



# Space-based Information in Disaster Management

By

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## PRESENTATION OUTLINE

- 🌀 Introduction.
- 🌀 Disaster Management from Space.
- 🌀 Space Based Mechanisms for Disaster Management.
- 🌀 International Charter on “Space and Major Disasters” .
- 🌀 How to use the International Charter on “Space and Major Disasters” .



## INTRODUCTION

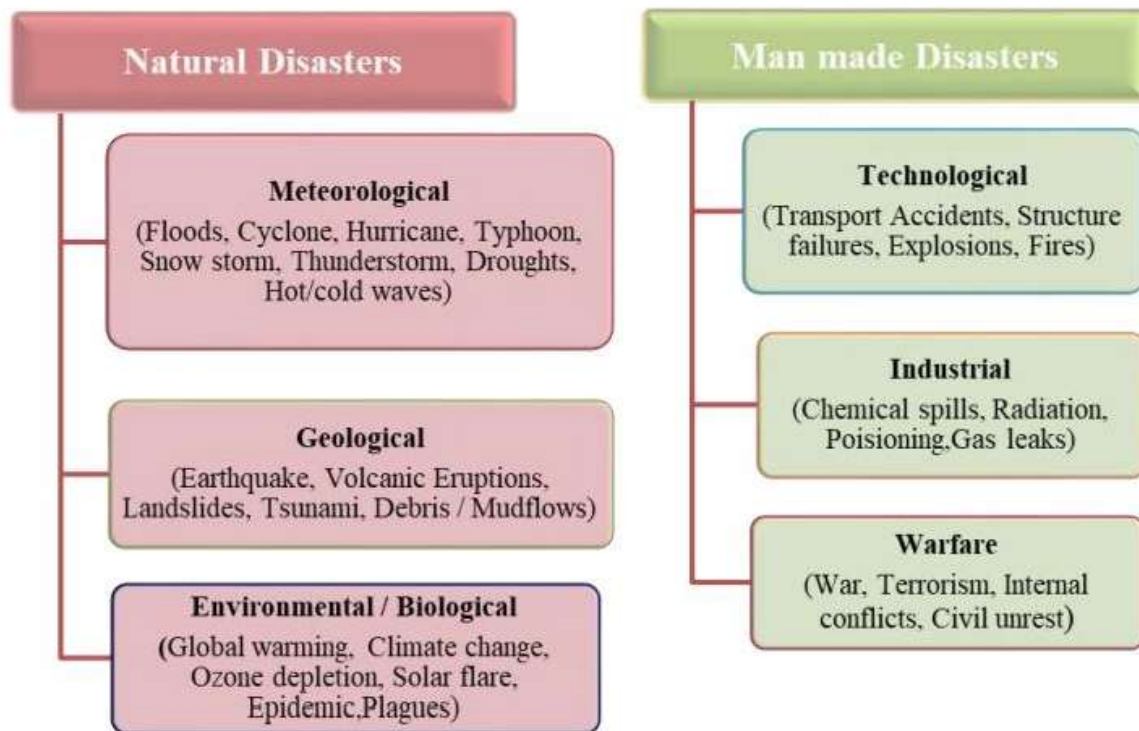
- Disasters are serious disruptions to the functioning of a community that exceed its capacity to cope using its own resources.
- Disasters can occur over a short or long period of time and it causes widespread human, material, economic or environmental loss.
- It may arise from natural or man-made or by various factors that influence the exposure and vulnerability of a community.





