BLUE PLANET

Tools for monitoring coastal eutrophication with satellite data in support of Sustainable Development Goal 14

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GEO Blue Planet Activities

Overview of GEO Blue Planet Activities

Focus of this Activity

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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.

Indicator 14.1.1

Index of coastal eutrophication and floating plastic debris density

14 LIFE BELOW WATER

UN environment programme

14.1.1a: Index of Coastal Eutrophication (ICEP)

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SDG Indicator 14.1.1a

The challenge:

Countries vary in their capacity to collect data to report on SDGs indicators

Approach:

- Publishing 14.1 eutrophication indicators methodology for the Global Manual on Ocean Statistics
- Producing statistics for the global indicators for eutrophication to be included in the 2021 SDG Progress report
- Developing a dashboard based on satellite-derived chlorophyll-a products to identify eutrophication hot spots
- Further implementation to be facilitated by CEOS Coastal Observations, Applications, Services & Tools (COAST) Ad Hoc Team - to include AI/MI approaches

https://chlorophyll-esrioceans.hub.arcgis.com/

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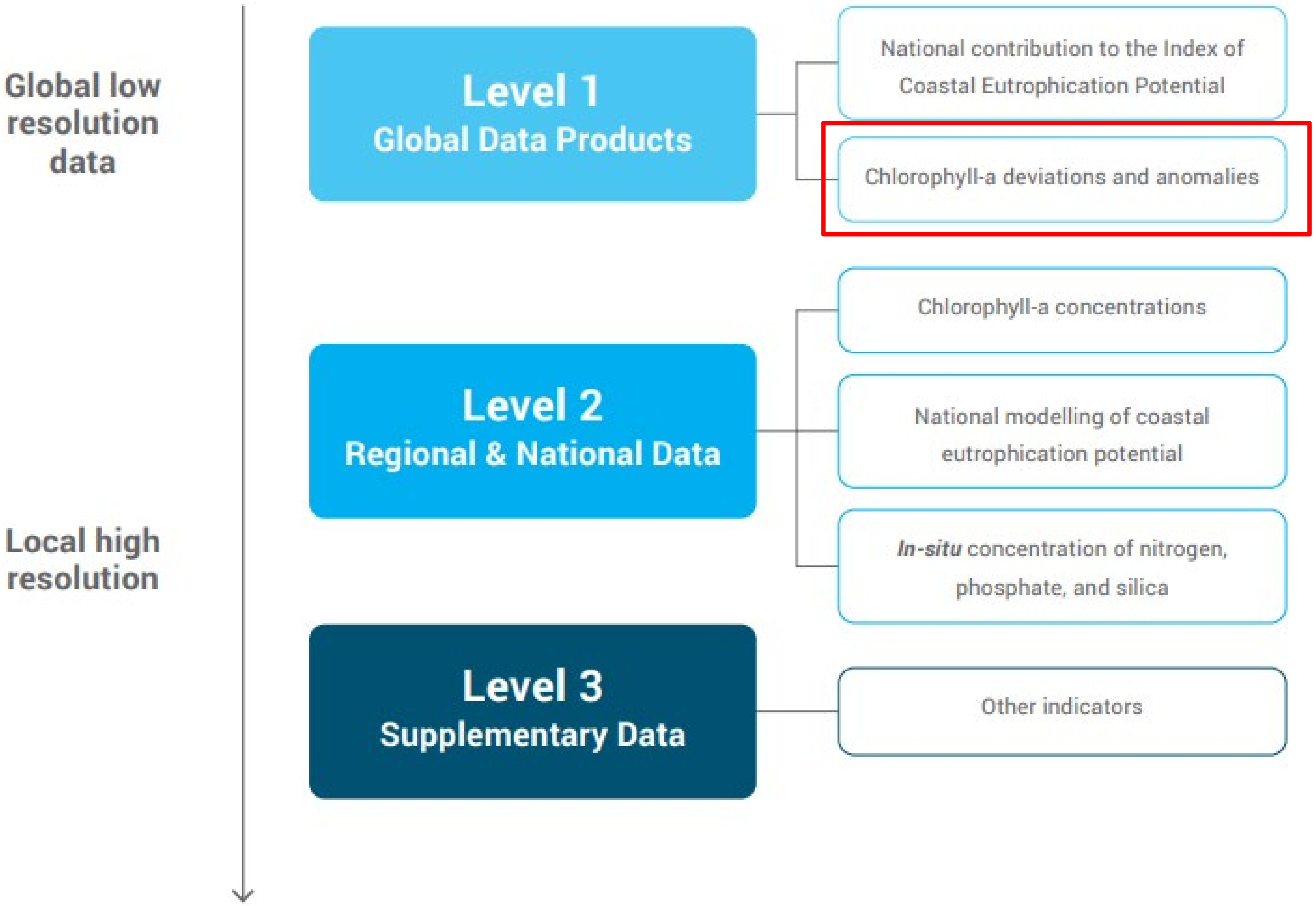
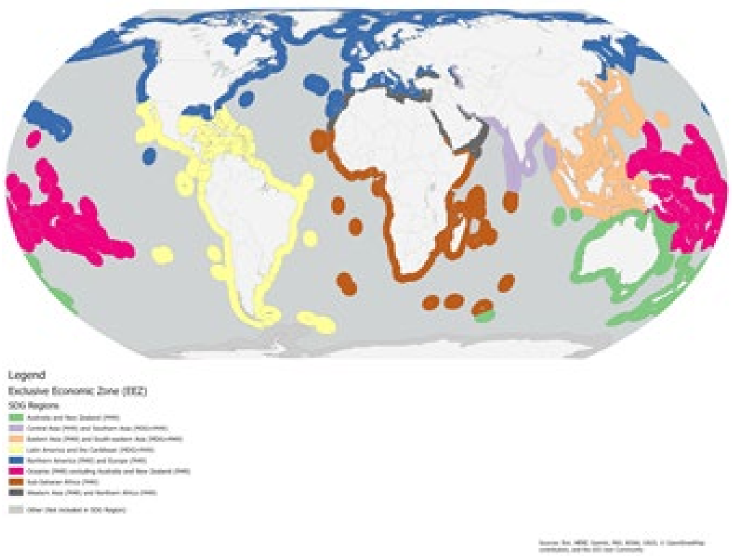
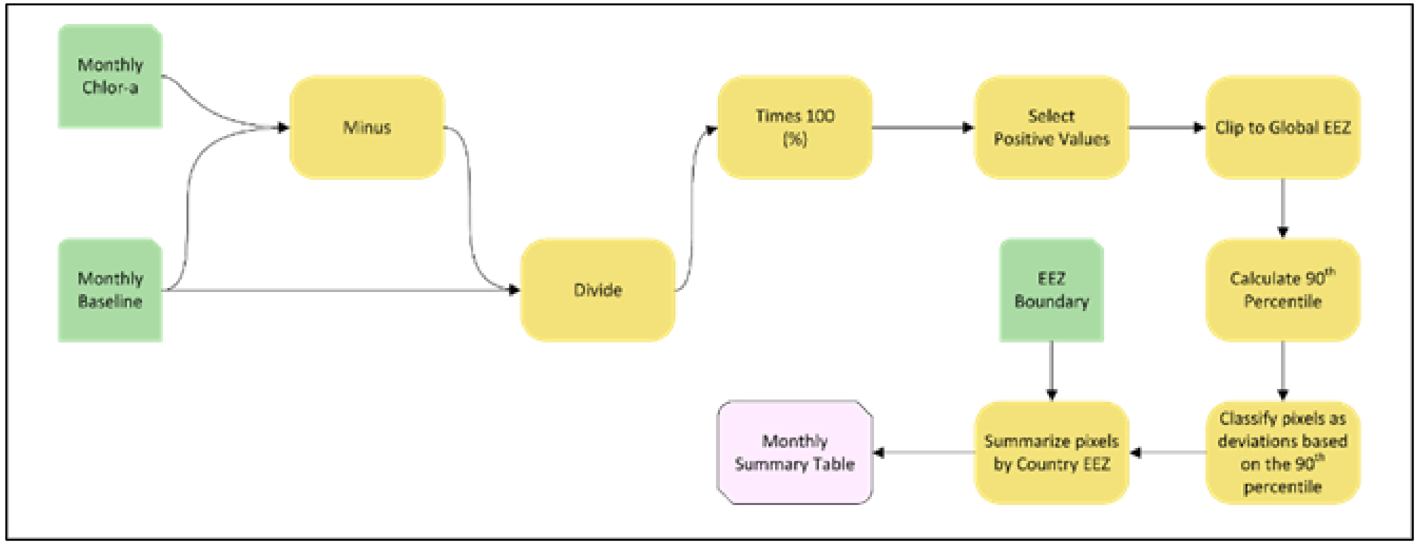
Methodology



