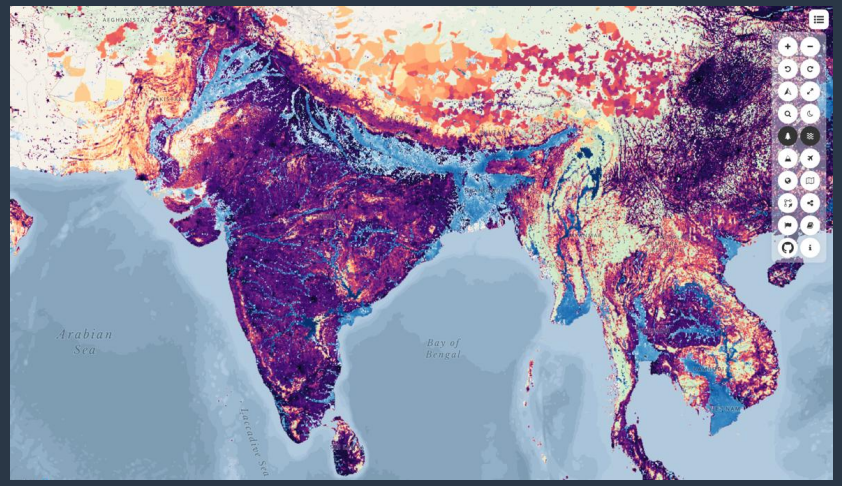
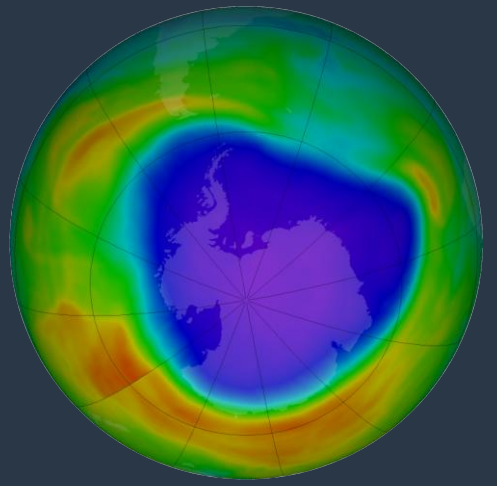
Leveraging Geospatial Information to Tackle Global Challenges



Geospatial



Satellite

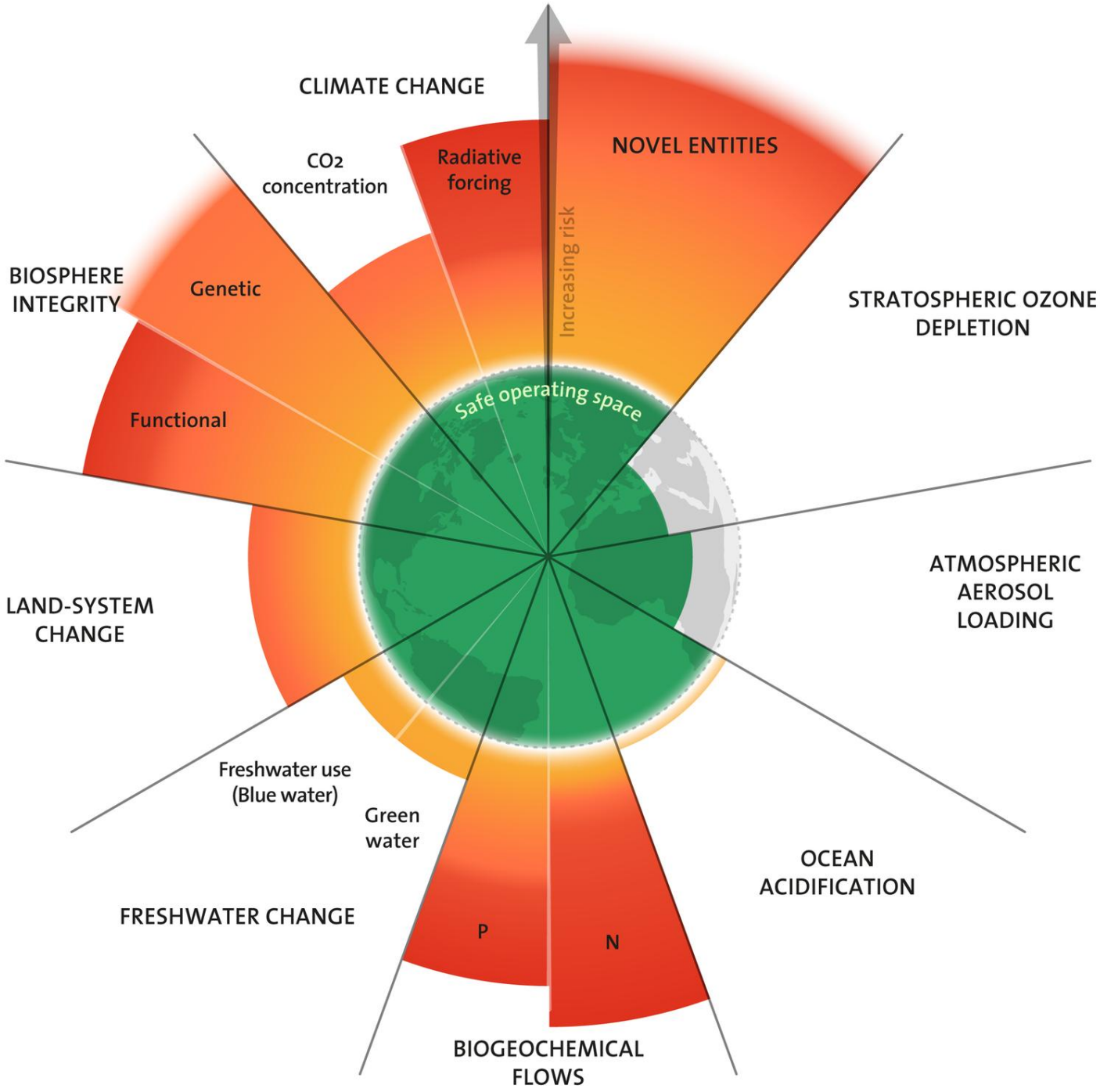
Pascal Peduzzi

UN-GGIM 13th Plenary Meeting

“Thanks to fossil fuel and the industrial revolution, humanity made a giant step forward”

UN environment programme GRID Geneva

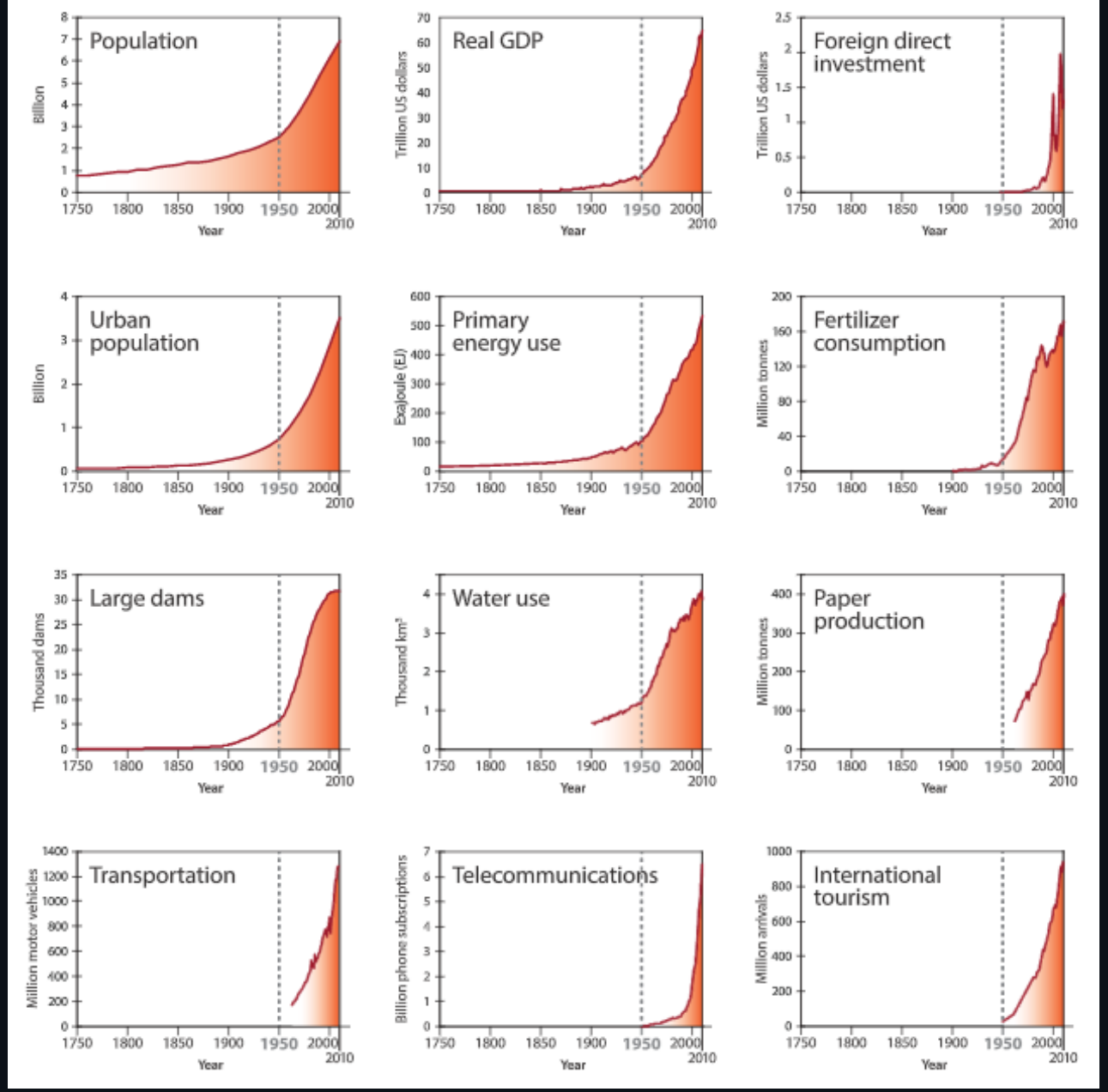

“Thanks to fossil fuel and the industrial revolution, humanity made a giant step forward”



2025 Earth beyond 7 of 9 Planetary Boundaries

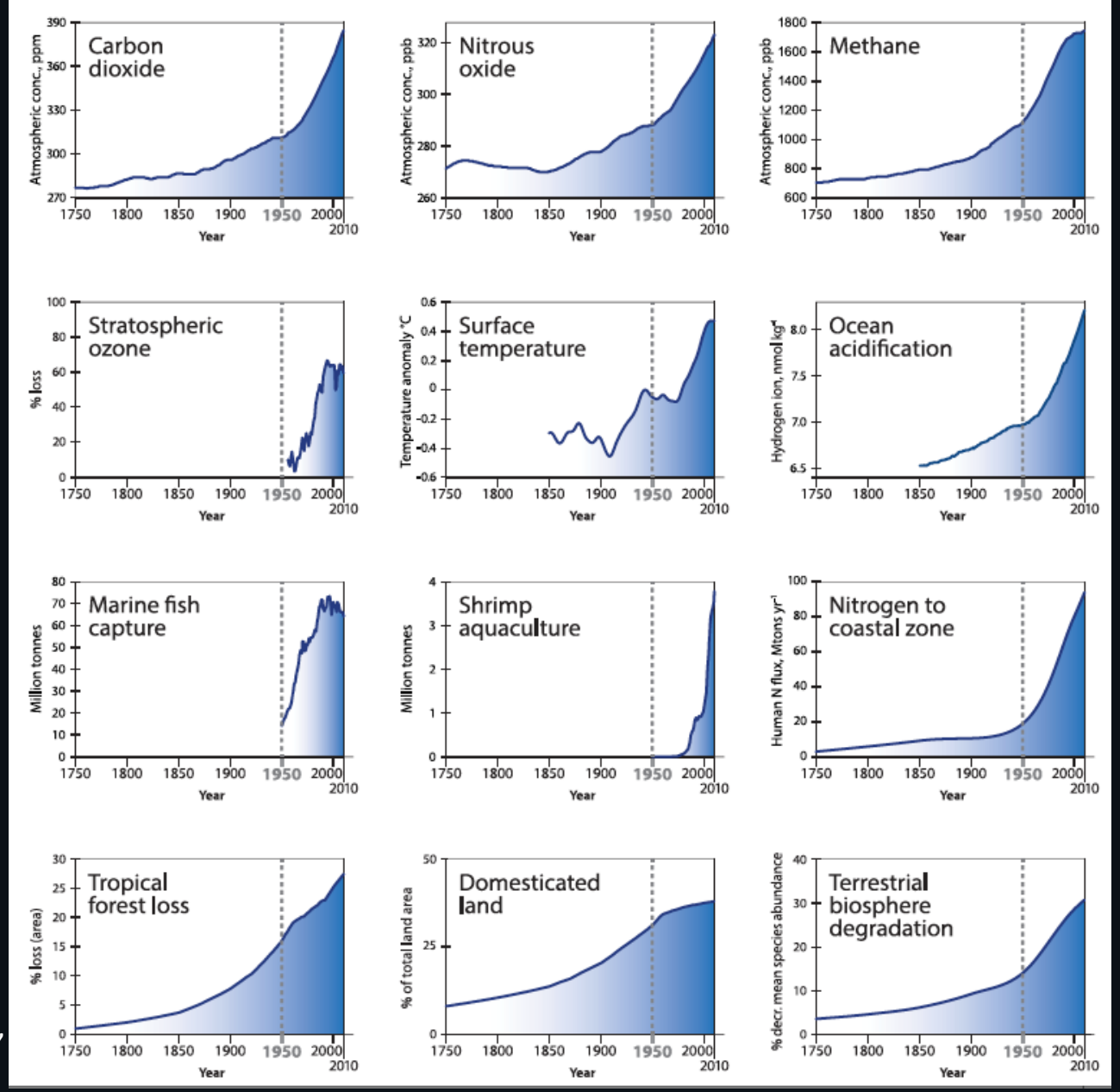
Findlay, H. S., Feely, R. A., Jiang, L. Q., Pelletier, G., & Bednaršek, N. (2025). Ocean acidification: another planetary boundary crossed. *Global Change Biology*, *31*(6), e70238.

Human activities have accelerated after WWII i.e. since 1950



Steffen et al. (2016), The trajectory of the Anthropocene: The Great Acceleration, *the anthropocene review*, **2**(1), 81-98.

So did the related impacts



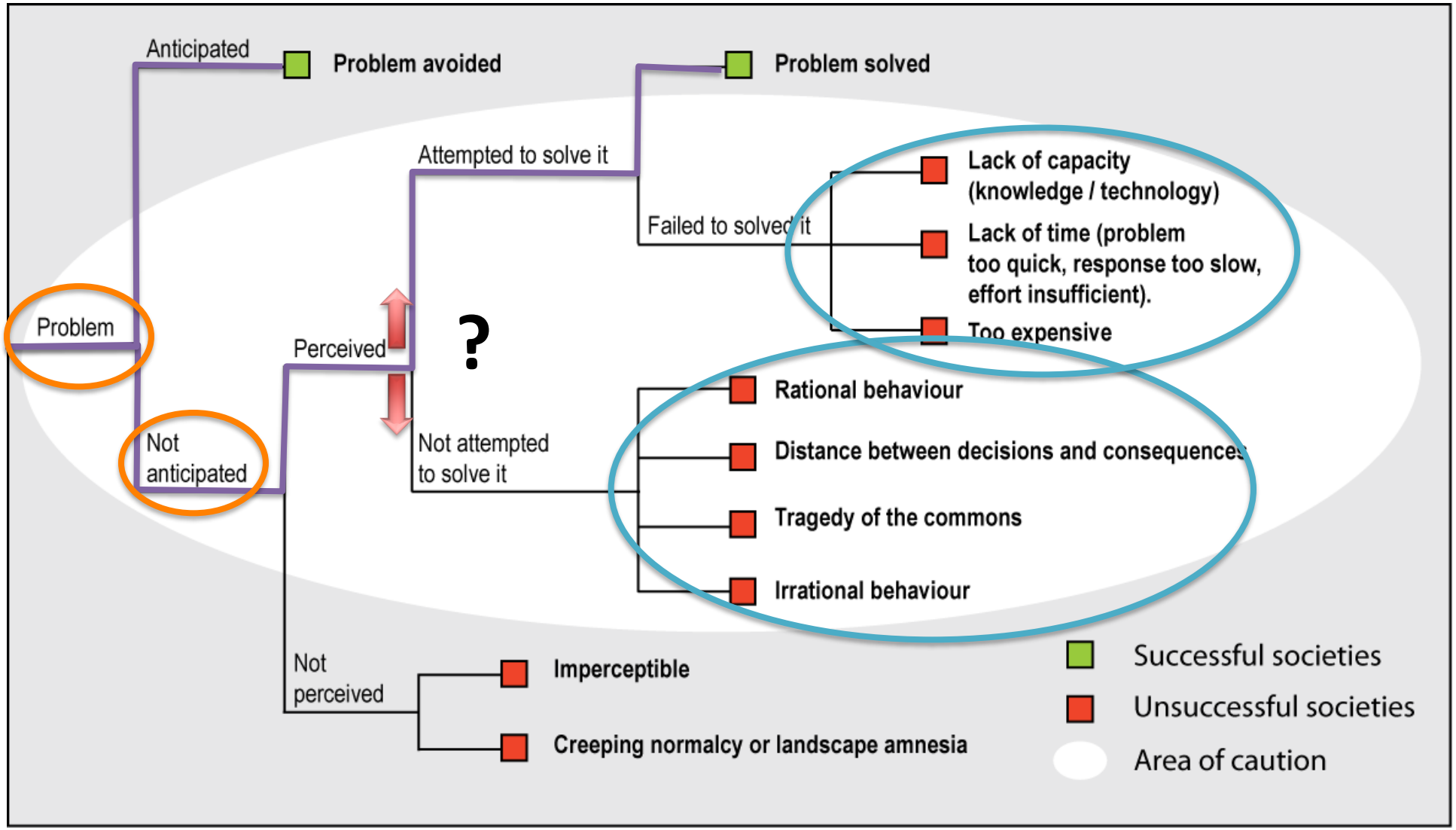
Steffen et al. (2016), The trajectory of the Anthropocene: The Great Acceleration, *the anthropocene review*, **2**(1), 81-98.

«Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist.»

The Economics of the Coming Spaceship Earth – Kenneth Boulding, economist (1966)

Photo: NASA, 30.03.2014

Pathway to successful societies



Sources: Peduzzi, P. (2012) Risk and global change: developing scientific methods for advocacy and awareness raising, University of Lausanne, Switzerland.

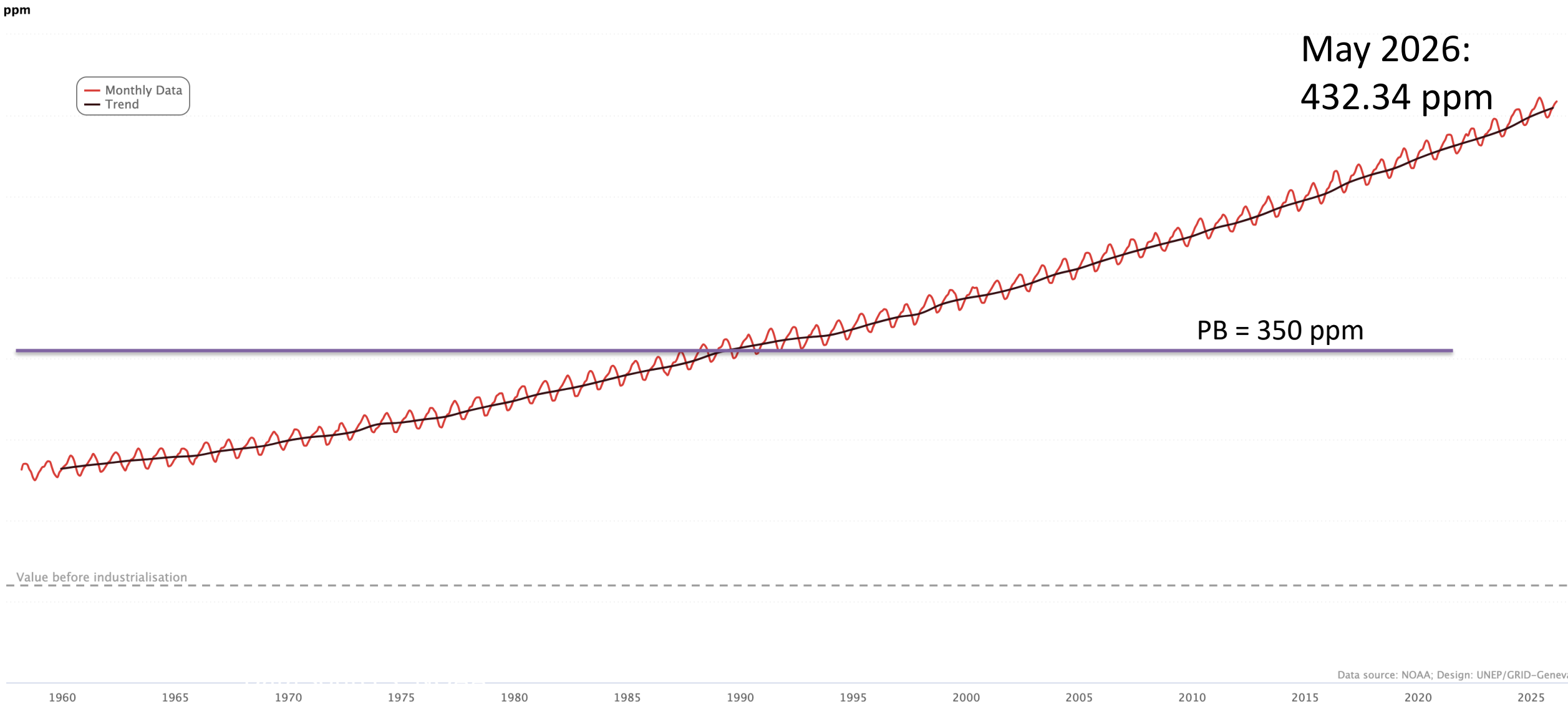
Narrow pathway to sustainable development

Like in a GPS, data tell us :

- Where we are (status)
- Where we came from (track)
- At what speed we are moving (trends)
- Where we may be going (scenarios)

