Using Ocean Color to Report on Sustainable Development Goal 14

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NOCCG Seminar

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Group on Earth Observations
An Overview

What is GEO?

GEO is an intergovernmental organization working to improve the availability, access and use of Earth observations for the benefit of society.

GEO GROUP ON EARTH OBSERVATIONS

@GEOSEC2025
www.earthobservations.org

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Group on Earth Observations Priorities

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

UN World Conference on
Disaster Risk Reduction
2015 Sendai Japan

- Biodiversity and Ecosystem Sustainability
- Disaster Resilience
- Energy and Mineral Resource Management
- Food Security and Sustainable Agriculture
- Public Health Surveillance
- Infrastructure and Transport Management
- Sustainable Urban Development
- Water Resources Management

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The GEO Work Programme

GEO Flagships

GEO Biodiversity Observation Network GEO BON	GEO Global Agricultural Monitoring GEOGLAM	Global Forest Observation Initiative GFOI	Global Observation System for Mercury GOS4M

GEO Initiatives

AquaWatch AQUAWATCH	Data Access for Risk Management GEO-DARMA	Data Integration and Analysis System DIAS	Earth Observations for Ecosystem Accounting EO4EA	Earth Observations for Health EO4HEALTH	Earth Observations for the Sustainable Development Goals EO4SDG
GEO Capacity Building in North Africa, Middle East, Balkans and Black Sea Region GEO-CRADLE	GEO Global Water Sustainability GEOGLOWS	GEO Human Planet HUMAN-PLANET	GEO Land Degradation Neutrality GEO-LDN	GEO Vision for Energy GEO-VENER	GEO Wetlands GEO-WETLANDS
Geohazard Supersites and Natural Laboratories GSNL	Global Drought Information System GDIS	Global Network for Observations and Information in Mountain Environments GEO-GNOME	Global Observation System for Persistent Organic Pollutants GOS4POPS	Global Urban Observation and Information GUOI	Global Wildfire Information System GWIS
Oceans and Society: Blue Planet BLUE-PLANET					

BLUE PLANET

GEO Blue Planet Mission

Advance and exploit synergies among the many observational programmes devoted to ocean and coastal waters

Improve engagement with a variety of stakeholders for enhancing the timeliness, quality and range of services delivered

Raise awareness of the societal benefits of ocean observations at the public and policy levels.

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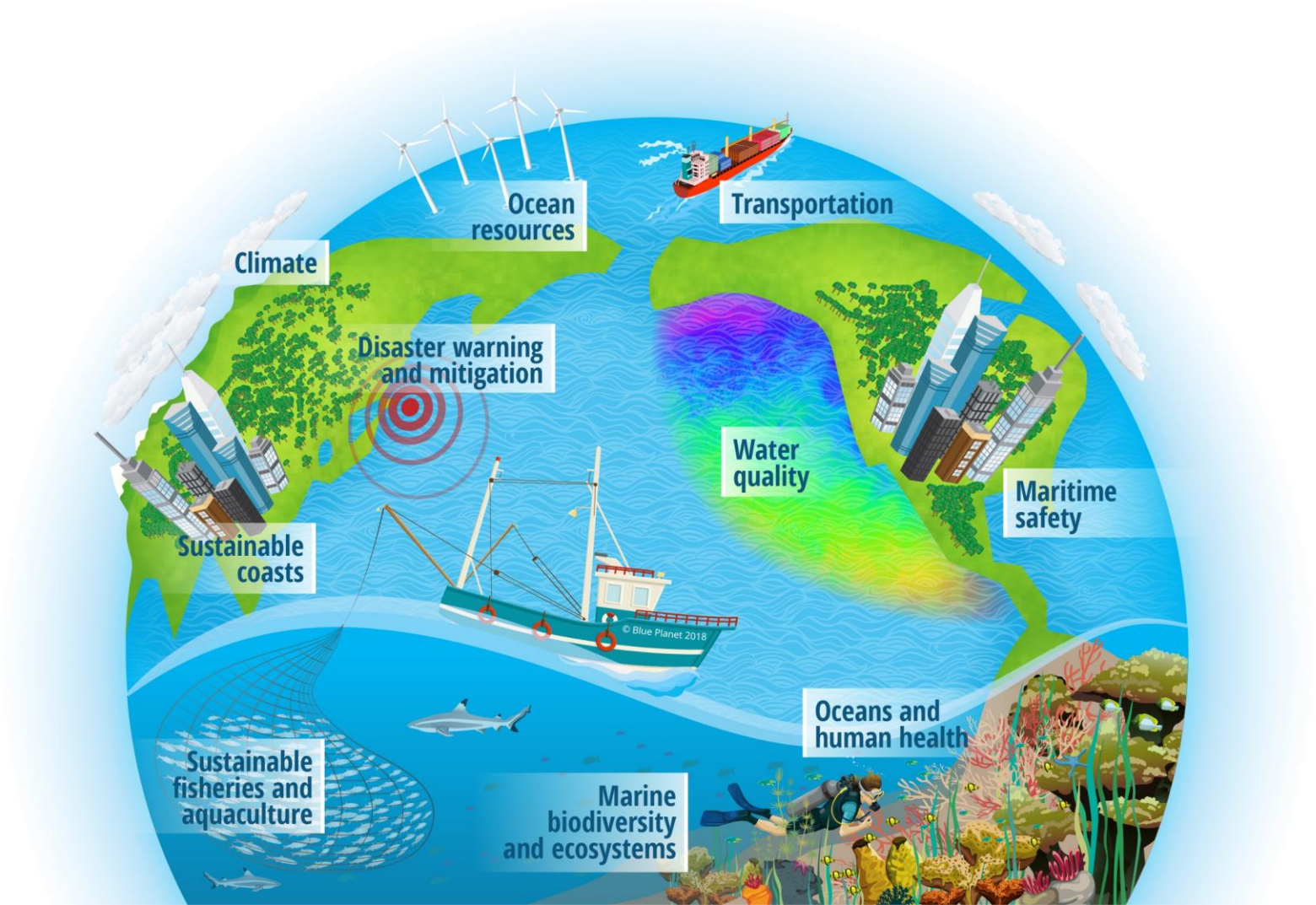
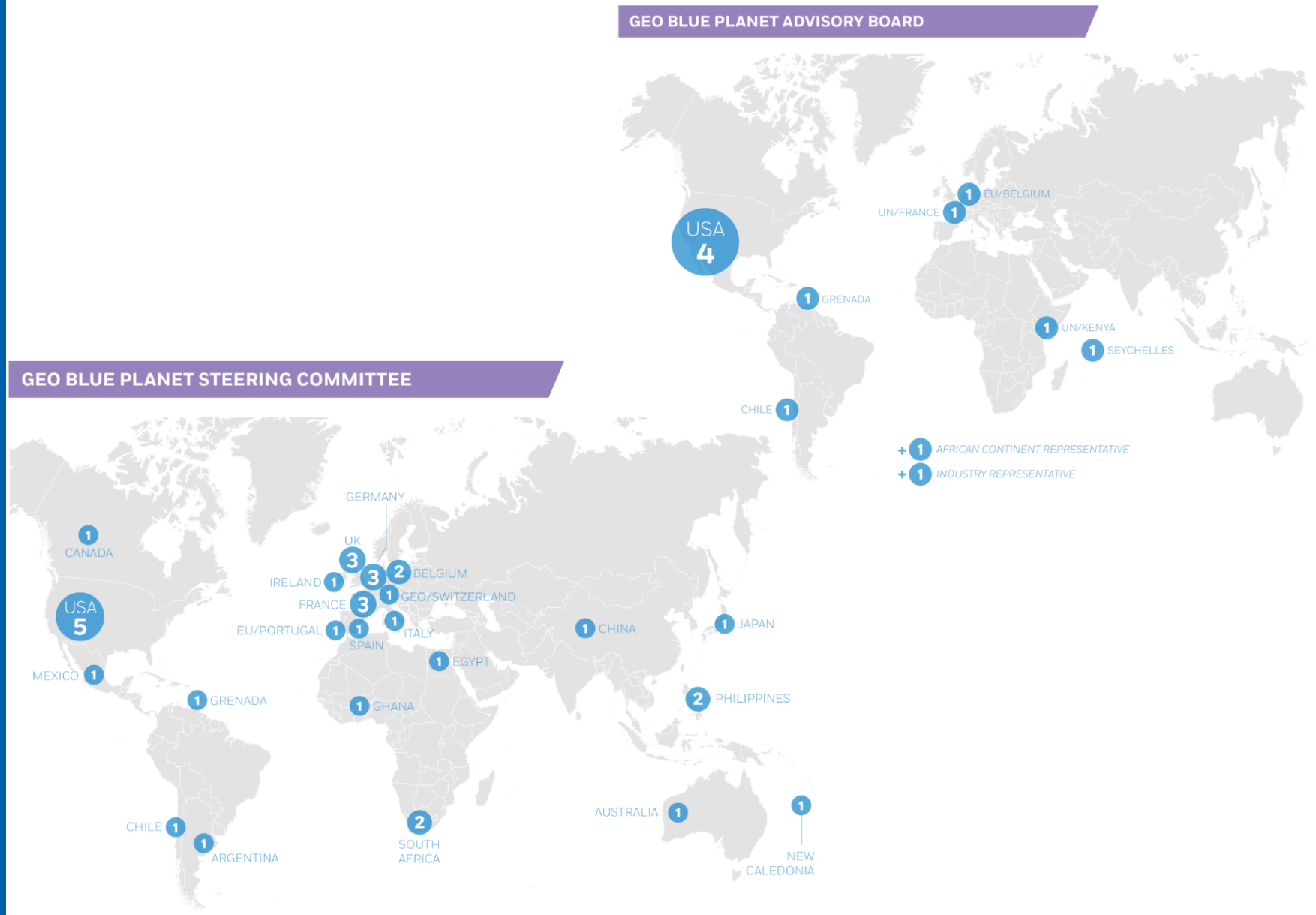
Linking Ocean and Coastal Information with Society