Methodology





PML/CCI 4-km Chlor-a product was used in this analysis. (http://www.esa-oceancolour-cci.org/)

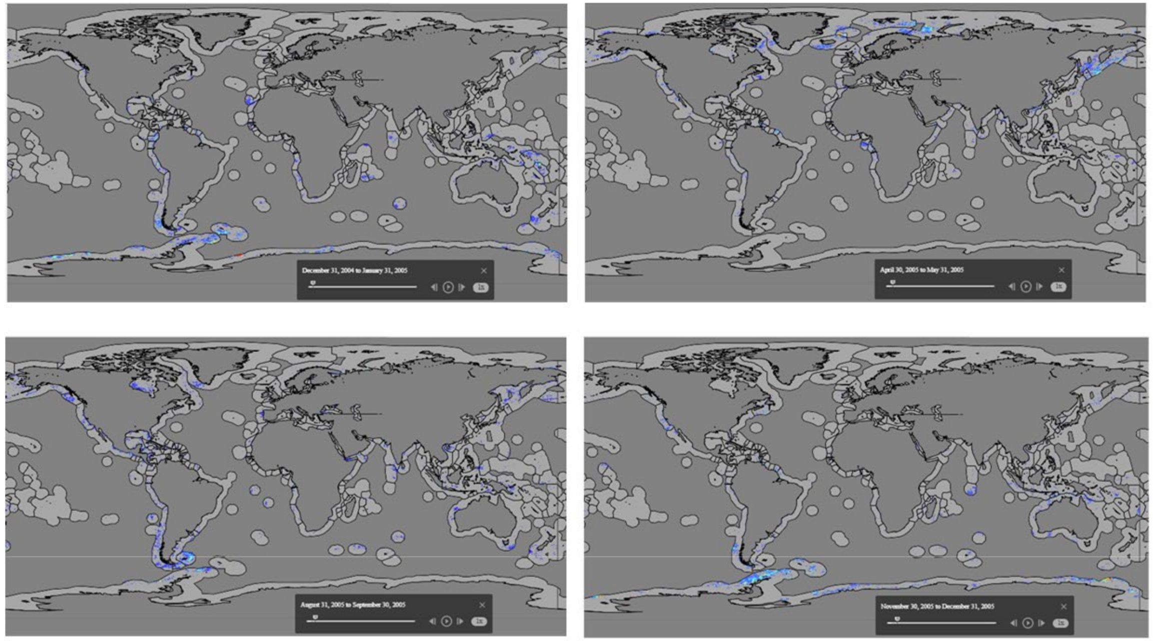
Impact Percent : Fraction of the pixel count in each EEZ which was flagged as Anomalous – meets the 90th percentile threshold value determined Globally for all EEZ pixels.

Collect Percent : Characterizes the valid observations for each EEZ by country as a percentage.

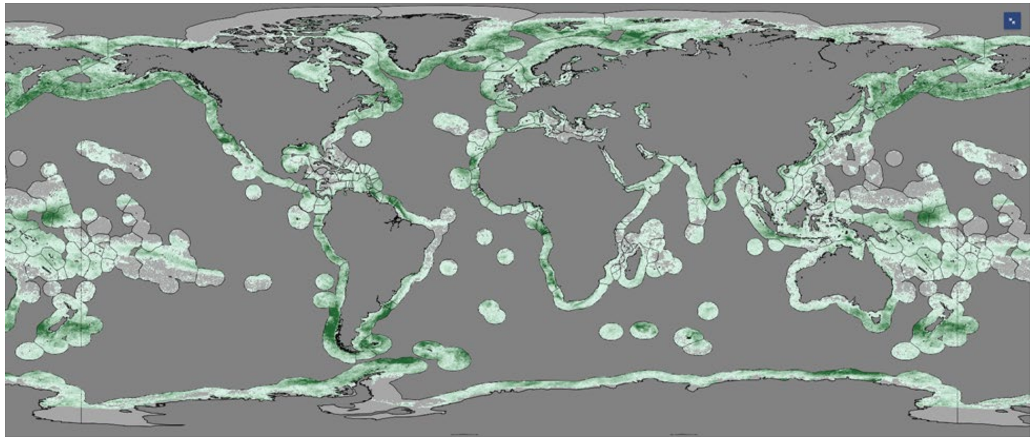
1. **Calculate the positive percent difference of monthly pixel values from the baseline monthly pixel values**.
   Using the monthly baseline averages, the percentage difference of the pixel value for the reporting period from the baseline value will be calculated as follows:
   Percent difference of pixel value from baseline = $[(\gamma - \beta) / \beta] \times 100$ values >0
   Where β = the average monthly pixel chlorophyll-a concentration for years 2000 to 2004
   Where γ = the average monthly pixel chlorophyll-a concentration for the reporting year.

