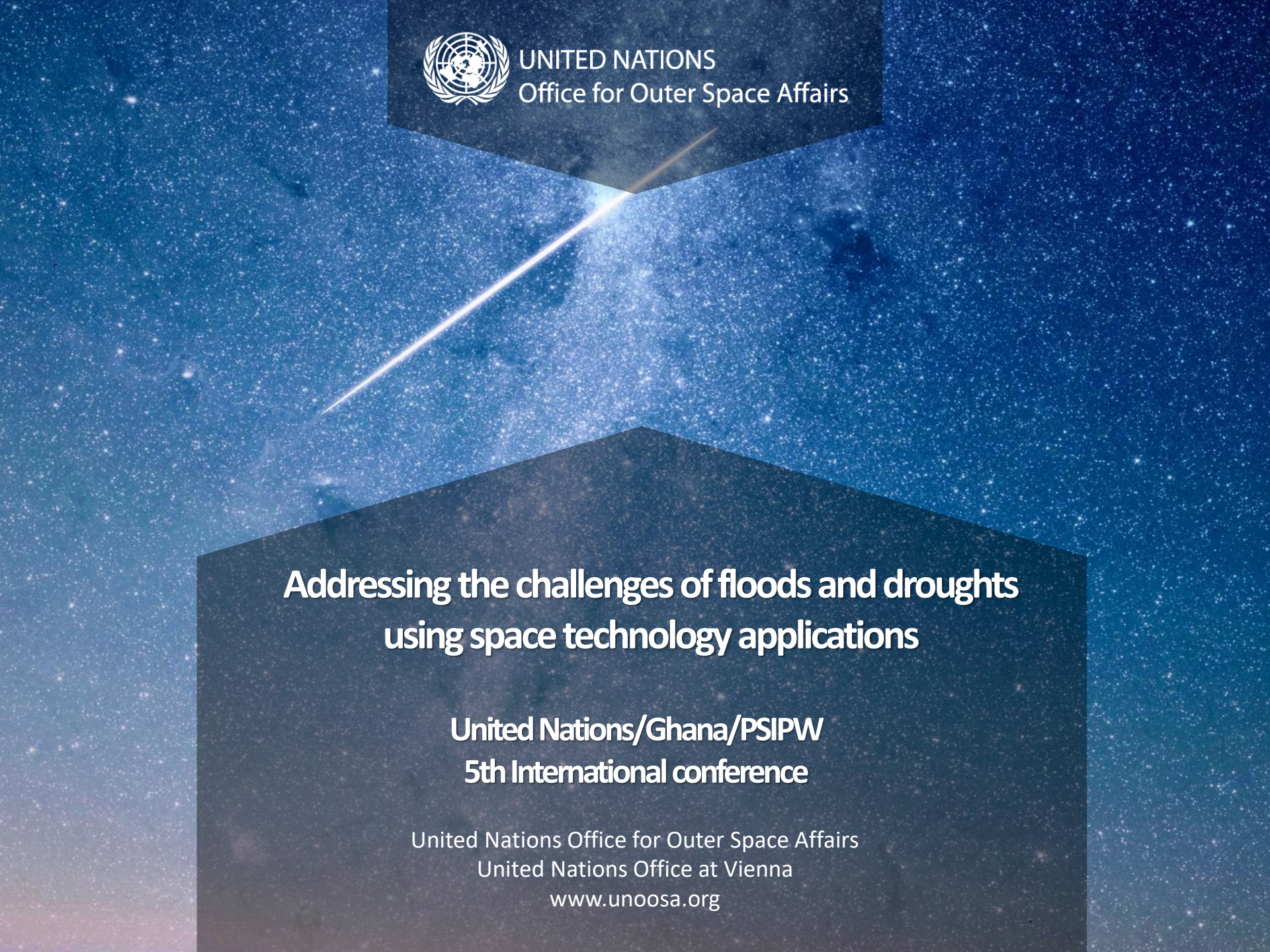
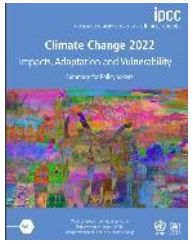

UNITED NATIONS
Office for Outer Space Affairs
Addressing the challenges of floods and droughts using space technology applications
United Nations/Ghana/PSIPW
5th International conference
United Nations Office for Outer Space Affairs
United Nations Office at Vienna
www.unoosa.org

UNITED NATIONS
Office for Outer Space Affairs

The need to address flood and drought challenges

Human-induced climate change, including **more frequent and intense extreme events**, has caused **widespread adverse impacts and related losses and damages** to nature and people, beyond natural climate variability (IPCC, 2022)

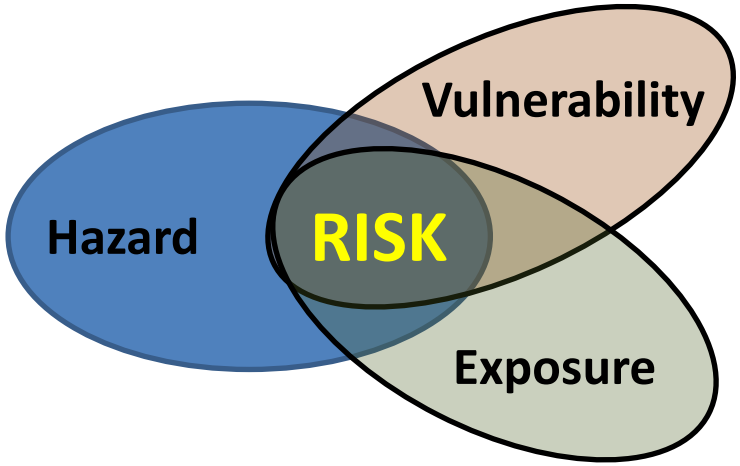


The **climate emergency** and the **systemic impacts of the COVID-19 pandemic** point to a new reality. More people were killed or affected by disasters in the last 5 years than in the previous 5 years. Human action is creating **greater and more dangerous risk** (UNDRR GAR Report 2022).