## INTRODUCTION

### Types of Disaster



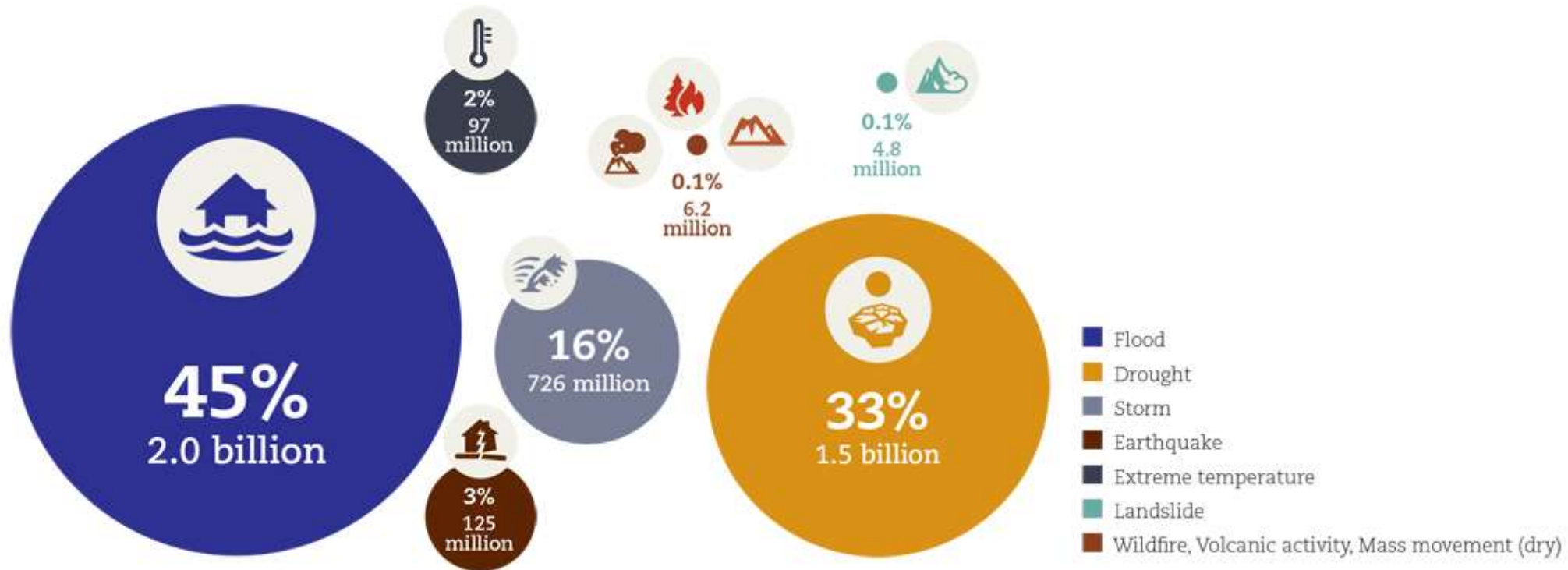
### Impacts of Disasters

- The effect of disasters can be felt at the community, city, state level or an entire country.
- Disasters destroy lives and properties, damages crops and farmlands, damages infrastructure, halt economic activities.



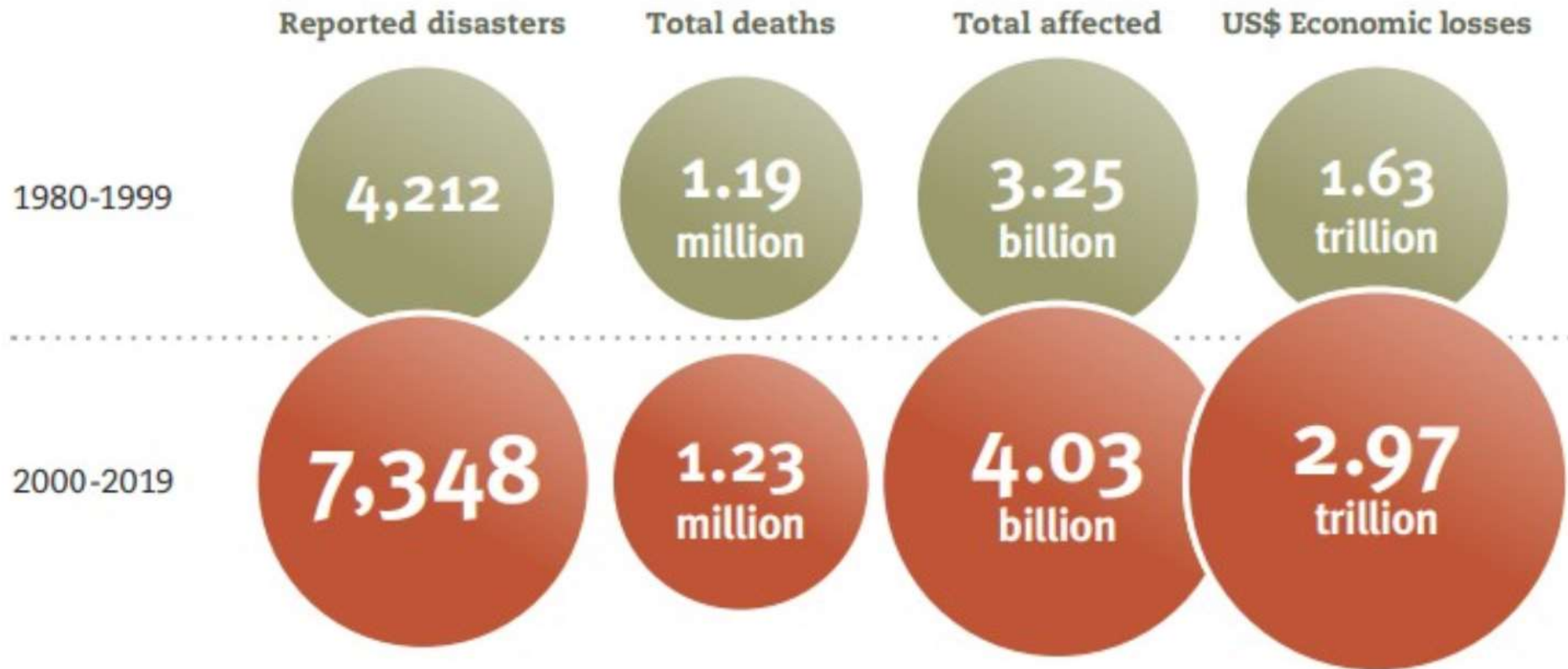
Total Number of People Affected: 4.459 Billion (60% of Global Population)