2. **Identify pixels with deviations**
   Pixels with differences from the baseline that are in the 90th percentile of values >0 across the cumulative global EEZ area as defined in World EEZ v11.

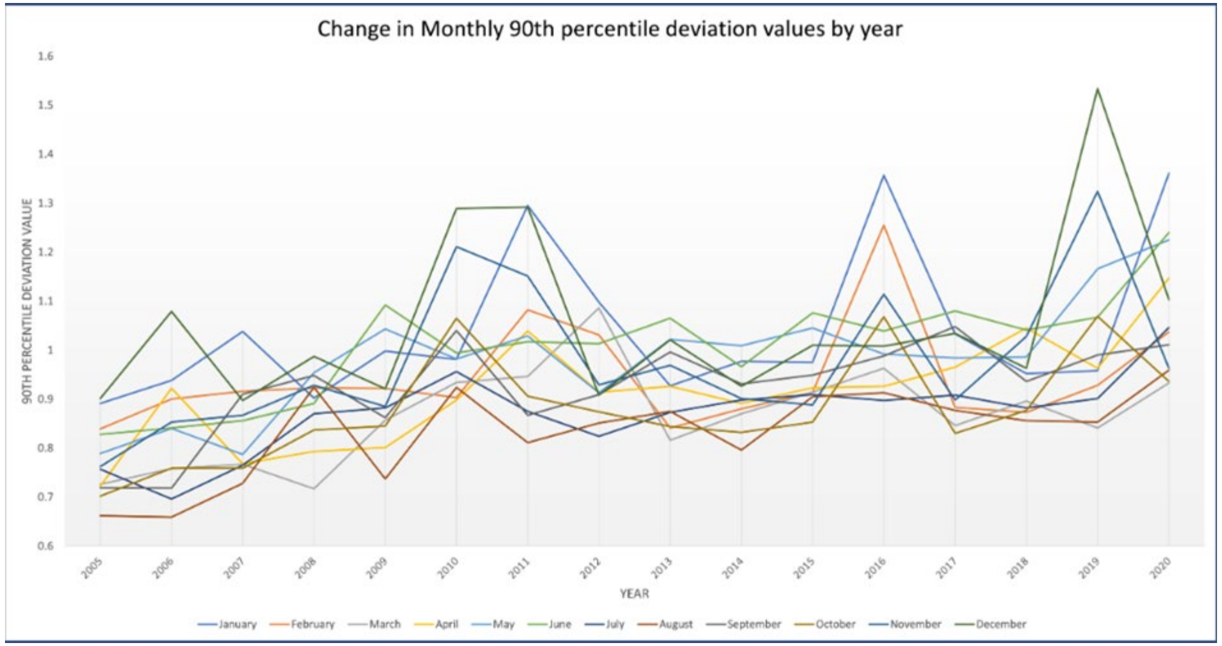
3. **Calculate the percentage of the EEZ with deviations**
   The percentage of pixels in a country's EEZ that are identified as deviating from the baseline (falling in the 90th percentile) will be calculated for each national EEZ by month. The annual average of these monthly values is then calculated.



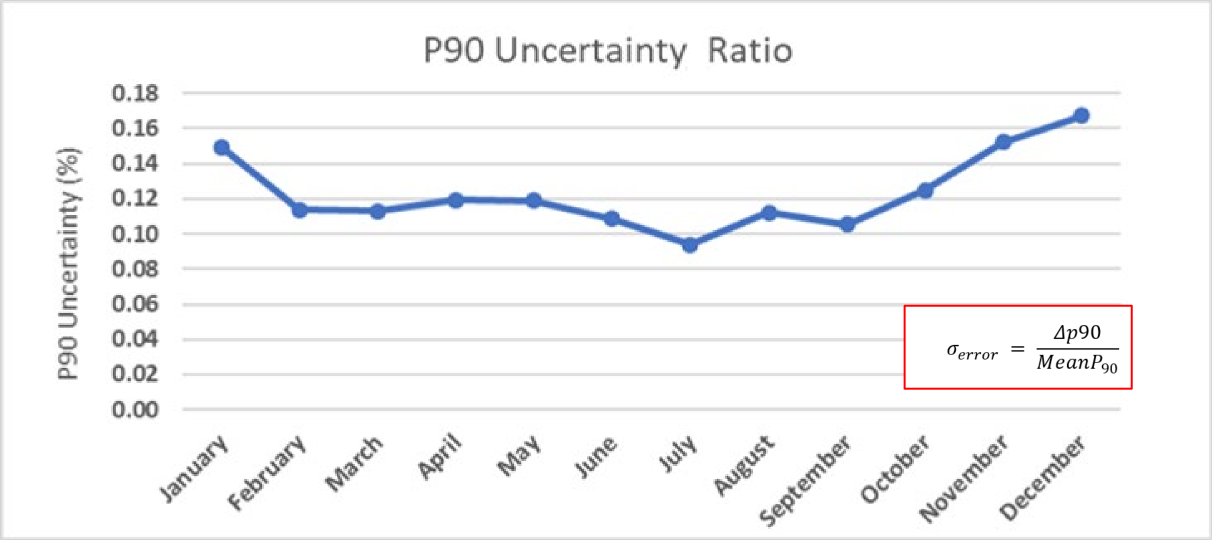
Monthly Chlorophyll Anomaly maps for sub-indicator 1, for a few representative months of the year 2005. It illustrates how sparse the high Anomaly value pixels are for the Global EEZ area, which are the only pixels shown along with the EEZ demarcations. The Antarctic pixels are also retained in the estimation of the P90 value for the Global aggregate of all the EEZ pixels.



