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Office for Outer Space Affairs



UNOOSA/UN-SPIDER

Knowledge Sharing and Improving Access to Emergency Response Mechanisms

December 2022

Joint Open Session, UN-Space / UN-SPIDER Workshop in Bangkok



United Nations

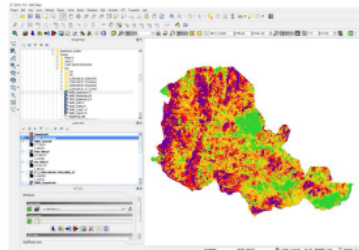
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Recommended Practices



When using space technologies for disaster risk management and emergency response, it is not only important to have access to space-based data and software, but also to workflows for processing and mapping the data in order to develop information products and gain insights into hazards.

For this reason, UN-SPIDER is joining efforts with a wide range of partners and its [network of Regional Support Offices](#) to provide step-by-step procedures, so-called Recommended Practices, that have proven effective in creating information products based on remote sensing to assess hazards such as floods, drought and forest fires.

Recommended Practices make use of data from different satellites and sensors, for instance Landsat 8 and Sentinel-2. To allow as many interested users as possible to use these procedures, UN-SPIDER makes them available in a growing variety of GIS software packages and programming languages such as QGIS, R and Python.

Each Recommended Practice consists of an overview, a step-by-step and in detail page. To see all software packages and programming languages a Recommended Practice is available in, navigate to its step-by-step page.

As part of its [technical advisory support activities](#), UN-SPIDER regularly trains civil protection agencies and other stakeholders in developing countries in using the Recommended Practices to develop information product that support that disaster management and emergency response efforts.

If you have questions or wish to share your own experience in applying these Recommended Practices, please [contact us](#).

Browse Recommended Practices

Hazard Type
- Any -

Related Software

Related Dataset



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Flowchart



Recommended Practice: Flood Mapping and Damage Assessment Using Sentinel-1 SAR Data in Google Earth Engine



SAR-based flood mapping is a standard and reliable method for determining the extent of major floods. SAR can penetrate cloud-cover, operate in any weather conditions and provide timely and crucial information about one of the most frequent and devastating natural disasters: flooding. Too often limited technical know-how separates the disaster community from the information they need; this Recommended Practice provides a near real-time, cloud-based and easy-to-use method for flood extent mapping, designed to overcome technical limitations.

Without the need for downloading large and complex data, this cloud-based Recommended Practice completes all analysis without taking up hard drive space or processing power of the end-users' device. By inputting the provided code and simply outlying the region of interest as well as the before and after dates, this methodology produces in seconds what a GIS user may take hours to complete.

Recommended by:



Related Practices

- [Recommended Practice: Flood Mapping and Damage Assessment using Sentinel-2 \(S2\) Optical Data](#)
- [Recommended Practice: Radar-based Flood Mapping](#)

Related data

- [MODIS Land Cover Products \(NASA\)](#)
- [Sentinel 1 - SAR Dataset \(ESA\)](#)
- [Global Human Settlement Layer \(GHSL - JRC\)](#)
- [Global Surface Water \(JRC\)](#)

[view all](#)

data on large scales. The advantage mainly lies in its computational speed, as processing is outsourced to Google's servers. The platform provides a variety of constantly updated datasets which can be accessed directly within the code editor. No download of raw imagery is required. While it is free of charge, an activate Google account with Google Earth Engine is required. A confirmation usually comes within 2-3 work days. For a quick orientation around the code editor, click here: <https://earthengine.google.com/platform/>.

The code for this Recommended Practice can be imported by following this link: <https://code.earthengine.google.com/f5c2f984c053c8ea574bfc04040d084e>.

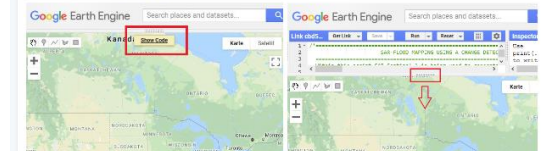


Fig. 1: Access the Google Earth Engine script by using the link.

There you will find detailed comments along with the code line-by-line. Alternatively, you can create a new file in the code editor, [download this script](#) and paste it.