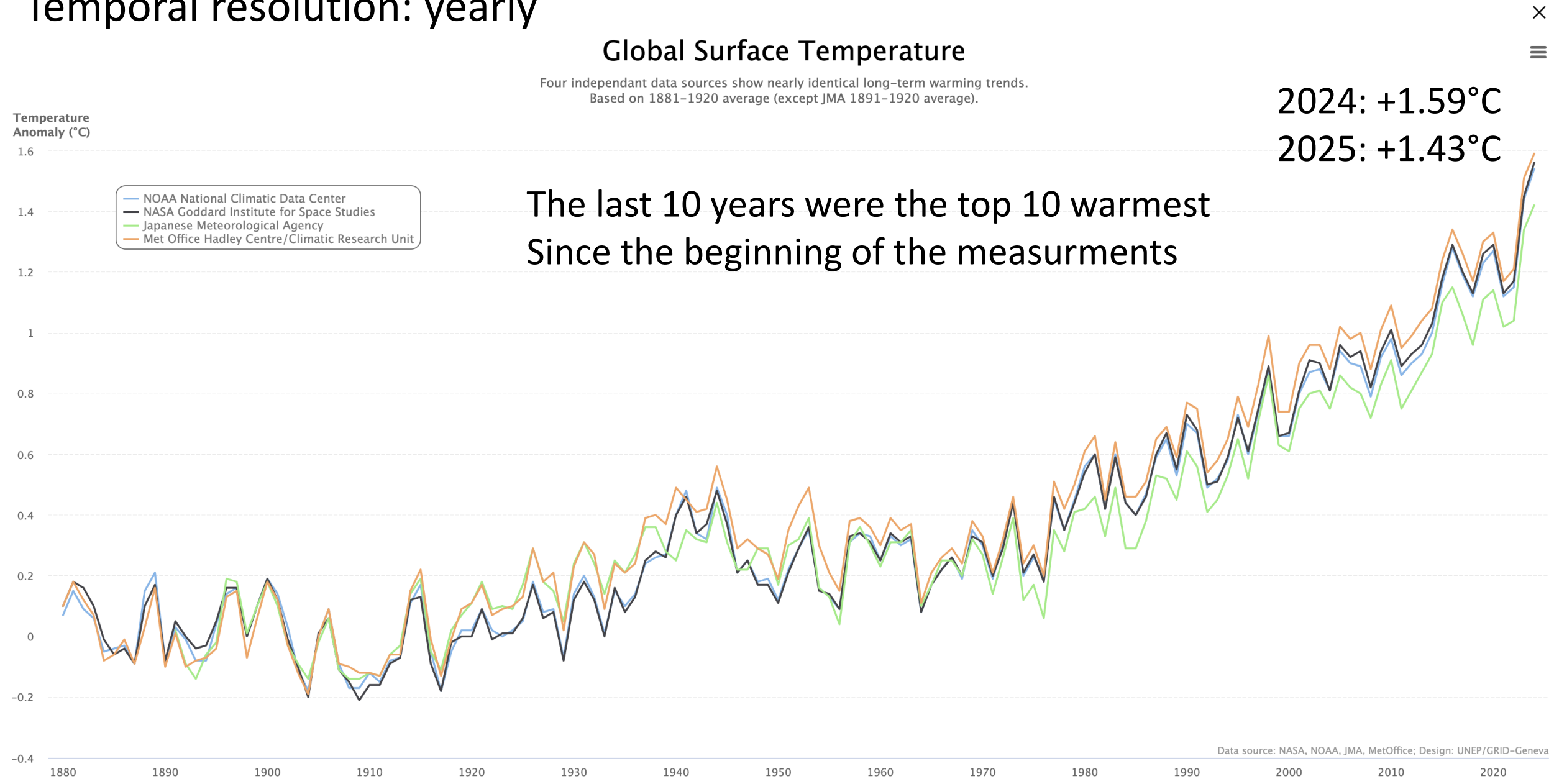
Trends in Atmospheric Carbon Dioxide Concentration

Monthly and annual mean carbon dioxide concentrations globally averaged over marine surface sites



Sources: https://graphs.unepgrid.ch

Temporal resolution: yearly



2024: +1.59°C

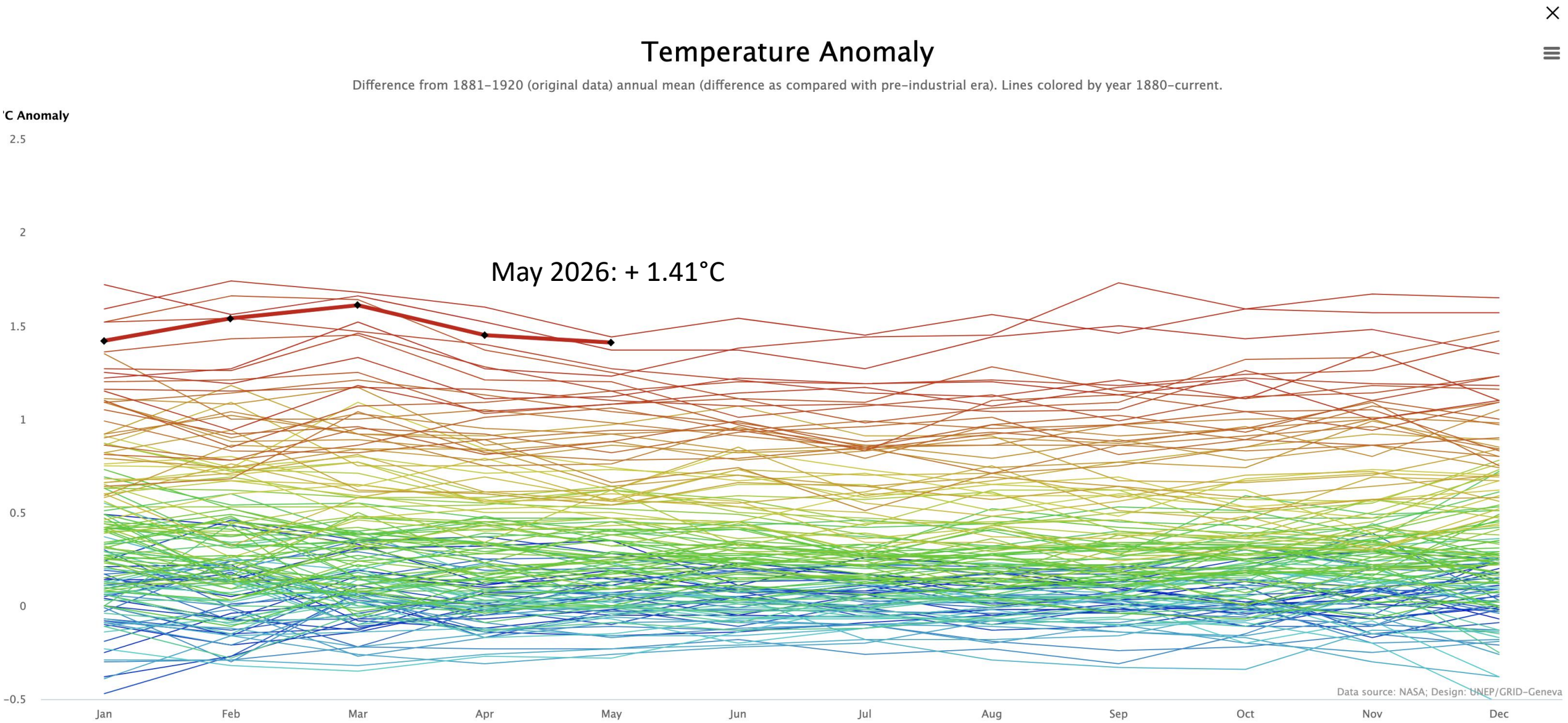
2025: +1.43°C

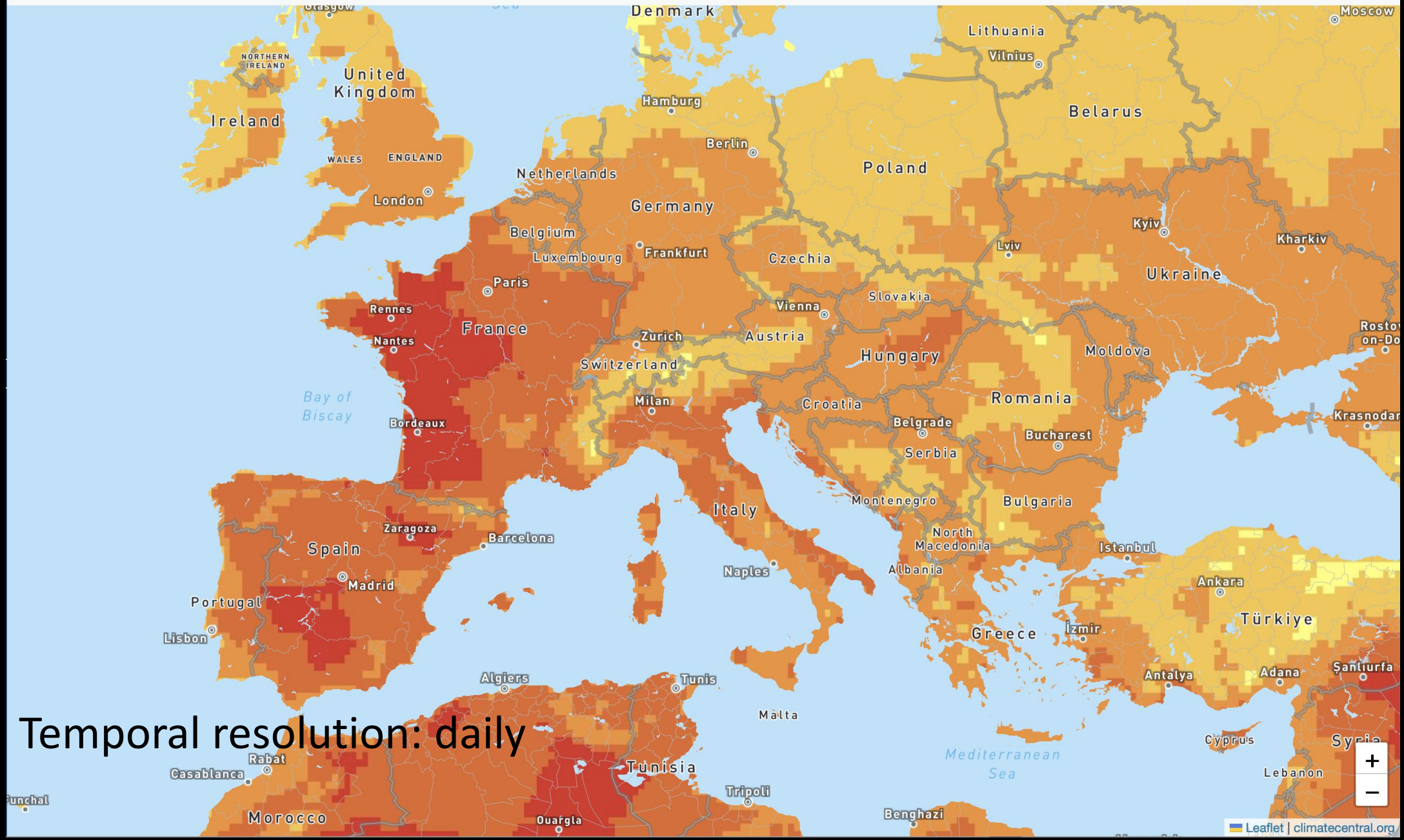
The last 10 years were the top 10 warmest