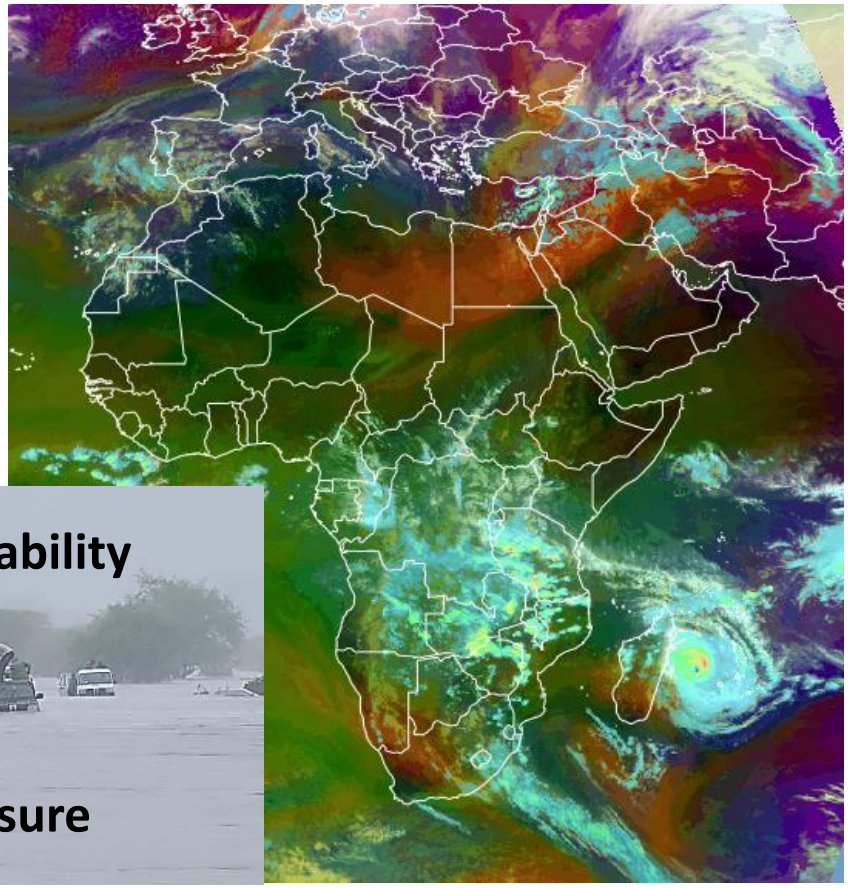
GAR
Global Assessment Report on Disaster Risk Reduction
Our World at Risk: Transforming Governance for a Resilient Future
2022

2021 was still one of the seven warmest years on record, according to six leading international datasets consolidated by the World Meteorological Organization. (WMO 2022)

The view from the DRR community



Photograph courtesy of A. Beleza, INGD, Mozambique. Feb. 2022



Hazard: Tropical cyclone Ana

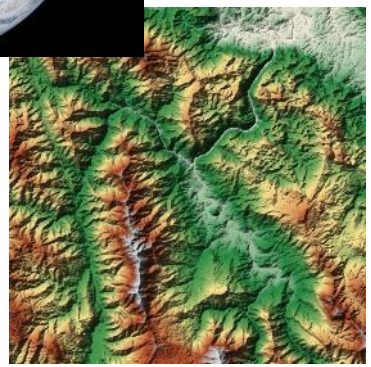
EUMETview courtesy of EUMETSAT 04 Feb. 2022

Space technologies can contribute to address these challenges

- **Satellite imagery.**

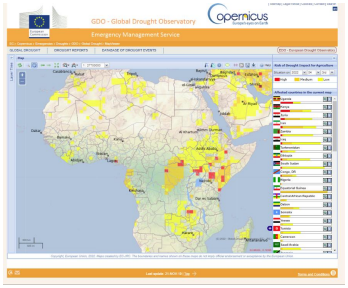
Satellite Image courtesy of NASA

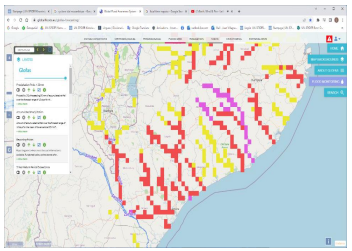
- **Space-based products (Digital Elevation Models).**