Who is GEO Blue Planet?

A global network of ocean and coastal observer, social scientists and end-user representatives from a variety of stakeholder groups including international and regional organizations, NGOs, national institutes, universities and government agencies.

Advisory Board & Steering Committee



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Secretariat

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What does GEO Blue Planet Do?

GEO Blue Planet promotes, partners and leads activities that support the initiative's mission

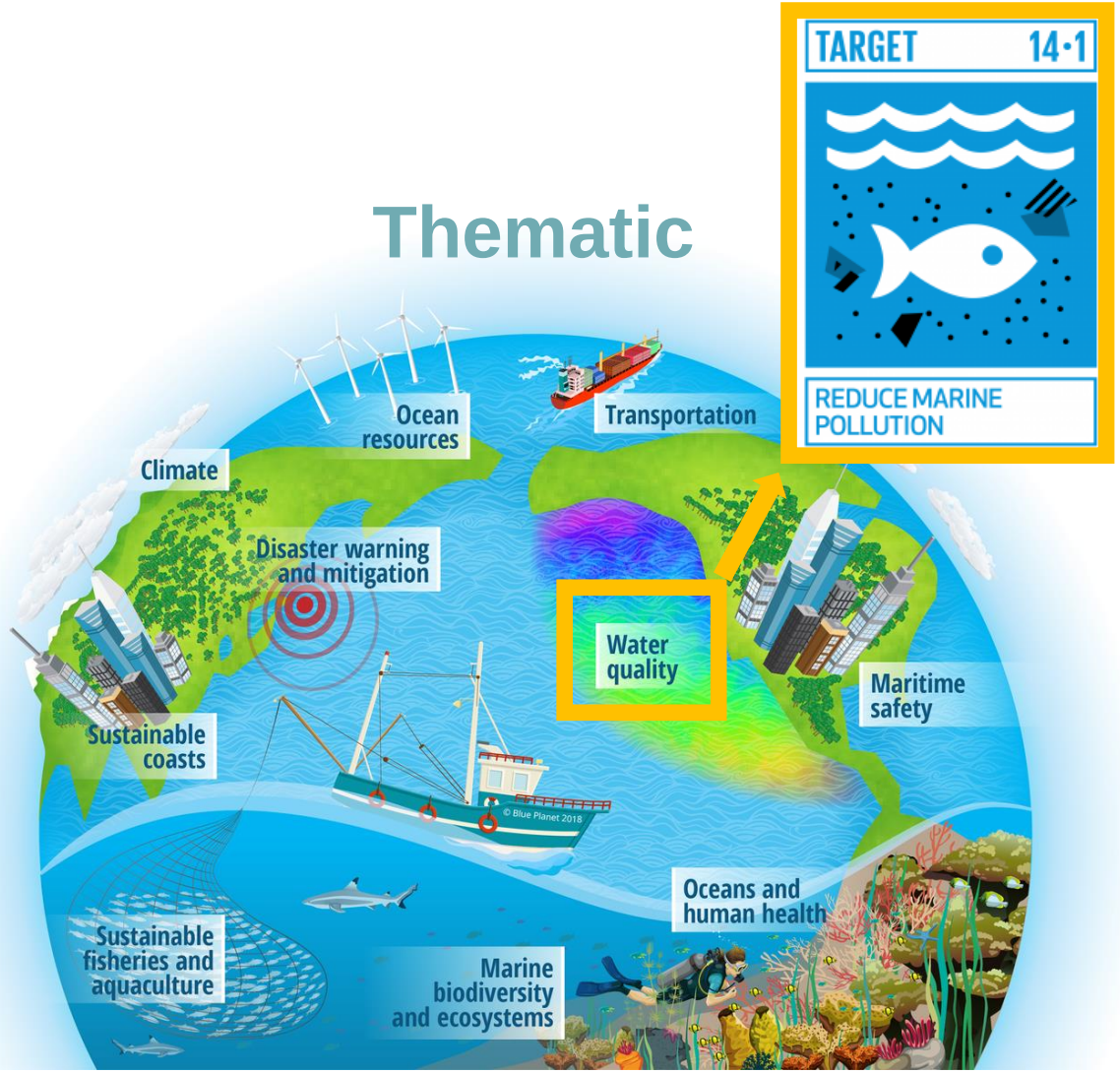
Cross-Cutting

Capacity Development

Observations, Data and Products

Stakeholder Engagement and Societal Awareness

Thematic



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About the SDGs

17 Sustainable Development Goals (SDGs)

169 targets

244 indicators

https://unstats.un.org/sdgs/indicators/indicators-list/

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SDG Indicator Framework

- SDG **Goals and Targets were set by Member States** with the adoption of the 2030 Agenda for Sustainable Development (2015).

- The General Assembly tasked the **UN Statistical Commission** with developing a monitoring framework.

- **Inter-Agency and Expert Group on the SDG Indicators (IAEG-SDG)**, 30 member state members, established to develop the indicator framework.

- IAEG-SDG agreed on a framework of 244 indicators and designated **UN agencies as custodians of the various indicators**. (adopted by UN General Assembly in 2017).

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SDG 14 Targets

- 14.1: Reduce marine pollution
- 14.2: Protect and restore ecosystems
- 14.3: Reduce ocean acidification
- 14.4: Sustainable fishing
- 14.5: Conserve coastal and marine areas
- 14.6: End subsides contributing to illegal fishing
- 14.7: Increase the economic benefits from sustainable use of marine resources
- 14.A: Increase scientific knowledge, research and technology for ocean health
- 14.B: Support small scale fishers
- 14.C: Implement and enforce international sea law

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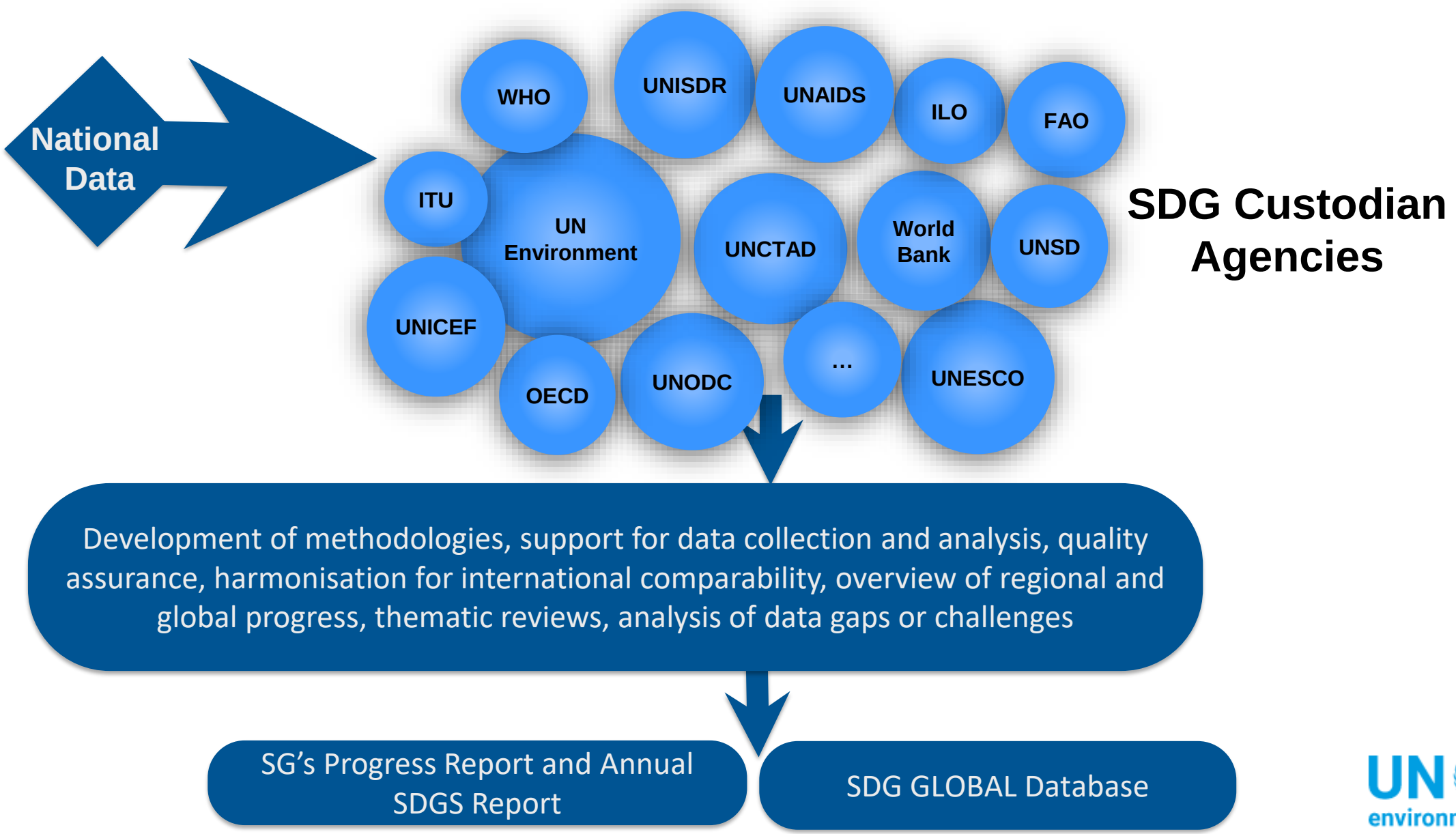
SDG 14 Indicators