## Number of people affected per disaster type 1998-2017





## Sharp increase in natural disasters over the past 20 years

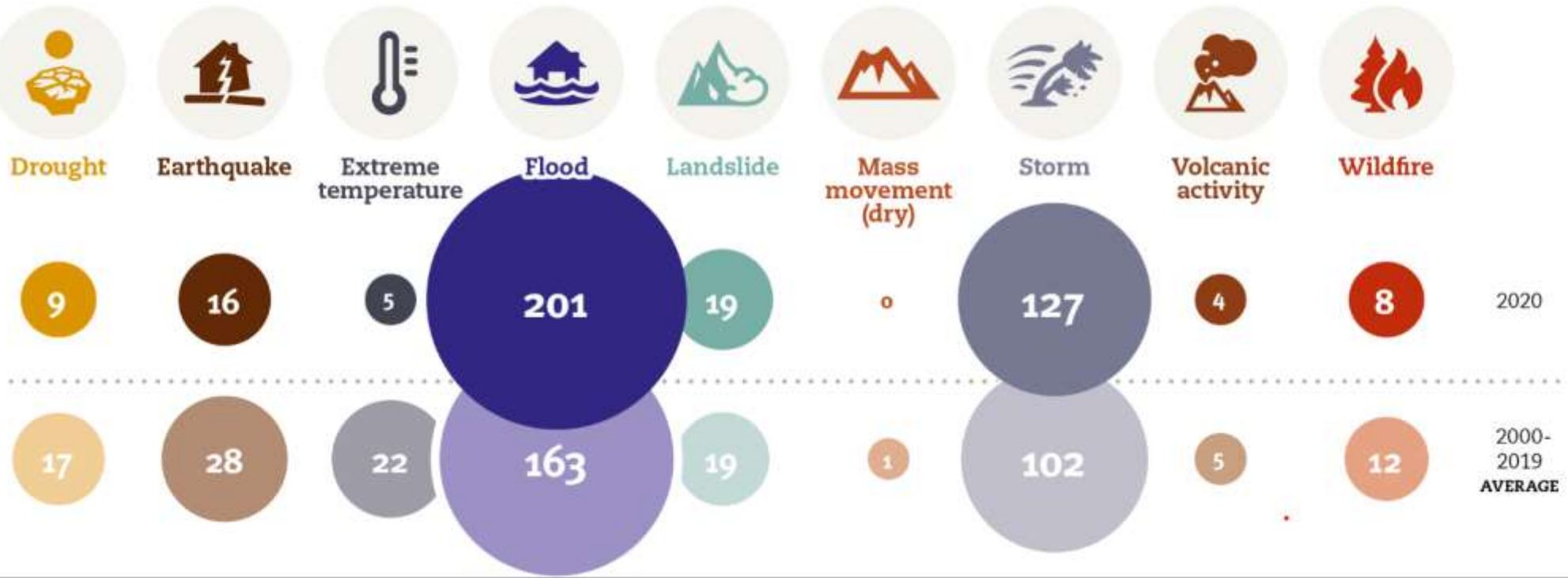




# Sharp increase in natural disasters over the past 20 years

Occurrence by disaster type: 2020 compared to 2000-2019 annual average

368 2000 to 2019 < 389 in 2020

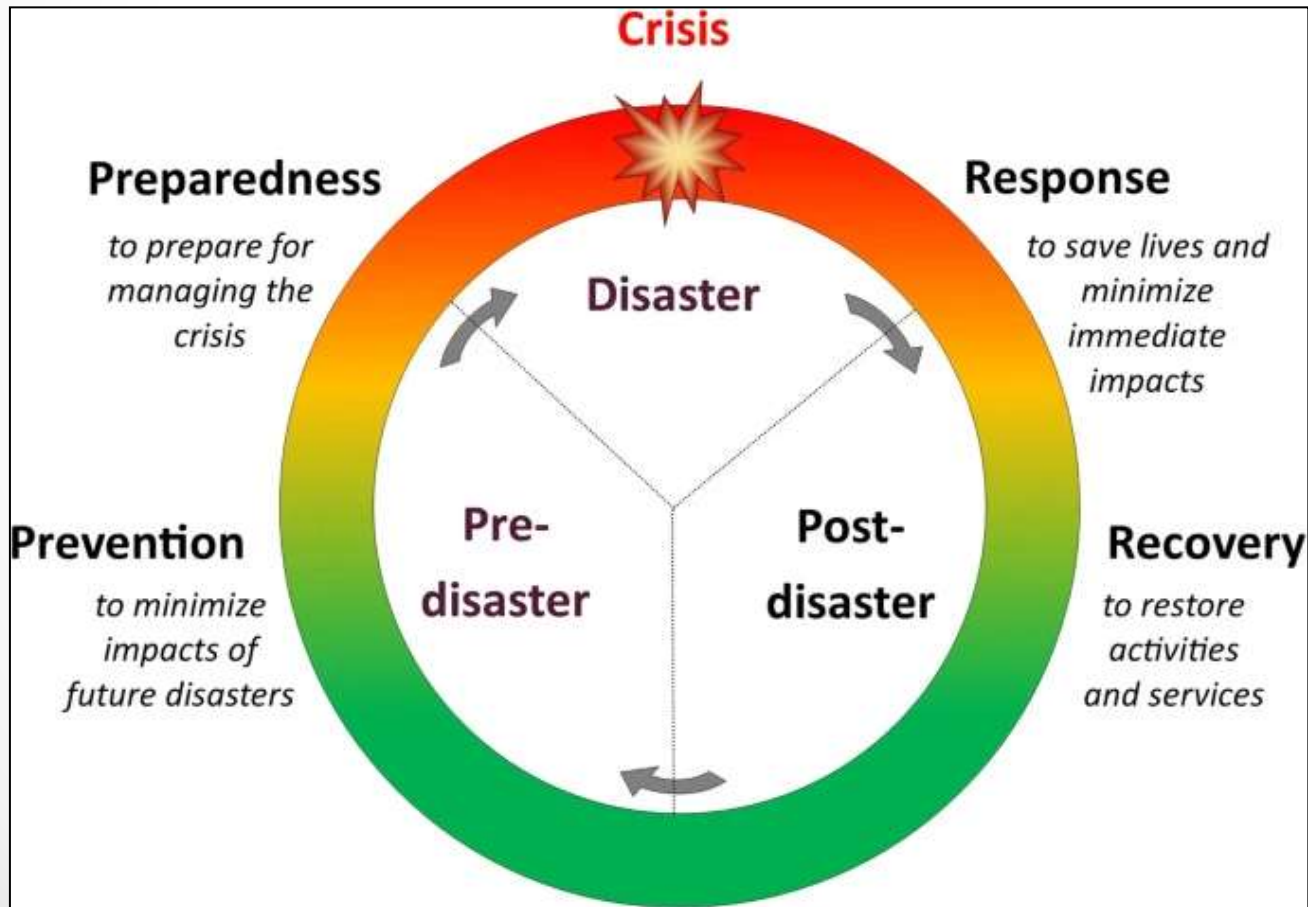


Major floods and storms were over 20% above the annual average in 2020