Example of WorldDEM™ courtesy of Airbus

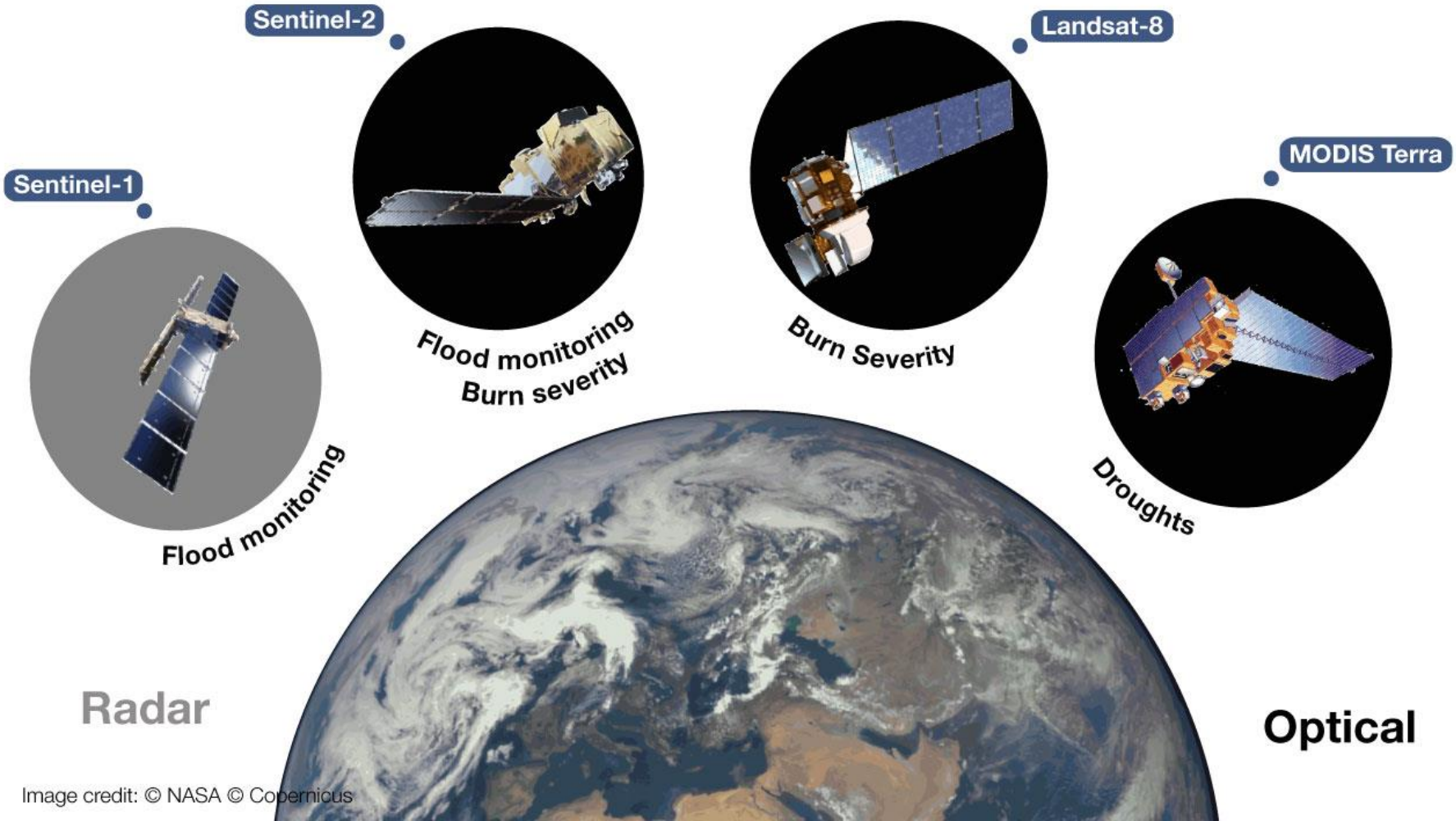
- **Information Services.**





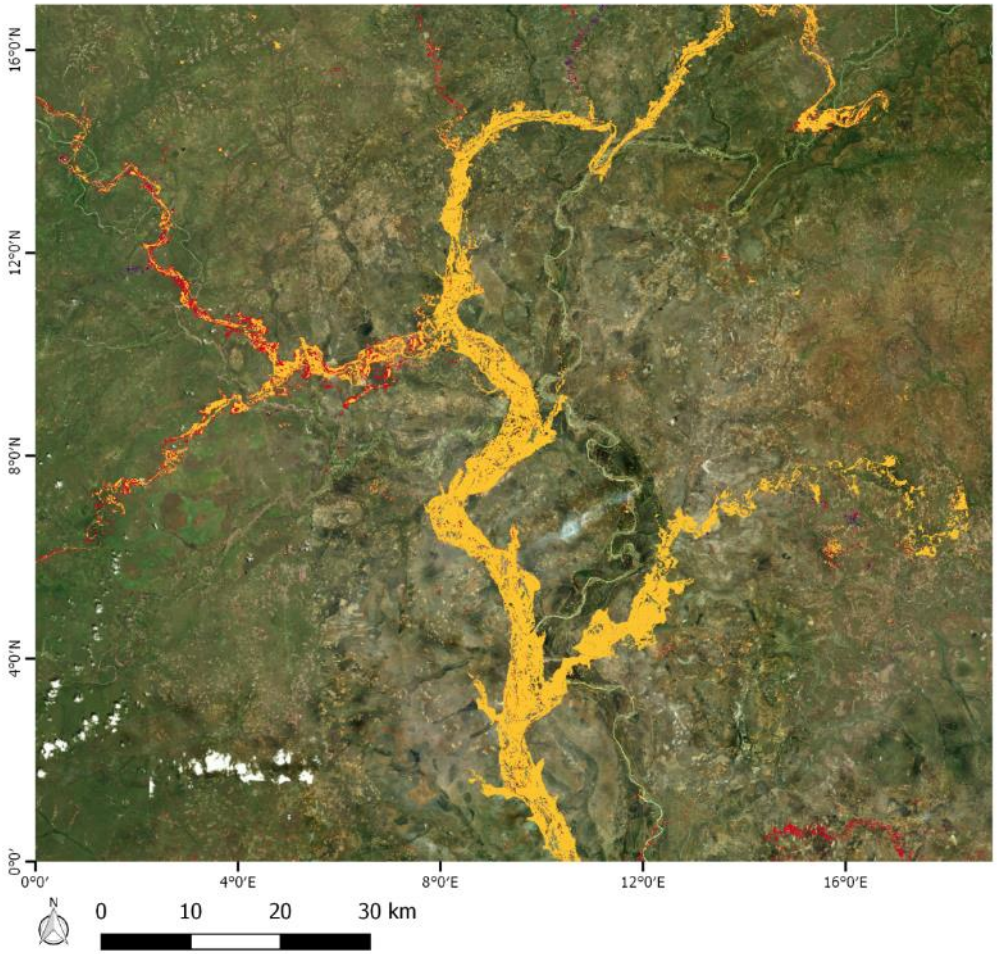
GDO and GLOFAS from the Copernicus EMS

Examples of satellites for risk and disaster management



Flood mapping in Ghana with Sentinel 1 imagery

Identification of inland water bodies Ghana



White Volta River
12 Sep 2018
6 Sep 2018
25 Aug 2018
Places
Bing Aerial Basemap

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.

