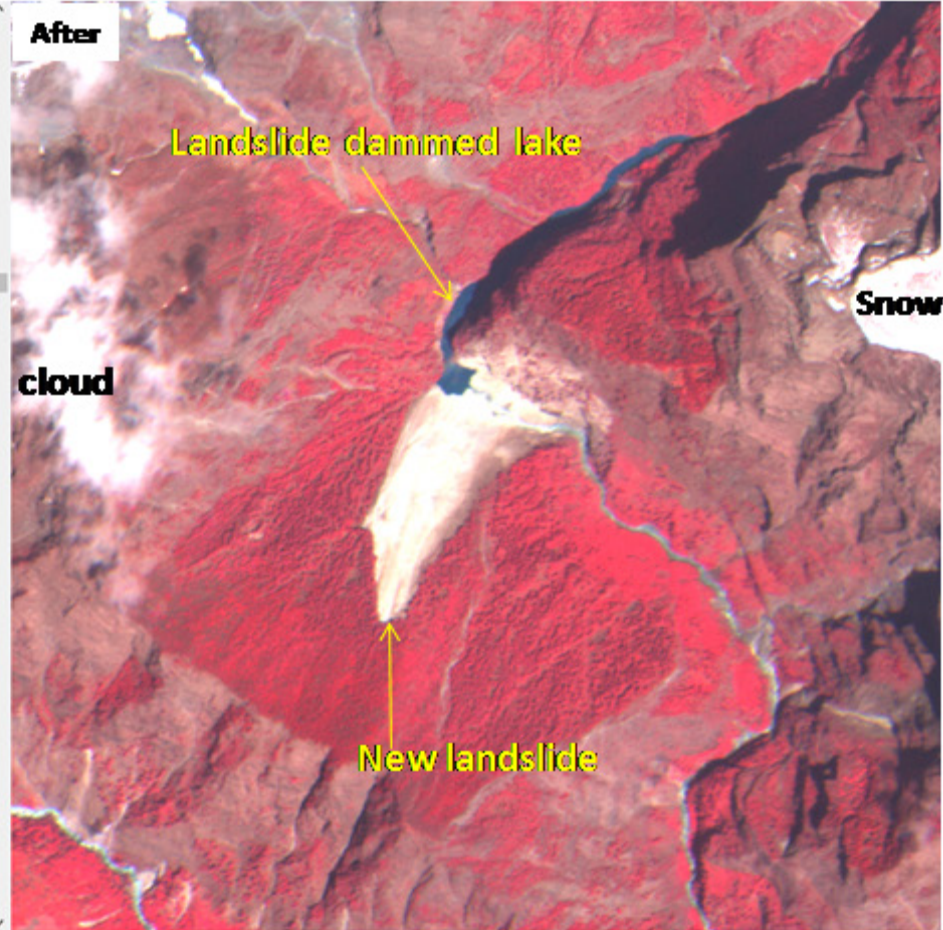
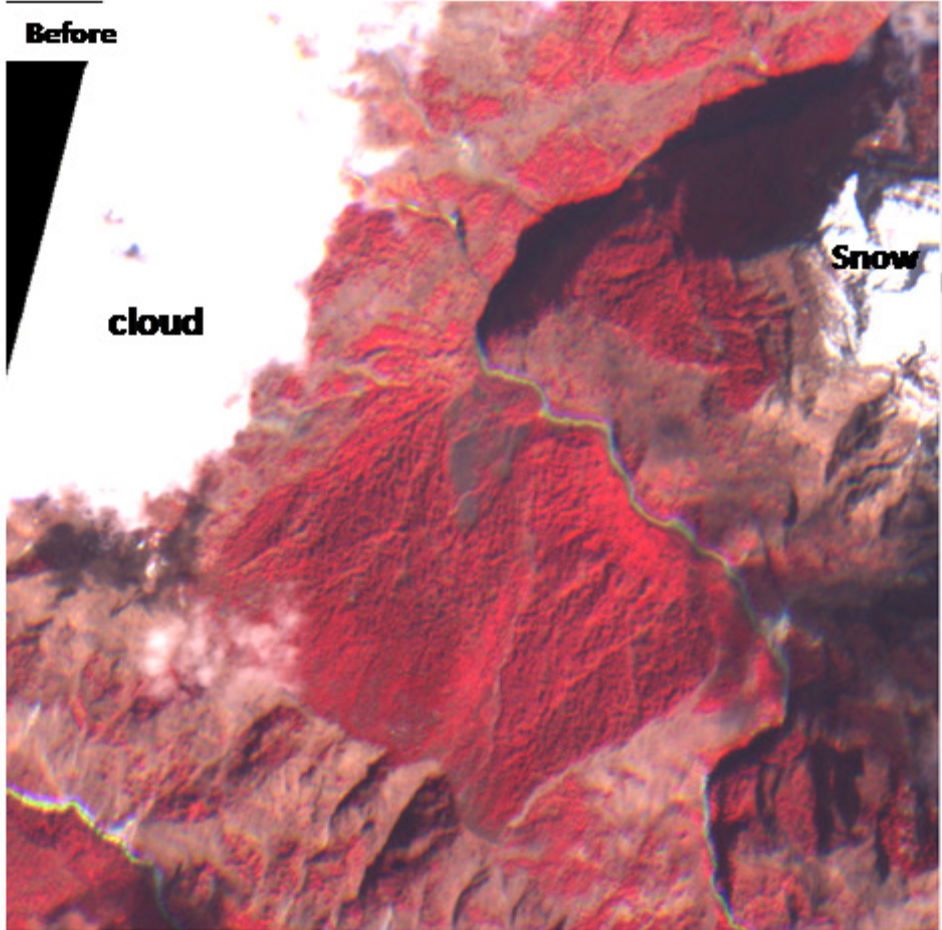