Since the beginning of the measurments

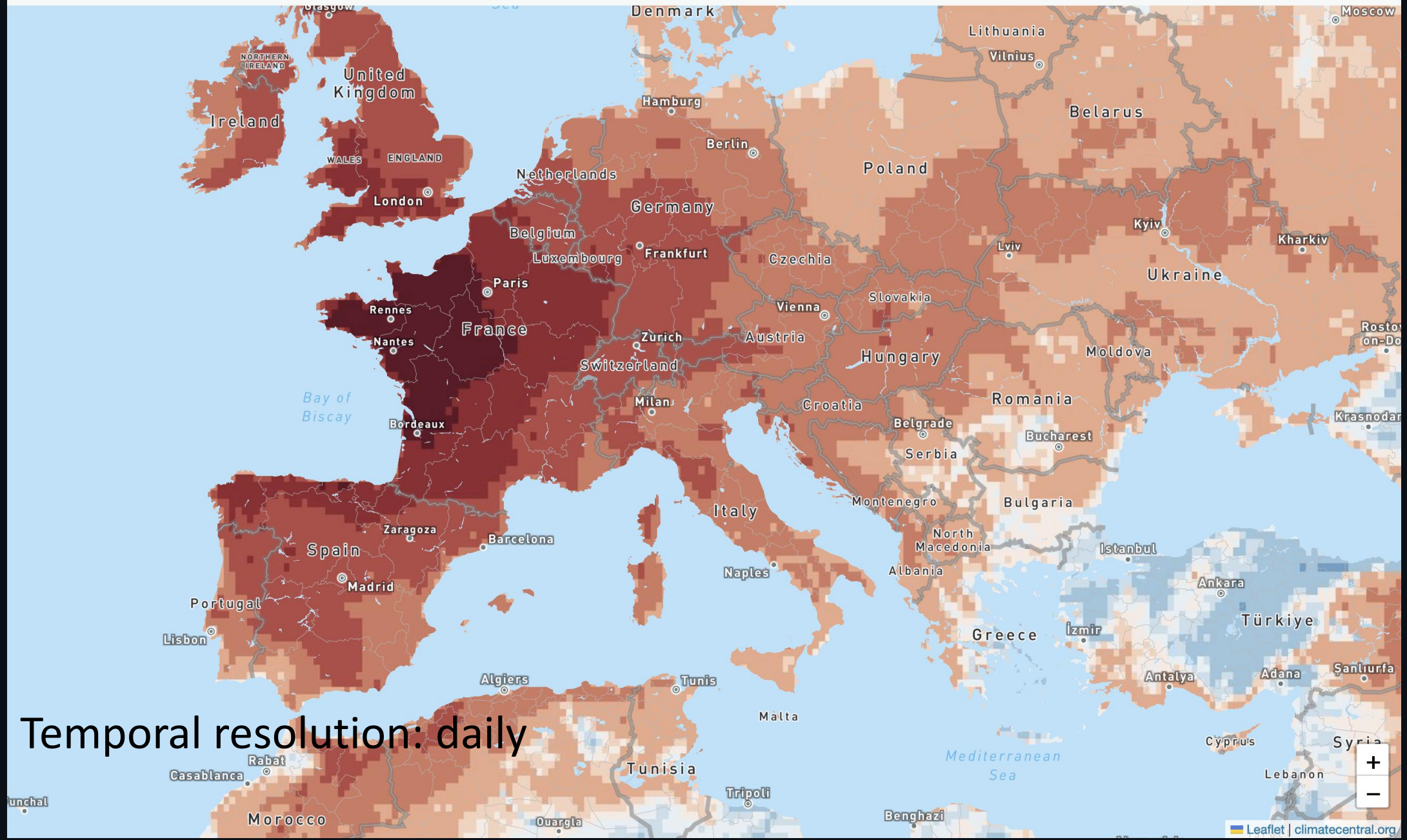
Sources: https://graphs.unepgrid.ch

Temporal resolution: monthly

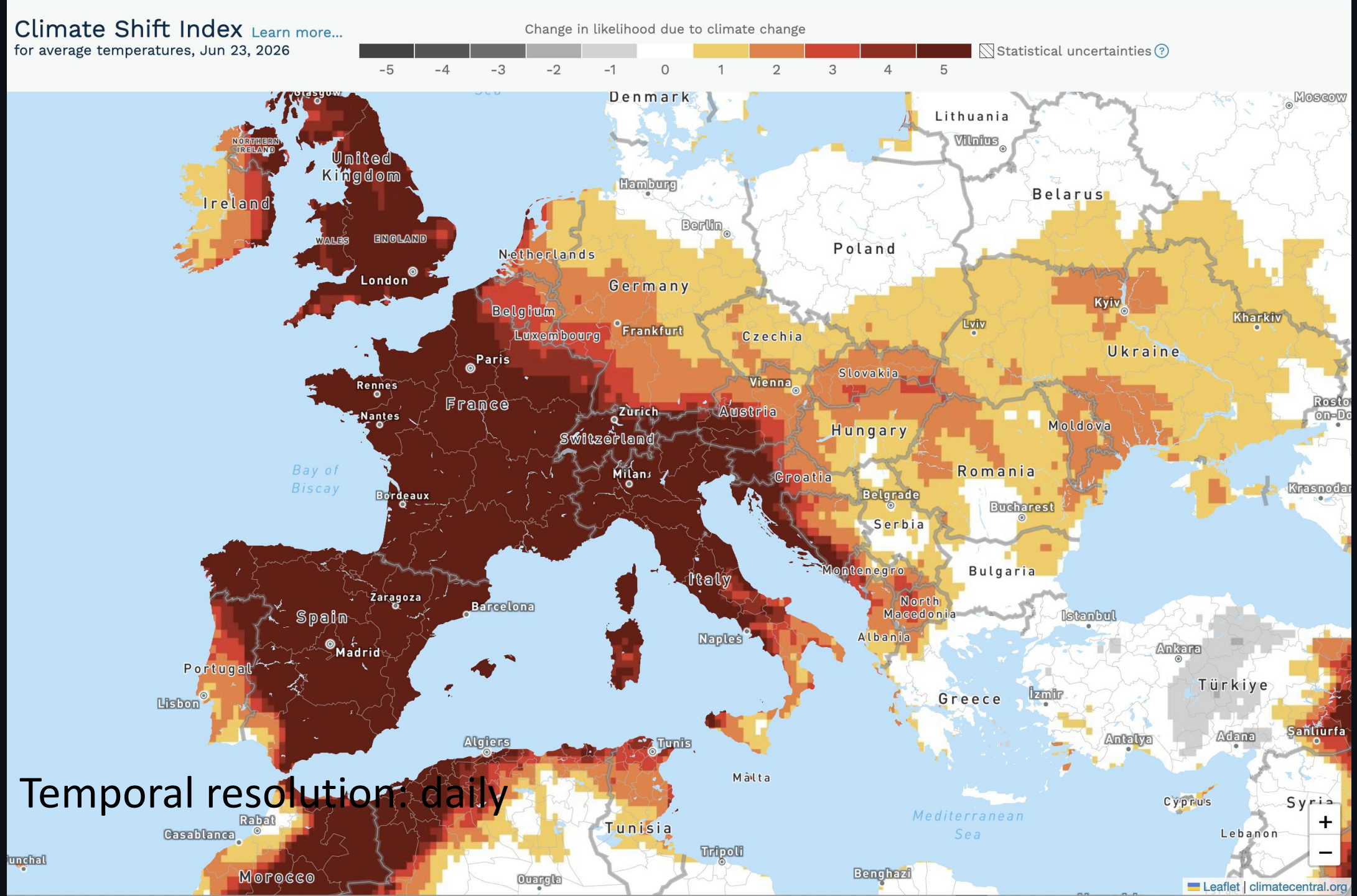




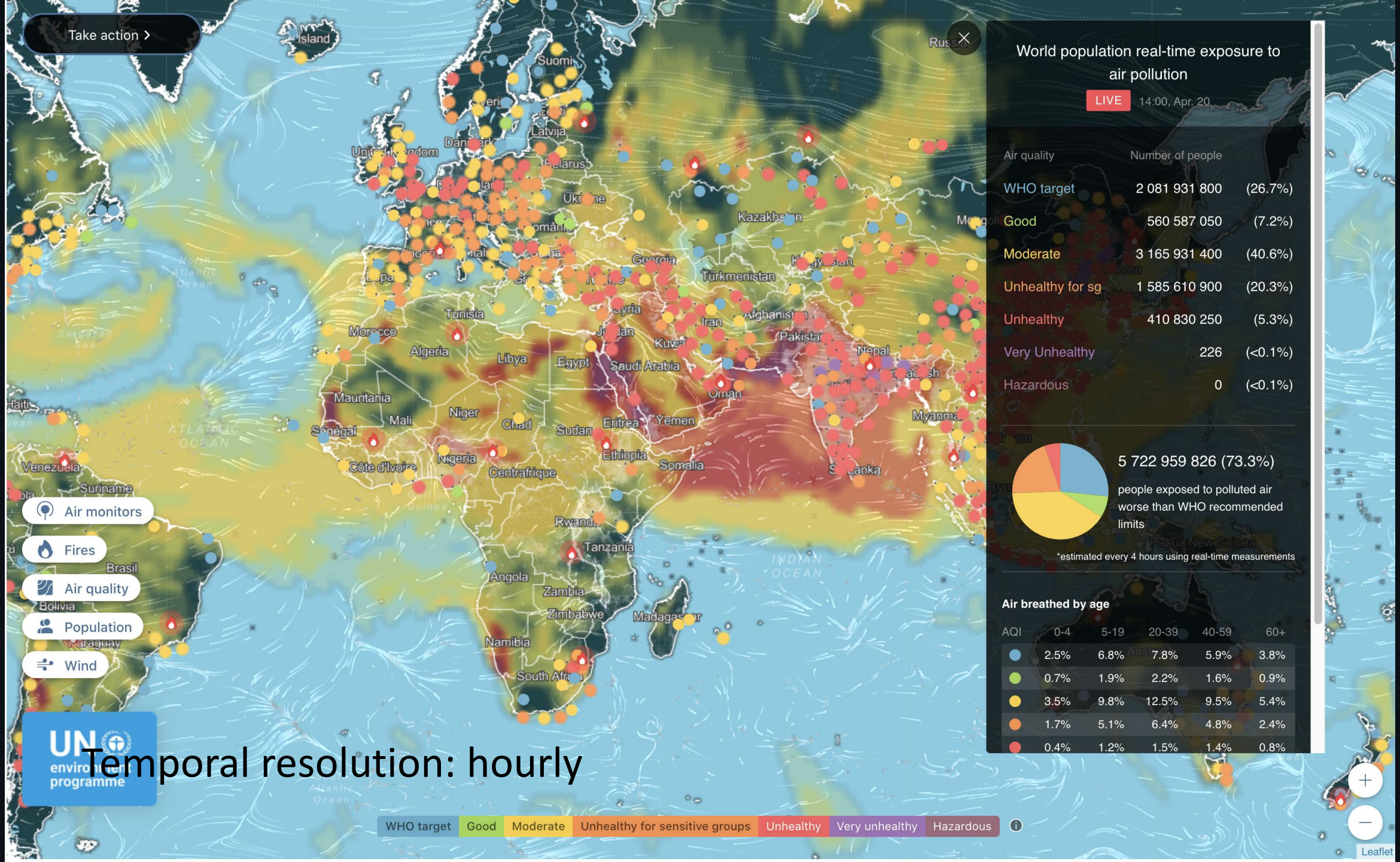
Temporal resolution: daily



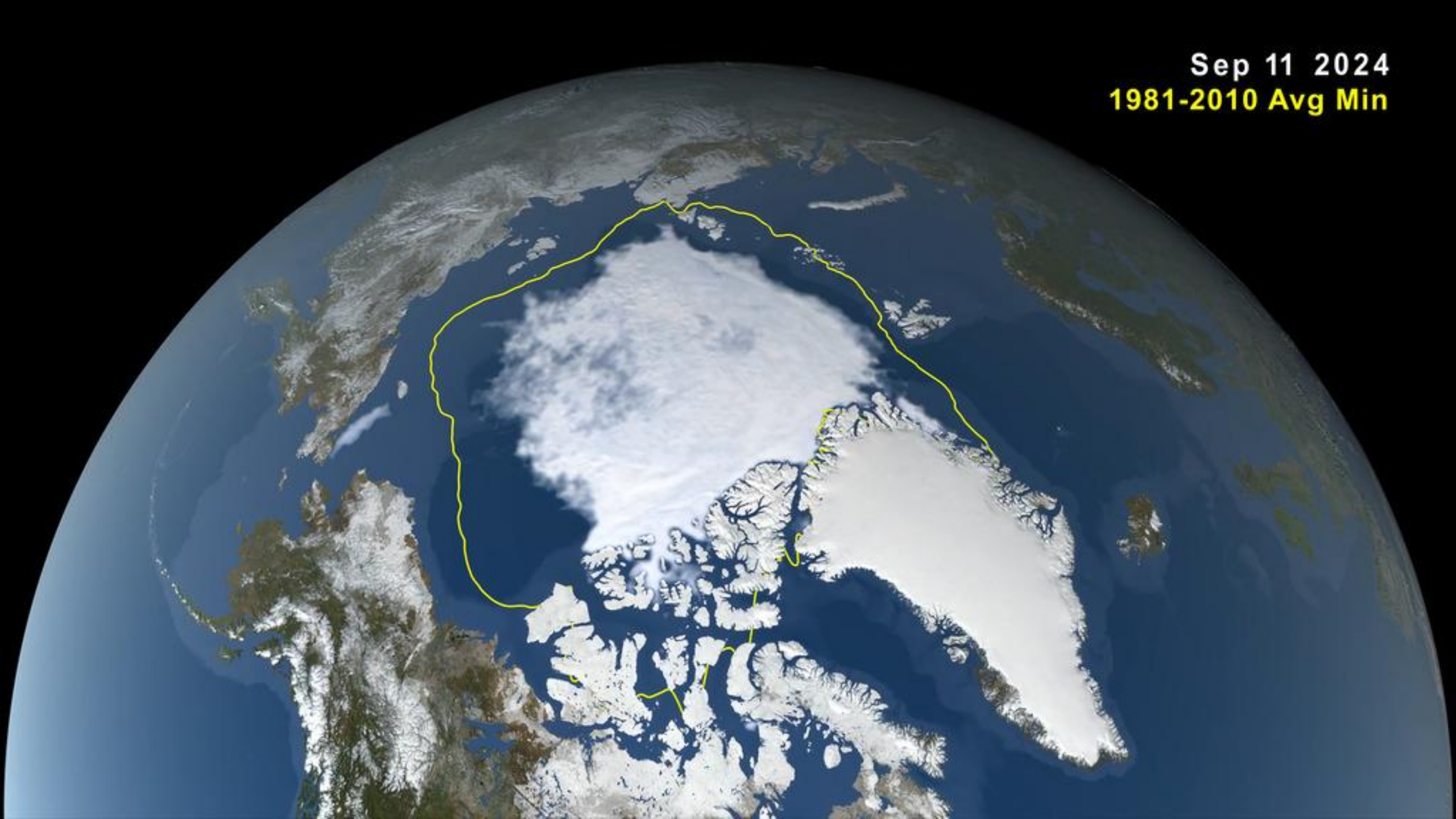
Temporal resolution: daily

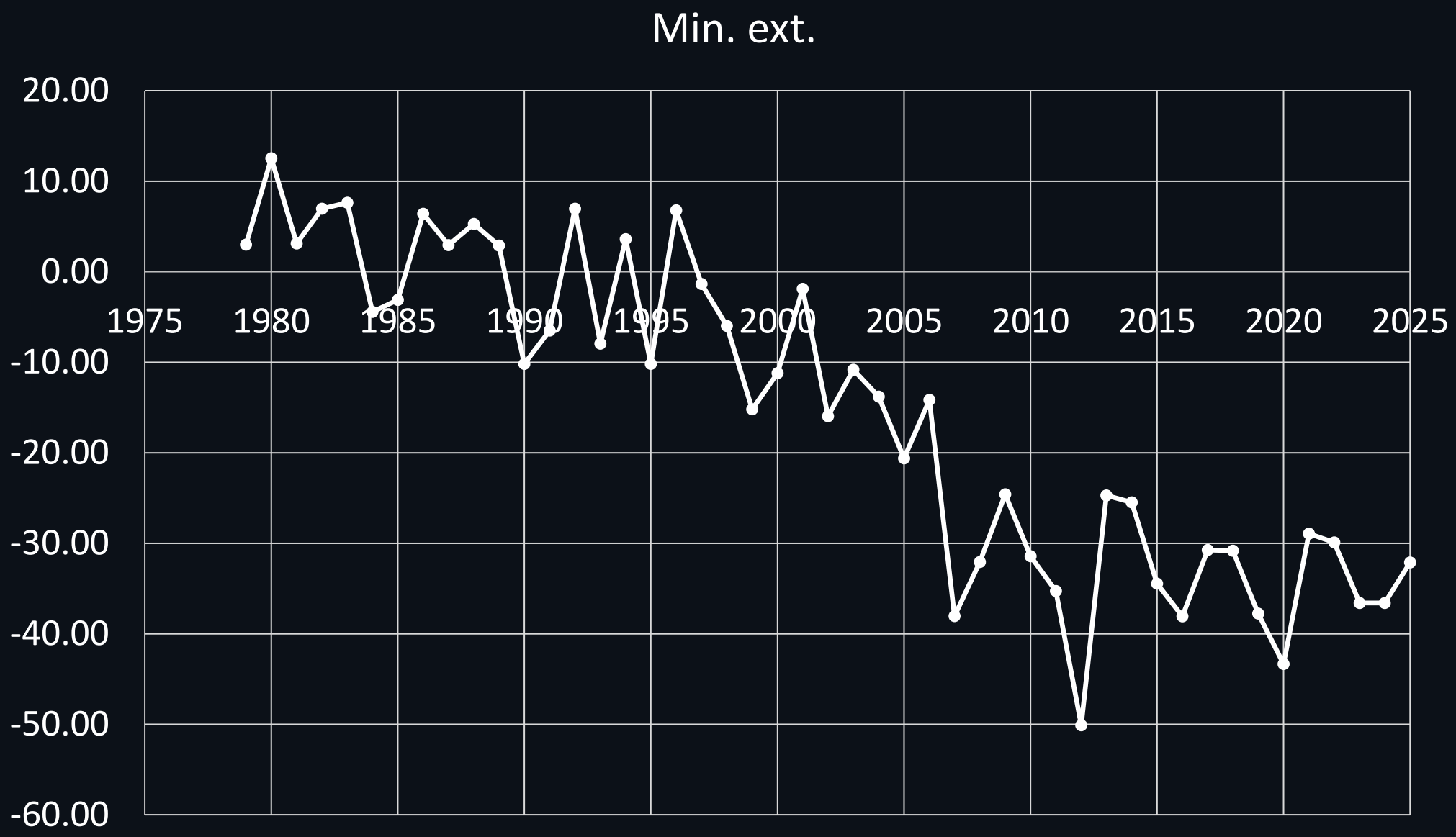


Temporal resolution: daily

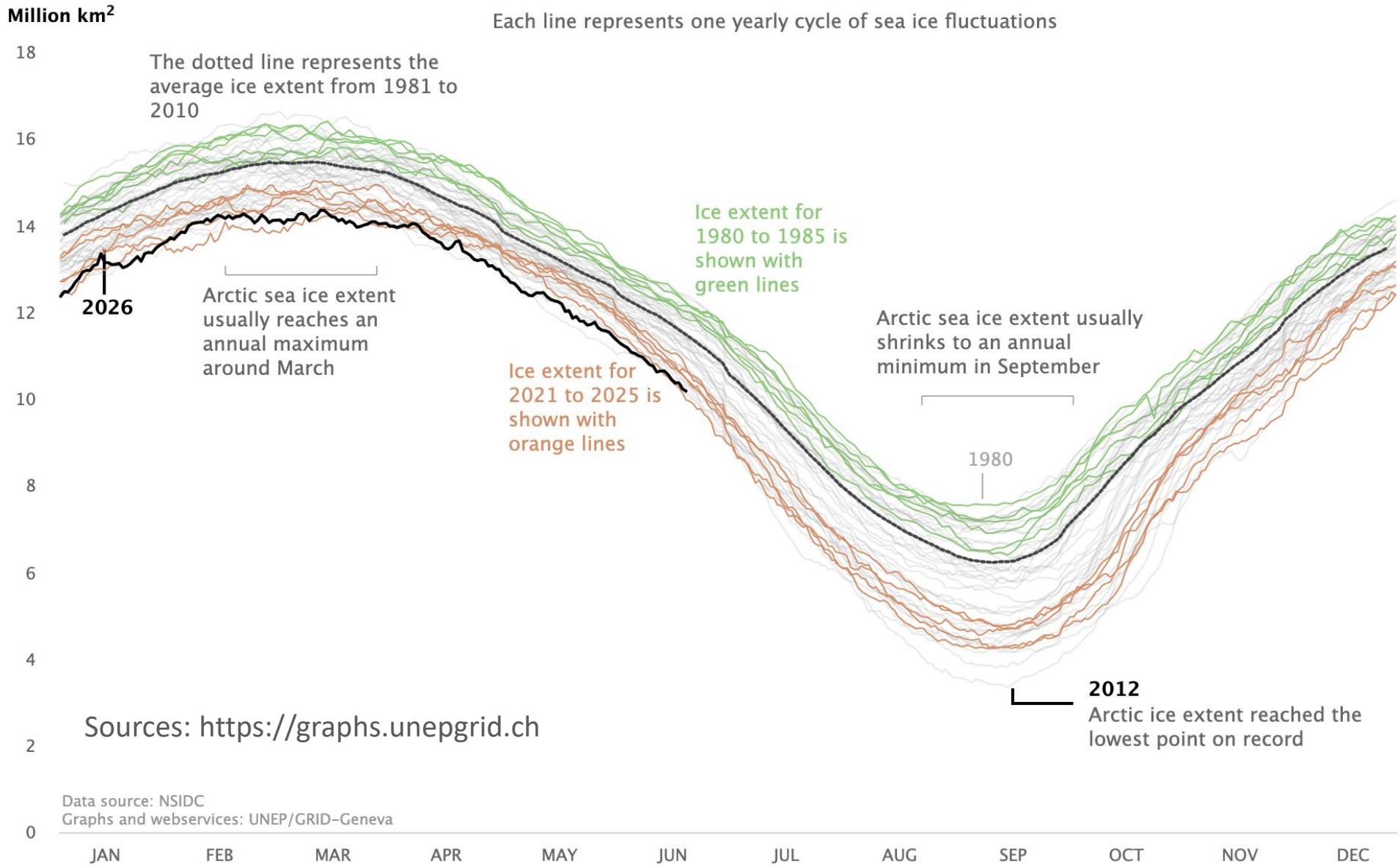


Temporal resolution: hourly


Sep 11 2024
1981-2010 Avg Min


Min. ext.
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025

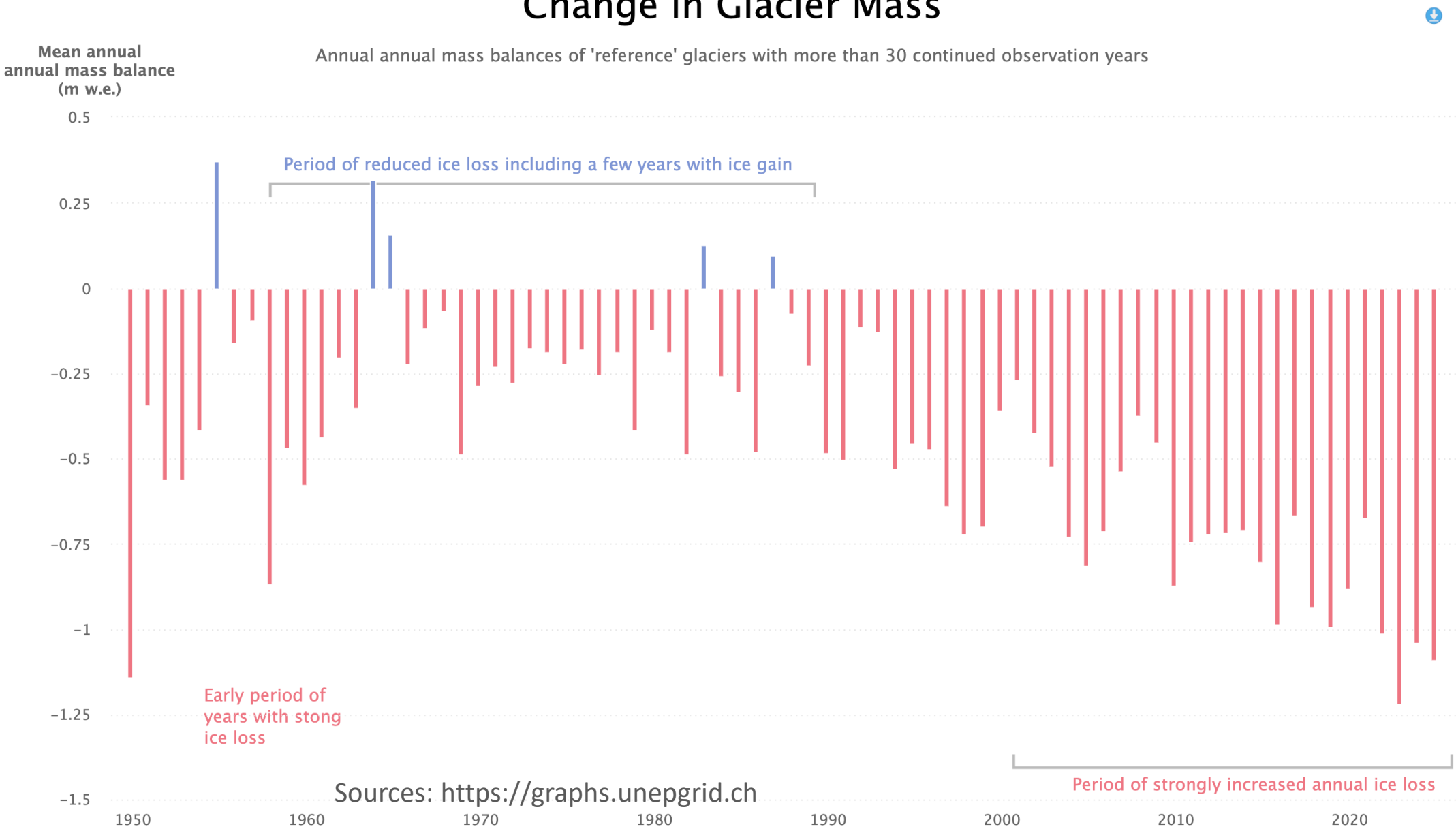
Arctic Sea Ice Extent



Sources: https://graphs.unepgrid.ch

Inspired by and adapted from New York Times

Change in Glacier Mass

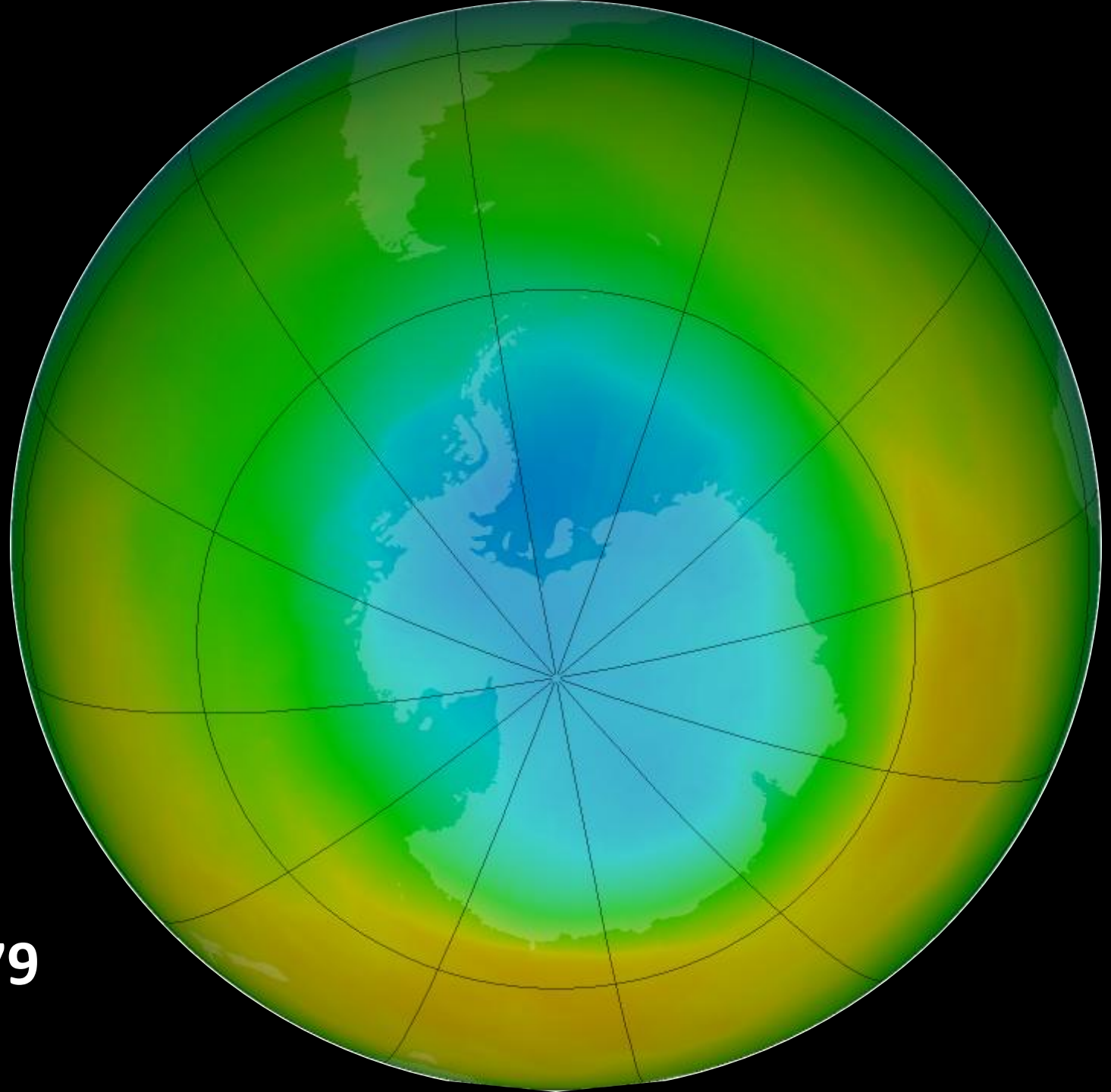


Sources: https://graphs.unepgrid.ch

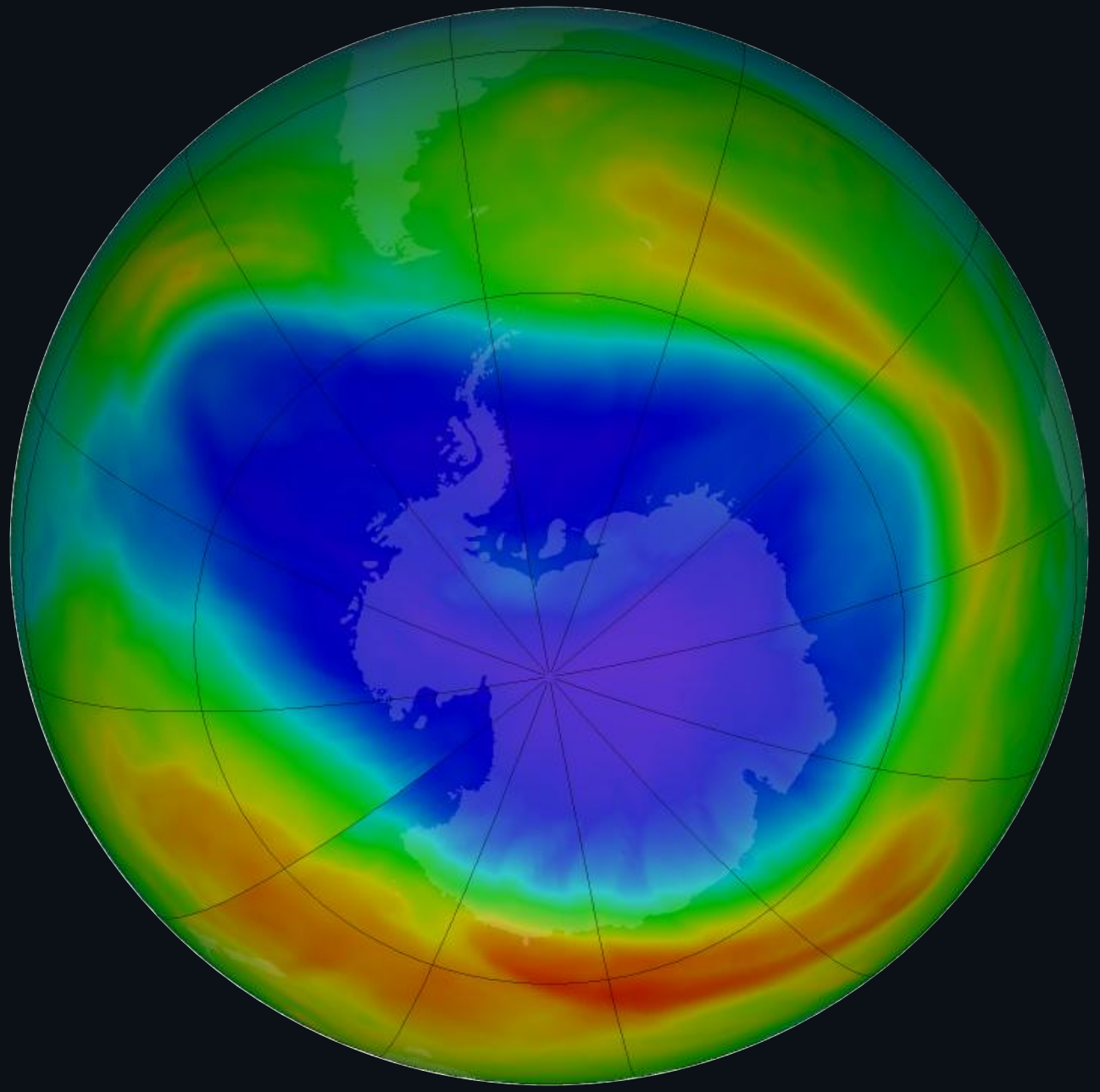
Glacier mcCarty (Alaska, USA)

Glacier du Trift
(Valais, Suisse)

Glacier d’Aletch (Valais, Suisse) Patrimoine mondiale de l’Humanité (UNESCO)