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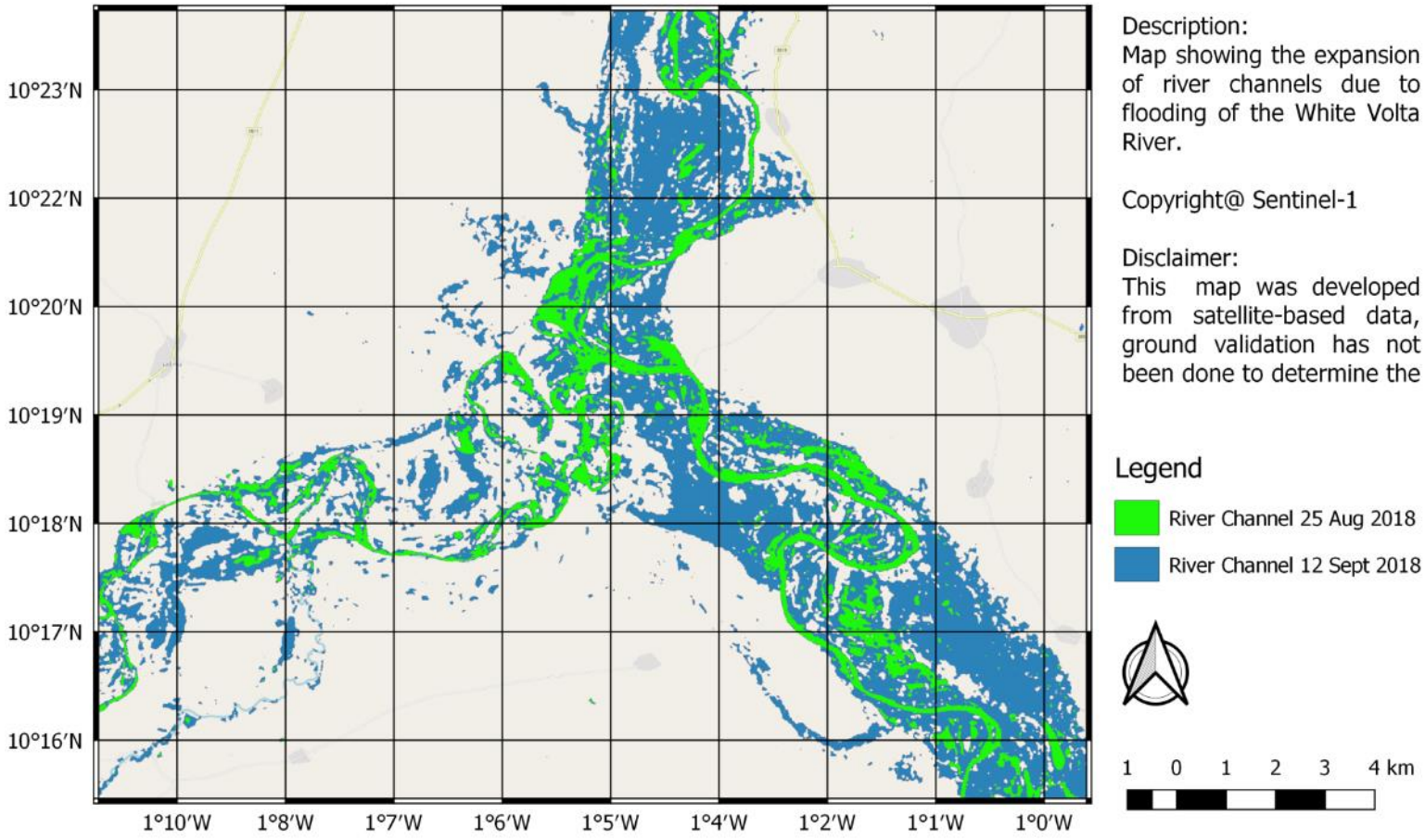
www.un-spider.org

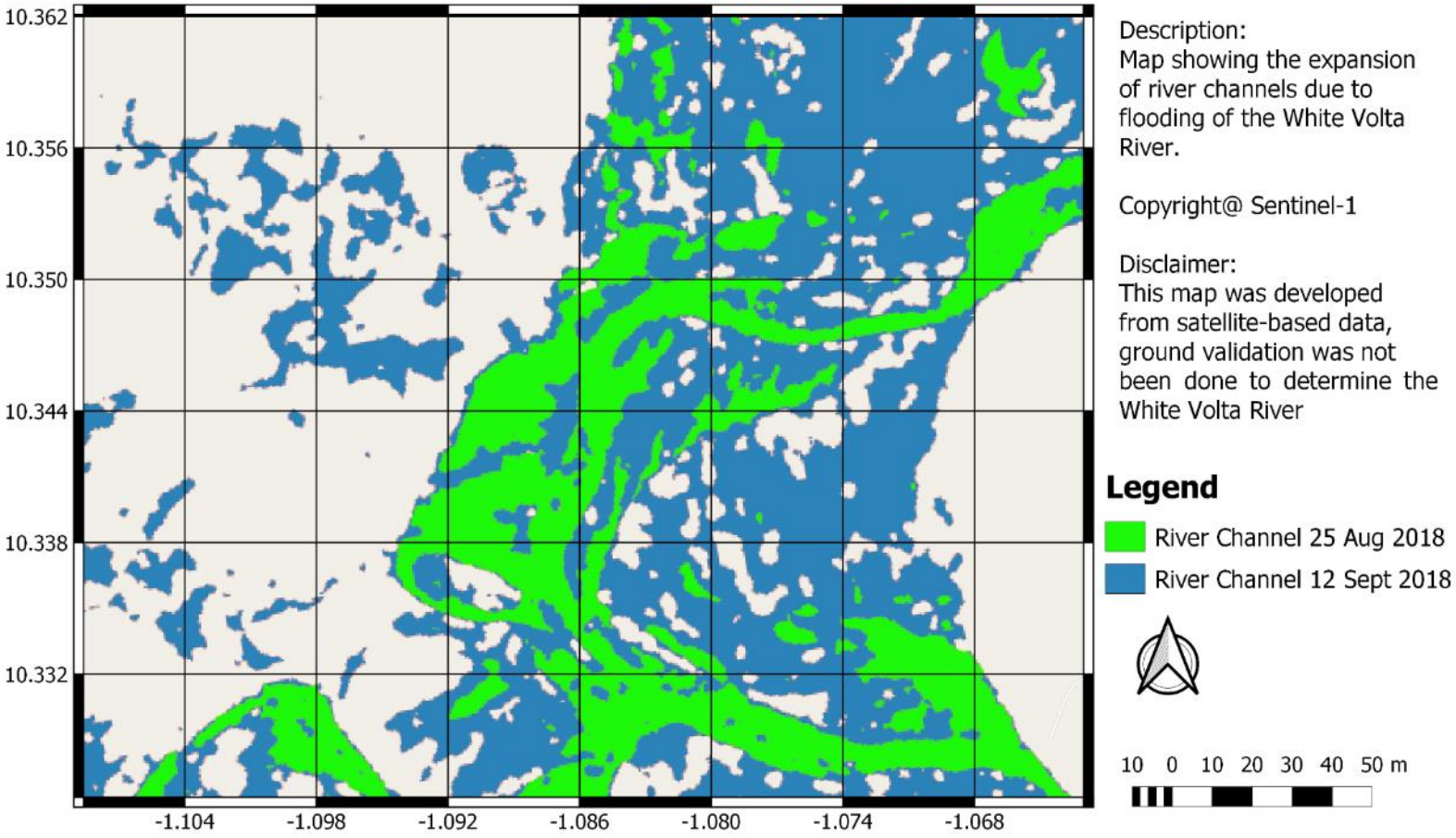
Flood mapping in Ghana with Sentinel 1 imagery