# Disaster Management From Space

## Disaster Management Cycle







# Disaster Management From Space

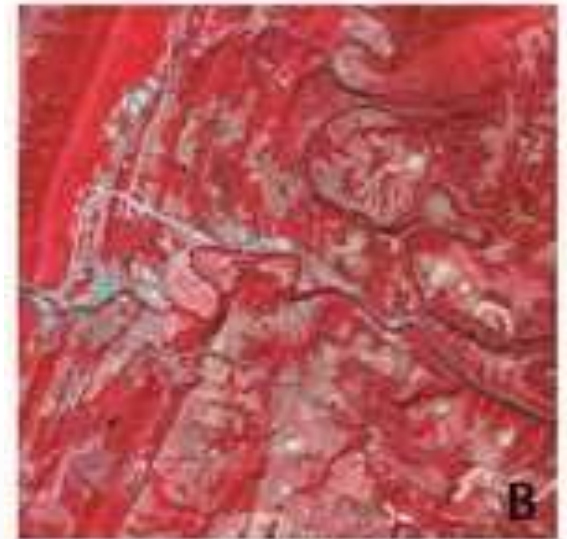
- Reliable and timely information is essential when it comes to dealing with disaster and the resulting impacts.
- Space-based technologies can contribute to all phases of the disaster management cycle:
  - **Prevention**
  - **Preparedness**
  - **Response**
  - **Recovery**
- Remotely sensed data provides information for systems and models which can predict disasters and provide early warnings.