Targets	Indicators
14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	**14.1.1** Index of coastal eutrophication and floating plastic debris density
14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	**14.2.1** Proportion of national exclusive economic zones managed using ecosystem-based approaches
14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	**14.3.1** Average marine acidity (pH) measured at agreed suite of representative sampling stations

Reporting on the SDG Indicators



Take Home Points for SDG Indicator Reporting

- IAEG-SDG designated a **custodian agency** for each indicator, responsible for:
  - Developing methodology (for Tier III)
  - Designing a data collection and reporting system for the indicator (national data or international sources)
  - Supporting improved capacity for data use and analysis
  - Regional and Global aggregation and harmonization of data
  - Reporting the data to the Global SDGs Database
  - Analysis of trends at regional and global levels for Annual SG's Report, SDGs Progress Report and thematic reviews

Take Home Points for SDG Indicator Reporting

- Indicator data needs to be a **single number per country per year**
- Only data that is **globally comparable** can be used
- Data that goes into **the SDG Global Database** can only be shared by custodian agencies which have a methodology which has been adopted by the IAEG-SDG.

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Indicator Tiers

- **Tier 1**: Indicator is conceptually clear, has an internationally established methodology and standards are available, and data are regularly produced by countries for at least 50 per cent of countries and of the population in every region where the indicator is relevant.

- **Tier 2:** Indicator is conceptually clear, has an internationally established methodology and standards are available, but data are not regularly produced by countries.

- **Tier 3:** No internationally established methodology or standards are yet available for the indicator, but methodology/standards are being (or will be) developed or tested.

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Indicator 14.1.1

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- **14.1.1a:** Index of Coastal Eutrophication (ICEP)

- **14.1.1b:** Floating plastic debris density

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Methodology for 14.1.1a: Index of Coastal Eutrophication

- **Level 1:** Global Indicators
  - National Contribution to the Index of Coastal Eutrophication Potential
  - Chlorophyll-a deviations

- **Level 2:** National Indicators
  - Chlorophyl-A concentration
  - National modelling of coastal eutrophication potential
  - In-situ concentration of nitrogen, phosphate and silica

- **Level 3:** Supplementary Indicators
  - The in situ indicators from 6.3.2 (proportion of bodies of water with good ambient water quality) for rivers
  - Other in situ and biological indicators

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Methodology for 14.1.1a: Index of Coastal Eutrophication

Monitoring parameters	Level 1	Level 2	Level 3
ICEP global modelling (N and P loading)	X		
Chlorophyll-a deviations (remote sensing)	X		
Chlorophyll-a concentration (remote sensing and in situ)		X	
ICEP national modelling		X	
Total Nitrogen of DIN (dissolved inorganic nitrogen)		X	
Total Phosphorus or DIP (dissolved inorganic phosphorus)		X	
Total silica		X	
Dissolved oxygen			X
Biological/chemical oxygen demand (BOD/COD)			X
Total organic carbon (TOC)			X
Turbidity (remote sensing)			X
River parameters from SDG 6.3.2			X
Other water parameters (O_2 % saturation, Secchi depth, river discharge, salinity, temperature, pH, alkalinity, organic carbon, toxic metals, persistent organic pollutants)			X
Microalgal growth, harmful algal blooms, submerged aquatic vegetation coverage, biodiversity and hypoxia			X

Chlorophyll-a Deviations (Remote Sensing)

1. Percentage of coastal zone with Chl-a deviations

- ESA Ocean Colour CCI (OC_CCI) product, led by the Plymouth Marine Laboratory (PML): consistent, merged chlorophyll-a product from SeaWiFS, MODIS, MERIS and VIIRS, spanning 1997 to 2018.

2. Intra-annual coastal zone chloryphyll-A anomalies

- NOAA VIIRS chlorophyll-a anomaly products: 1) the difference anomaly and 2) the anomaly ratio, both calculated using a running 61-day Chl-a median.

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Percentage of Coastal zone with Chl-a Devations

1. Reporting year v.s. baseline from 2000 – 2004 using

Month	Pixel longitude	Pixel latitude	Monthly Average Chl a 2000	Monthly Average Chl a 2001	Monthly Average Chl a 2002	Monthly Average Chl a 2003	Monthly Average Chl a 2004	Baseline Chl a (average of 2000-2004)	2018 monthly average Chl a
Month	XXXX	XXXX	XX mg/m3	XX mg/m3	XX mg/m3	XX mg/m3	XX mg/m3	XX mg/m3	XX mg/m3

Magnitude of Chlorophyll-a Deviation = $\frac{(\beta - \gamma)}{\beta}$ x 100

Where β = the average monthly pixel chlorophyll-a 2000-2004

Where γ = the average monthly pixel chlorophyll-a for the reporting year

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Percentage of Coastal zone with Chl-a Deviations