Radar mapping of White Volta before and during floods 2018



Flood mapping in Ghana with Sentinel 1 imagery

Radar mapping of White Volta before and during floods 2018



Drought Indices using MODIS composite products

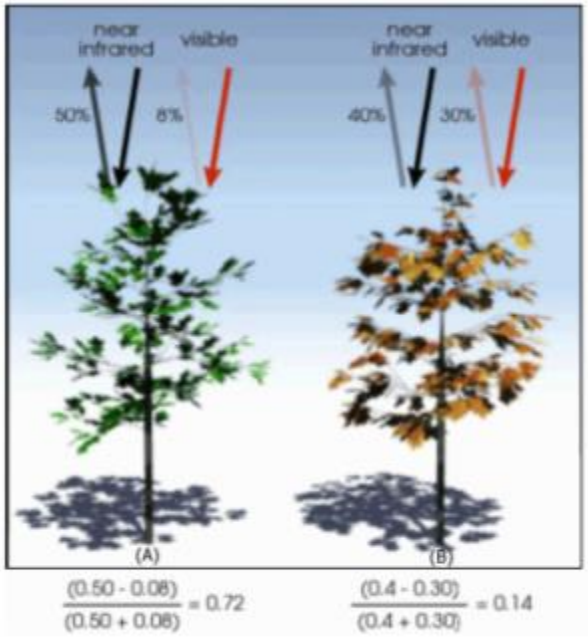
NDVI — **Normalized Difference Vegetation Index**

Combining values of red and infrared bands

EVI — **Enhanced Vegetation Index**

Combining values of red, infrared and blue bands

(to remove atmospheric noise like aerosols)

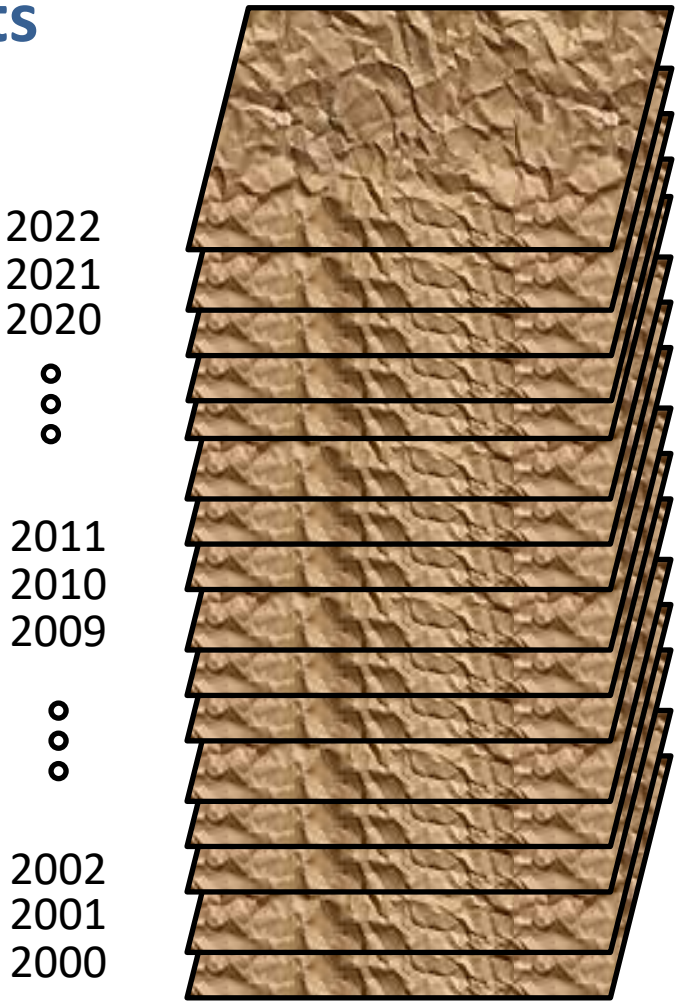


Combination of archived and up-to-date MODIS composite products

Satellites with the MODIS sensor go over each region between 3 and 5 times every 16 days.

Composite NDVI and EVI maps are derived every 16 days (23 maps per year) from MODIS sensor combining the best pixels.

An algorithm attempts to remove bad quality pixels or pixels with snow cover.