Example: Landslide caused by the Nepal earthquake on 25 Apr 2015

Resourcesat-2 LISS IV mx (01-Apr-2015)

Resourcesat-2 LISS IV Mx (30-Apr-2015)



Observation: A new major landslide has blocked the valley resulting in development of a lake. Several other small new landslide are also seen.

Location of the landslide: **84° 47' 30" E & 28° 33' 8" N**

The Charter's response to tsunamis disasters



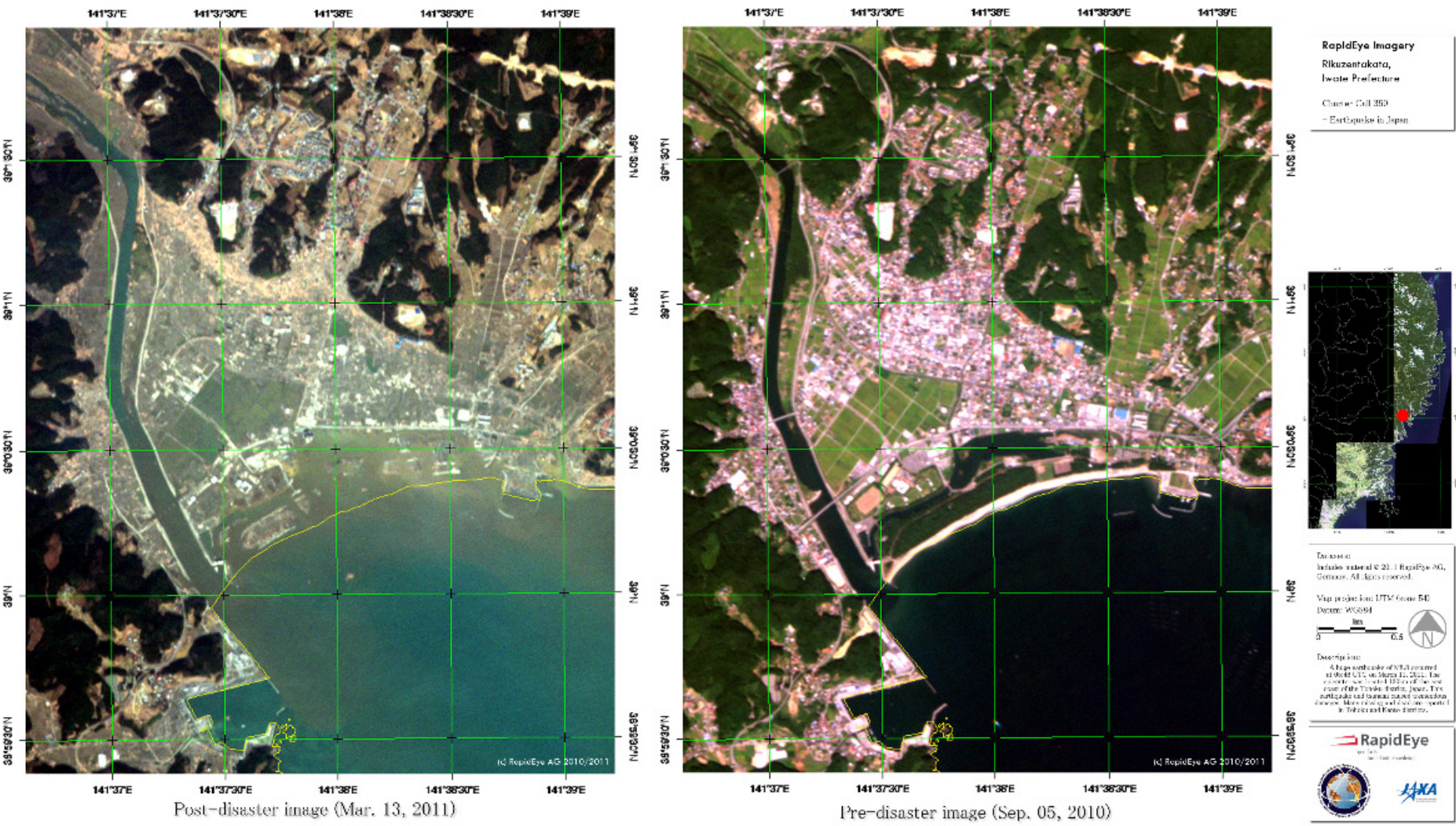
Issues:

- Large area affected (in cases of major tsunamis)
- High risk of technological disasters caused by Tsunami

Solution:

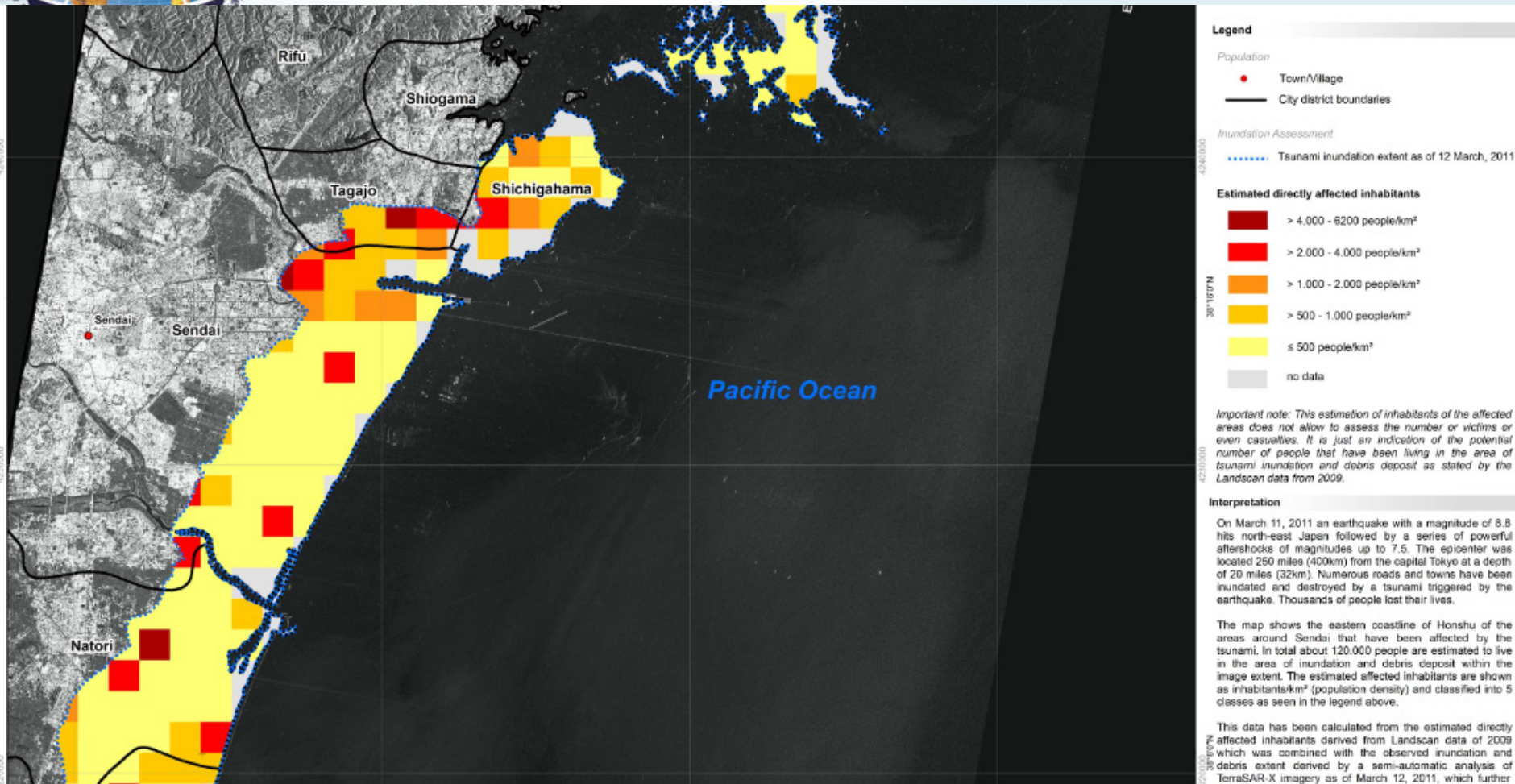
- Acquisition of many data and all different image types
- Combination of flooded area detection and damage assessment