2. Percentage of coastal zone with Chl-a deviations greater than 50%

Reporting year	Percentage of Pixels with Chl-a Deviations > 50%
2019	X%

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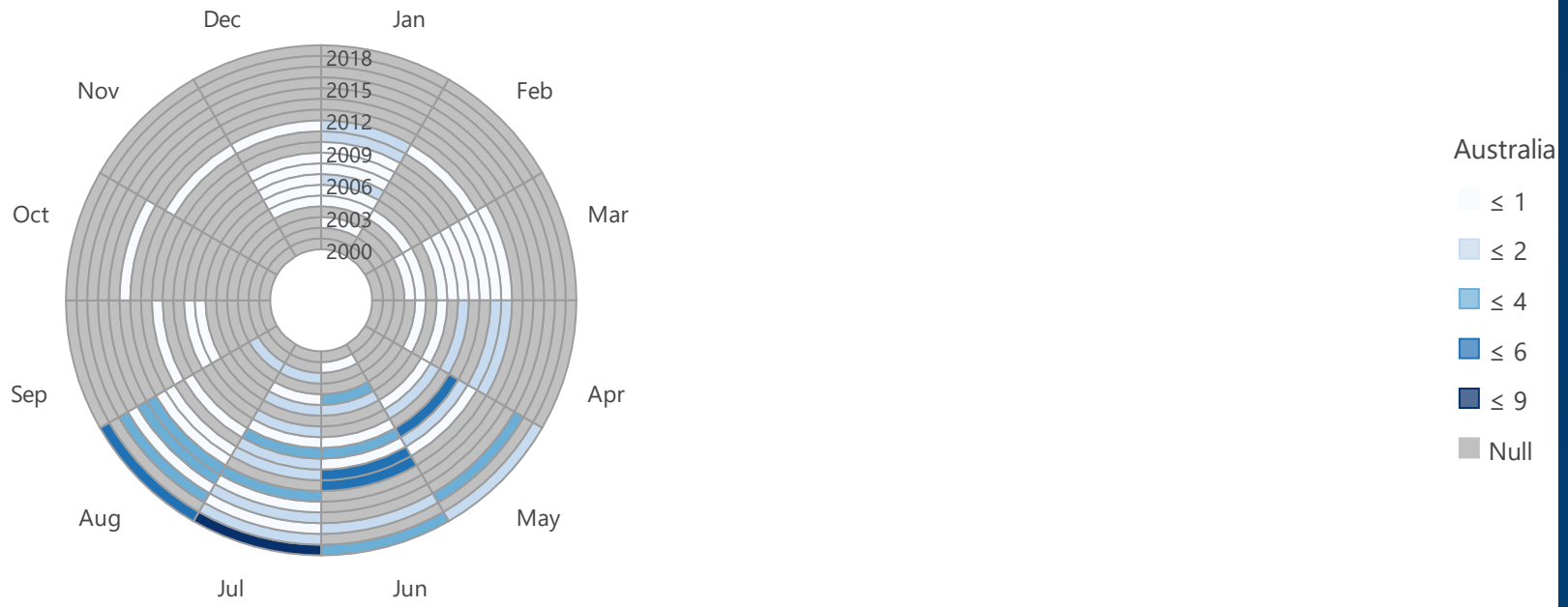
Test Country Summary Results

chlor-a processing for SDG 14.1

Processing Steps

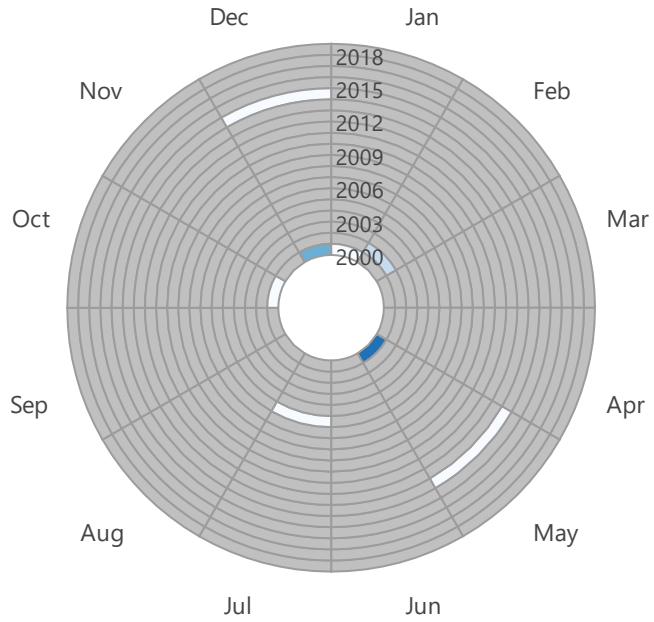
- 1. Reclassify Data
- 2. Create Results Table
- 3. Zonal Stats per EEZ Summary
- 4. Fix Date Info
- 5. Remove Fields from High
- 6. Add Join Code
- 7. Join and Summarize
- 8. Produce Excel Report Table

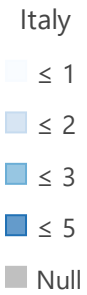
Change in number of HIGH COUNT pixels by Months/Years



Pixel values >= 50 within the EEZ boundary were counted for each month.

Change in number of HIGH COUNT pixels by Months/Years





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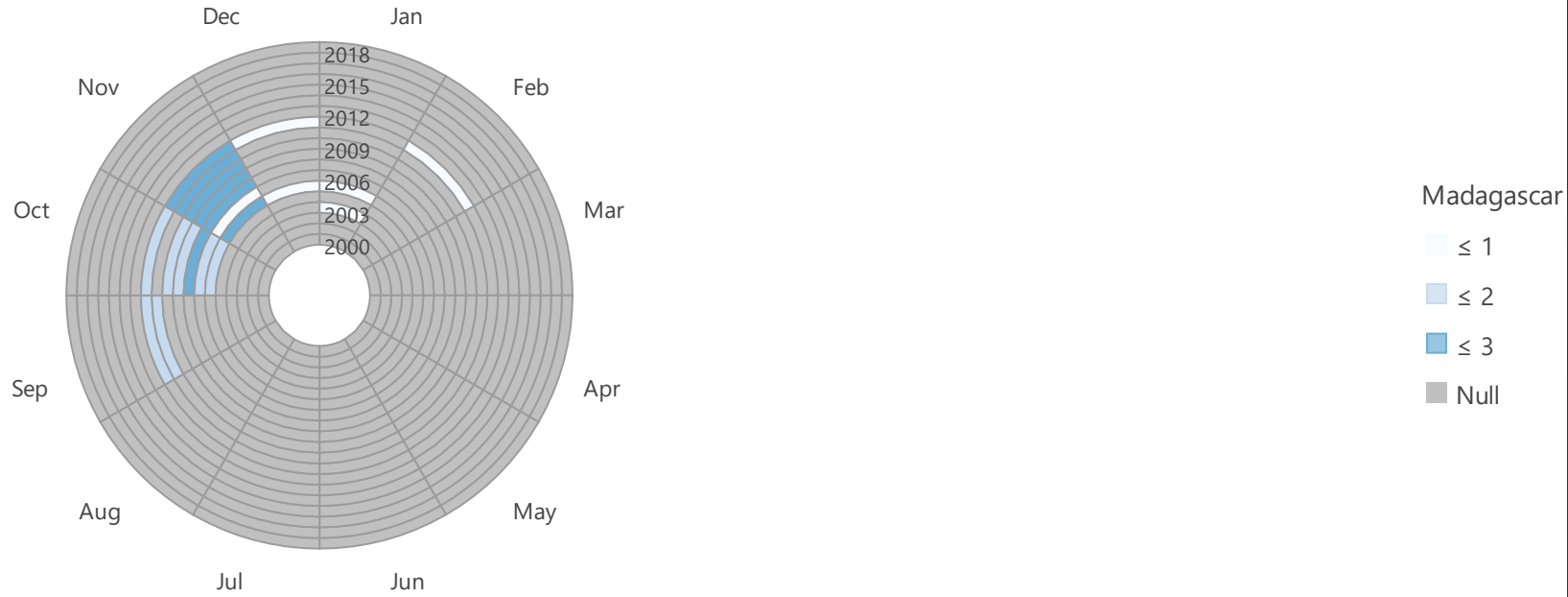