# Disaster Management From Space

## Advantages of Disaster Management from Space

- Space technology provides near real time response
- Satellite imagery provides access to dangerous and remote areas
- It provides geo-referenced and calibrated data
- Spatially explicit mapping
- It Provides global coverage and repetitive coverage
- Provides data beyond human eye capability.



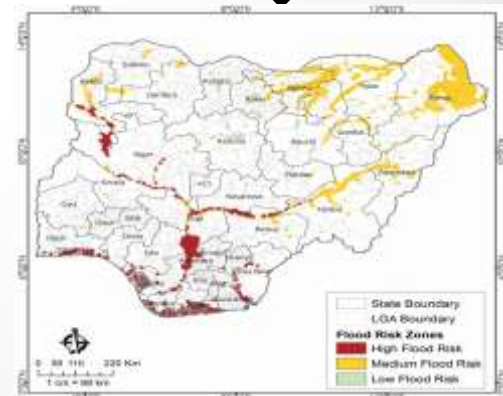
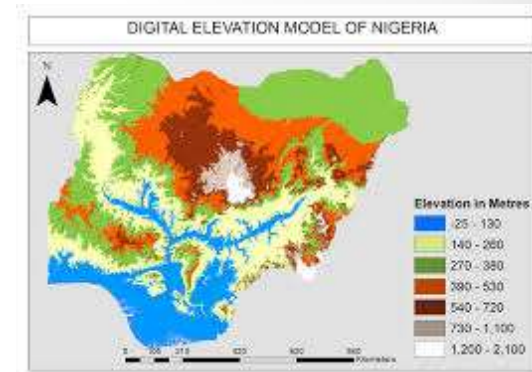


# Disaster Management From Space

## Disaster Prevention Phase:

- Space technology supports disaster reduction initiatives through the process of risk identification and reduction
  - Images from earth observing satellites are used to assess the vulnerability of a community to hazards.
  - For example in flood hazard mapping
- Digital Elevation Models (DEM) and other environmental variables can be used to model flood hazard and risk assessment before the onset of the flood

## Flood hazard mapping





# Disaster Management From Space

## Disaster Preparedness Phase

- Space technology is used for the identification and development of necessary systems, skills and resources before hazard events occur.
- LiDAR data is used to produce hazard and risk maps, which are used by authorities to communicate information about location and range of hazards to their communities.
- These information are used to prepare an action plan for evacuation plans by the necessary authorities.

Example; **Satellite communications** help warn people who are at risk, especially in remote areas.





# Disaster Management From Space

## Disaster Response Phase:

- Remote sensing aids in search and rescue, evacuation plans through the combination of observing weather patterns and hazard behaviour and establishing immediate emergency shelter.
- Remote sensing can be used to determine magnitude, location and duration of impacts
- Global Navigation Satellite System (GNSS) can assist in search and rescue operators in areas that have been devastated and where it is difficult to navigate



# Disaster Management From Space

## Damage Assessment

- Remote sensing is used to conduct a damage assessment analysis using before and after satellite imagery



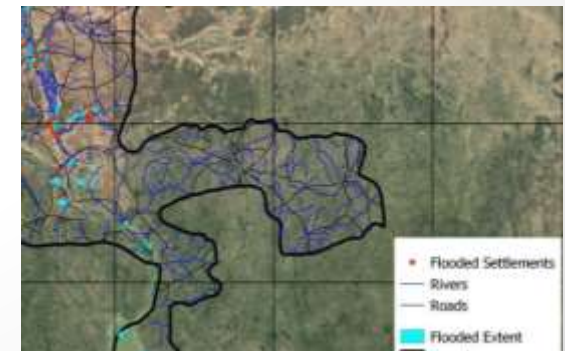
Pre flood



During flood



After flood





# Disaster Management From Space

## Disaster Recovery Phase:

- The impact and departure of the disaster event leaves behind an area of immense devastation.
- Remote sensing provides information in:
  - Disaster situation maps
  - Rate of recovery e.g. vegetation regrowth, reconstruction using moderate to very high resolution imagery in a continuous time series analysis
  - Compare the effectiveness of different recovery strategies e.g. to determine if aid funding is being used appropriately
  - Monitoring and provide a quantitative base for relief operations.
  - Infrastructure and facilities locations



## SPACE-BASED MECHANISM FOR DISASTER MANAGEMENT

- Copernicus Emergency Management Service (EMS).
- Disaster Monitoring Constellation.
- Sentinel Asia.
- The SERVIR mechanism.
- United Nations Institute for Training and Research (UNITAR) Operational Satellite Applications Programme (UNOSAT).
- The International Charter on "Space and Major Disasters"
- Scripts developed in Google Earth Engine.