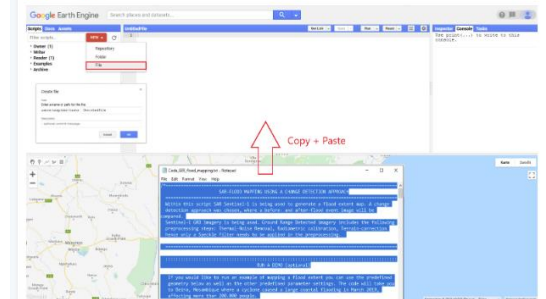


Fig. 2: Access the Google Earth Engine script by copy-and-pasting the text-file.



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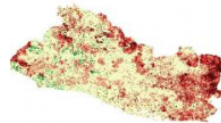
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Flowchart



Recommended Practice: Drought monitoring using the Standard Vegetation Index (SVI)



Drought monitoring is an important component in drought early warning systems. This practice shows how to monitor the impacts of meteorological drought on natural vegetation using MODIS optical satellite imagery. The practice has been developed in the context of the SEWS-D project. It is similar to the practice developed by the Iranian Space Agency but it proposes the use of a different index (SVI instead of VCI). The practice was developed by the Universidade Federal de Santa Maria (UFSM) in Brasil. (The above image shows the standard vegetation index based on EVI for El Salvador on 28 July 2014.)

- Step by Step
- In Detail

Objective

Recommended by:



Related Practices

Recommended Practice: Drought monitoring using the Vegetation Condition Index (VCI)

Related data

MODIS Vegetation Product (NASA)
Crop monitoring - GEOGLAM (GEO)

view all

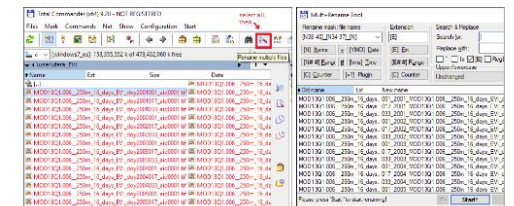
Related Software

R CRAN(Comprehensive R Archive

Step 2 Renaming and Structuring of the data

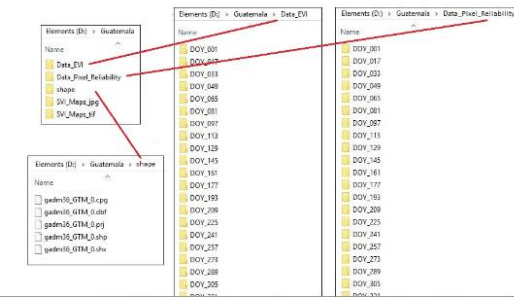
For processing this Recommended Practice in R, it is required to first rename and second sort the data according to their DOY. Download the folder structure here and copy it both in the folders **Data_EVI** and **Data_Pixel_Reliability**.

- Rename the EVI and pixel reliability data following the pattern: `DOY_YYYY_[Original Name]`. It is recommended to use Total Commander to rename multiple files (Download Link: <http://www.ghsler.com/index.htm>). Renaming the files is important because this pattern is used to automatize the filenames and the titles of the resulting maps in the R script.
- Sort the EVI and Pixel Reliability data according to the DOY in the respective folders.




Create following folders in addition to **Data_EVI** and **Data_Pixel_Reliability**:

- 'shape' (store the shapefile with the country border here including .shp, dbf, prj, and .shx files)
- 'SVL_Maps_jpg'
- 'SVL_Maps_tif'







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Flowchart

Modis Products

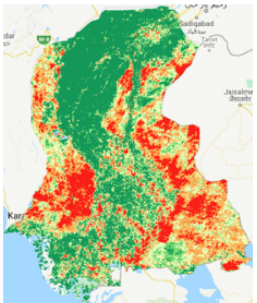
1000 m Resolution

Download Indices via Google Earth Engine

Products (VCI, TCI & VHI)


Drought Zonation

Recommended Practice: Agriculture Drought Monitoring and Hazard Assessment using Google Earth Engine