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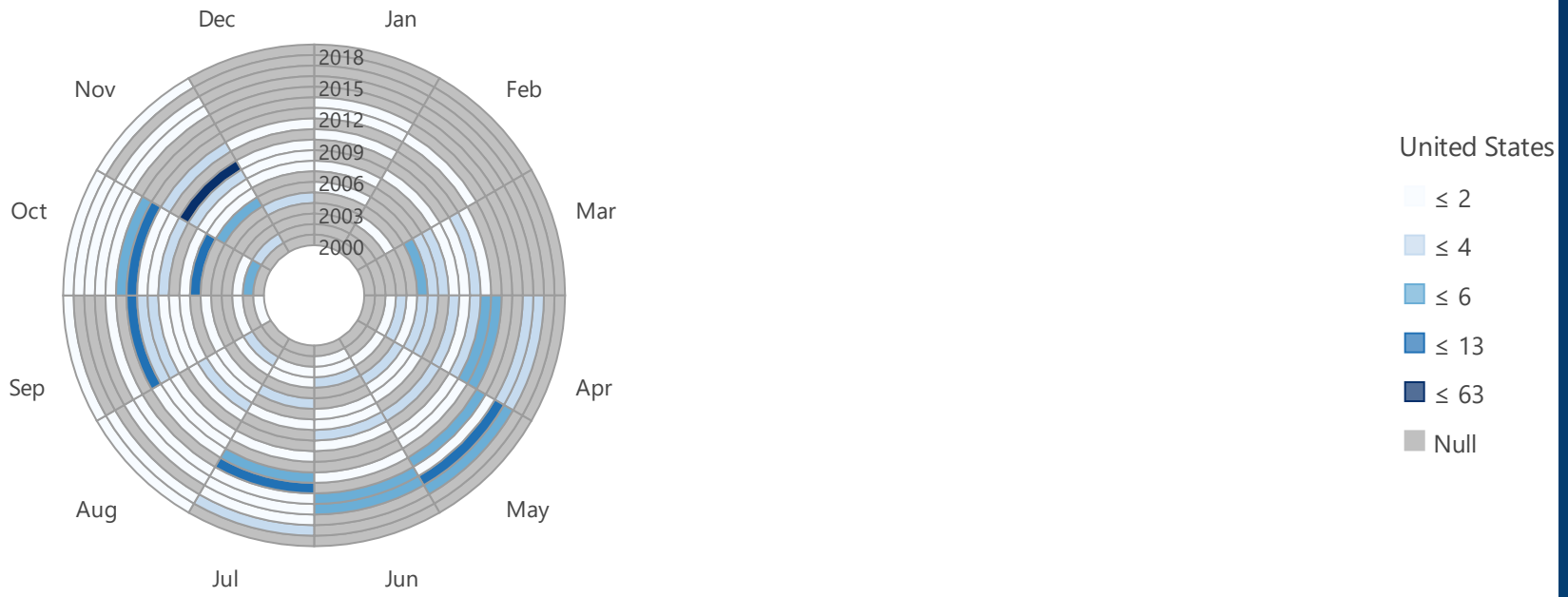


Pixel values >= 50 within the EEZ boundary were counted for each month.

Summary Table Info

COUNT = total Number of pixels that fall within the EEZ for that month

MIN, MAX, RANGE, MEAN, STD and SUM = the statistics about the pixels within the EEZ

HIGH COUNT = number of pixels that are greater than or equal to 50 for that month within EEZ

Impact Percentage = HIGH COUNT /COUNT * 100

Blank/Null HIGH COUNT and HIGH AREA reflects that there were no pixels that met the criteria of greater than or equal to 50.

COUNT varies per month as there are sometimes holidays/gaps in the data that are represented as empty pixels with no data