Tsunami in Japan, March 2011



Pre- and post-disaster image from the RapidEye satellite constellation.

Tsunami in Japan, March 2011



Estimated directly affected population
(product made by DLR/ZKI, based on flood extent derived from
TerraSAR-X data and Landsat 2009™ population data)



The Charter's response to tropical storm disasters

Issues:

- Different damage types may occur in combination: direct storm damage, flooding, landslides...
- Areas of most severe damages not always known immediately after landfall
- High probability of cloud cover
- Very high resolution images needed for detection of direct storm damages

Solution:

- Redundant tasking of all VHR satellites (hoping for breaks in the clouds...)
- Radar and lower resolution optical for floods, landslides etc.



Example: Damage analysis after Typhoon Haiyan, Philippines, November 2013

Philippines - Daanbantayan
Maya area
Potentially affected building structures
Observed the 14/11/2013



- Legend
- | | | | |
|--------------------------|----------------------|---------------------|-----------------------|
| Building structures | Potentially affected | Roof infrastructure | Potential obstruction |
| Occlusion in crisis data | Primary road | Bus terminal | Port |
| Points of interest | Secondary road/path | | |

Interpretation
Typhoon Haiyan hit Daanbantayan, Cebu Island, the 8th of November, associating heavy rainfalls and very strong winds. A Pléiades 1B image was acquired the 14th of November 2013 over Maya. Analysis highlights many destroyed dwellings particularly in areas close to trees, and much debris on the ground, especially along the sea front. Many trees have been flattened by the strong winds and some roads could be blocked. However, considering the lack of reference data, the cloud coverage, the reduced visibility in cloud shadows, and the extreme change in tree cover, this interpretation of highly damaged building structures cannot be exhaustive and hence is more indicative.

Cartographic information
Local projection: UTM 51 North, Datum: WGS 84
Geographic projection: Lat/Lon (DMS), Datum: WGS 84
Scale: 1:7 500 for A3 prints
Geometric references: Horizontal: OpenStreetMap

Data Sources
Crisis layers
Potentially affected building structures © SERTIT 2013
Pléiades 1B image (0.50m) acquired the 14/11/2013
© CNES 2013 - distribution Airbus Services/Spot Image, SA, France, all rights reserved
Geometry & pan-sharpening SERTIT
Reference layers
Road network © SERTIT 2013
Toponymy © OpenStreetMap

Framework
The products elaborated for this Rapid Mapping Activity are realized to the best of our ability within a very short time frame, during a crisis, optimizing the material available. All geographic information has limitations due to the scale, resolution, date and interpretation of the original source materials. No liability concerning the content or the use thereof is assumed by the producer.