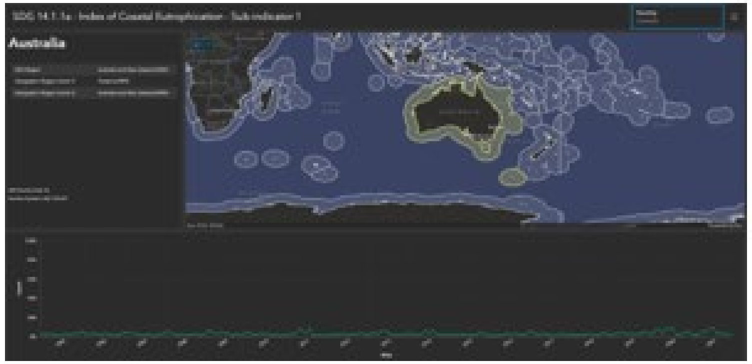
Cumulative Anomaly Map shows the number of times between 2005 and 2020 that an individual pixel was flagged as anomalous for the time span under study.

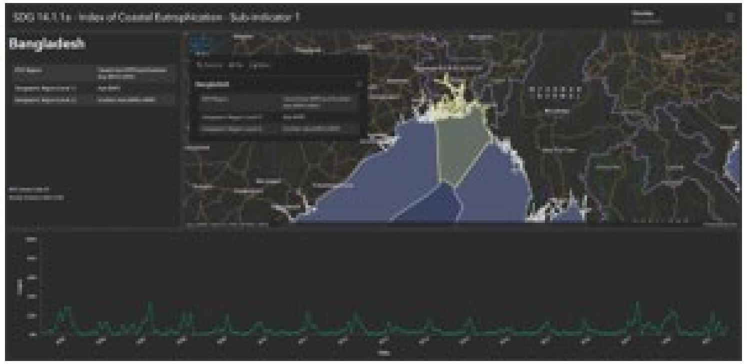


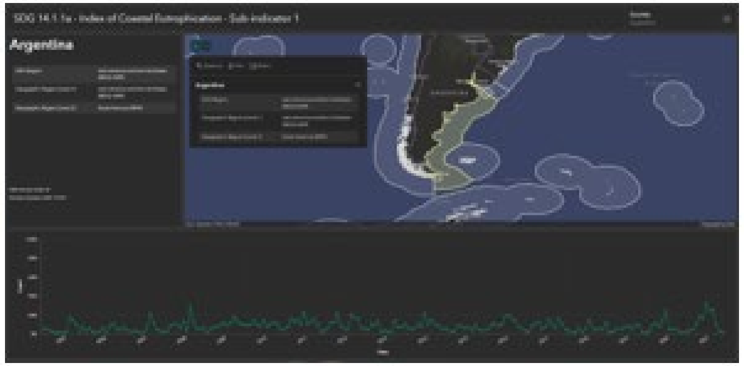
The y-axis shows the P90 threshold calculated for each month plotted for all the years between 2005 to 2020. The different months are labeled. There is a sharp jump around 2008 to 2009, following which the time series is fairly stable for each month.



Snapshots of the ArcGIS interactive tool to explore the different EEZ Eutrophication characteristics.