OBJECTID	GeoName	ZONE_CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	Date	HIGH_COUNT	HIGH_AREA	Impact Percentage
1	Madagascan Exclusive Economic Zone	1	58527	101.6093836	0.014513364	18.06588936	18.05137599	0.174902795	0.41396758	10236.53588	2000-01-01 0:00:00			
2	Italian Exclusive Economic Zone	2	32056	55.6527825	0.103104703	55.07287598	54.96977127	0.43830005	0.987480846	14050.14641	2000-01-01 0:00:00	1	0.001736111	0.003119541
3	Australian Exclusive Economic Zone	3	358772	622.8681084	0.00712021	16.92240143	16.91528122	0.231458648	0.411360849	83040.88207	2000-01-01 0:00:00			
4	United States West Coast Exclusive Economic Zone	4	48796	84.71528496	0.084403925	15.57557964	15.49117572	0.477904213	0.45750791	23319.81399	2000-01-01 0:00:00			
5	Madagascan Exclusive Economic Zone	1	55807	96.88716099	0.00828803	14.36737633	14.3590883	0.220927489	0.451141883	12329.30037	2000-02-01 0:00:00			
6	Italian Exclusive Economic Zone	2	32163	55.8385464	0.1841591	40.42355728	40.23939818	0.413459059	0.778080104	13298.0837	2000-02-01 0:00:00			
7	Australian Exclusive Economic Zone	3	330958	574.5799098	0.004038058	16.987257	16.98321895	0.219462208	0.369381054	72632.77342	2000-02-01 0:00:00			
8	United States West Coast Exclusive Economic Zone	4	49031	85.1232711	0.054890774	9.10358429	9.048693515	0.45660246	0.429525047	22387.67521	2000-02-01 0:00:00			
9	Madagascan Exclusive Economic Zone	1	58317	101.2448002	0.011256457	37.10297012	37.09171367	0.224193573	0.480271008	13074.2966	2000-03-01 0:00:00			
10	Italian Exclusive Economic Zone	2	32171	55.85243529	0.11245466	5.712643623	5.600188963	0.374239936	0.276582977	12039.67299	2000-03-01 0:00:00			
11	Australian Exclusive Economic Zone	3	361812	628.1458866	0.010255216	24.61131096	24.60105574	0.272196124	0.571515523	98483.82384	2000-03-01 0:00:00			
12	United States West Coast Exclusive Economic Zone	4	49226	85.4618128	0.083289556	14.20597553	14.12268598	0.575008242	0.622438037	28305.35574	2000-03-01 0:00:00			
13	Madagascan Exclusive Economic Zone	1	59292	102.9375087	0.029237028	17.86920929	17.83997226	0.2072516	0.463781015	12288.36186	2000-04-01 0:00:00			
14	Italian Exclusive Economic Zone	2	32183	55.87326863	0.078819513	19.59562302	19.5168035	0.347764919	0.446831685	11192.1184	2000-04-01 0:00:00			
15	Australian Exclusive Economic Zone	3	358225	621.9184555	0.005104794	16.65903664	16.65393184	0.259910381	0.448410978	93106.39625	2000-04-01 0:00:00			
16	United States West Coast Exclusive Economic Zone	4	48961	85.00174332	0.058052942	24.54929161	24.49123867	0.557561578	0.823979611	27298.77241	2000-04-01 0:00:00			
17	Madagascan Exclusive Economic Zone	1	59494	103.2882032	0.01565001	16.65154457	16.63589456	0.210807695	0.4768248	12541.79302	2000-05-01 0:00:00			
18	Italian Exclusive Economic Zone	2	32228	55.95139363	0.046410341	81.70737457	81.66096423	0.29017943	1.479814198	9351.90267	2000-05-01 0:00:00	5	0.008680556	0.015514459
19	Australian Exclusive Economic Zone	3	358756	622.8493306	0.014148913	18.44133118	18.39718226	0.305166825	0.4188851	109458.9942	2000-05-01 0:00:00			