## The International Charter on "Space and Major Disasters"

- The International Charter on "Space and Major Disasters" is a global collaborative effort among space agencies, through which satellite-derived information and products are made available, on request, to support disaster response efforts.
- The Charter has been operational since November 2000, and currently, the following global space agencies participate in the mechanism:  
ESA, CNES, CSA, NOAA, CONAE, ISRO, JAXA, USGS, UKSA & DMCii, CNSA, DLR, KARI, INPE, EUMETSAT, and ROSCOSMOS.
- The Charter also benefits from satellite data provided by Planet and Digital Globe.
- The basic principle is that on activation, any satellite within the charter framework flying over the disaster area must image the disaster area.



## The International Charter on "Space and Major Disasters"

### Charter Partners

The Charter is supported by partners from around the world who contribute to our efforts or share similar goals.

- Some organisations provide disaster monitoring services for specific regions of the world, and work with the Charter to further the distribution of data to the end users
- Data providers contribute additional satellite data for use in monitoring disasters
- Value added providers produce maps based on the satellite data for use in interpreting and assessing disaster situations.



Algerian Space Agency (ASAL)



Asian Disaster Reduction Center (ADRC)



Committee on Earth Observation Satellites (CEOS)



Group on Earth Observations (GEO)



Mohammed Bin Rashid Space Centre (MBRSC)



National Space Organisation of Taiwan (NSPO)



National Space Research and Development Agency (NASRDA)



United Nations Office for Outer Space Affairs (UNOOSA)



United Nations Satellite Centre



Airbus Defence and Space



Copernicus



ICEYE



Maxar Technologies



MDA



Planet



Satellite Imaging Corp.



Satellogic



Sentinel Asia



Tübitak-BİLTEN



# National Space Research and Development Agency

## The International Charter on "Space and Major Disasters"



### INTERNATIONAL CHARTER SPACE & MAJOR DISASTERS

A worldwide collaboration through which satellite data are made available for the benefit of disaster management



**+750**  
ACTIVATIONS



**+130**  
COUNTRIES



**17**  
CHARTER MEMBERS



**+270**  
SATELLITES

**+35**  
CONSTELLATIONS



OPERATING  
24 HOURS A DAY  
7 DAYS A WEEK



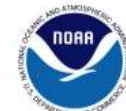
FOUNDED BY ESA,  
CNES AND CSA ON  
20 OCTOBER 2000

**+20**

SUPPORTED BY MORE  
THAN 20 INTERNATIONAL  
ORGANISATIONS



MORE THAN 80 NATIONAL USERS FROM OVER 80 COUNTRIES CAN REQUEST DATA FROM THE CHARTER. FIND OUT HOW TO REGISTER THROUGH UNIVERSAL ACCESS:  
[disasterscharter.org/web/guest/how-to-register-as-a-user](http://disasterscharter.org/web/guest/how-to-register-as-a-user)