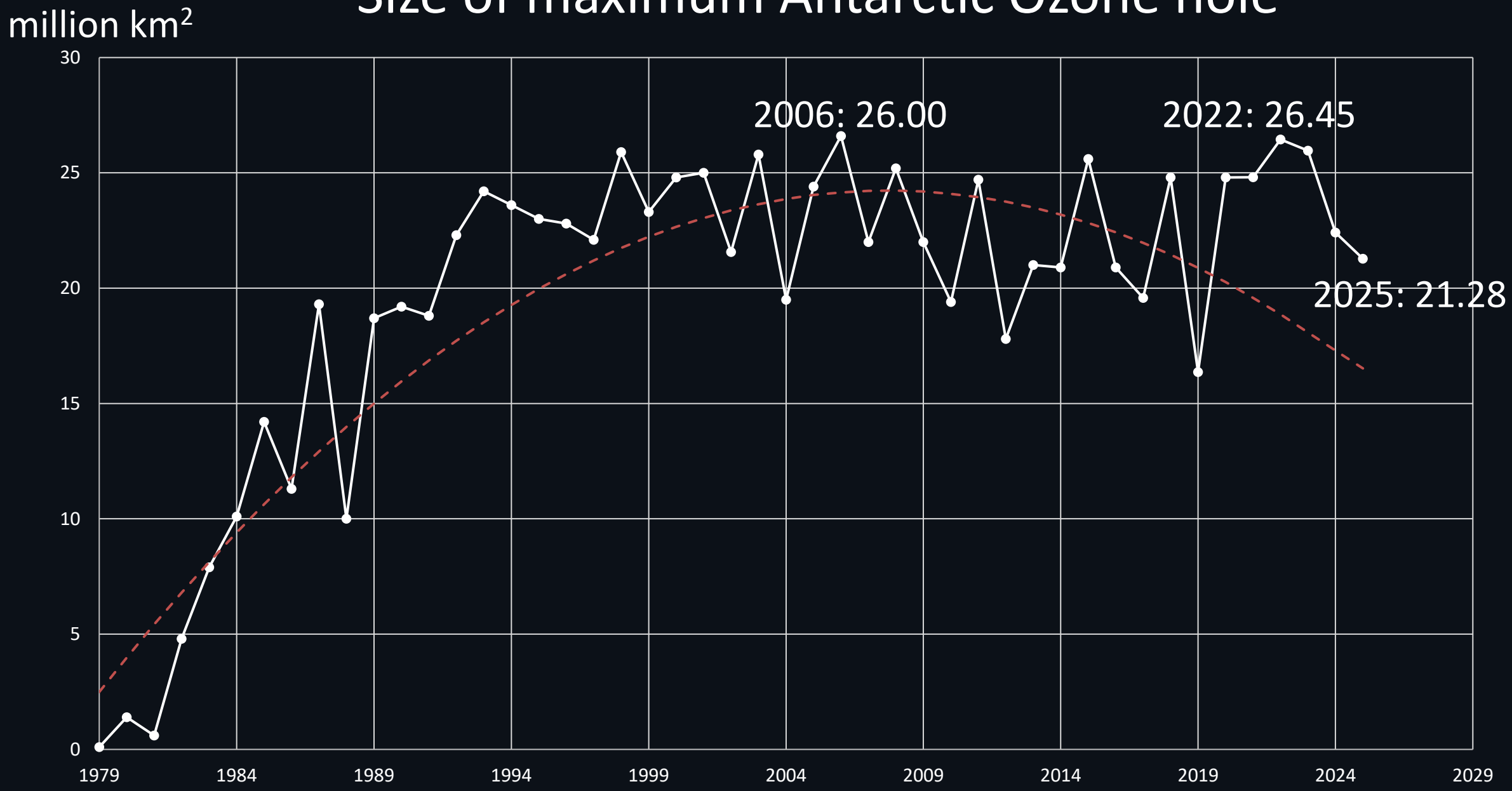


1979

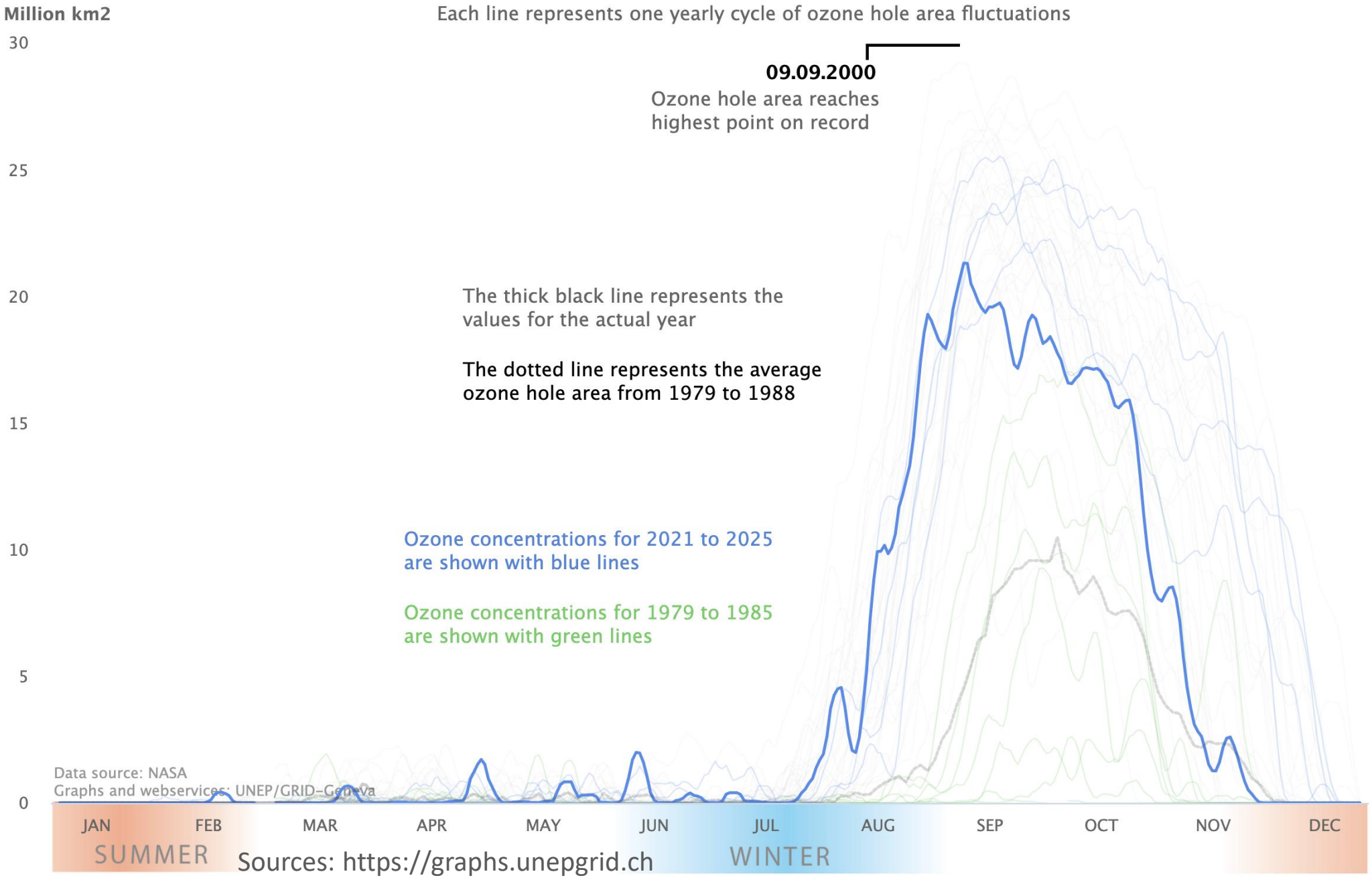


2025

Size of maximum Antarctic Ozone hole

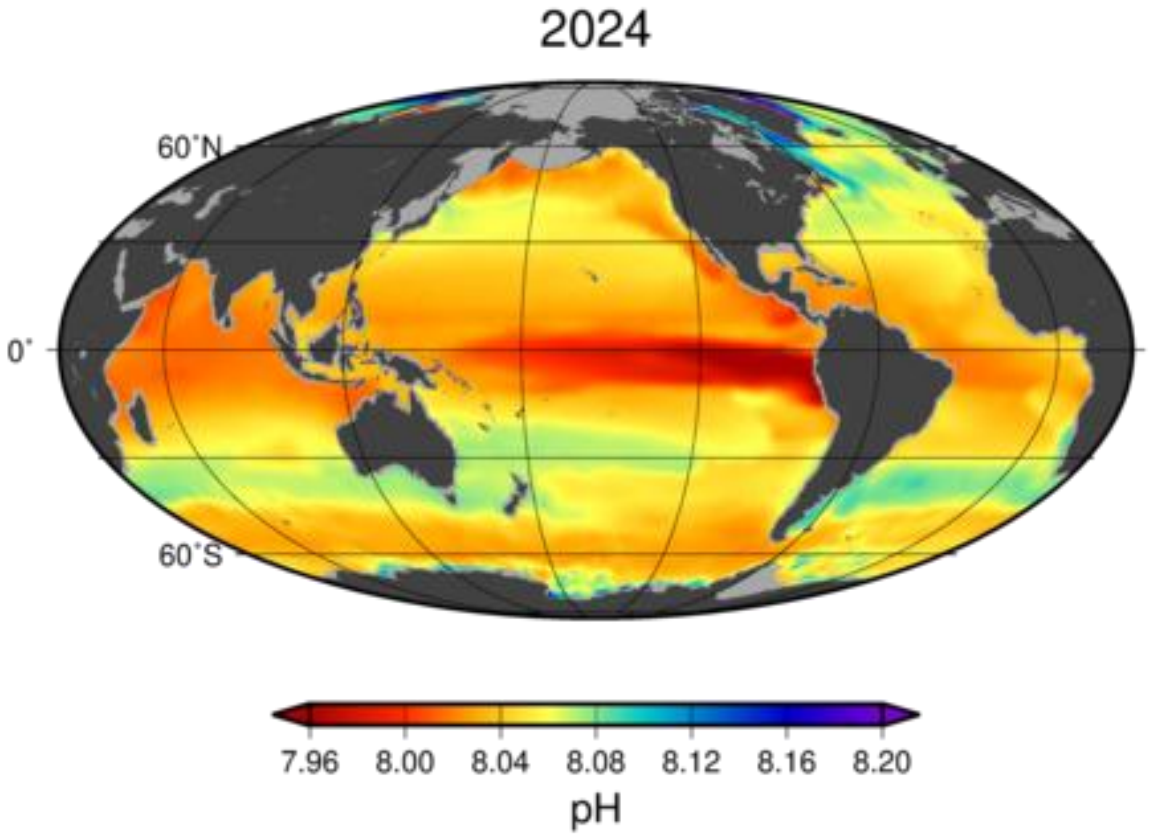


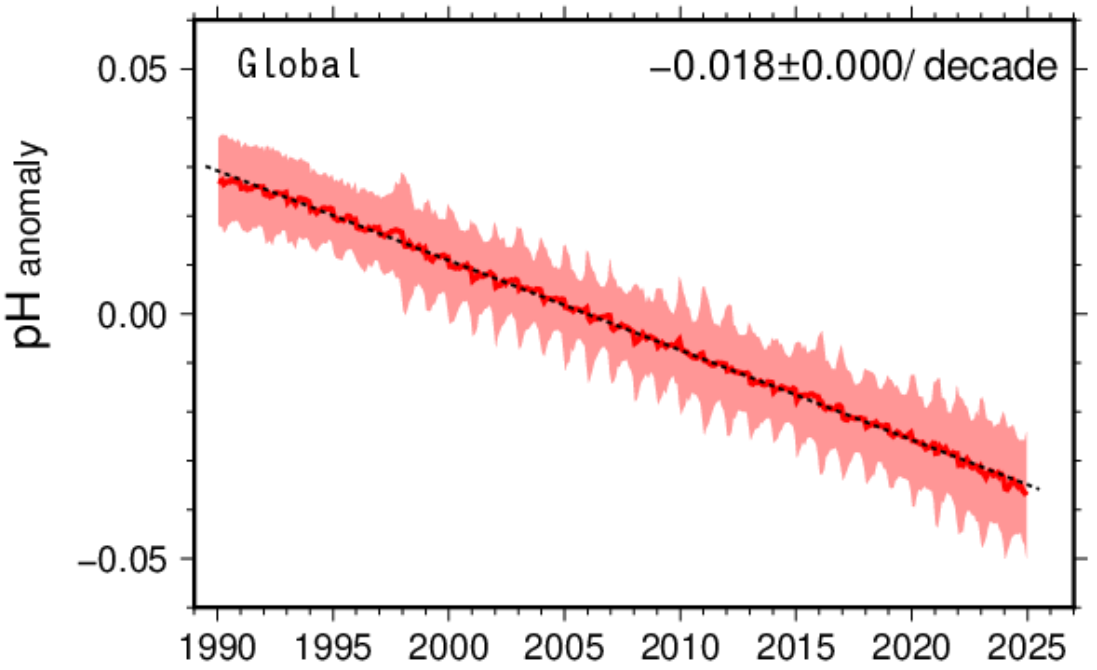
Antarctic Ozone Hole Area



Sources: https://graphs.unepgrid.ch

Ocean acidification





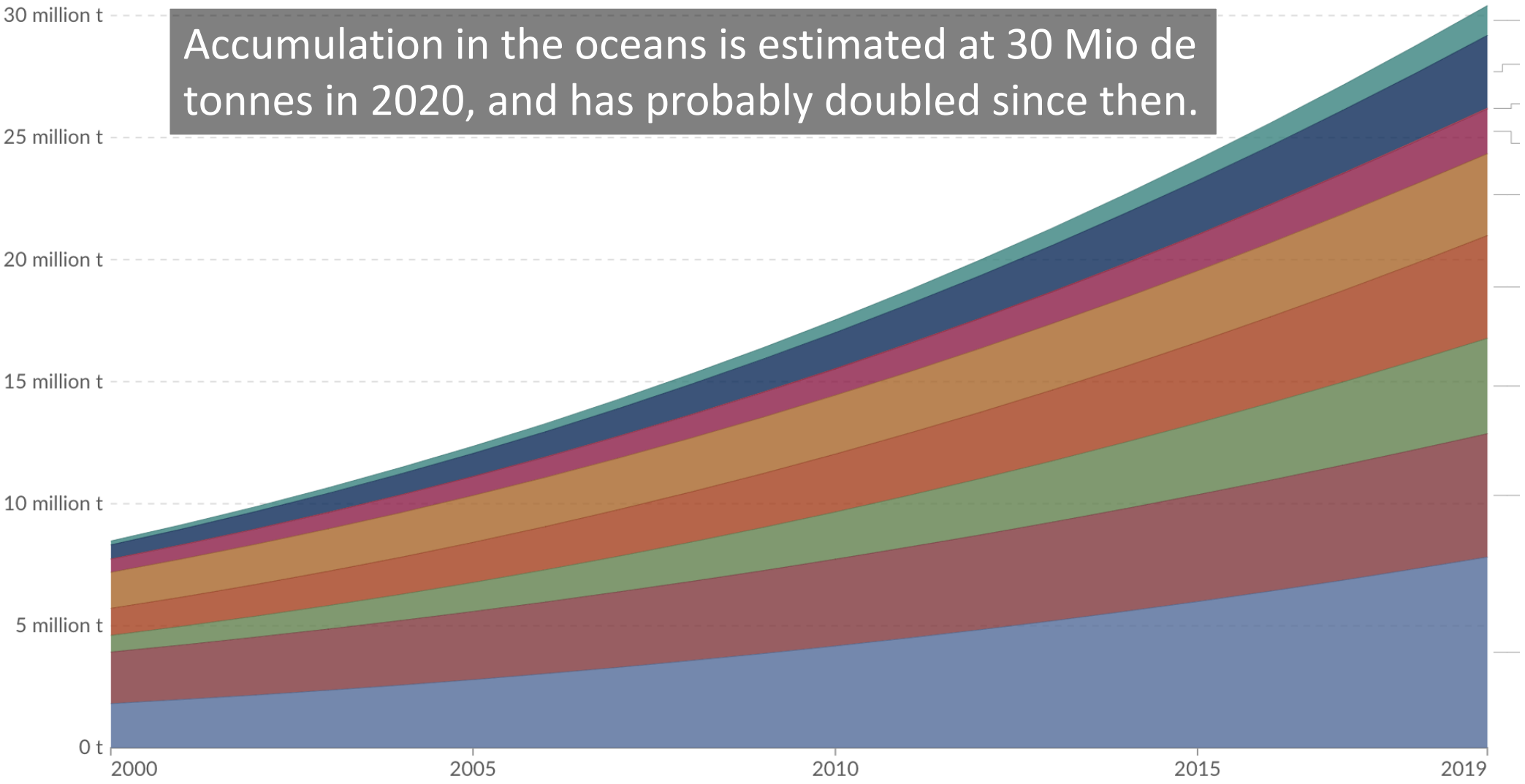
$CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow HCO_3^- + H^+$

https://www.data.jma.go.jp/gmd/kaiyou/english/oa_global/oceanacidification_global_en.html

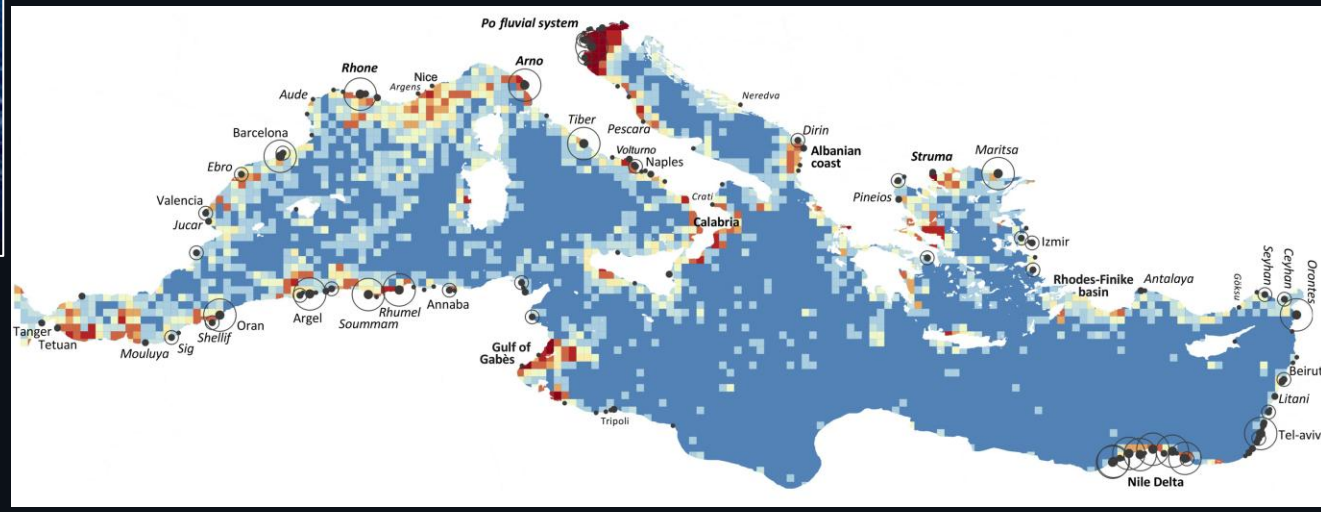
Plastic waste accumulated in the oceans, 2000 to 2019

The amount of plastic waste that has accumulated in the oceans since 1951. This is calculated as the running total of plastic flowing into the ocean each year.

Table | Chart

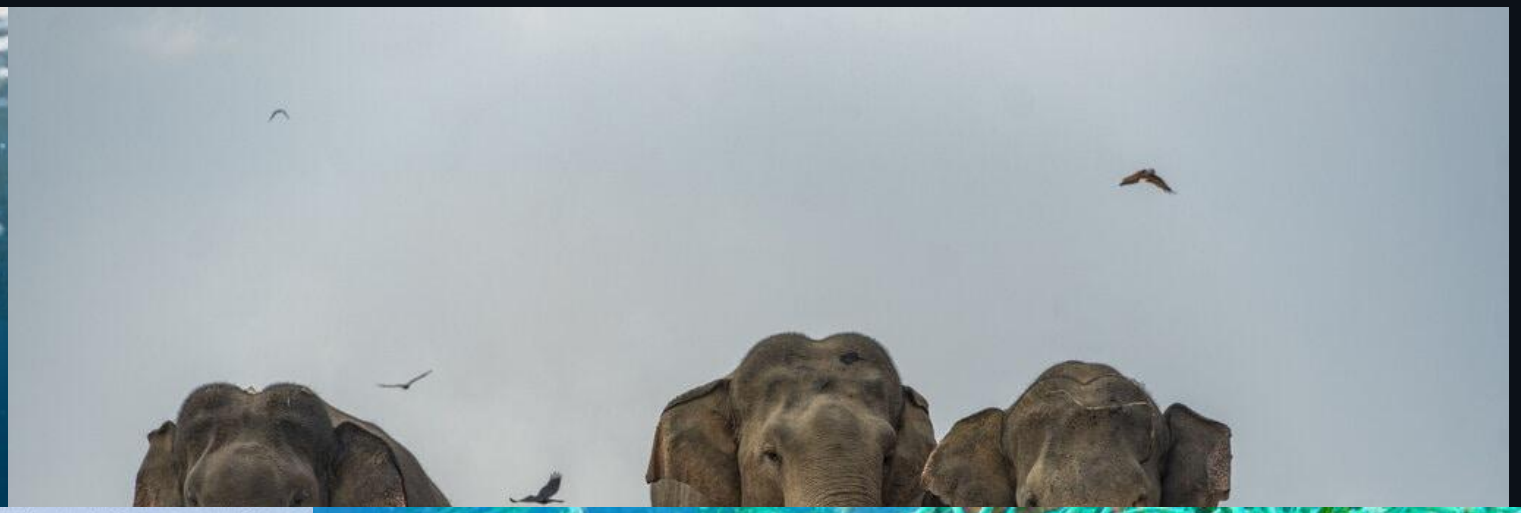


Detecting macro marine litter from space, is now (big enough) to be a reality

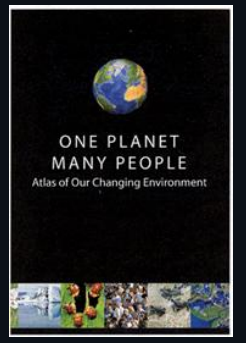


Source ESA, Sentinel 2

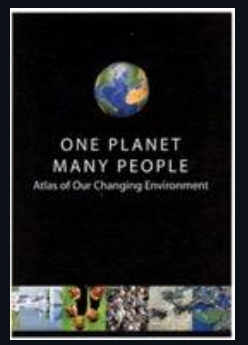
Challenges are for micro plastics, or for below water marine litters



Monitoring deforestation (Bolivia)