Italy January 2000

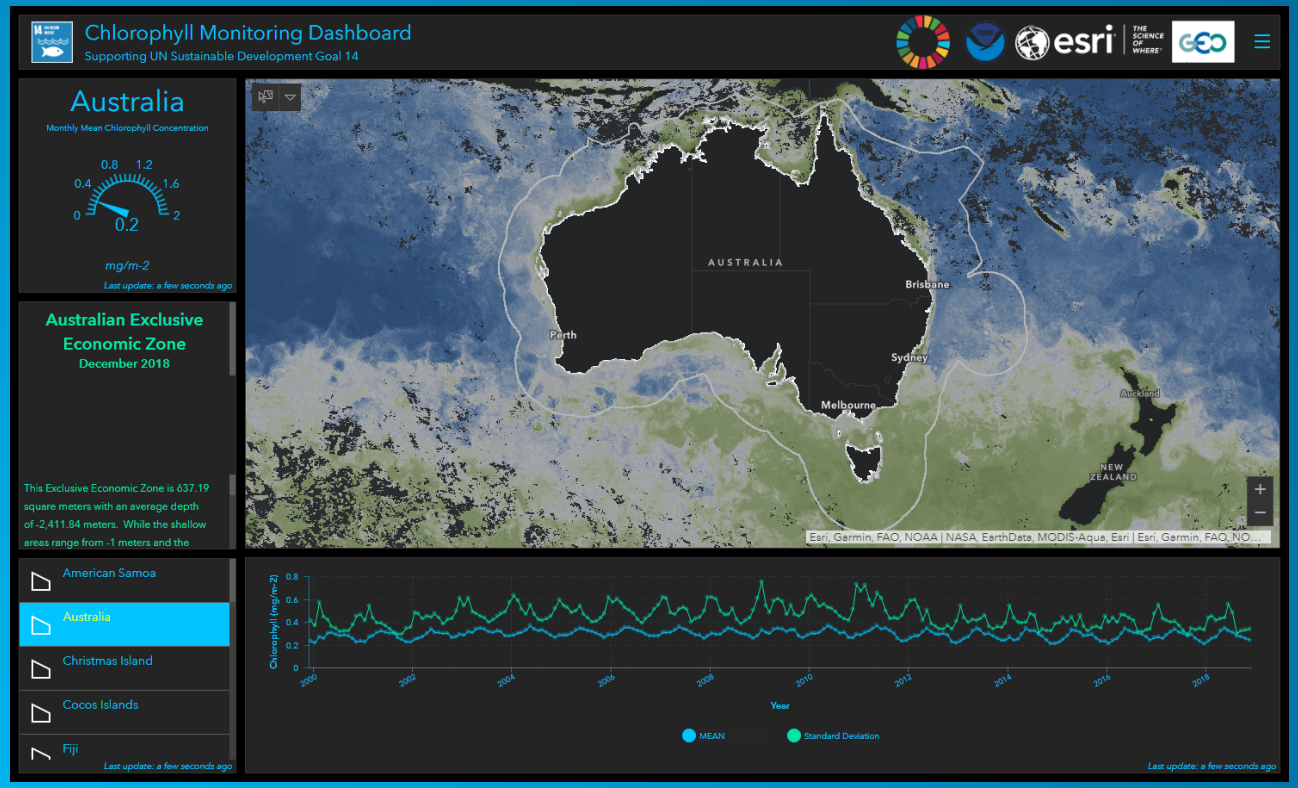
Example of missing pixels

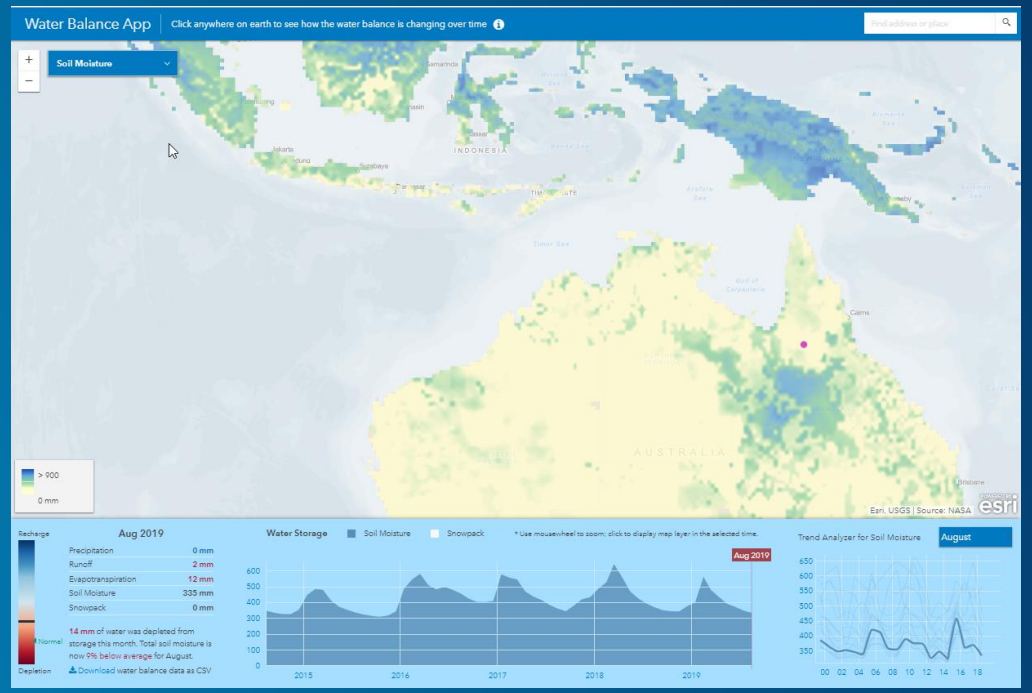
Italy November 2009

Next Steps

1. Process 2019 data and produce Stats for each EEZ

2. Produce visualizations/dashboard applicaitions





Example Water Balance Application/Dashboard

Chlorophyll-a Deviations (Remote Sensing)

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   - ESA Ocean Colour CCI (OC_CCI) product, led by the Plymouth Marine Laboratory (PML): consistent, merged chlorophyll-a product from SeaWiFS, MODIS, MERIS and VIIRS, spanning 1997 to 2018.

2. **Intra-annual coastal zone chloryphyll-A anomalies**
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Intra-annual coastal zone Chl-a anomalies

Frequency of intra-annual Chl-a anomalies = number of days calculated to have a high anomaly based on number of days where acceptable data is collected

Relative Frequency

Relative frequency of pixel Chl-a anomalies = β/γ

Where β = the number of days with a high anomaly (>1?)
Where γ = the number of days valid observations