Drought is slow on-set disaster which affects agriculture and associated livelihood in many parts of the world. Drought causes stress to vegetation; hence the extent of a drought can be

Recommended by:



SUPARCO

Related Practices

- Recommended Practice: Drought monitoring using the Vegetation Condition Index (VCI)
- Recommended Practice: Drought monitoring using the Standard Vegetation Index (SVI)
- Recommended Practice: Drought monitoring using the Standardized Precipitation Index (SPI)

Related data

The decision to monitor vegetation indices for drought analysis is based on the greenness of the vegetation. However, VHI is more robust and effective due to its good representation of drought occurrence phenomena. VHI time series products pertaining to the study area are placed in Figure 9. This figure clearly shows the evolution of a drought-like situation, which evolved gradually from 2016 to 2019 respectively.

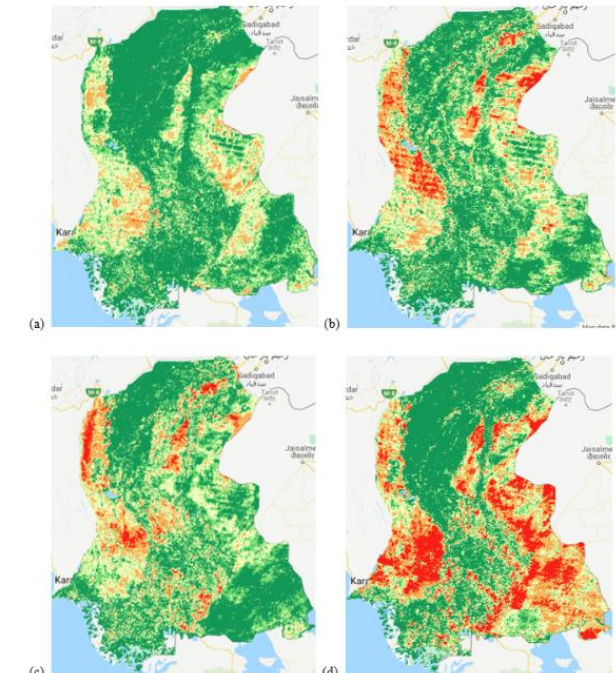
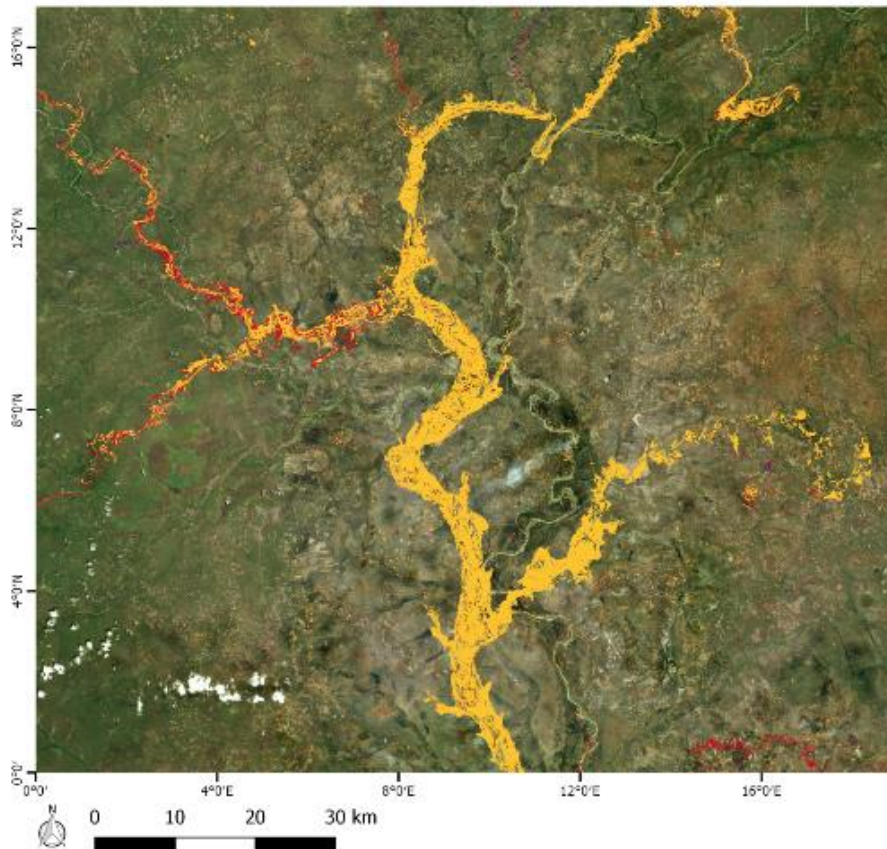