وكالة الإمارات للفضاء  
UAE SPACE AGENCY





## The International Charter on "Space and Major Disasters"

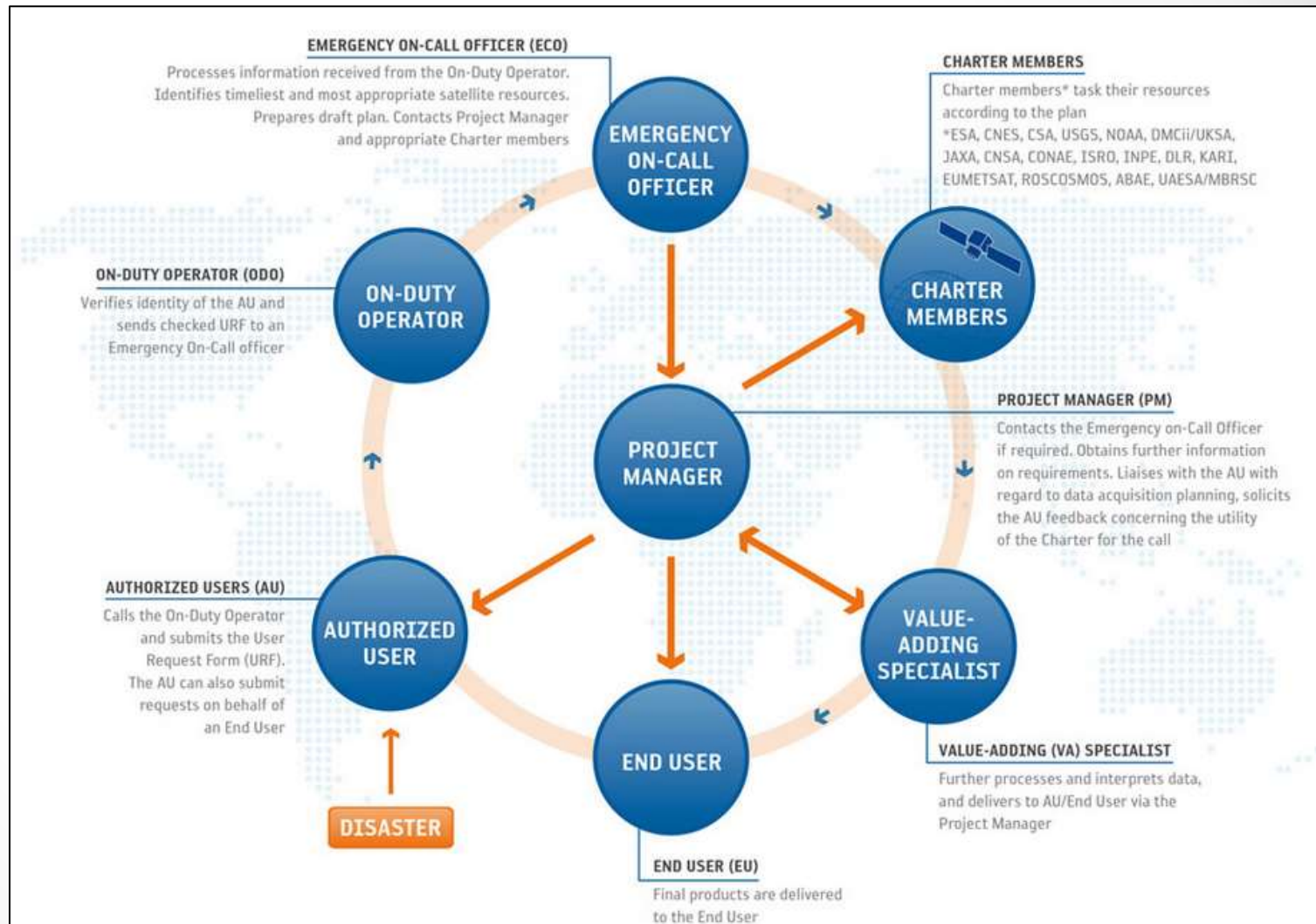
### How can the Charter be used?

- The Charter can be used through activation.
- The Charter can be activated by a predefined list of appointed users, known as 'Authorized Users' (AUs).
- At inception, AUs are typically disaster management authorities, from countries of Charter member agencies, able to request Charter support for emergencies in their own country, or in a country with which they cooperate for disaster relief. The United Nations and other international entities were later co-opted as AU.
- From 2012, the principle of Universal Access was established.
- All disaster management entities globally can now serve as AU after formalizing relationship with the Charter Secretariat.



## The International Charter on "Space and Major Disasters"

Operations of the Charter:  
How it works





## The International Charter on "Space and Major Disasters"

### How to become an Authorized User

- Authorized Users must:
  - Be a national disaster management authority or its delegated agency in that country (e.g. NEMA)
  - Have the capacity to download and utilize maps
  - Be able to submit and pursue its activation requests in English



## How to become an Authorized User

- Download the registration form.
- Fill the form.
- Submit the registration form, together with a cover letter of the user organisation, to the Charter Executive Secretariat ([ExecutiveSecretariat@disasterscharter.org](mailto:ExecutiveSecretariat@disasterscharter.org)), which coordinates Charter operations.
- The request will be processed by the Charter members who may ask for additional clarification or information.
- The final acceptance of a national user is subject to approval and written notification via official letter by the Charter Board, the policy body of the Charter.