Iguaçu Region
(Brazil, Paraguay, Argentina)
Monitoring deforestation



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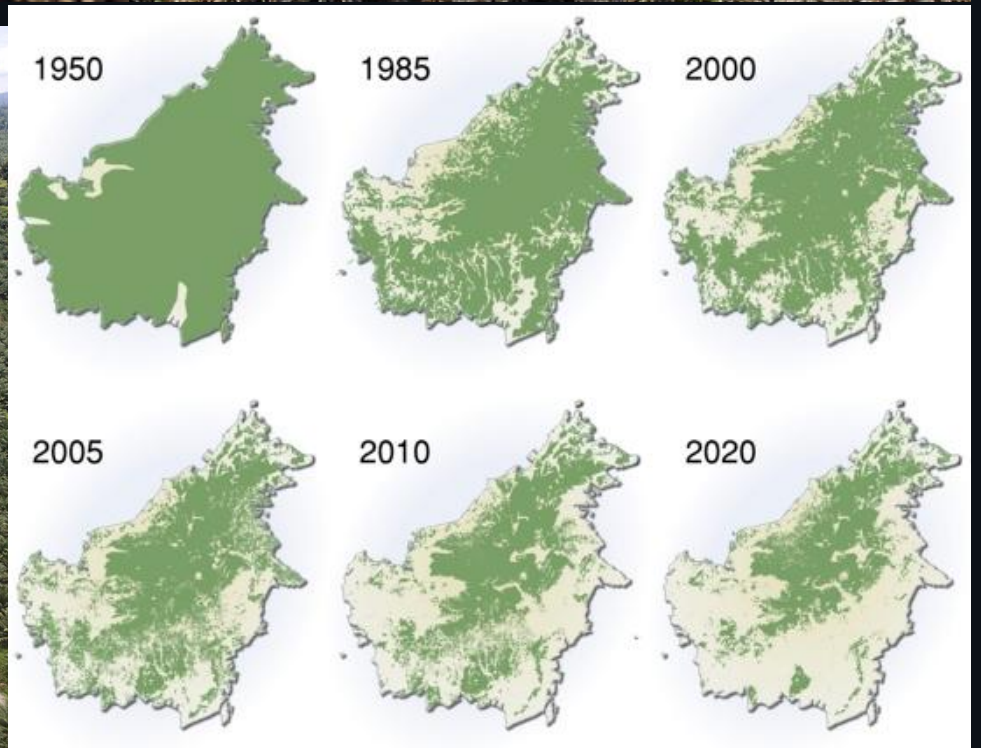
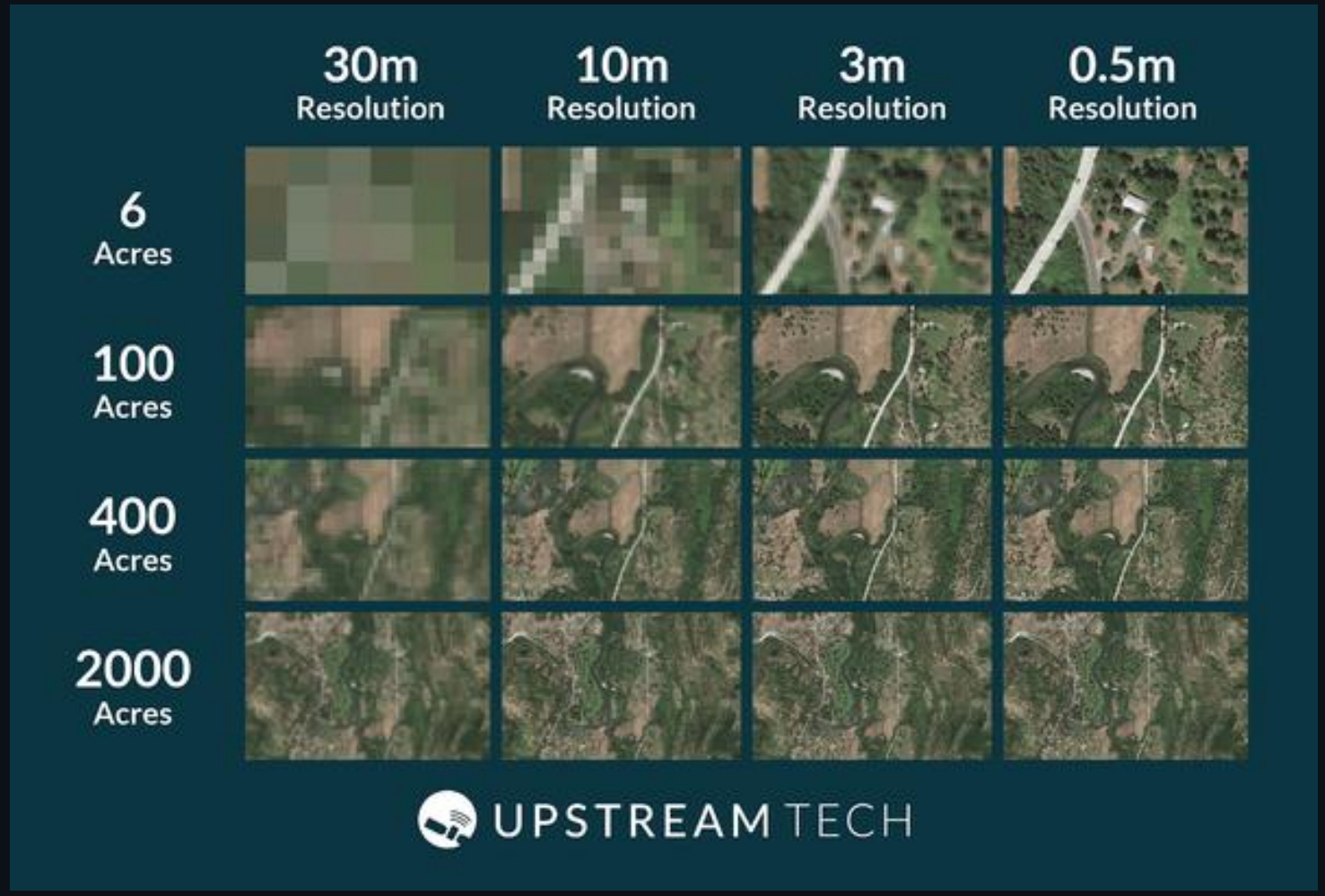
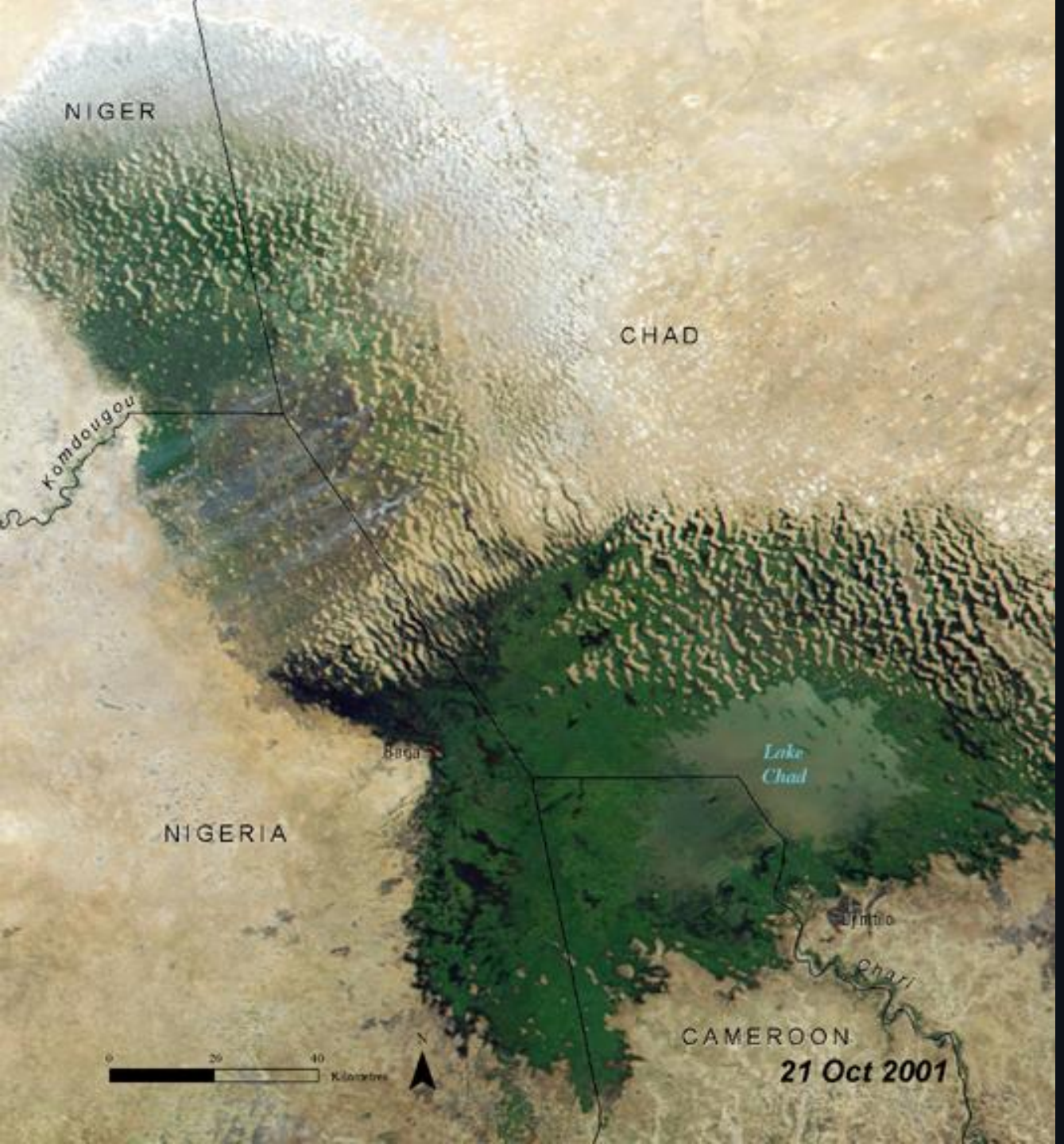

1950
1985
2000
2005
2010
2020

We have improved drastically temporal, spatial and spectral resolutions.
We can now observe deforestation at 0.5 m if we wish to.
But we are still observing deforestation !

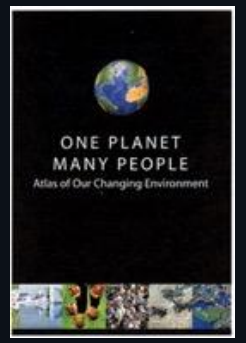


An overview of spatial resolution from satellites. Imagery © 2018 Planet Labs Inc., Maxar (formerly Digital Globe), European Space Agency. All rights reserved. Post processing and analysis by Upstream Tech.

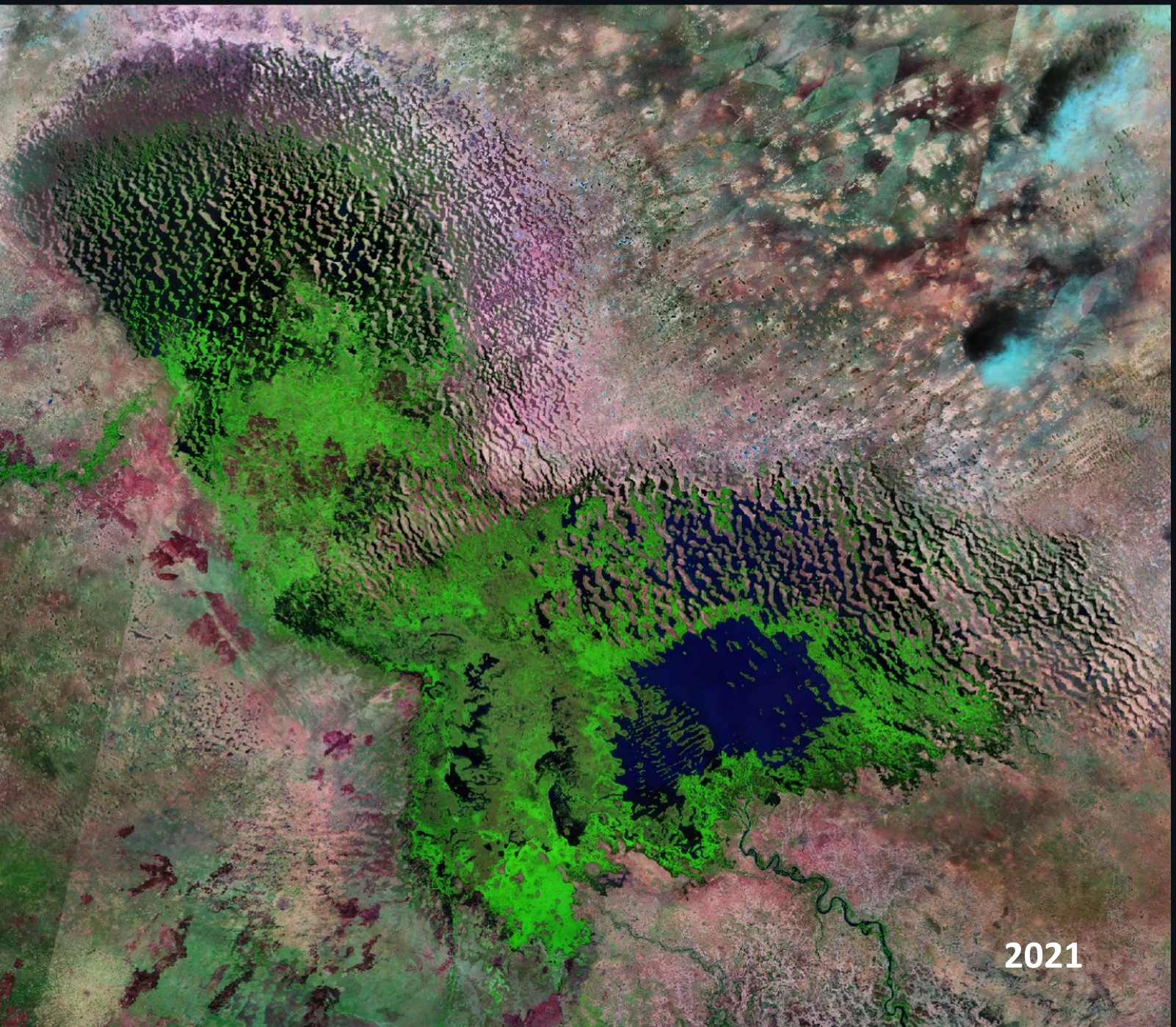


Lake Chad (Chad, Nigeria, Cameroon)

Since the early 1960's, rainfall over the basin decreased significantly while irrigation increased dramatically over the same period. The lake is especially susceptible to climatic variability as it is rather shallow, with an average depth of 4.11 m. As a result of decreased rainfall and increased water usage, the extent of Lake Chad decreased by 95 per cent over 45 years.



UN environment programme
GRID Geneva



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UN environment programme

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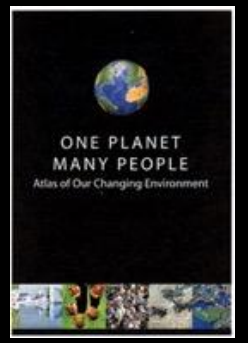
Aral sea (when cotton absorbs a sea)



UN environment programme

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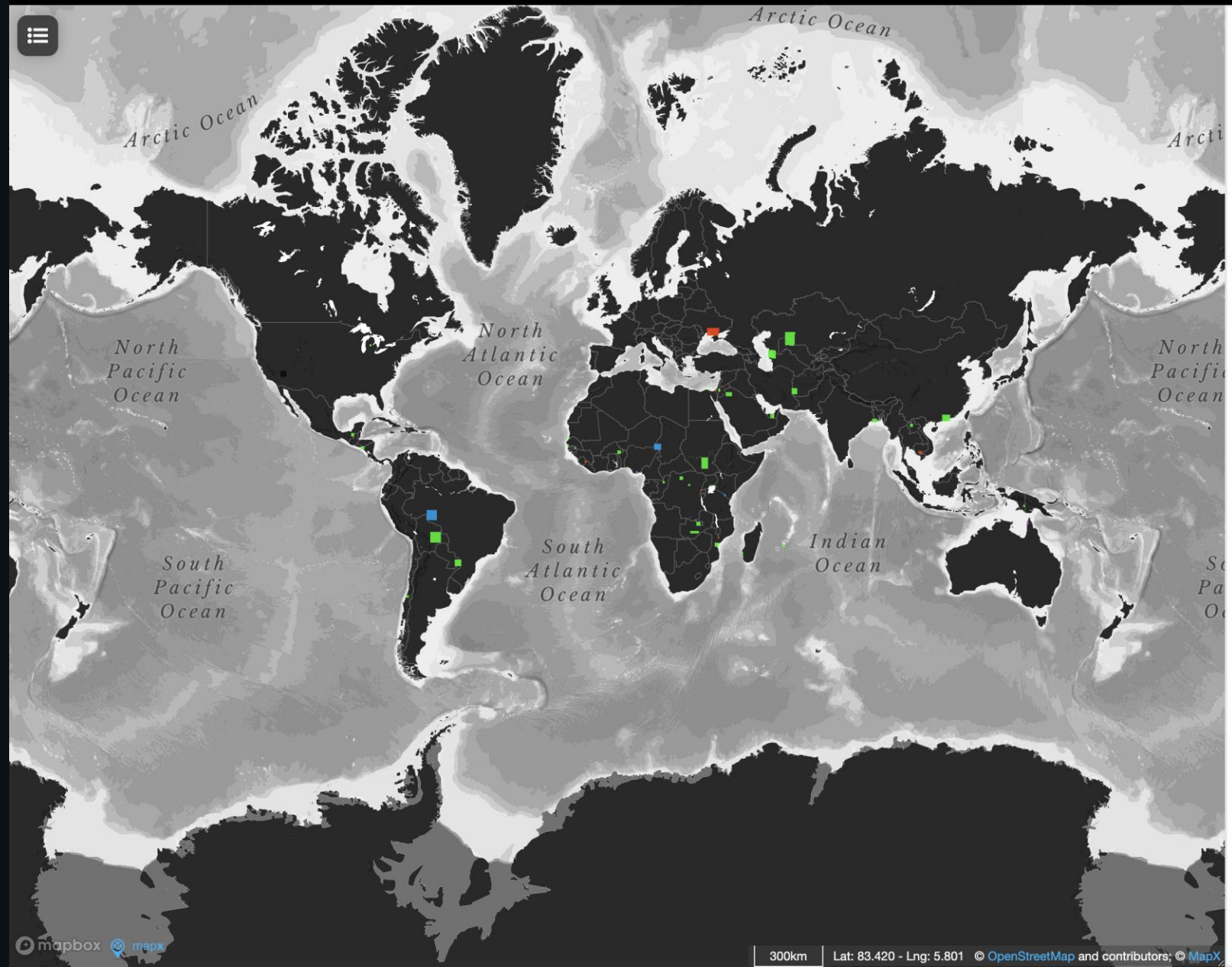
Aral sea (when cotton absorbs a sea)

UN environment programme
GRID Geneva

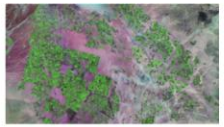


EXAMINE A HOTSPOT

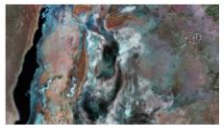
Search

Theme (none

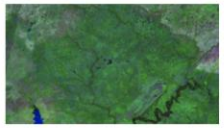
AL-ZAATARI
Jordan, Syrian Arab Republic
Disasters and Conflicts



AL'ISAWIYAH
Saudi Arabia
Ecosystems

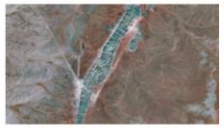


ARAL SEA
Kazakhstan
Ecosystems

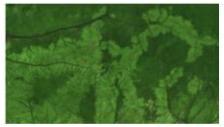


ARLY NATIONAL PARK
Burkina Faso
Ecosystems

BEIRA FIRE SCARS
Mozambique
Ecosystems



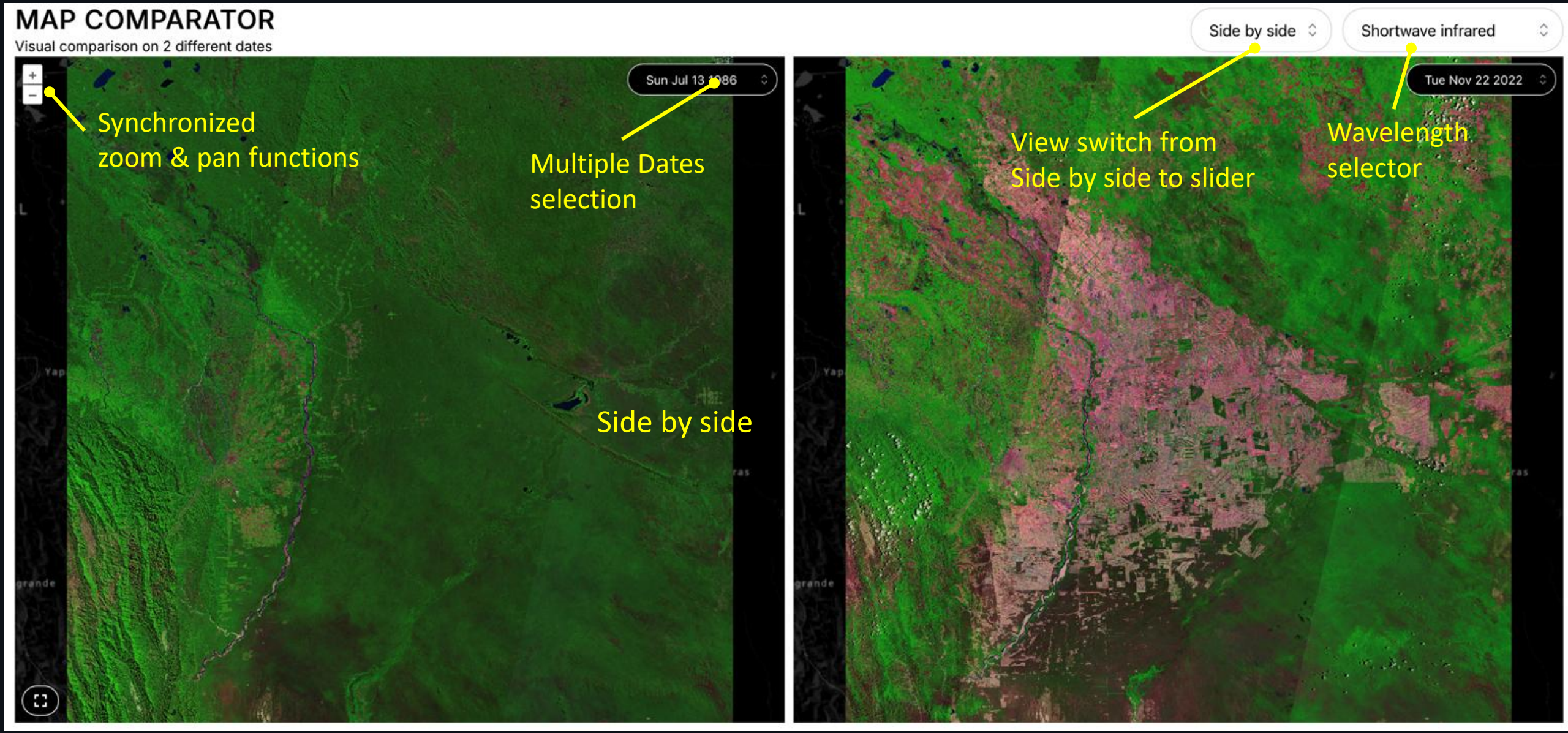
BOU CRAA
Western Sahara
Resource Extraction