Map produced the 26th of November 2013 by SERTIT
© SERTIT 2013

sertit@osrtit.fr
<http://sertit.fr>



Daanbantayan, affected individual housing, detected via Pléiades data

The Charter's response to volcanic disasters



Issues:

- Surrounding area often inaccessible
- Possible combination of local devastation and wide-spread ash clouds

Solution:

- Optical observation as well as radar-based change detection



Example: Sinabung volcano eruption in 2014



Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)

Deutsches Fernerkundungs-Datenzentrum (DFD)



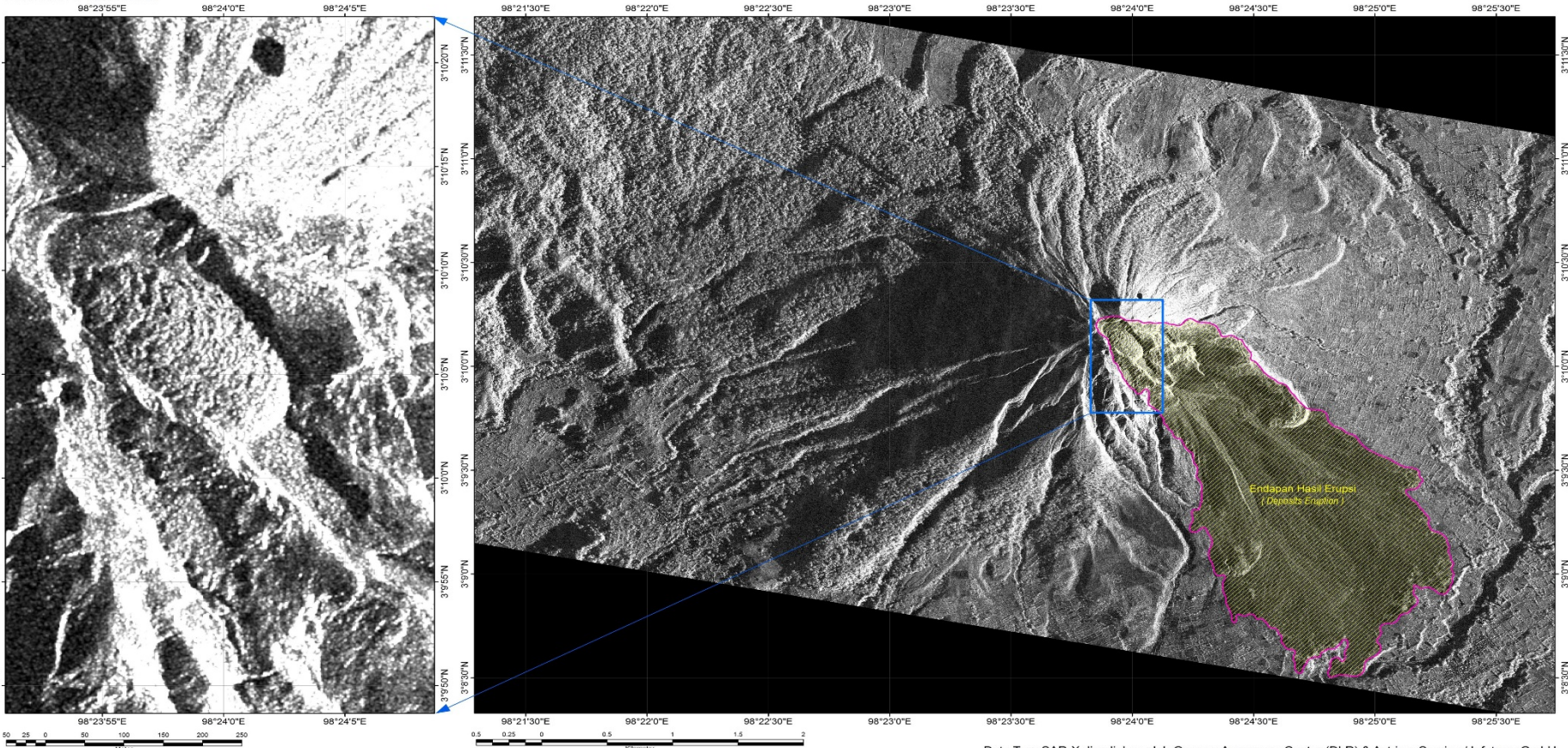
RESPON TANGGAP DARURAT BENCANA BERBASIS DATA SATELIT
SPACE-BASED DISASTER EMERGENCY RESPONSE