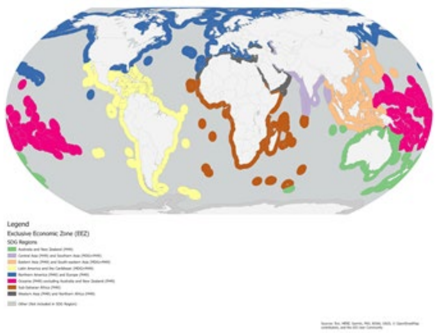


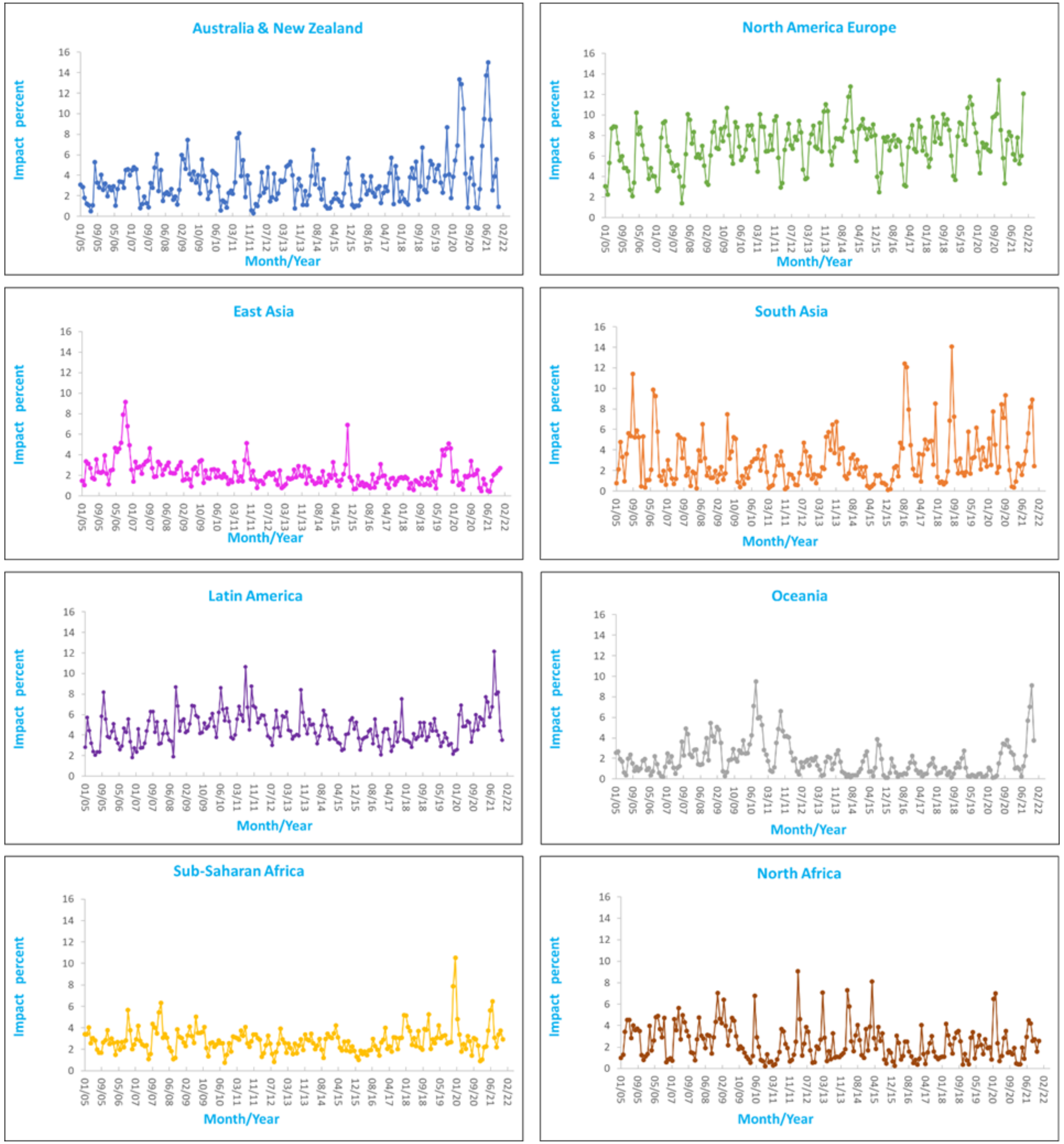


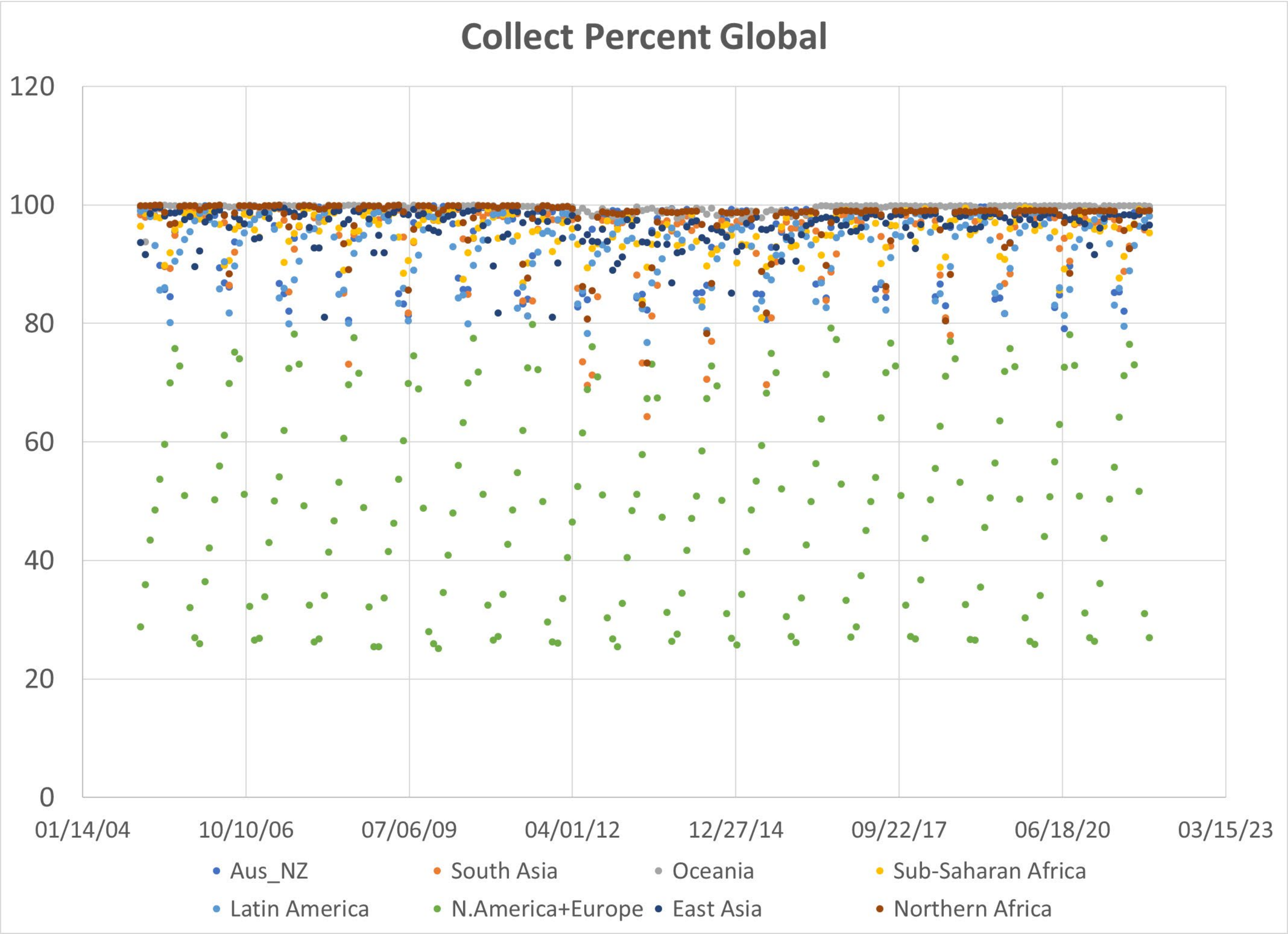
https://storymaps.arcgis.com/stories/cb657c3d22cf45699bc5c4580a3c379d

https://www.arcgis.com/apps/dashboards/9f3bca0205f74a31aa2133fbb818fd10

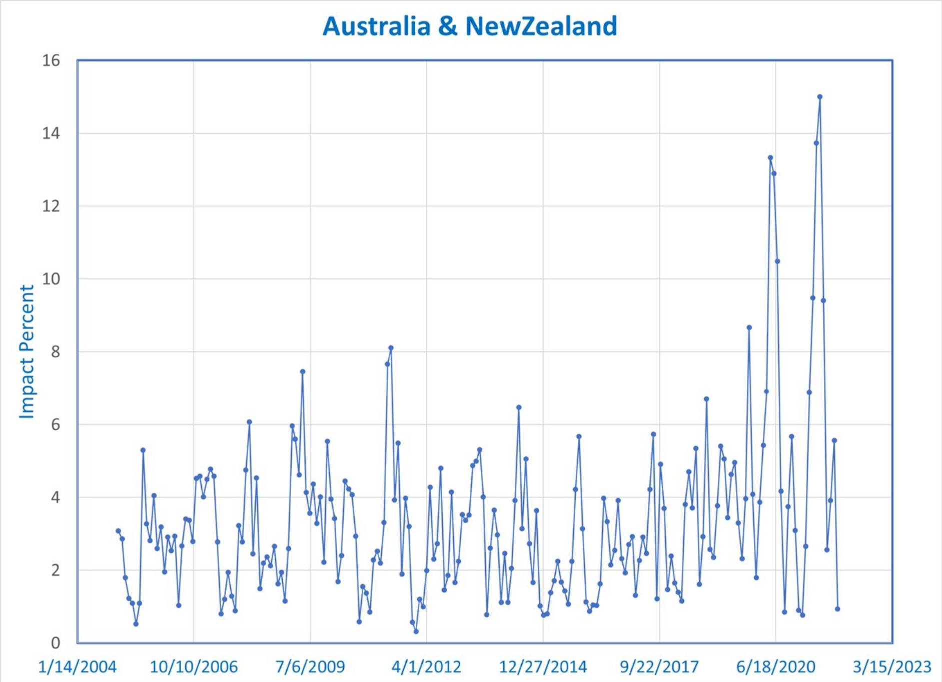
Credits: Keith VanGraafeiland (ESRI)