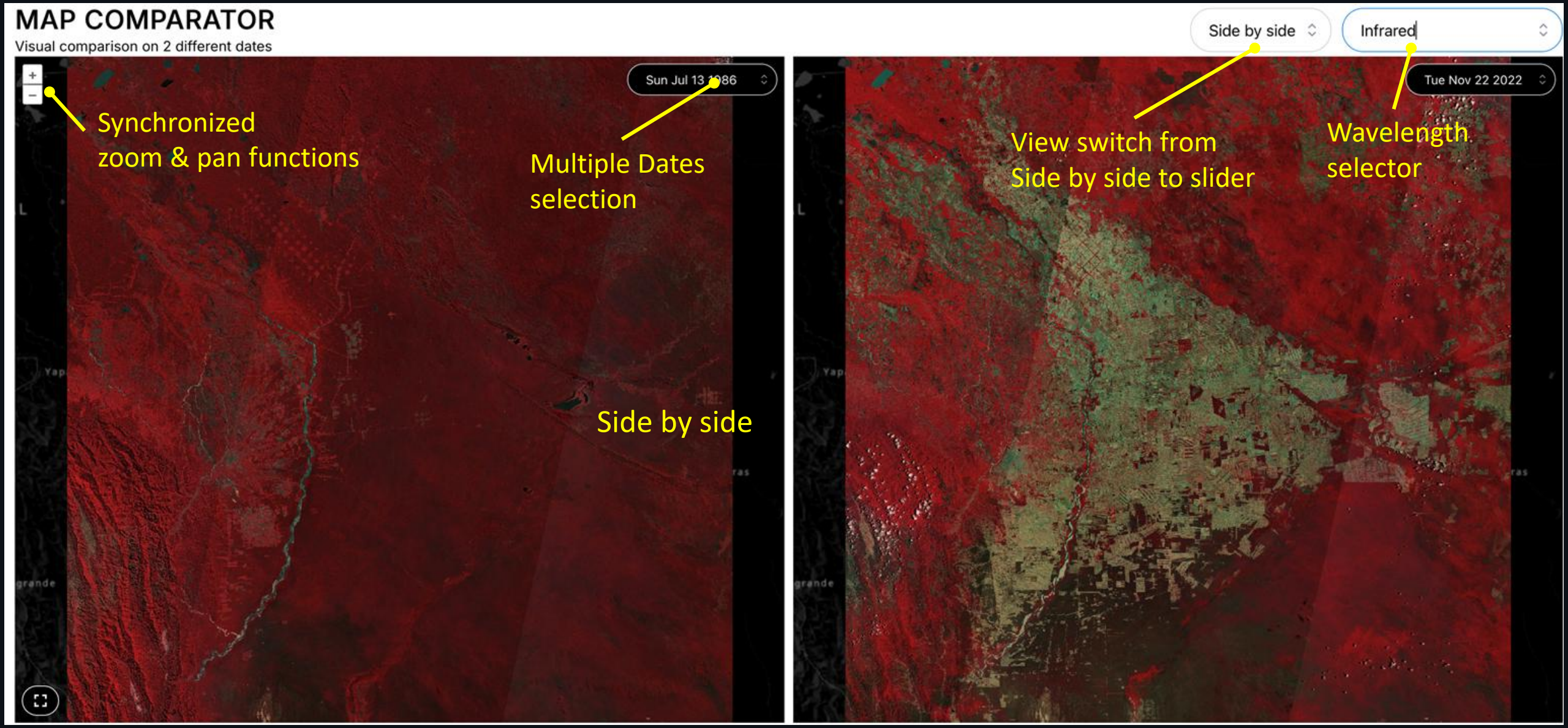
BUMBA
Democratic Republic of the Congo
Ecosystems

CAMPO-MA'AN FOREST
Cameroon

Santa Cruz region (Bolivia)



Santa Cruz region (Bolivia)



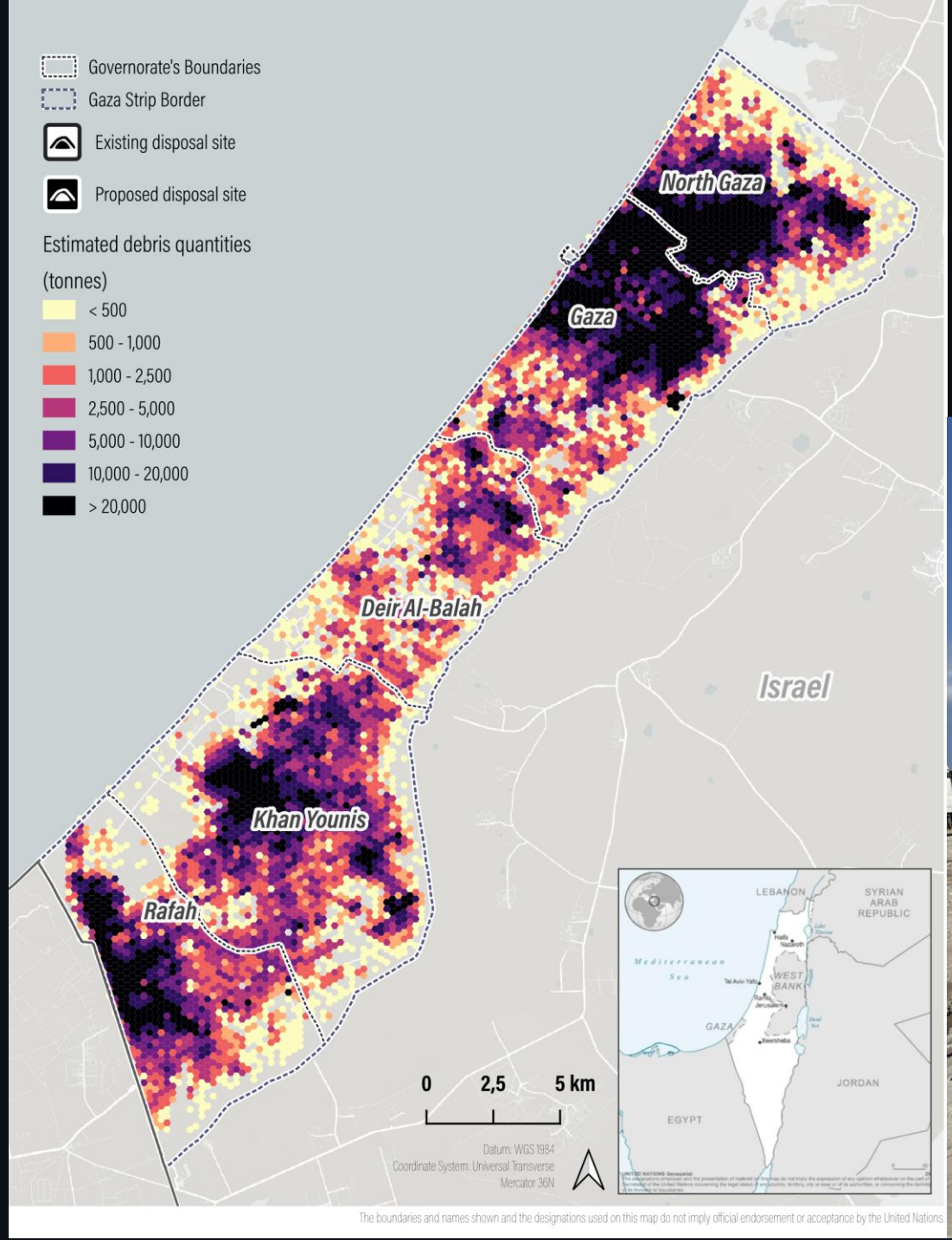
Brought to you by UNEP/GRID-Geneva, Oct. 2024

Support to UNEP Disasters and Conflicts Branch

UN environment programme

GRID Geneva


© 2025, AFP/Omar Al-Qattaa



57 million tons of debris after the war in Gaza
Recycled: 0.17%, at this paste it will take 140 years
There are urgent needs for help.

Photo: Hassan Partow, UNEP

UN environment programme GRID Geneva

Data | Themes | Resources | Activities | About us | Search

Global Resource Information Database - Geneva

Statistical data

Our strength lies in the quality and scope of our data. Drawing from 34 authoritative sources, we provide reliable and timely indicators to support informed decision-making.

MORE THAN 3,500 STATISTICAL INDICATORS FROM 34 TRUSTED PROVIDERS

Search all data (e.g. CO2, Land)

Advanced search API

Geospatial data

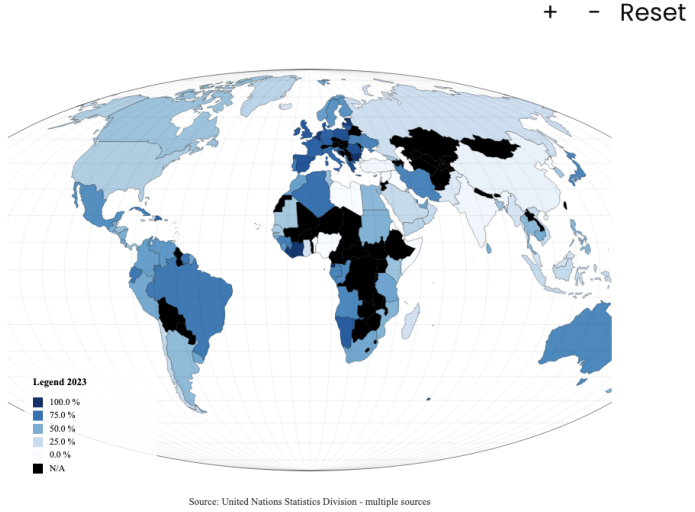
More than 2000 geospatial datasets can be explored on MapX, our cloud-based platform designed to make spatial information accessible, interactive, and actionable.

MORE THAN 2000 GEOSPATIAL DATASETS

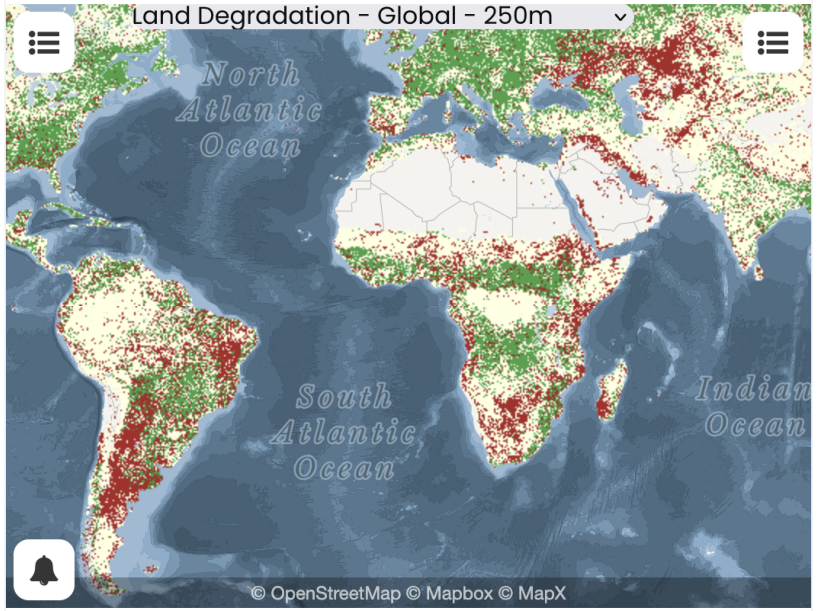
Search geospatial

API

FEATURED STATISTICAL DATA



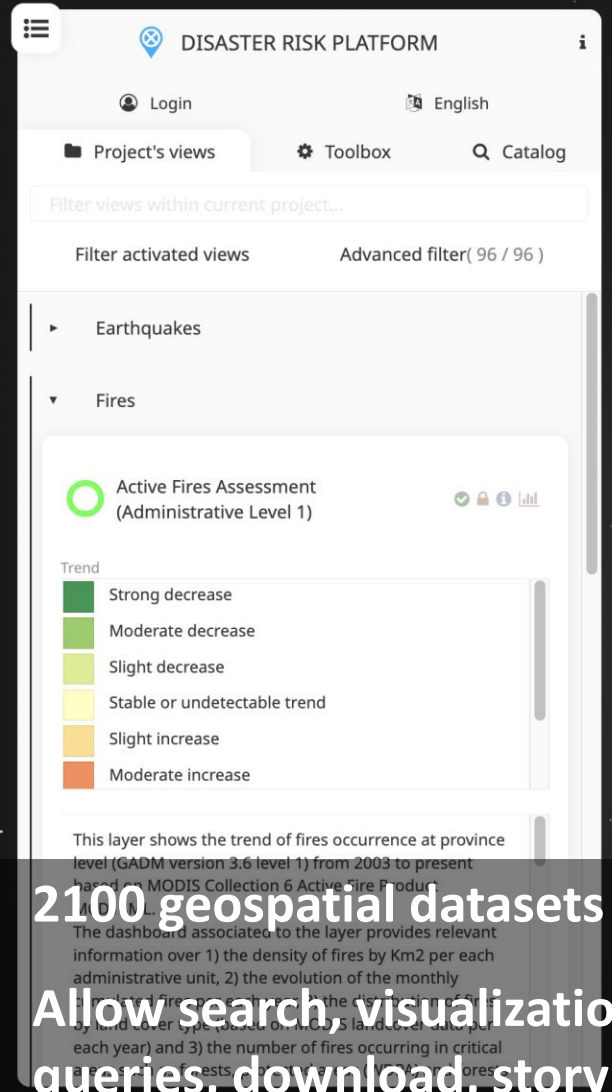
FEATURED GEOSPATIAL DATA

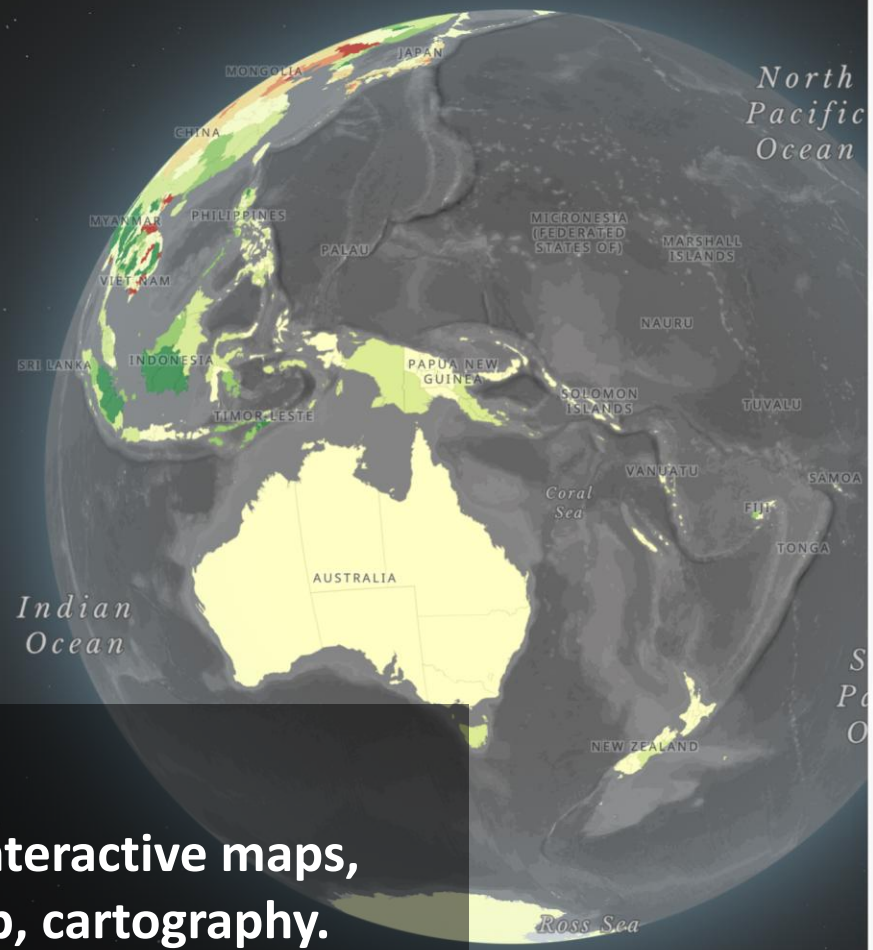


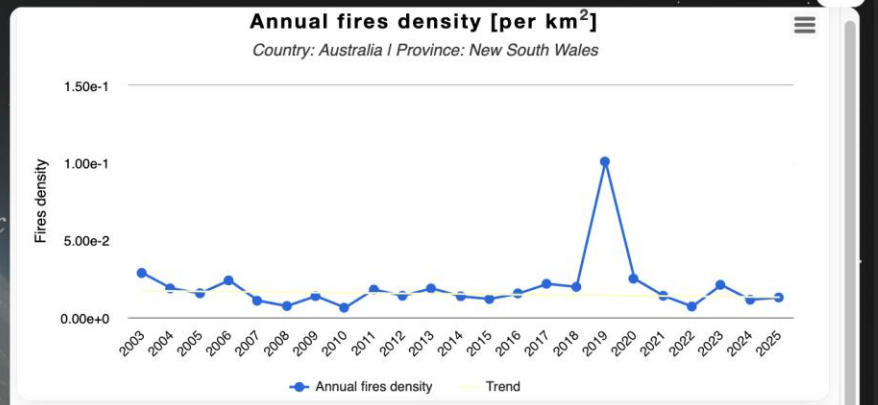
GRID-Geneva database includes: 5500 datasets (2100 geospatial datasets + 3500 statistics datasets).
The geospatial module (MapX) is already fully operational (since 2015).
The new statistics module will be operational in September 2025.

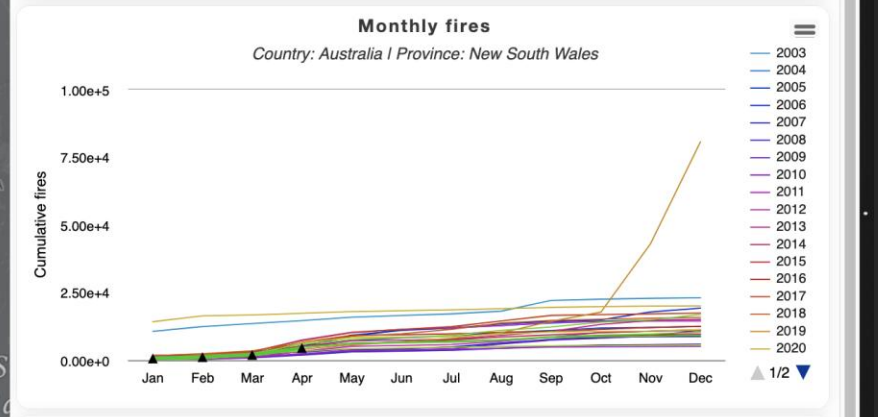
UN environment programme GRID Geneva

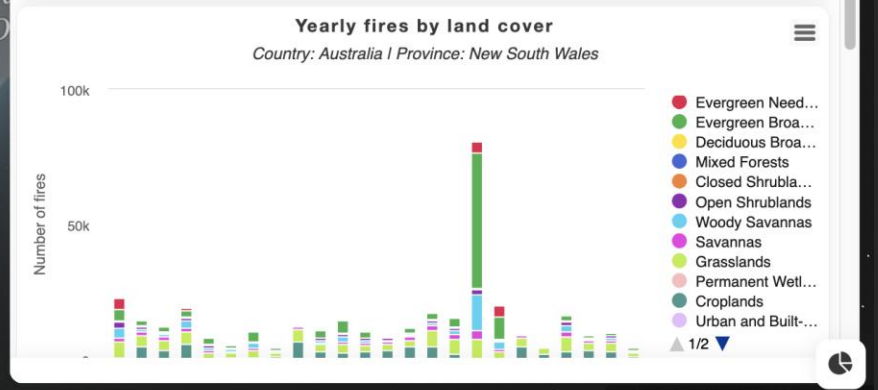
GRID-Geneva Geospatial Database: maps.unepgrid.ch



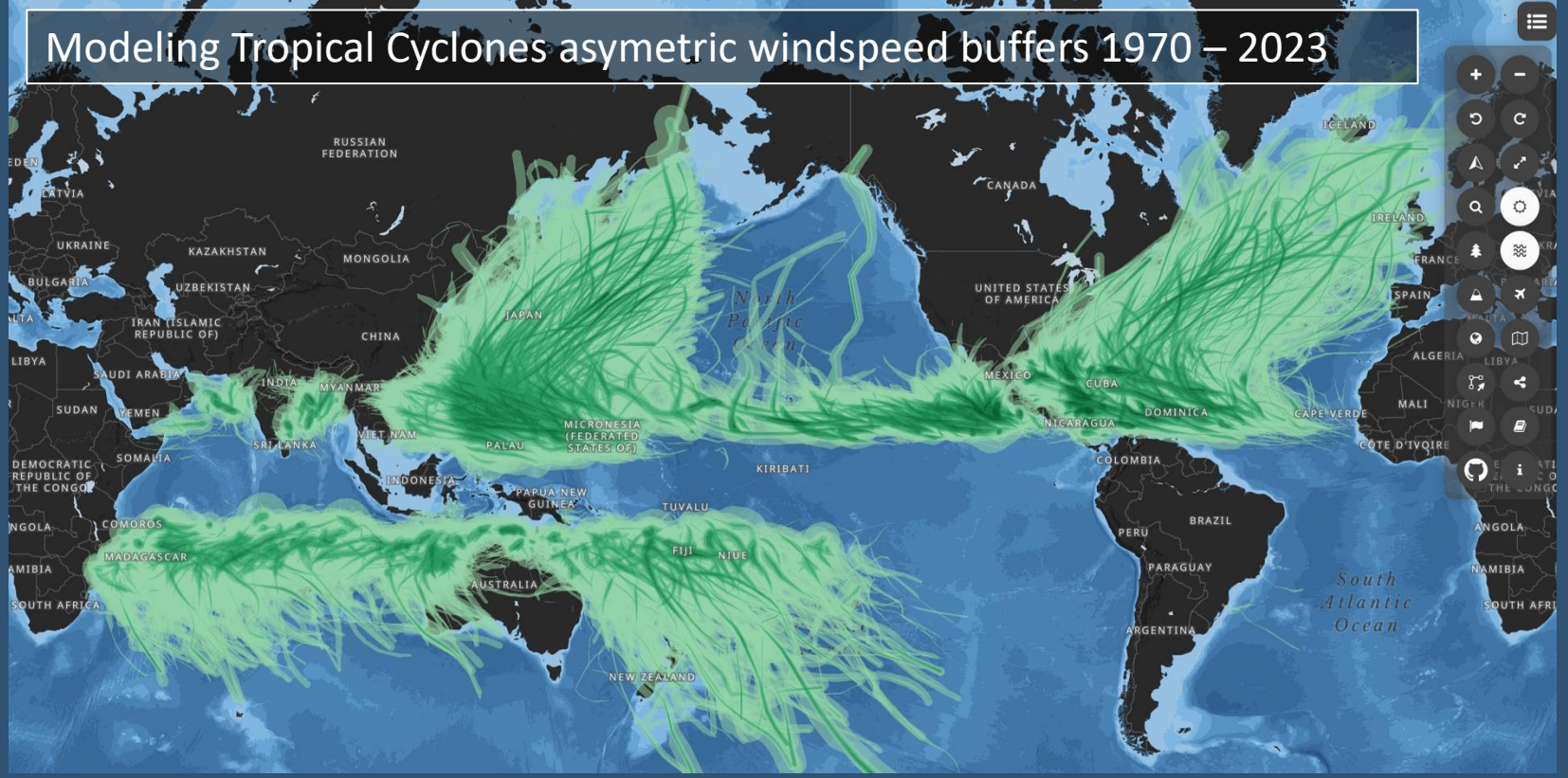




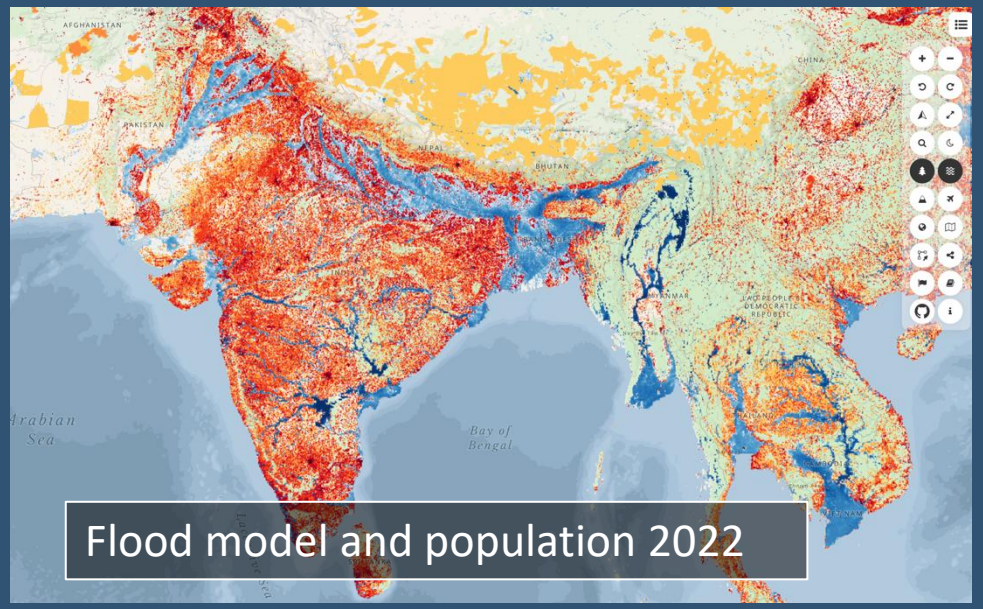


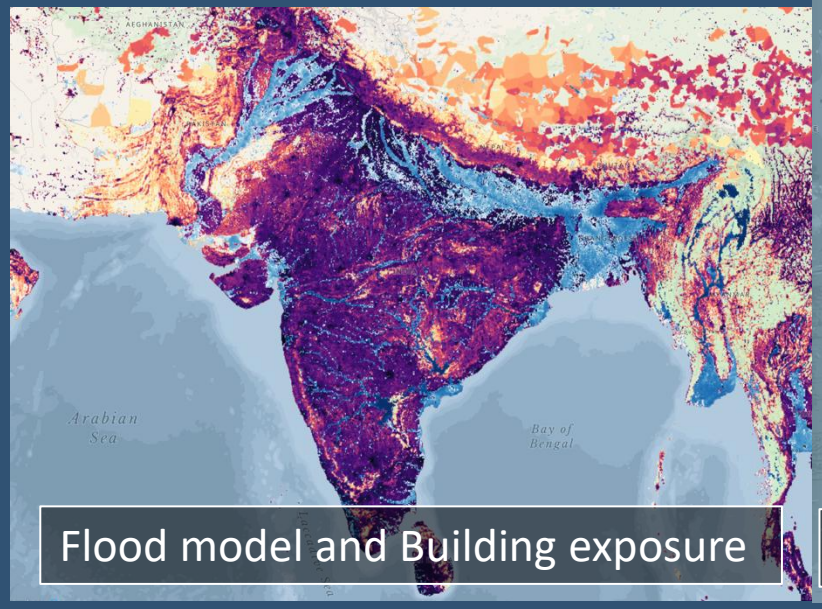


- 2100 geospatial datasets
- Allow search, visualization, interactive maps, queries, download, story map, cartography.
- Available in all 6 UN official languages
- Developed in 2015, updated ever since.