Comparative Drought Indices

Vegetation Condition Index (from the ***NDVI***)

$$VCI_i\ (NDVI) = \frac{NDVI_i - NDVI_{min}}{NDVI_{max} - NDVI_{min}}$$

Standard Vegtetation Index (from the ***EVI***)

$$SVI_i\ (EVI) = \frac{EVI_i - EVI_{average}}{Stardard\ Deviation}$$

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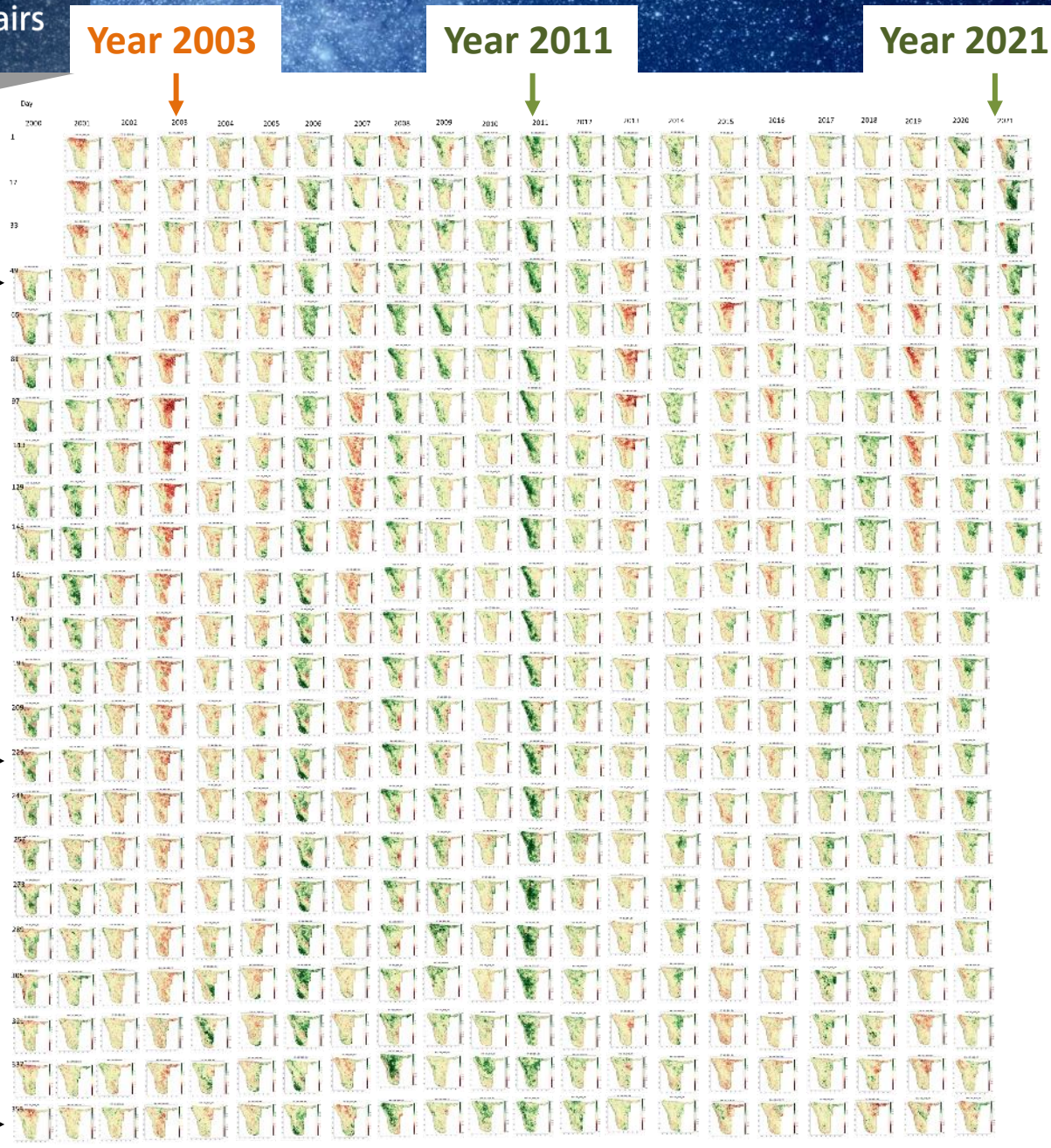
How severe are droughts in Namibia?

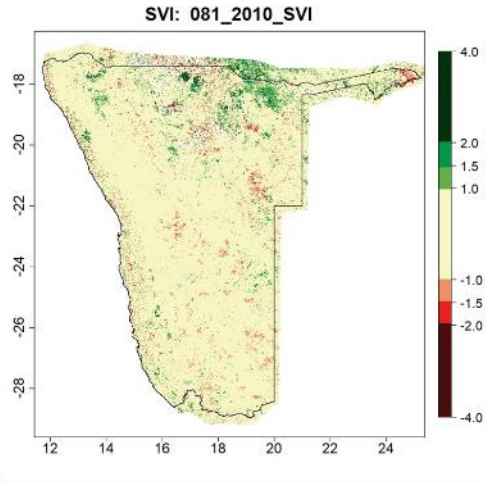
Temporal comparison using MODIS EVI from April 2000 to May 2021

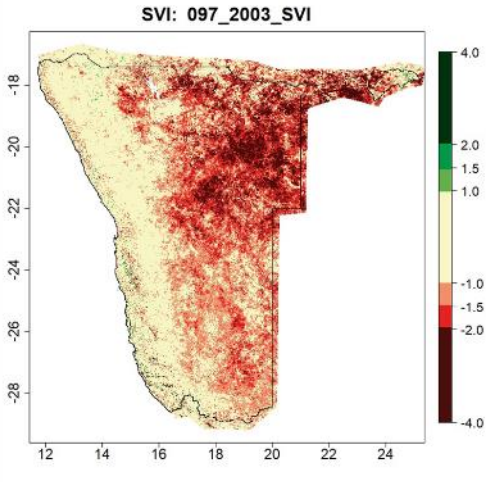


How severe are droughts in Namibia?