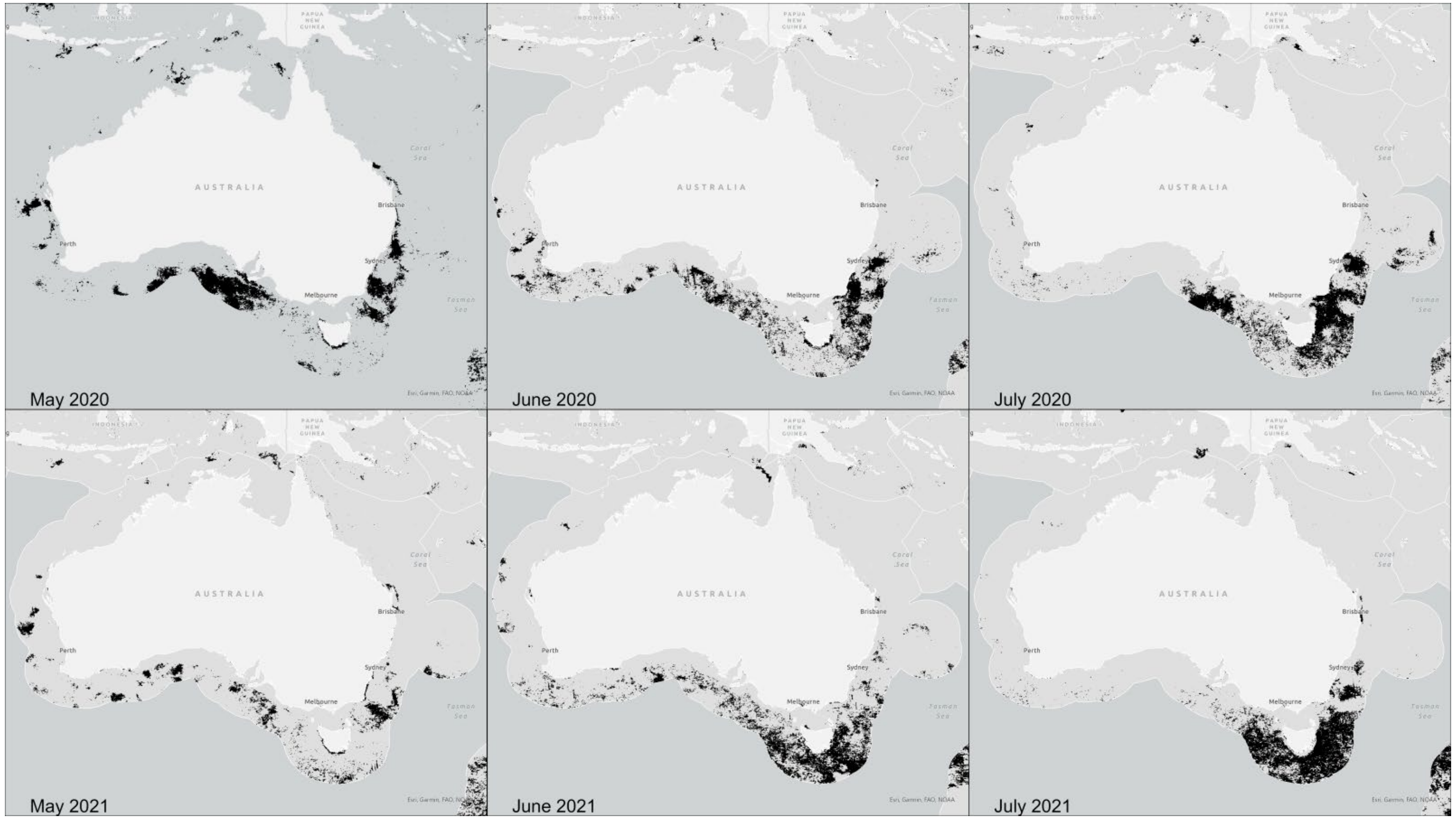

Legend
Exclusive Economic Zone (EEZ)
SDG Regions


Australia & New Zealand
North America Europe
East Asia
South Asia
Latin America
Oceania
Sub-Saharan Africa
North Africa
Impact percent
Month/Year



Strong seasonal dependence for N.America+Europe for collect percent or observation percent. But this is true for all years in this study – which means the trends seen in last decade is not due to this seasonality in sampling induced bias in estimating the trends.





1) Tang, W., Llort, J., Weis, J. *et al.* Widespread phytoplankton blooms triggered by 2019–2020 Australian wildfires. *Nature* **597,** 370–375 (2021). https://doi.org/10.1038/s41586-021-03805-8

Credits: Keith VanGraafeiland (ESRI)