Modeling Tropical Cyclones asymetric windspeed buffers 1970 – 2023
RUSSIAN FEDERATION
CANADA
ICELAND
IRELAND
UKRAINE
KAZAKHSTAN
MONGOLIA
BULGARIA
UZBEKISTAN
JAPAN
UNITED STATES OF AMERICA
IRAN (ISLAMIC REPUBLIC OF)
CHINA
FRANCE
SPAIN
LIBYA
SAUDI ARABIA
INDIA
MYANMAR
MEXICO
CUBA
ALGERIA
SUDAN
YEMEN
DOMINICA
CAPE VERDE
MALI
NICARAGUA
MICRONESIA (FEDERATED STATES OF)
SRI LANKA
VIET NAM
PALAU
CÔTE D'IVOIRE
SOMALIA
COLOMBIA
INDONESIA
KIRIBATI
PAPUA NEW GUINEA
TUVALU
BRAZIL
COMOROS
PERU
ANGOLA
MADAGASCAR
FIJI
NIUE
PARAGUAY
NAMIBIA
AUSTRALIA
SOUTH AFRICA
ARGENTINA
NEW ZEALAND
North Pacific Ocean
South Atlantic Ocean


African conflicts 1997-2001


Flood model and population 2022

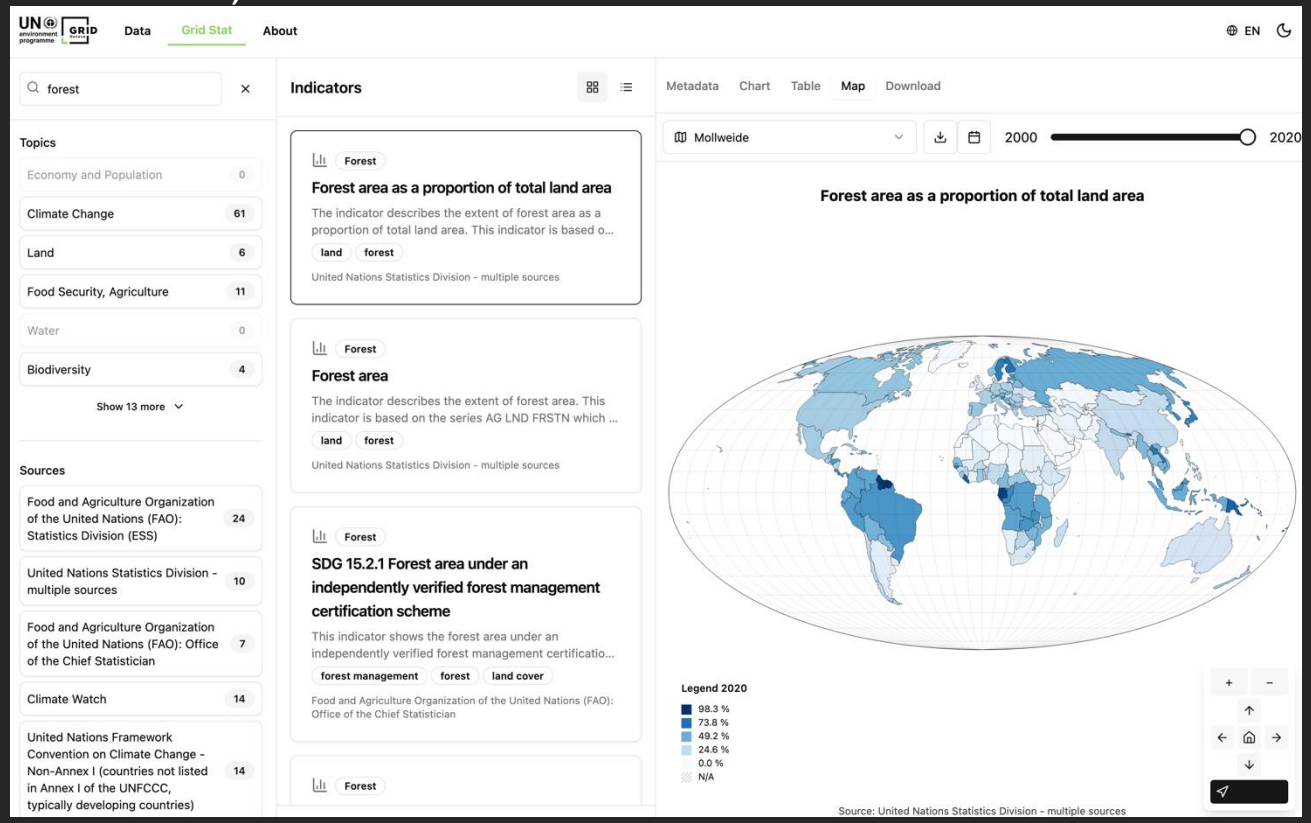

Flood model and Building exposure

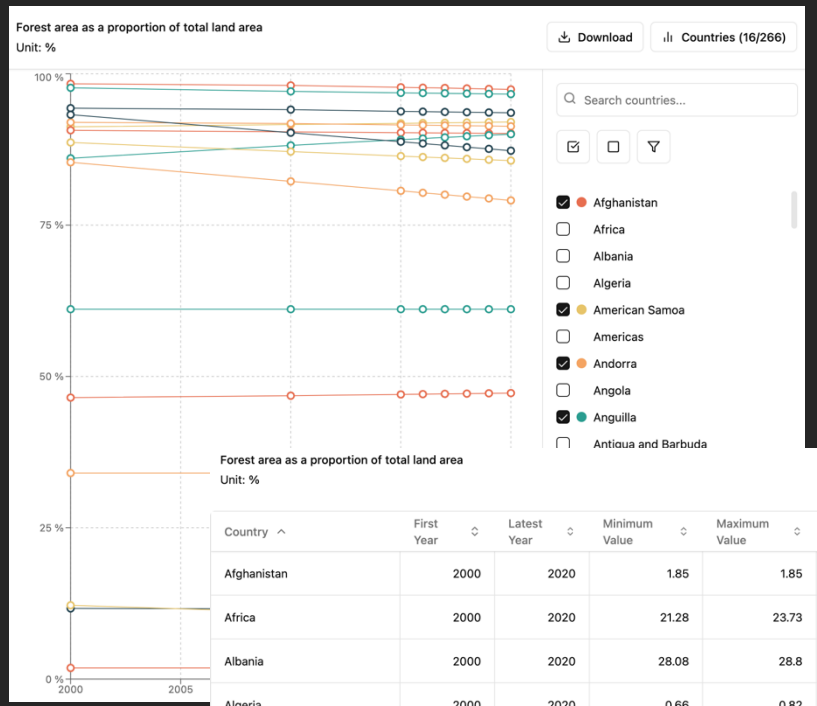

African conflicts 2020-2024

Global Resource Information Database – Statistics module

Currently under development with 1000 datasets
Aim to provide access to 3100 statistics datasets with automatic updates by September 2025.
Allows for:

- Data discovery/search
- Display (graphs, table, map)
- Interogation/querry
- Access, link and download



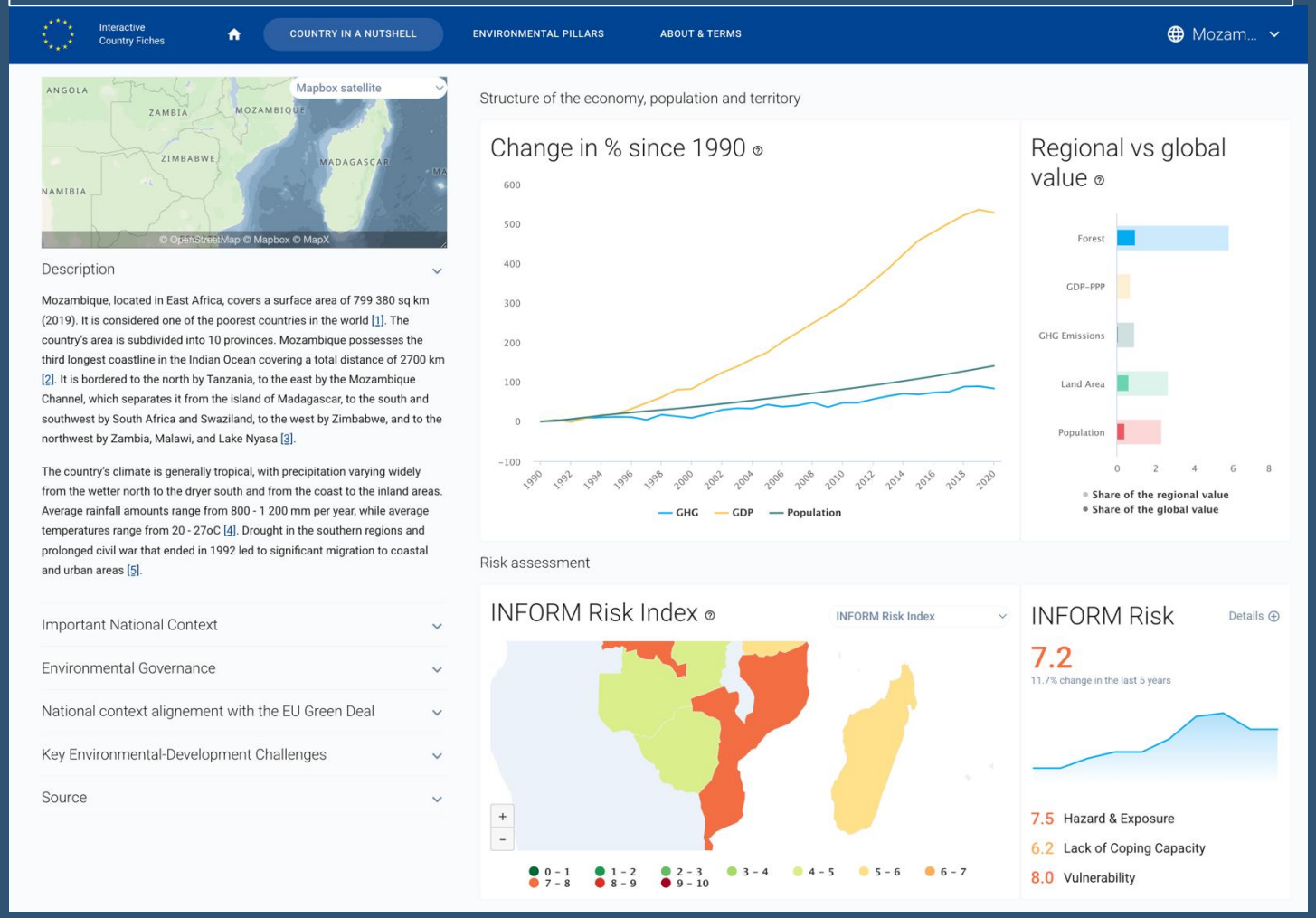


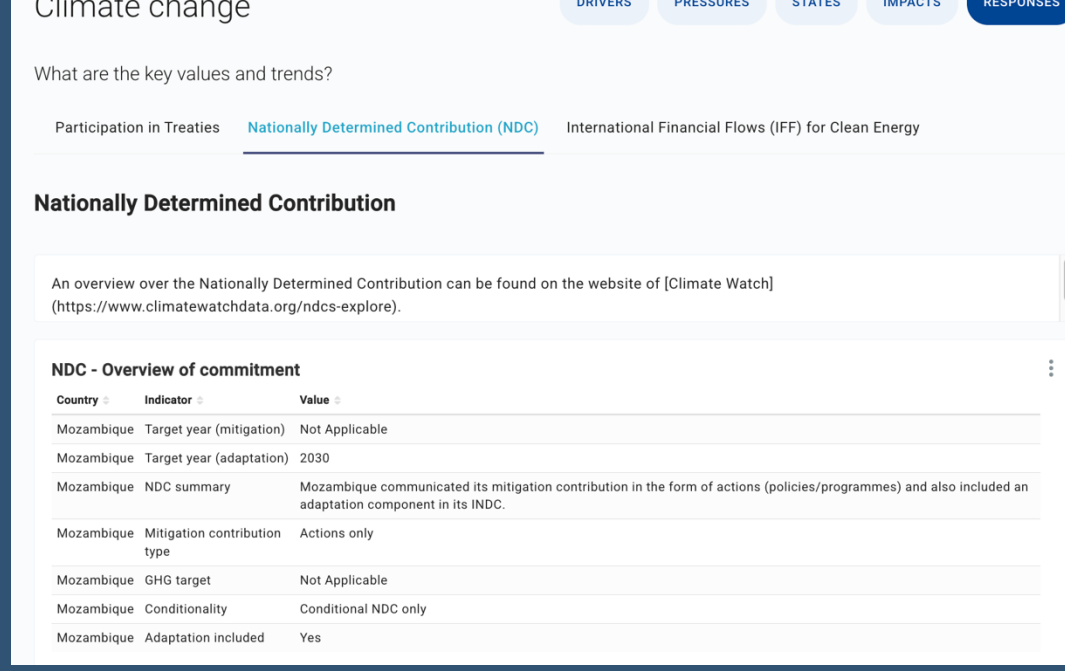
Forest area as a proportion of total land area
Unit: %

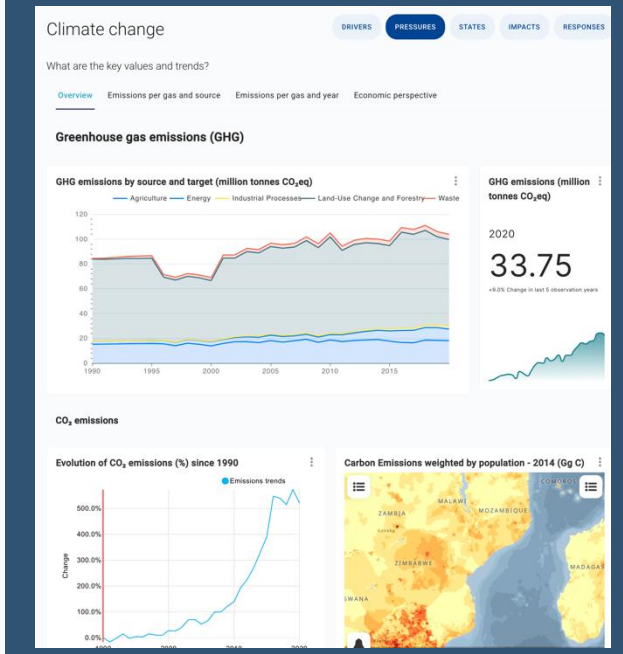
Country	First Year	Latest Year	Minimum Value	Maximum Value	Latest Value	Trend
Afghanistan	2000	2020	1.85	1.85	1.85	
Africa	2000	2020	21.28	23.73	21.28	
Albania	2000	2020	28.08	28.8	28.79	
Algeria	2000	2020	0.66	0.82	0.82	
American Samoa	2000	2020	85.65	88.65	85.65	
Americas	2000	2020	41.31	43.3	41.31	
Andorra	2000	2020	34.04	34.04	34.04	
Angola	2000	2020	53.43	62.33	53.43	
Anguilla	2000	2020	61.11	61.11	61.11	
Antigua and Barbuda	2000	2020	18.45	21.48	18.45	
Argentina	2000	2020	10.44	12.2	10.44	
Armenia	2000	2020	11.54	11.68	11.54	
Aruba	2000	2020	2.33	2.33	2.33	

On-line, but not yet public

EC Interactive Country Fiches – Environmental Platform (46 countries, 450 indicators per country) https://dicf.unepgrid.ch/