AVERAGE (NOT DRY NOR GREEN

16-day period for Julian Day 81 22 March 2010



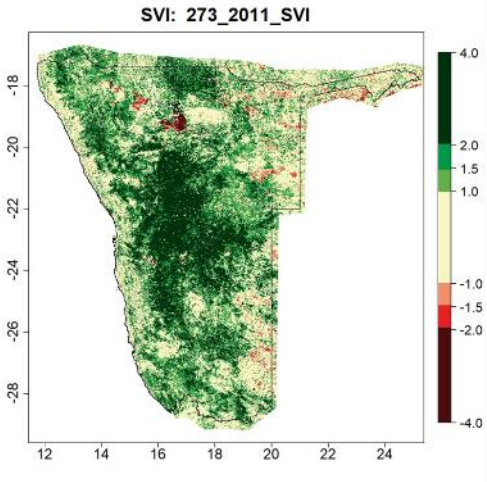


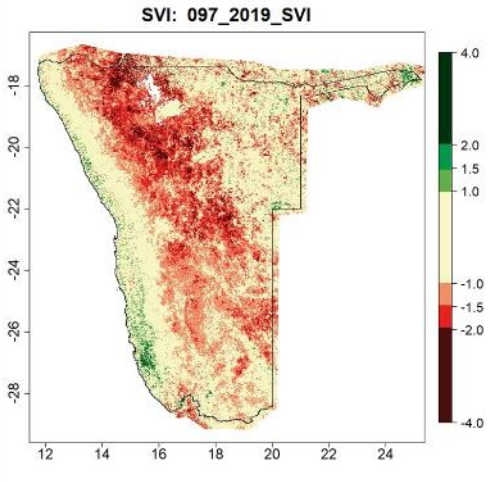
FAR BELOW AVERAGE (DRYER THAN OTHER YEARS FOR THE SAME PERIOD IN NORTH WWESTERN REGION

16-day period for Julian Day 97 7 April 2003

FAR ABOVE AVERAGE (GREENER THAN OTHER YEARS FOR THE SAME PERIOD

16-day period for Julian Day 273 30 Sept 2011





DRY YEAR IN 2019

16-day period for Julian Day 97 22 March 2019

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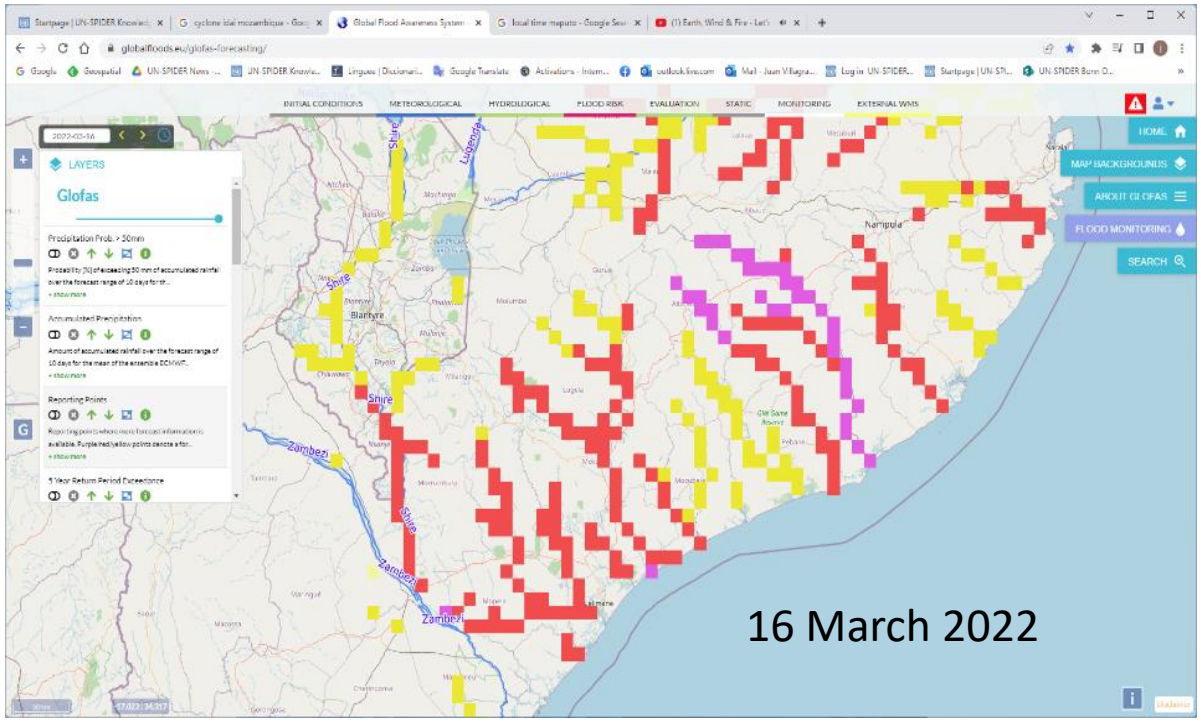
Services from the Space community for floods

Global Flood Awareness System (GLOFAS)