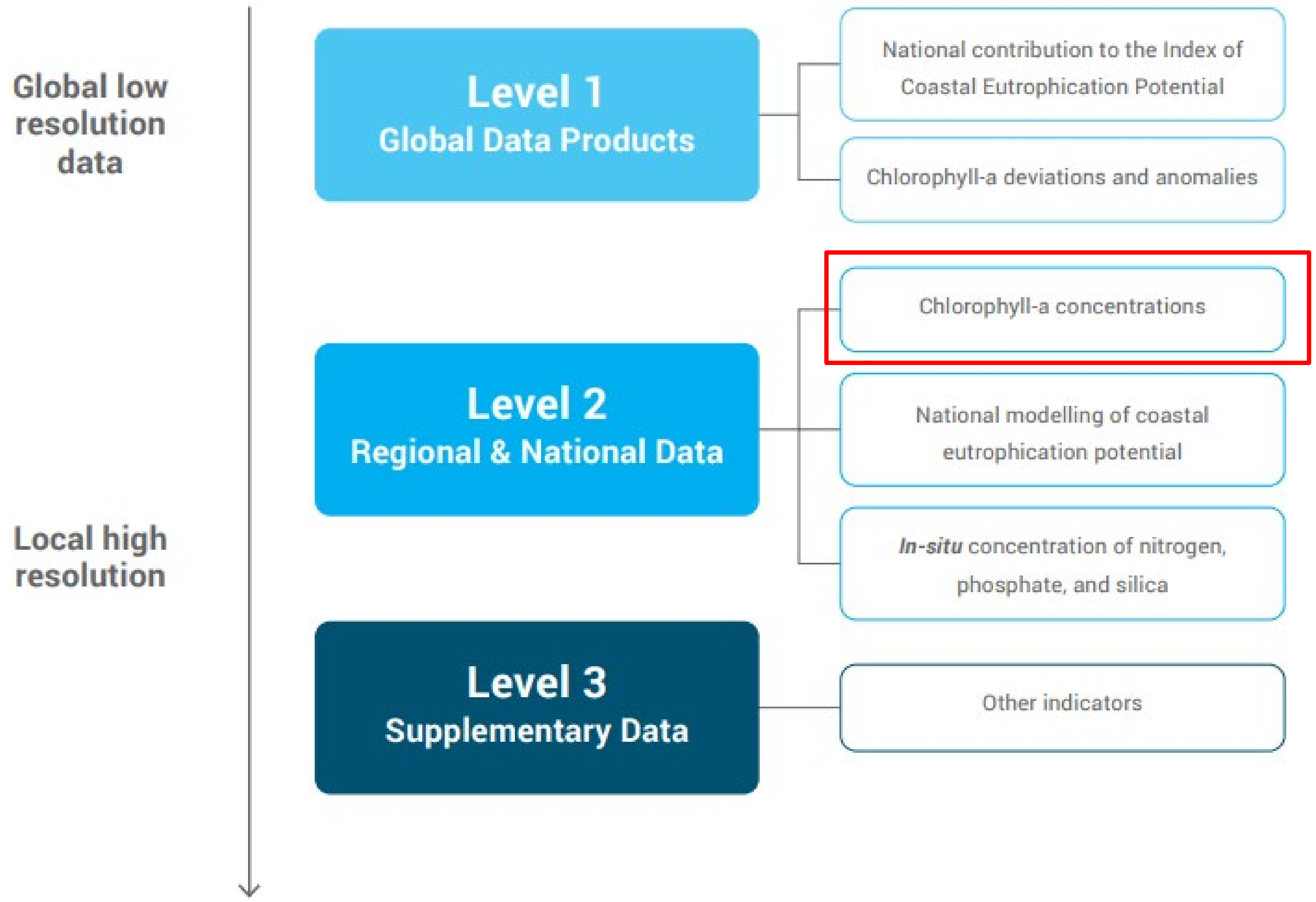
Summary

- Only Sub-indicator 1 data and analysis was shown here.
- Continue work on further analysis to write up a paper for publication.
- Need to address lack of in situ validation of the Eutrophication indicator.
    - Being addressed with exploration of collaboration with a few member countries.

https://storymaps.arcgis.com/stories/cb657c3d22cf45699bc5c4580a3c379d

https://www.arcgis.com/apps/dashboards/9f3bca0205f74a31aa2133fbb818fd10

Methodology



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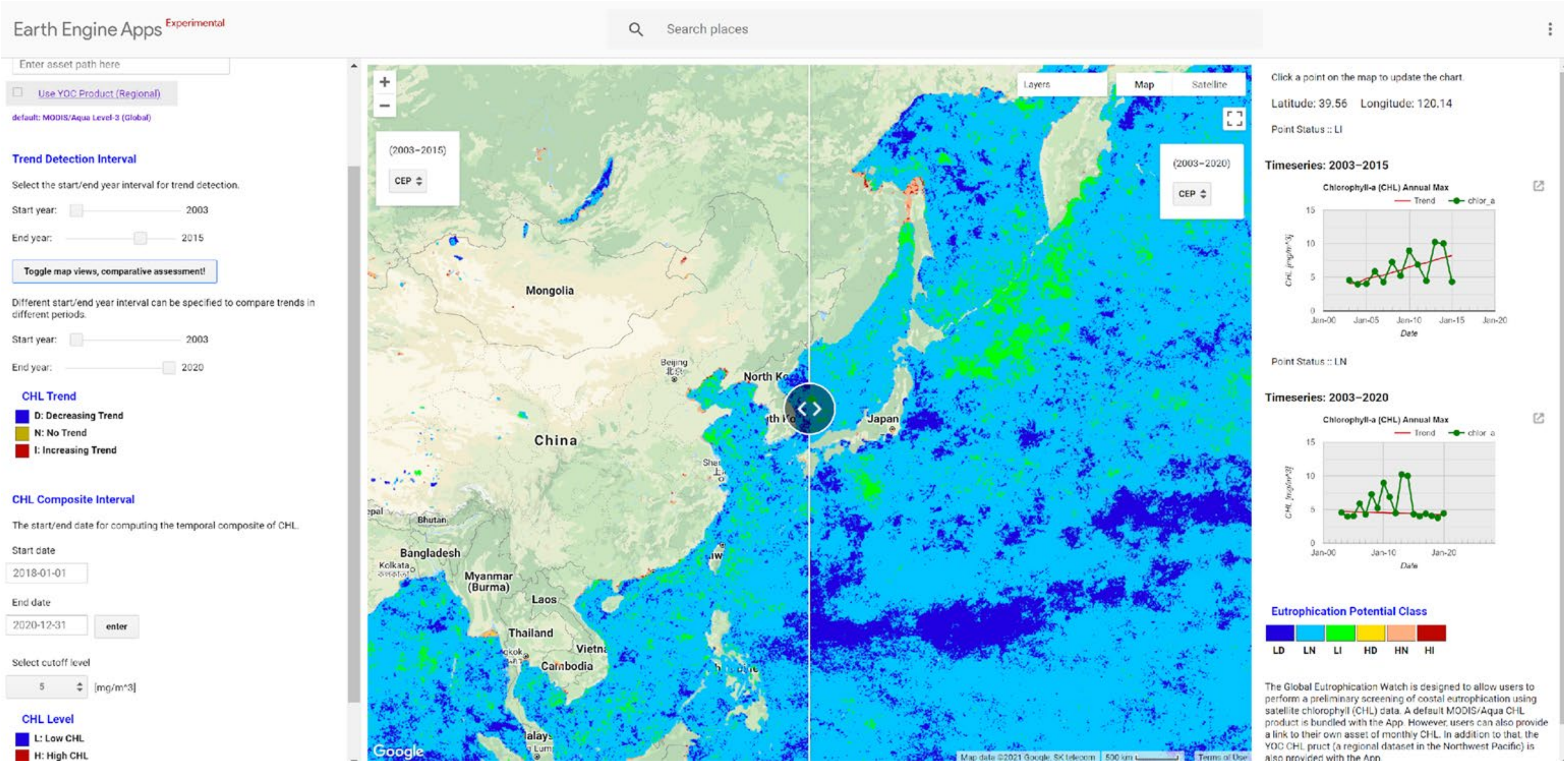
Level 2: The Northwest Pacific Action Plan (NOWPAP)