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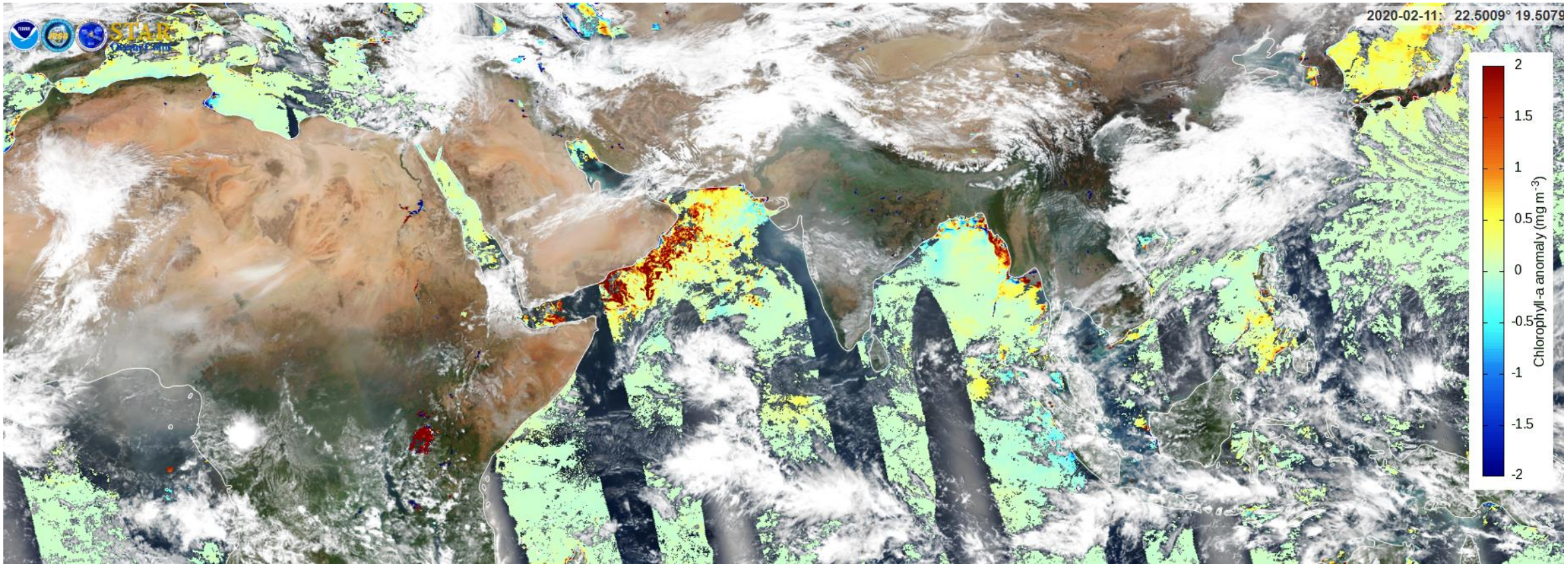
Chl-a anaomaly from STAR Oean Color on Feb. 11, 2020



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STAR Ocean Color

Intra-annual coastal zone Chl-a anomalies

Frequency of intra-annual Chl-a anomalies = number of days calculated to have a high anomaly based on number of days where acceptable data is collected

Cumulative Relative Frequency

- The cumulative relative frequency will be calculated based on the range of values associated with levels of anomaly (no anomaly, moderate, high and extreme), the frequency with which the anomalies occur, and the number of days with acceptable data collected.
- The cumulative relative frequency can be used as a visualization tool to show anomaly occurrences at a given location. UN Environment and GEO Blue Planet plan to make this available as supplementary information for this sub-indicator.

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Thank you

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