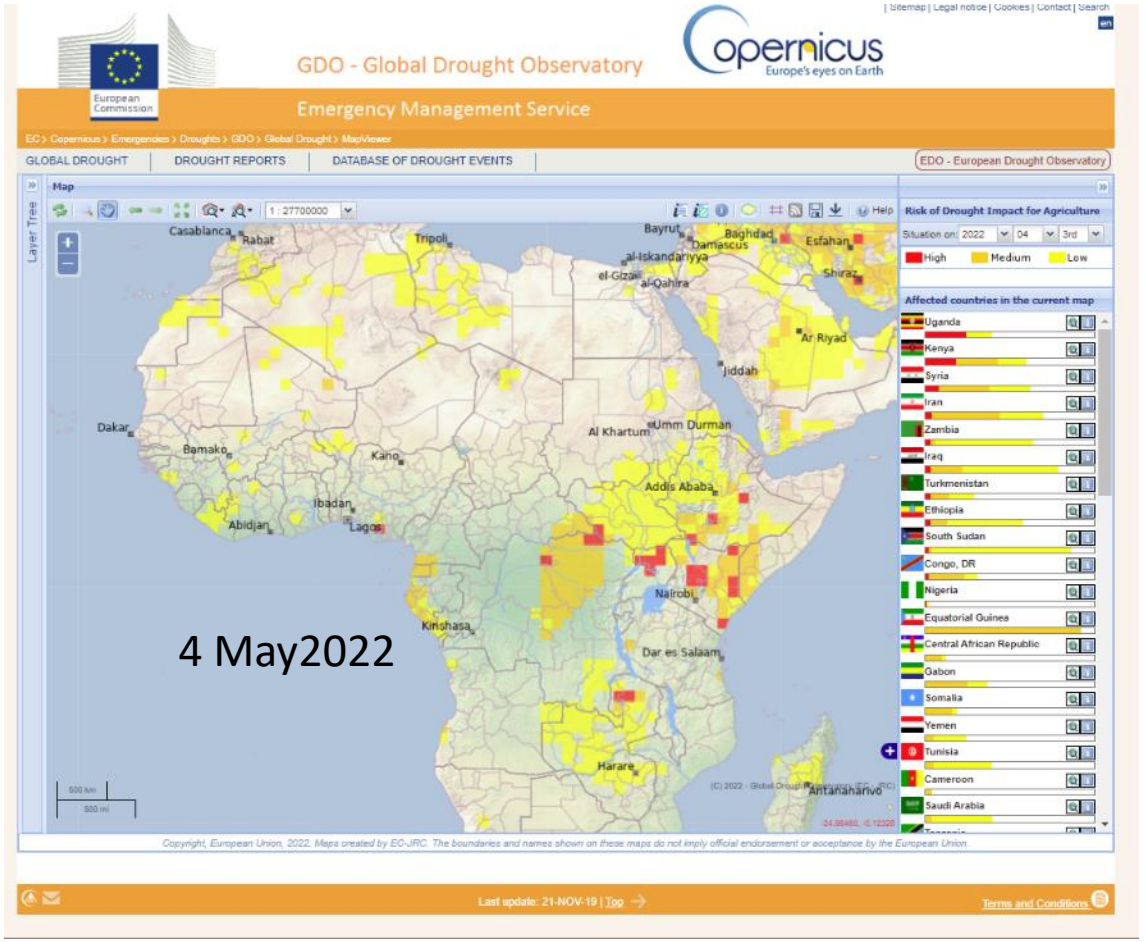


GLOFAS Cyclone Gombe, March 2022

https://www.globalfloods.eu/

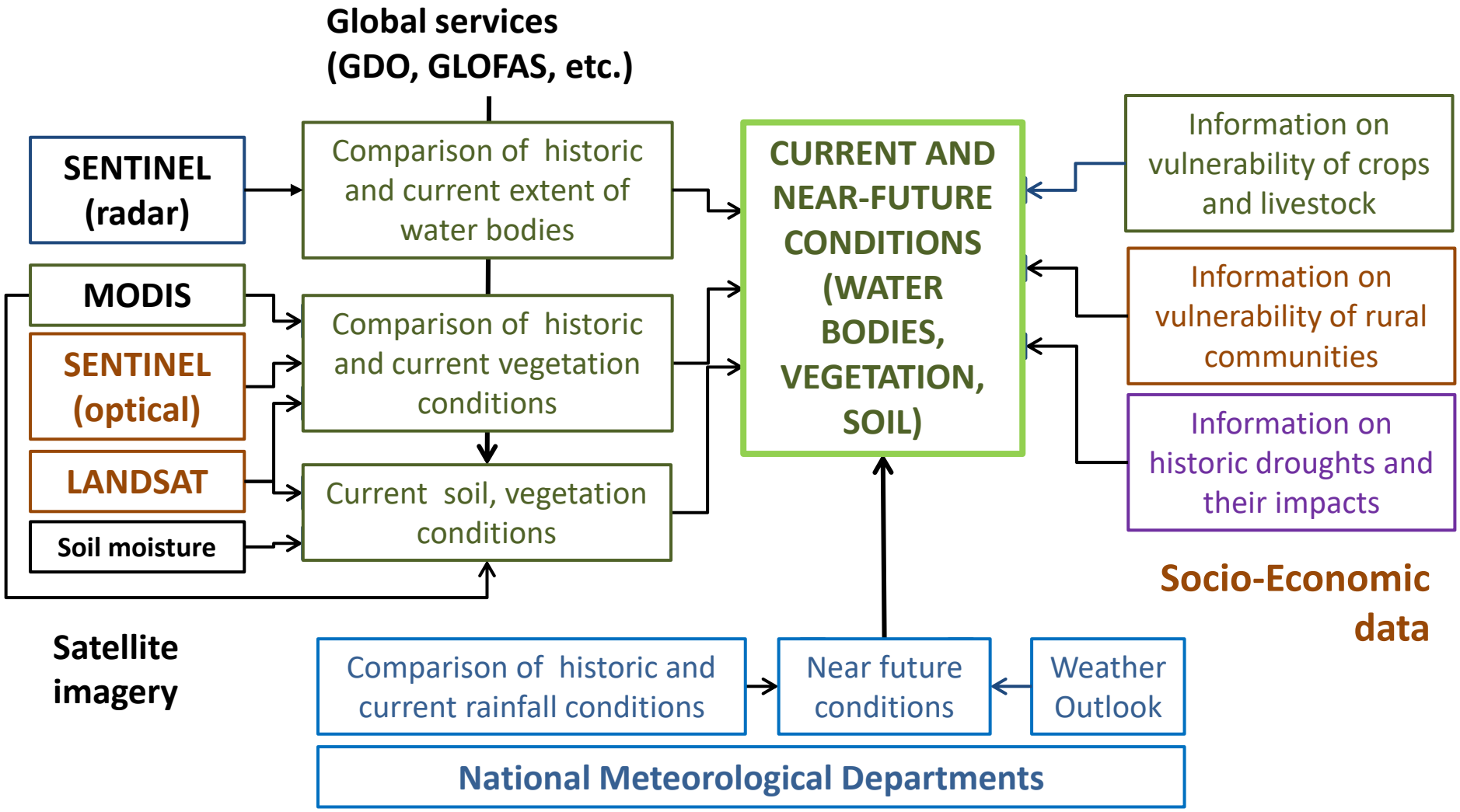
Services from the space community for droughts

Global Drought Observatory (GDO)



https://edo.jrc.ec.europa.eu/gdo/php/index.php?id=2001

A suggestion for a Decision-Support System

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