LETUSAN GUNUNGGAPI SINABUNG
KABUPATEN KARO, PROVINSI SUMATERA UTARA
ERUPTION OF SINABUNG VOLCANO
KARO REGENCY, NORTH SUMATERA PROVINCE

TERRASAR-X, 18 Januari 2014
TERRASAR-X, January 18, 2014

KAWAH G. SINABUNG
THE CRATER OF MT. SINABUNG

ESTIMASI SEBARAN ENDAPAN ERUPSI (LAVA dan PIROKLASTIK)
ESTIMATED DISTRIBUTION OF DEPOSITS ERUPTION (LAVA and PYROCLASTICS)



PROYEKSI GEODETIK
Projection Geodetic
DATUM WGS 84
Datum WGS 84

Data TerraSAR-X disediakan oleh German Aerospace Center (DLR) & Astrium Service / Infoterra GmbH.
TerraSAR-X provided by German Aerospace Center (DLR) & Astrium Service / Infoterra GmbH.

Kompilasi dan analisis data oleh Pusat Pemanfaatan Penginderaan Jauh, Lembaga Penerbangan dan Antariksa Nasional (LAPAN).
Data compilation and analyzes by Center for Remote Sensing Application Center, Indonesian National Institute of Aeronautics and Space (LAPAN).

The Charter's response to wildfire disasters

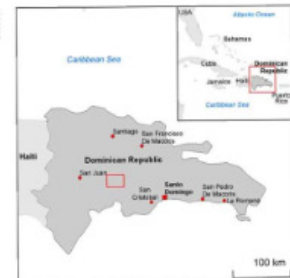
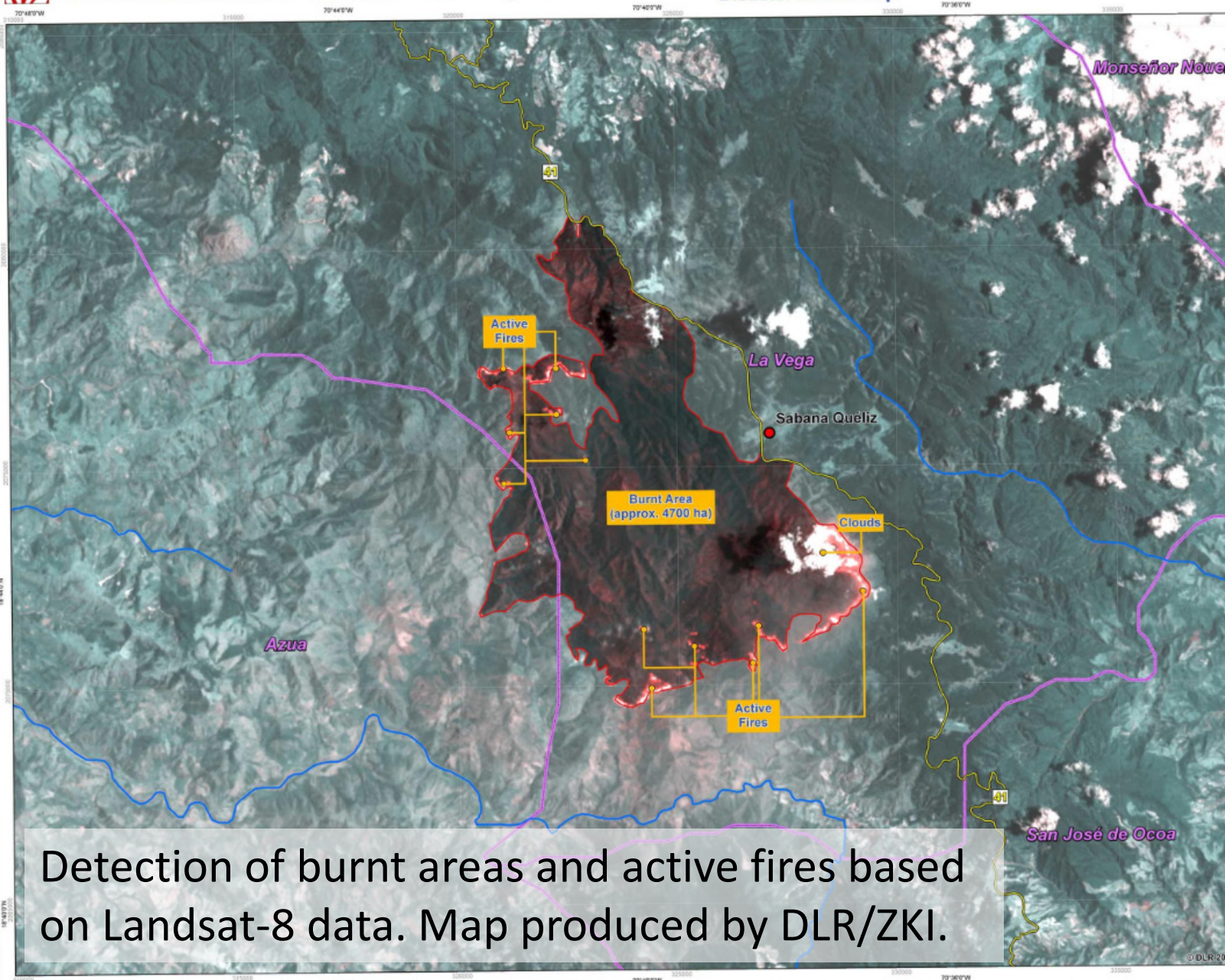