Figure 8: VHI Time Series Products (a) March 2016 (b) March 2017 (c) March 2018 (d) March 2019

flood mapping in Ghana

Identification of inland water bodies Ghana



Interpretation

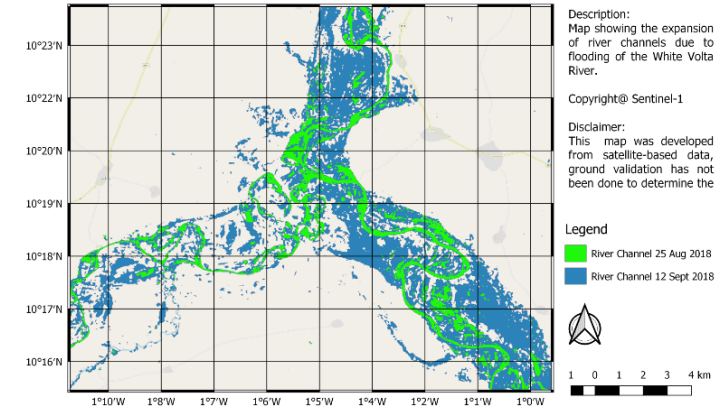
The map shows the increase in the extent of water bodies detected in the White Volta river using radar satellite imagery in Northern Ghana. The extent of water bodies corresponding to 12 September 2018 is shown in yellow.

In the north east, close to Yagaba, the extent of water has decreased slightly in comparison to the previous assessment conducted with the radar satellite imagery of 6 September (red) and 25 August 2018 (dark violet). In contrast, the area of the river near Disiga and Pigu showed an increase in the extent of water by 12 September 2018 compared with 25 August and 6 September 2018.

Data: Water extents from Sentinel 1
Acquisition data: 25 Aug 2018, 6 Sep 2018, 12 Sep 2018
Data source: Copernicus
Coordinate system: WGS 84/ Pseudo Mercator
EPSG:3857
Product modified on: 17 Sep 2018
Produced by: UN-SPIDER
Disclaimer: The information presented is entirely based on remote sensing data derived without field validation.



Radar mapping of White Volta before and during floods 2018



Description:
Map showing the expansion of river channels due to flooding of the White Volta River.

Copyright@ Sentinel-1

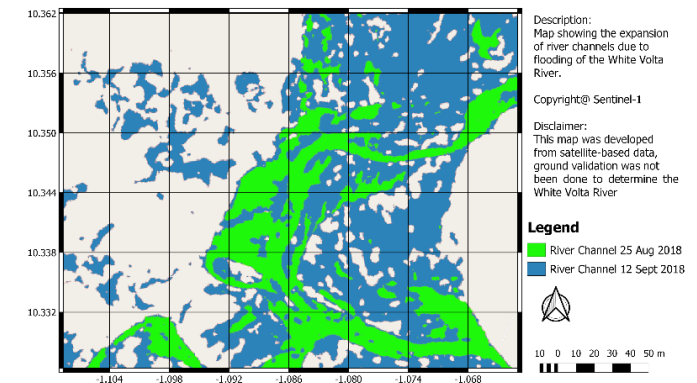
Disclaimer:
This map was developed from satellite-based data, ground validation has not been done to determine the

Legend

River Channel 25 Aug 2018
River Channel 12 Sept 2018



Radar mapping of White Volta before and during floods 2018



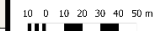
Description:
Map showing the expansion of river channels due to flooding of the White Volta River.