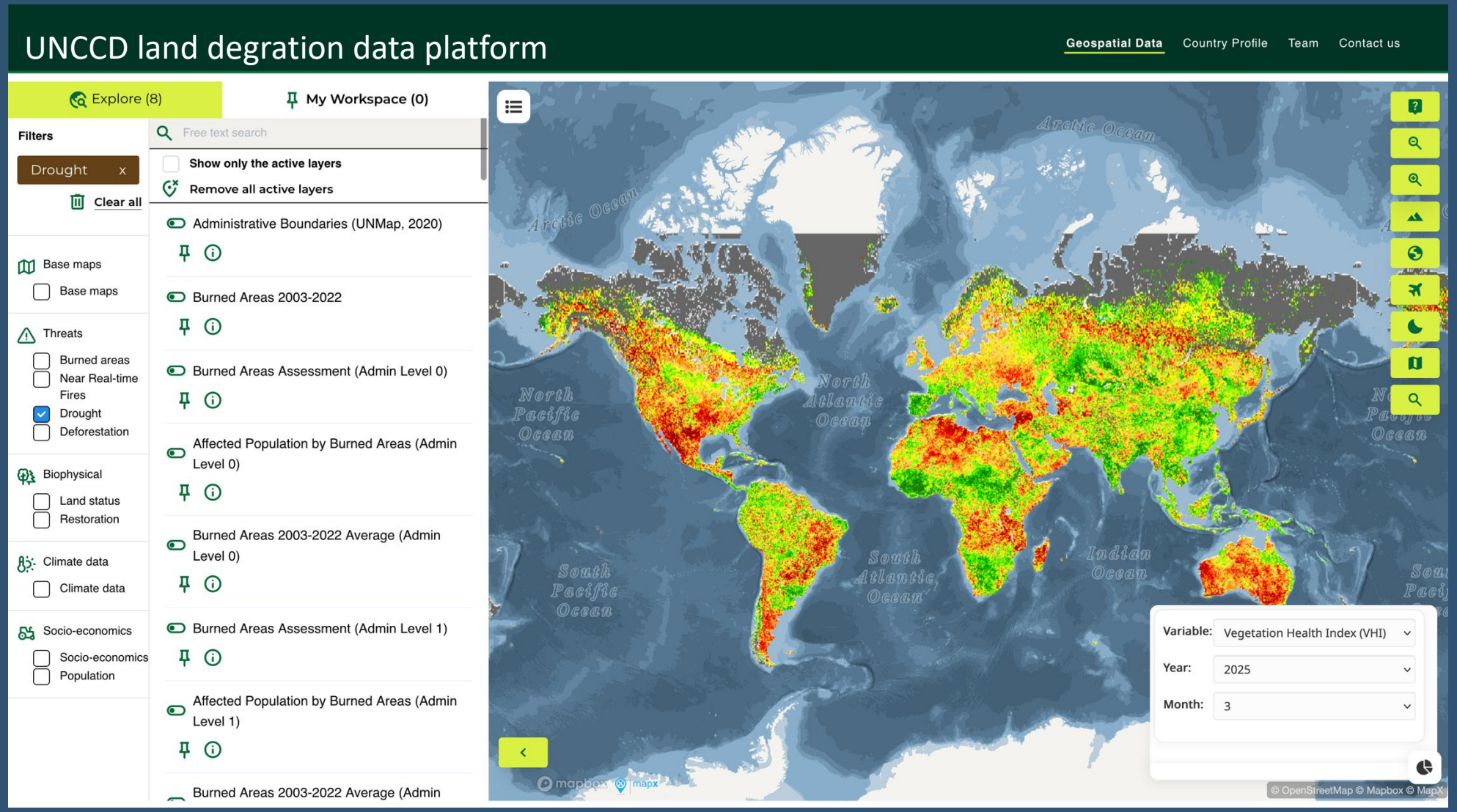




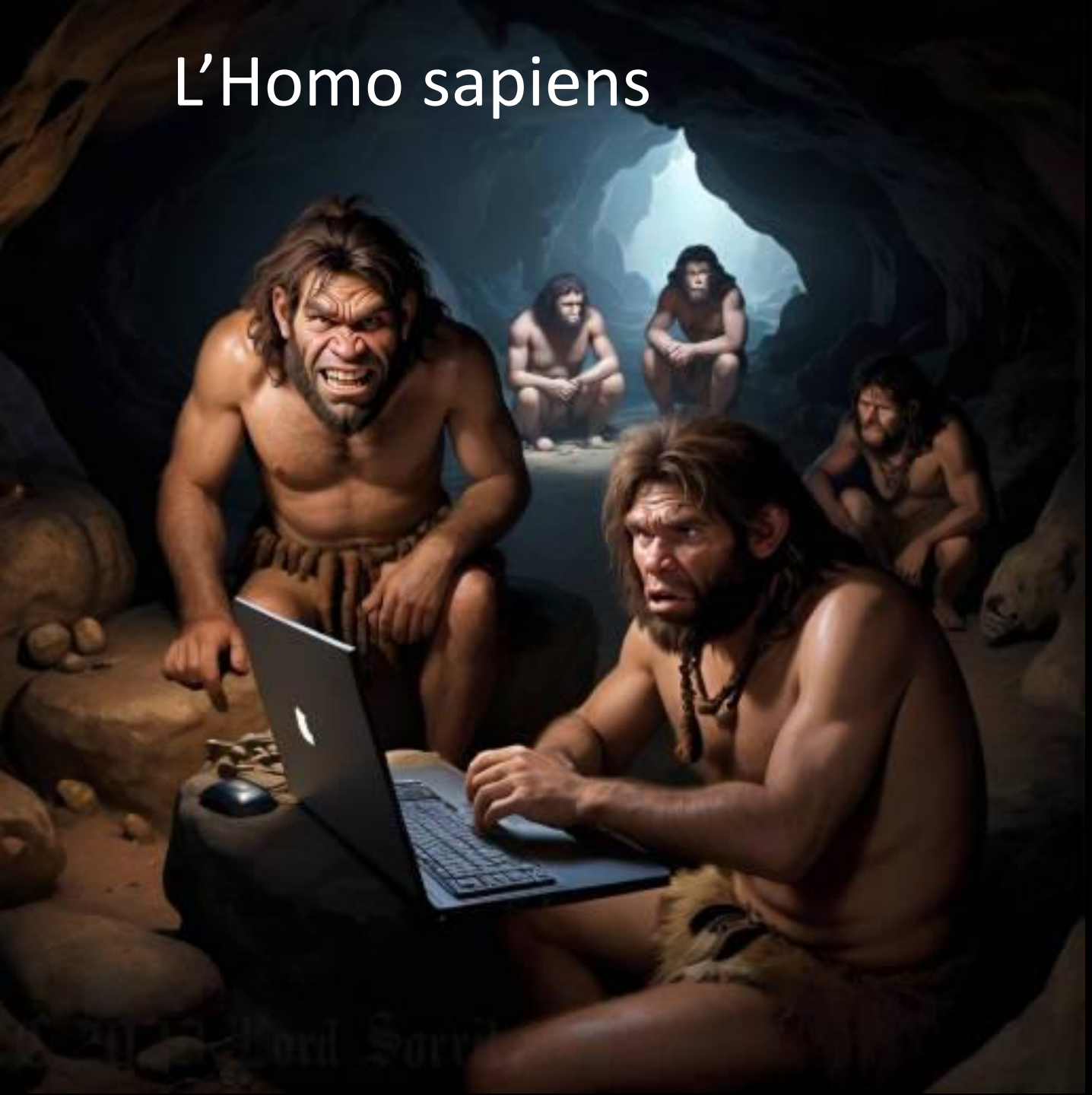


UN environment programme
GRID Geneva

UNCCD data platform, covering all member states on land degradation

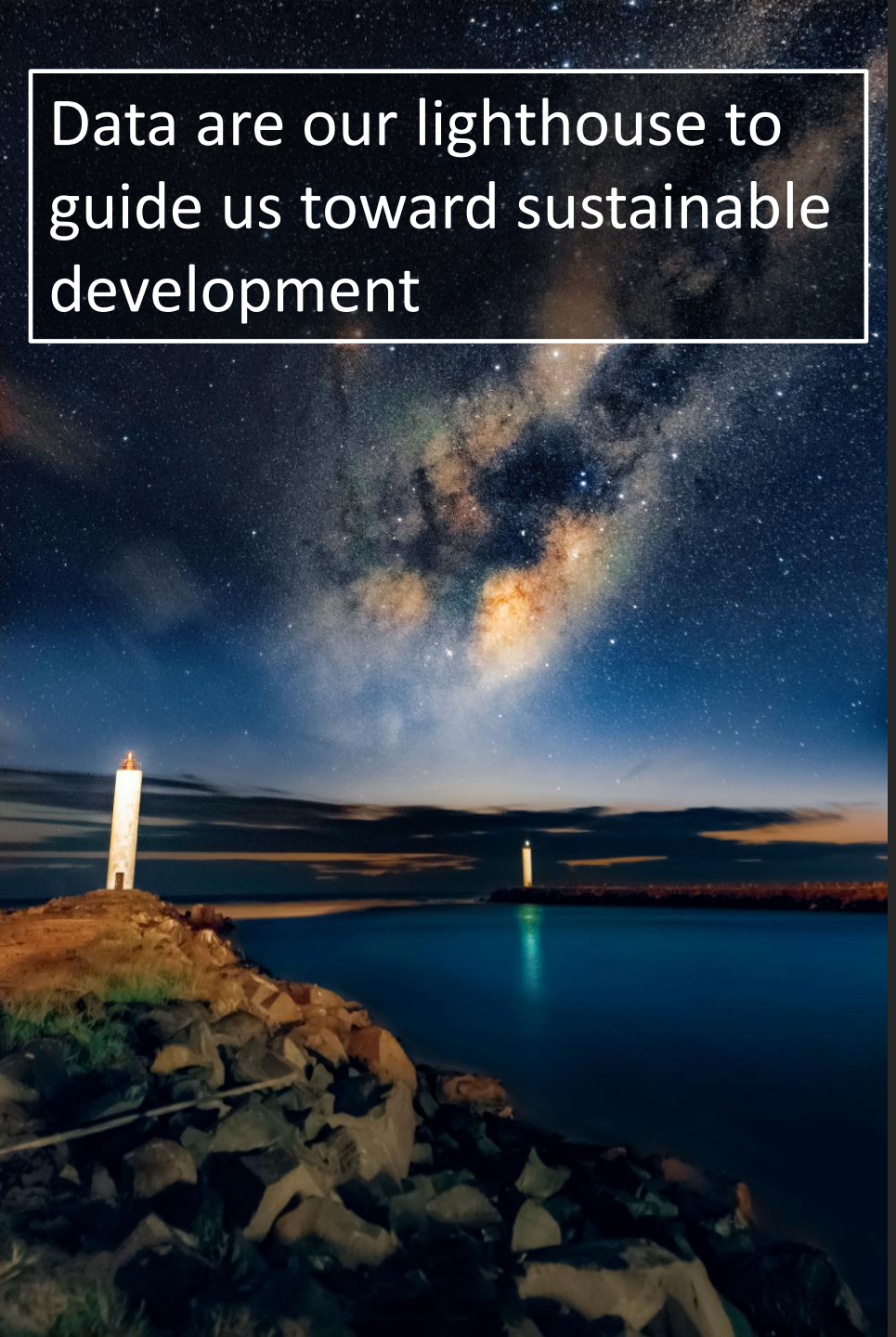


L’Homo sapiens



Bottom line:
We have the brain of a cavemen, but we are dealing with 21st century issues.

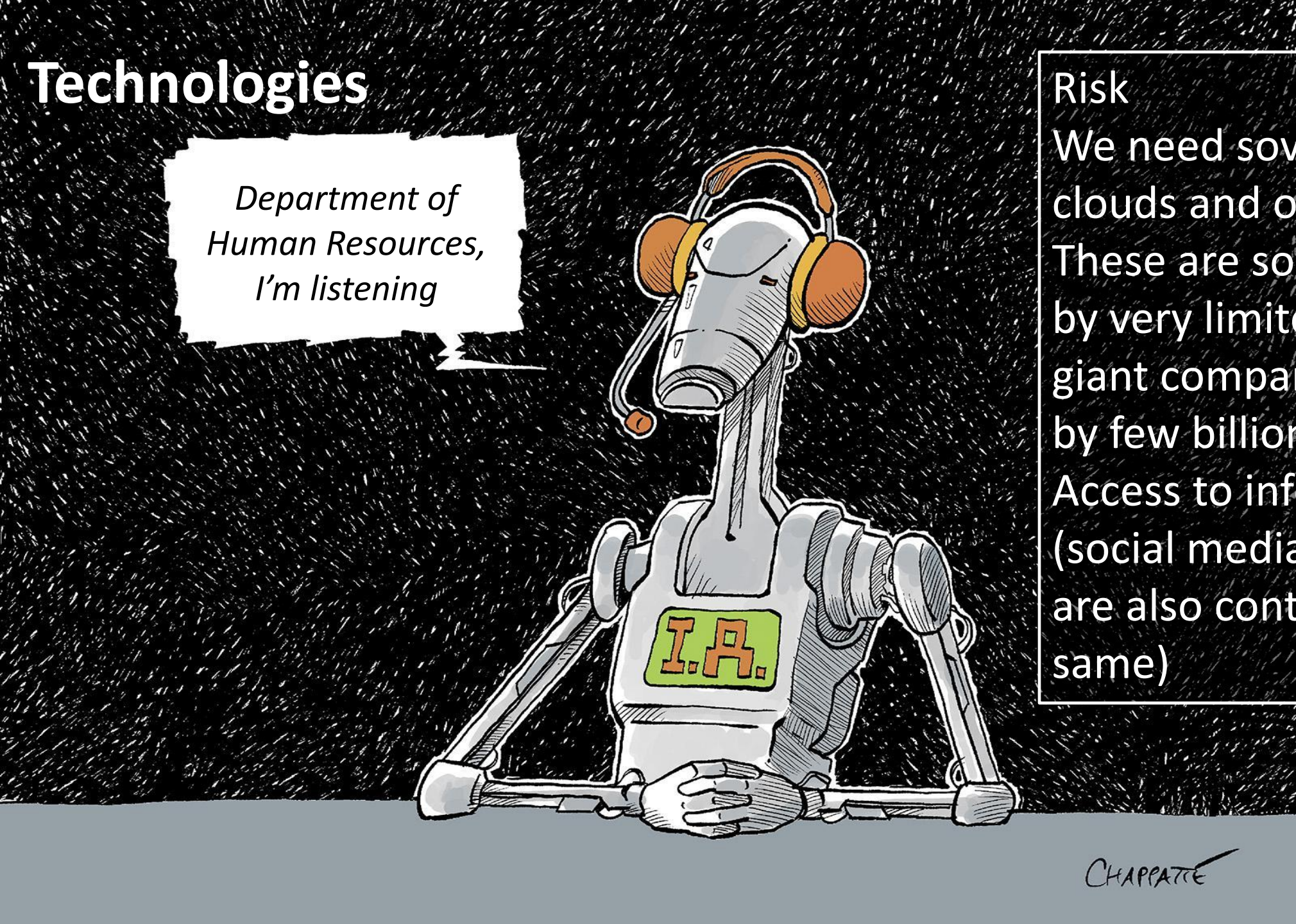
- Our brain is optimised for solving issues from 200,000 years ago… when chased by a mammoth, we run.
- We are prioritising short-term over long terms.
- We are il-equipped for slow onset / continuous hazards (e.g. biodiversity loss, pollution, climate change, deforestation,...



Challenges

- We never had so many data, but we never had so many challenges
- Monitoring and forecasting doesn’t solve the problem, need to connect data to actions (i.e. used data).
- Data are costly, we need open access for essential data. Meaning public funds (or private but as donnation) to keep data in the public open. Risk of data privatisation by geant industry, which we need for common good.
- We need data to debunk Fake news with facts.
- We need to inform many stakeholders (government, economy, education, media, general public, industries,…)
- Digital divide: access of data from the Global South
- Yet, we have enough data to take decisions

Technologies



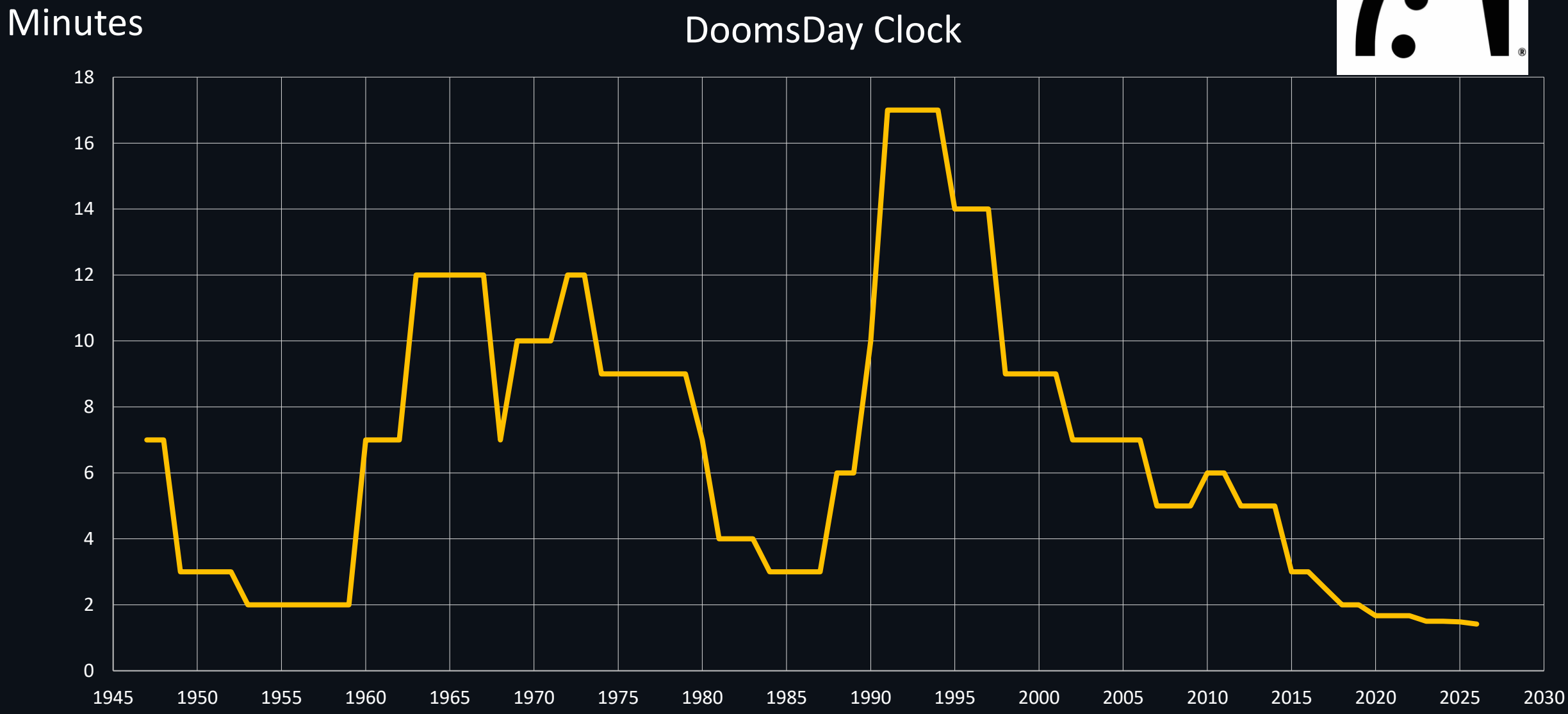
Risk

We need sovereignty on clouds and on A.I.

These are so far controled by very limited limited of giant companies, owned by few billionaires.

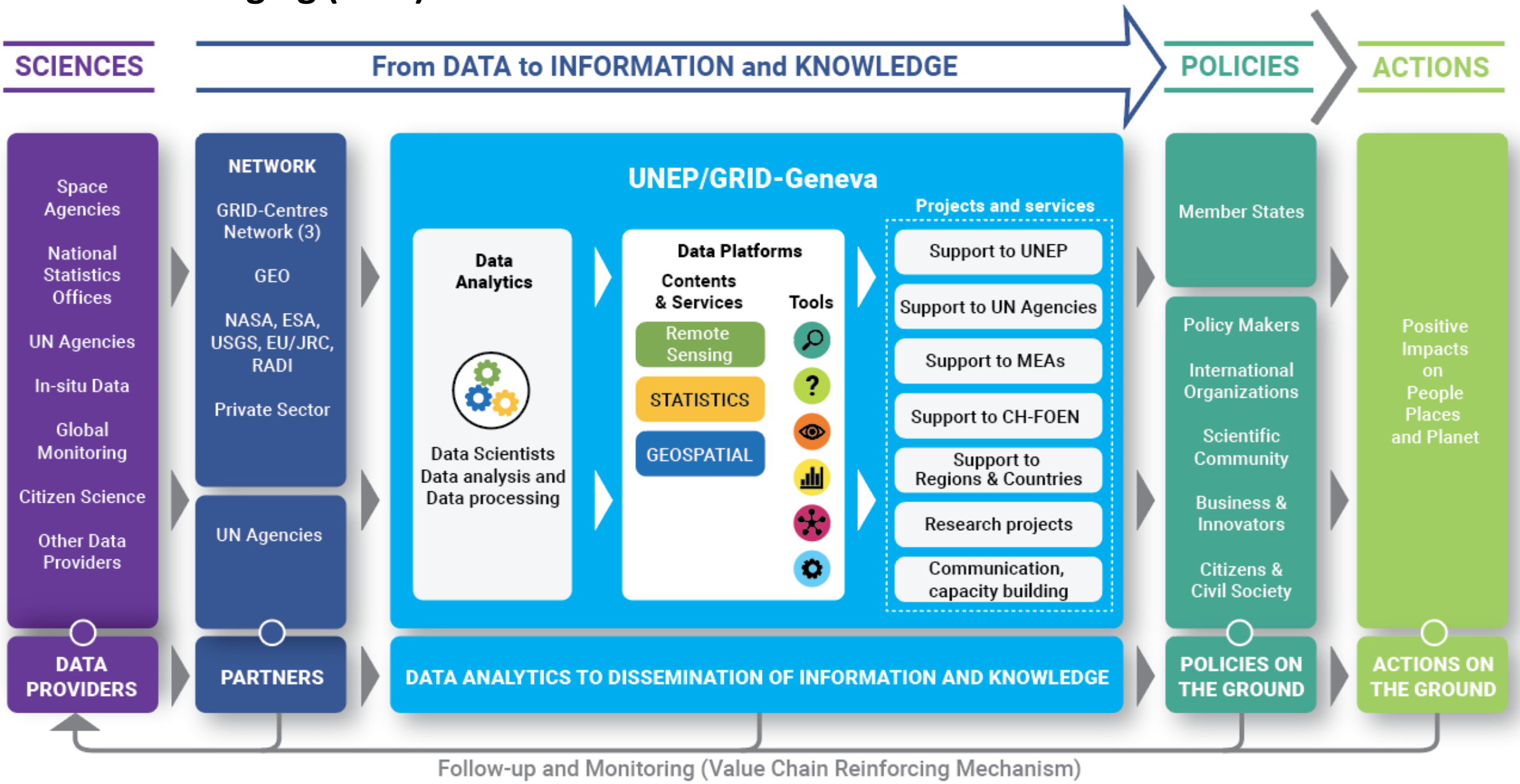
Access to information (social media and media) are also controled by the same)

Time is ticking: It is midnight minus 85 sec

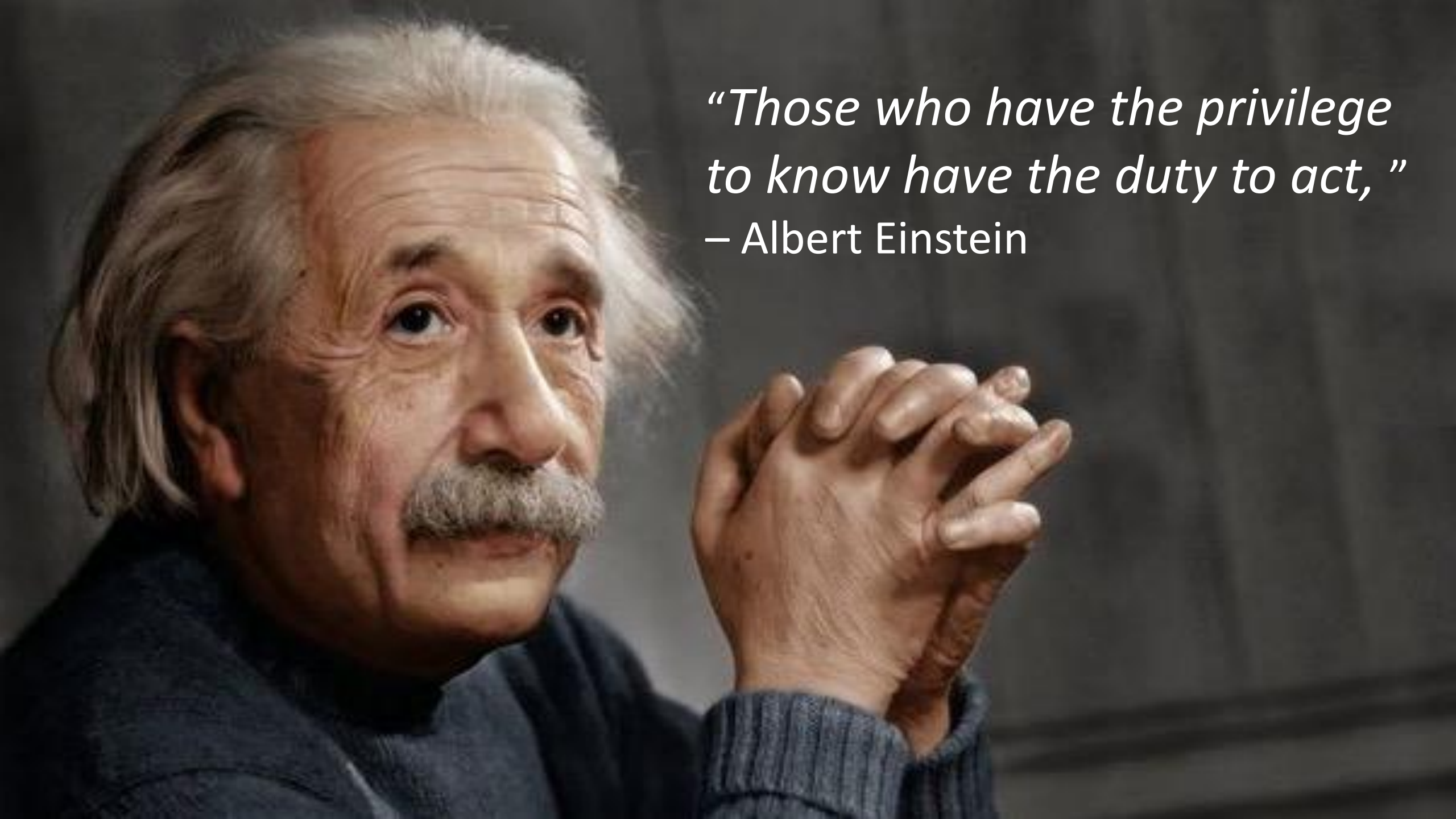


Data source: Bulletin of the atomic sientists

Our role: bridging (data) Science to Policies



We need to transform data to knowledge and then to connect knowledge to actions


“Those who have the privilege to know have the duty to act, ”
– Albert Einstein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