Issues:

- Very quick progression of fire fronts
- Clouds or smoke may hide fire spots

Solution:

- Optical or thermal-infrared observations
- Extra-fast preparation of maps



Interpretation

Since July 20, 2014, several forest fires occurred in the Valle Nuevo National Park, La Vega Province, Dominican Republic. Thousands of hectares of pine and other ancient timber forest have been devastated. Around 700 firefighters are in action to get the forest fire under control.

The burnt area extent was derived by visual interpretation of Landsat 8 imagery (15m spatial resolution) acquired on July 28, 2014. The analysis has shown, that approximately 4.700 hectares of forest are burnt.

A false color composite (7/6/4) of the Landsat 8 imagery is used as backdrop.

Cartographic Information

0 1 2 3 km

Local projection: UTM Zone 19N, Datum: WGS 1984
Geographic projection: Lat/Lon (DMS), Datum: WGS 84
Scale: 1:40,000 for A1 prints.

Data Sources

Landsat-8 (15 m) © USGS 2014
Vector Data © DLR 2014

Framework

The products elaborated for this Rapid Mapping Activity are realized to the best of our ability, within a very short time frame, optimizing the material available.

All geographic information has limitations due to the scale, resolution, date and interpretation of the original source materials. No liability concerning the content or the use thereof is assumed by the producer.

The ZKI crisis maps are constantly updated. Please make sure to visit <http://www.zki.dlr.de> for the latest version of this product.

Map produced July 31, 2014 by ZKI
© DLR 2014
zki@dlr.de
<http://www.zki.dlr.de>



Center for Satellite Based Crisis Information
- Emergency Mapping & Disaster Monitoring -
a service of DLR

German Remote Sensing Data Center
German Aerospace Center

Detection of burnt areas and active fires based on Landsat-8 data. Map produced by DLR/ZKI.

Conclusions



- The Charter is an international mechanism providing space-based information, with a focus on the phase of immediate disaster response.
- The Charter provides earth-observation based information at no cost to the user.
- National Disaster Management authorities can become Charter Authorized Users to be able to directly activate the Charter.
- The Charter is indirectly related to disaster resiliency: countries prone to natural disasters can become better prepared by benefiting from the Charter's Universal Access initiative.



The Charter online

Website

www.disasterscharter.org

@DisastersChart

Follow the Charter on Twitter

Newsletter

<https://www.disasterscharter.org/web/guest/news/newsletter>





International Charter Space and Major Disasters

Thank you for your attention!

Emergency enquiries from users requiring direct access to Charter resources should be addressed to:

ExecutiveSecretariat@disasterscharter.org

General requests for information should be addressed to

webmaster@disasterscharter.org