Copyright@ Sentinel-1

Disclaimer:
This map was developed from satellite-based data, ground validation was not been done to determine the White Volta River

Legend

River Channel 25 Aug 2018
River Channel 12 Sept 2018





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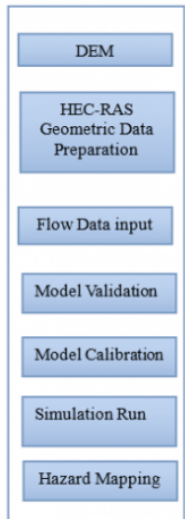
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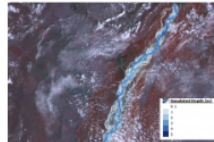
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Flowchart



Recommended Practice: Flood Hazard Assessment



Flood hazard assessments are critical to identifying areas at risk and taking relevant preparation and mitigation measures to address the hazard. Using the HEC-RAS 2D model for preparing flood hazard maps, this Recommended Practice explains how to identify flood-prone areas and exposed infrastructure. Through its focus on the prevention and mitigation stages of the disaster management cycle, it complements the Recommended Practice on Flood Mapping and Damage Assessment with Sentinel-2, also developed by SUPARCO.

[Step by Step](#)

[In Detail](#)

Objective

The objective of this practice is to carry out a flood hazard assessment, identify potential flood-prone areas and potentially affected infrastructure namely roads, settlements, agriculture and in-land areas etc. against a flood hazard of particular return period i.e. 2, 5, 10, 25, 50 and 100 years. This information can be used by disaster management agencies and other stakeholders

Recommended by:



Related Practices

- [Recommended Practice: Flood Mapping and Damage Assessment using Sentinel-2 \(S2\) Optical Data](#)
- [Recommended Practice: Use of Digital Elevation Data for Storm Surge Coastal Flood Modelling](#)

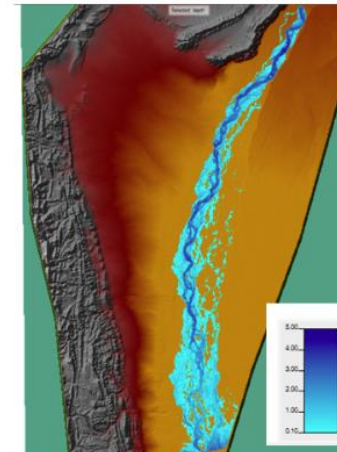
Related data

[WorldDEM™ \(AIRBUS\)](#)

[view all](#)

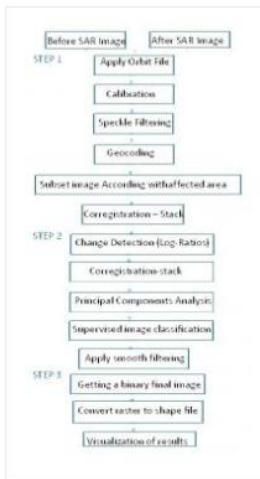
Related Software

31. Simulation results can be viewed in RAS Mapper Window. Flood model main outputs include Depth, Velocity and WSE. Flood model simulated depth, velocity and WSE for known Flood2010 event is shown below (Figure 19-21).





Flowchart



Recommended Practice: Mudslides and Associated Flood Detection Using Sentinel-1 Data



Floods and landslides are the first and fourth most frequent disasters around the world (Petley, 2012). There are several examples of downstream flooding caused by massive mudslides where rapid mapping is an indispensable tool for supporting disaster management activities by civil protection authorities.

Since July 2014, the Copernicus programme of the European Union has been providing free-of-charge access to Sentinel-1 radar data covering the entire world. This allows for the exploration of new applications to strengthen hazard monitoring and disaster mitigation activities.

This UN-SPIDER Recommended Practice emphasizes the use of SAR data during and after a disaster crisis, since optimum atmospheric conditions for optical satellite images are not always available. In the example provided here, it is used to map the mudflow following the dam collapse that occurred on 25 January 2019 at Brumadinho, Brazil.