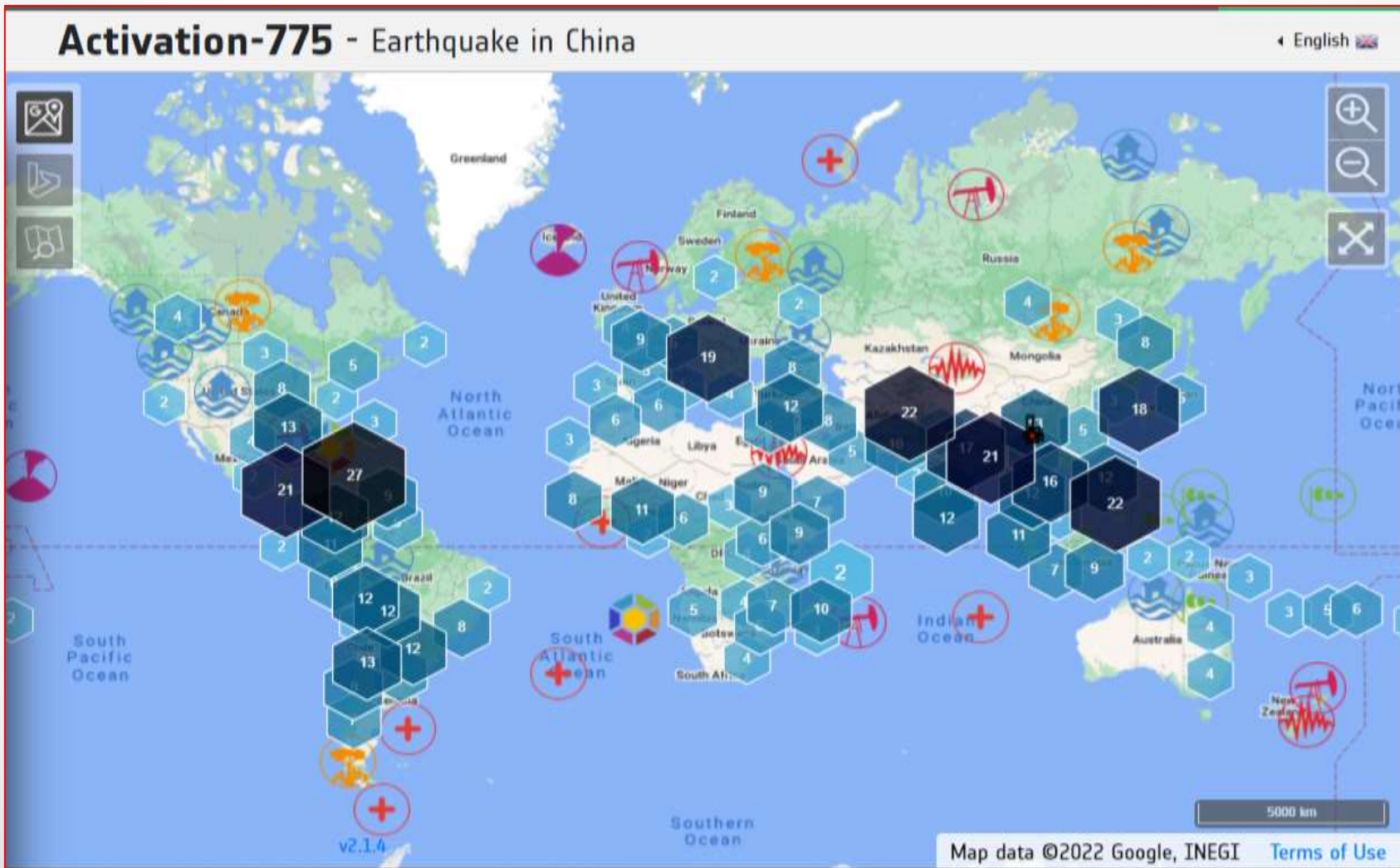
## How to become an Authorized User

- New users will be asked to sign a document specifying certain procedures and contacts for Charter activation requests. This is necessary to ensure adherence to Charter rules and to avoid loss of time and resources during emergencies.
- To complete the process, the candidate will undergo a simple exercise to simulate the steps of a Charter activation.
- This process will validate the ability of national authorities to access and use Charter assets for disaster response, in accordance with Charter operational procedures.





Global Activation





## Charter Benefits

- Support National Needs during disaster response.
- Mobilize Global Space Assets for response.
- Operates 24 hours a day, 7 days a week.
- Service is at no cost to the user.
- The satellite data obtained by the Charter offers invaluable aid to the end-users - typically disaster relief organisations.
- Following a successful activation of the Charter, they may receive satellite data of affected areas within a matter of hours or days; depending on the type of the disaster and available satellite resources.



Thank You