Recommended by:



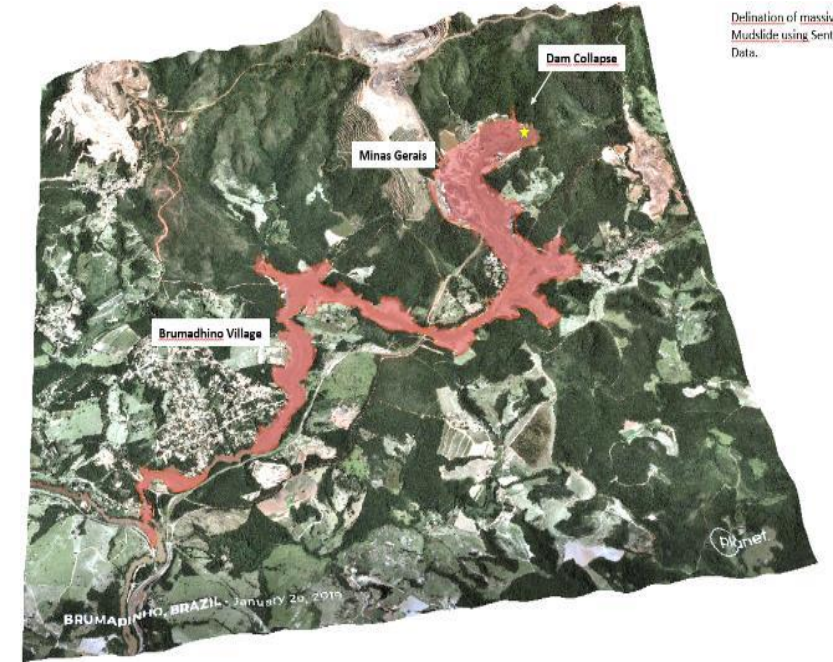
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Related Practices

- [Recommended Practice: Flood Mapping and Damage Assessment using Sentinel-2 \(S2\) Optical Data](#)
- [Recommended Practice: Radar-based Flood Mapping](#)



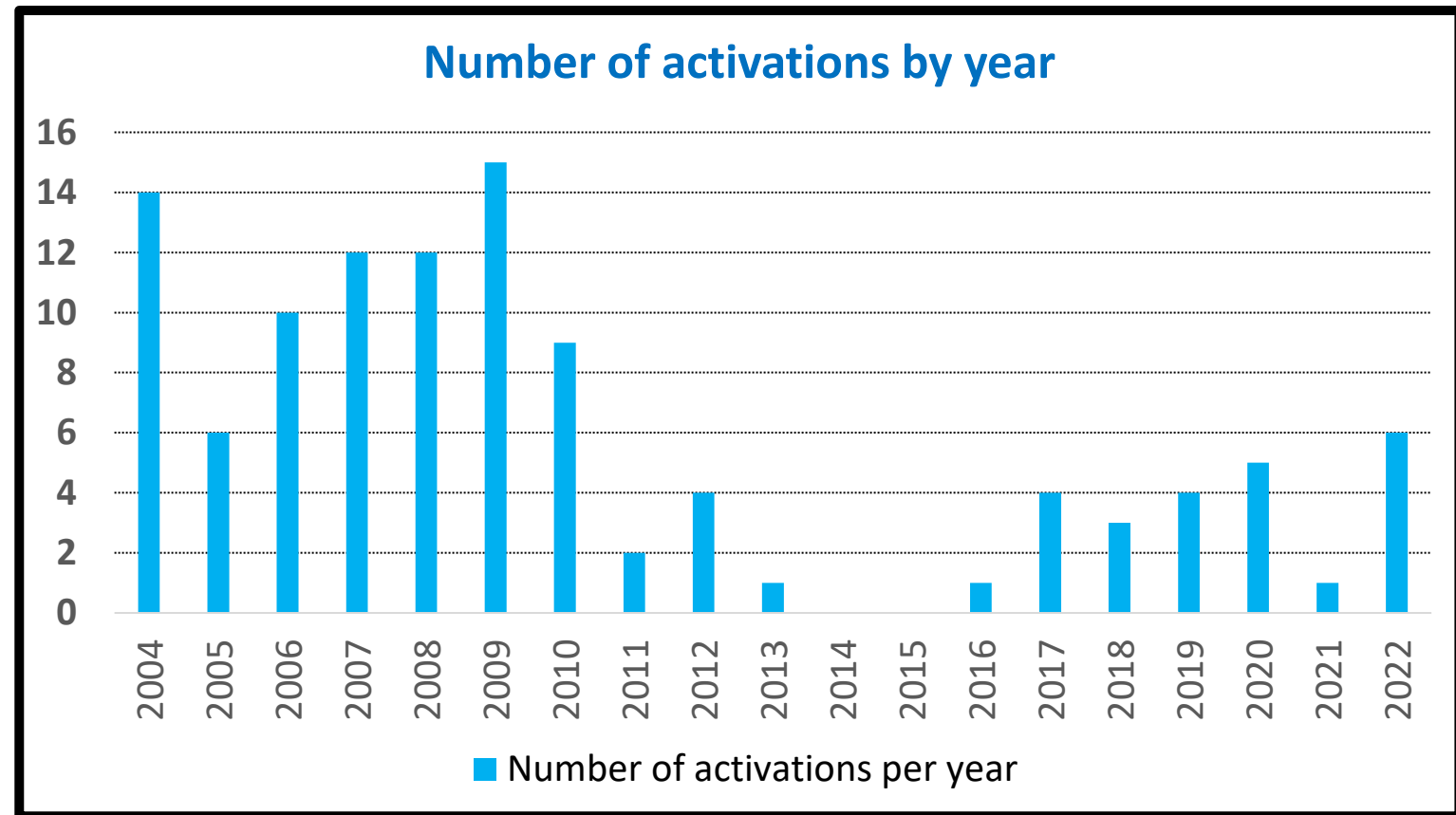
Definition of massive Mudslide using Sentinel-1 Data.

Brumadinho mining dam collapse in Brazil, using Sentinel 1 radar imagery



Requests for activation of the International Charter

Between 2003 and 2022, UNOOSA and its UN-SPIDER programme sent 113 requests for activation to the Charter (nearly 15% of all activations of the Charter up to Sept. 2022).





UNOOSA as a Cooperating Body

- UNOOSA's 113 requests for activation of the International Charter were at the request of UN agencies, national disaster management agencies and in selected cases, ministries of environment. In addition, it has supported other activations
- UNOOSA through UN-SPIDER has constantly raised awareness about the International Charter in a variety of ways (International conferences, expert meetings, publications, UN-SPIDER Knowledge Portal, Technical Advisory Missions to developing countries)
- UN-SPIDER has actively promoted the International Charter with the disaster management community and has carried out efforts to engage national disaster management agencies of countries in Asia, Asia Pacific, Africa, Latin America and the Caribbean as users
- More than 20 national disaster management agencies have submitted official requests to be incorporated as Charter Authorised Users as a result of UN-SPIDER efforts

International Charter Space and Major Disasters



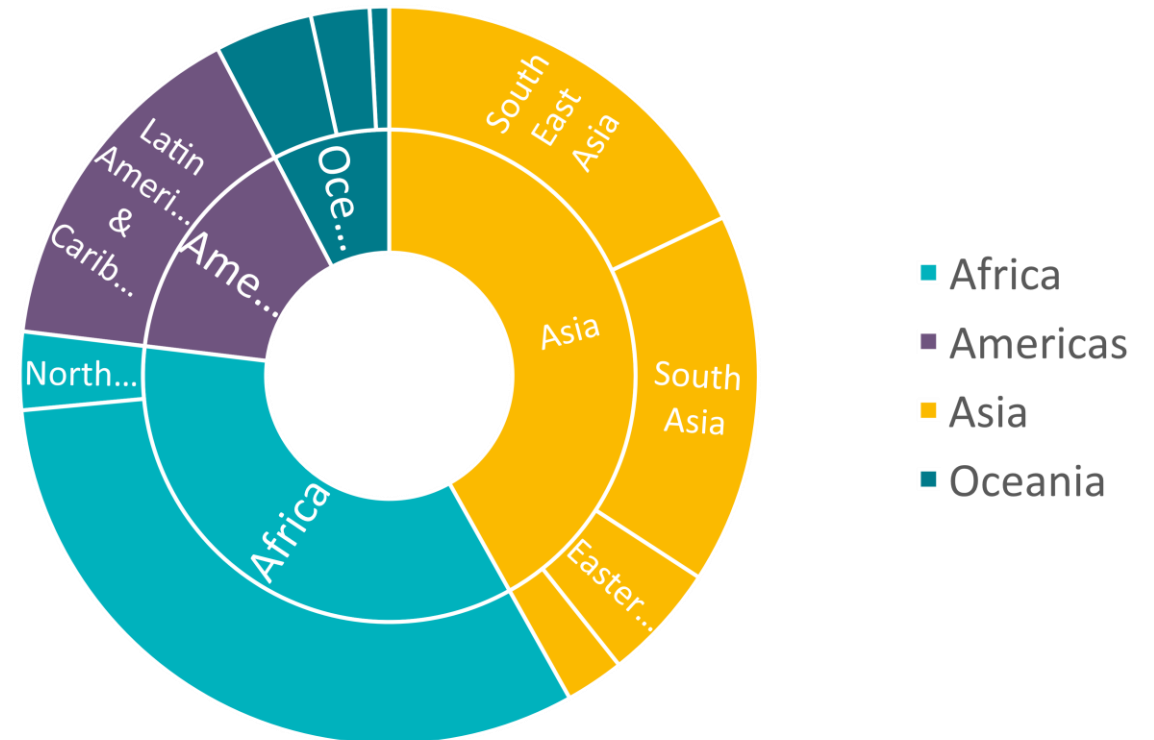
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- The activations addressed disasters of different types affecting around 60 developing countries in Asia, Asia Pacific, Africa, Latin America and the Caribbean.

Region	Activations
Africa	37
Americas	18
Asia	49
Oceania	9
Total	113

Activations requested by UNOOSA by region and sub-region





Facilitating admission of national disaster management agencies as Authorised Users

Contribution to the Charter Universal Access initiative:

- Since 2014, UN-SPIDER has been encouraging National Disaster Management Agencies (NDMAs) to request Authorised User status with the International Charter
- The over 20 NDMAs admitted as Authorised Users are from Asia, Africa, Latin America and the Caribbean

Efforts to engage NDMAs in Asia and Asia Pacific as Authorised Users

COUNTRY	STARTED PROMOTING EFFORTS	INCORPORATION AS AU
Myanmar	2017	2017
Vietnam	2017	in process
Samoa	2019	in process
Salomon Islands	2019	in process
Mongolia	2020	in process
Armenia	2022	in process
Philippines	2022	In process



Facilitating admission of national disaster management agencies as Authorised Users

Efforts to engage African NDMA as Authorised Users

COUNTRY	STARTED PROMOTING EFFORTS	INCORPORATION AS A. U.
South Africa	2018	2021
Ghana	2018	2019
Zimbabwe	2018	in process
Cameroon	2019	2020
Ethiopia	2019	2020
Tanzania	2019	2020
Gambia	2020	2021
Mozambique	2020	in process
Niger	2020	2021

Efforts to engage Latin American and Caribbean NDMA as Authorised Users

COUNTRY	STARTED PROMOTING EFFORTS	INCORPORATION AS A. U.
Colombia	2013	2014?
Dominican Republic	2014	2015
El Salvador	2015	2015
Guatemala	2015	2016
Honduras	2015	2022
Uruguay	2016	2016
Ecuador	2016	2017?
Costa Rica	2017	2020
Haiti	2017	2019?
Mexico	2020	2021
Cayman Islands	2020	2020
Nicaragua	2021	2022
Panama	2021	2022



Recent activities carried out with the Charter and some of its members

- Joint UN-SPIDER/Charter/CEPREDENAC Training for project managers of Mexico, Central America and Dominican Republic (Guatemala, Dec, 2021)
- Simulation of activation of the Charter for a hypothetical earthquake in Guatemala (Feb. 2022)
- Joint UN-SPIDER/Charter/NASRDA virtual training on the use of the Charter Mapper (Sept 2022)
- Simulation of activation of the Charter for hypothetical very large floods in Nigeria at NASRDA/UN-SPIDER workshop in Abuja (Nigeria, Sept 2022)





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