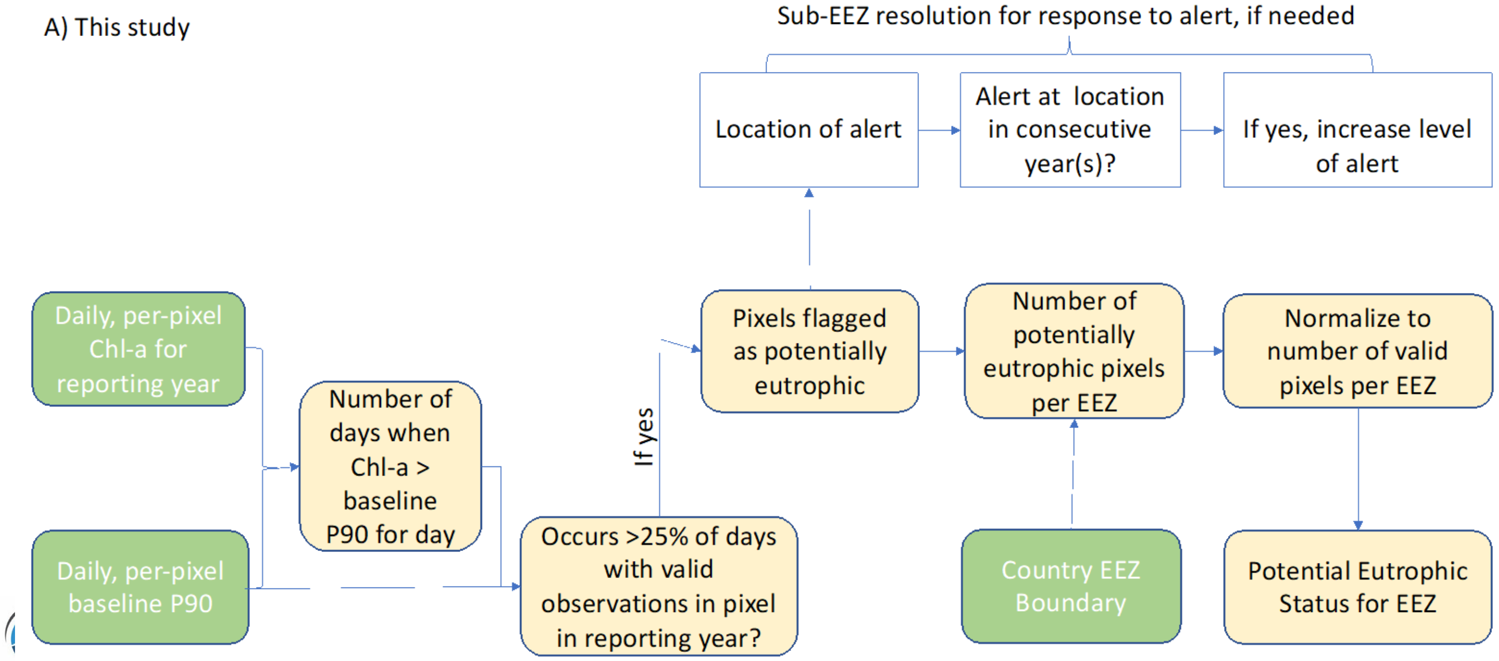
Level 2: Other regions?

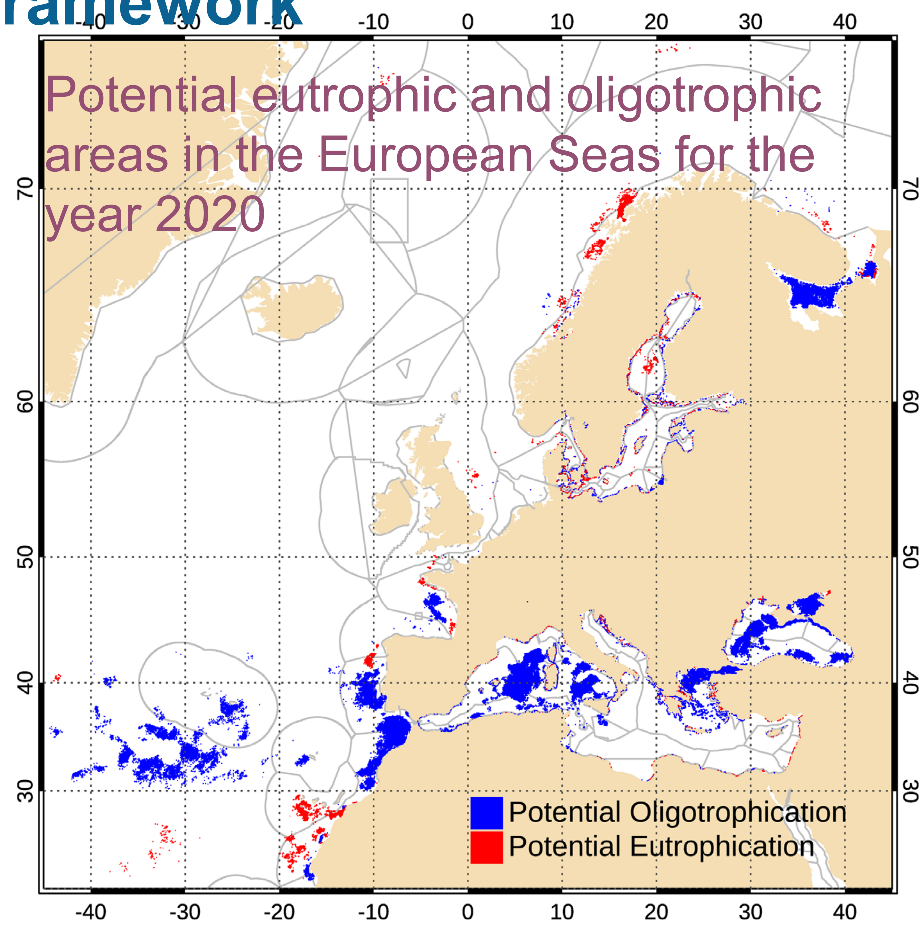
- Bay of Bengal/India?
- US?
- Other?

Level 2:European Indicator

Potential eutrophication of European waters using satellite derived chlorophyll following the UN Sustainable Development Goal 14 framework

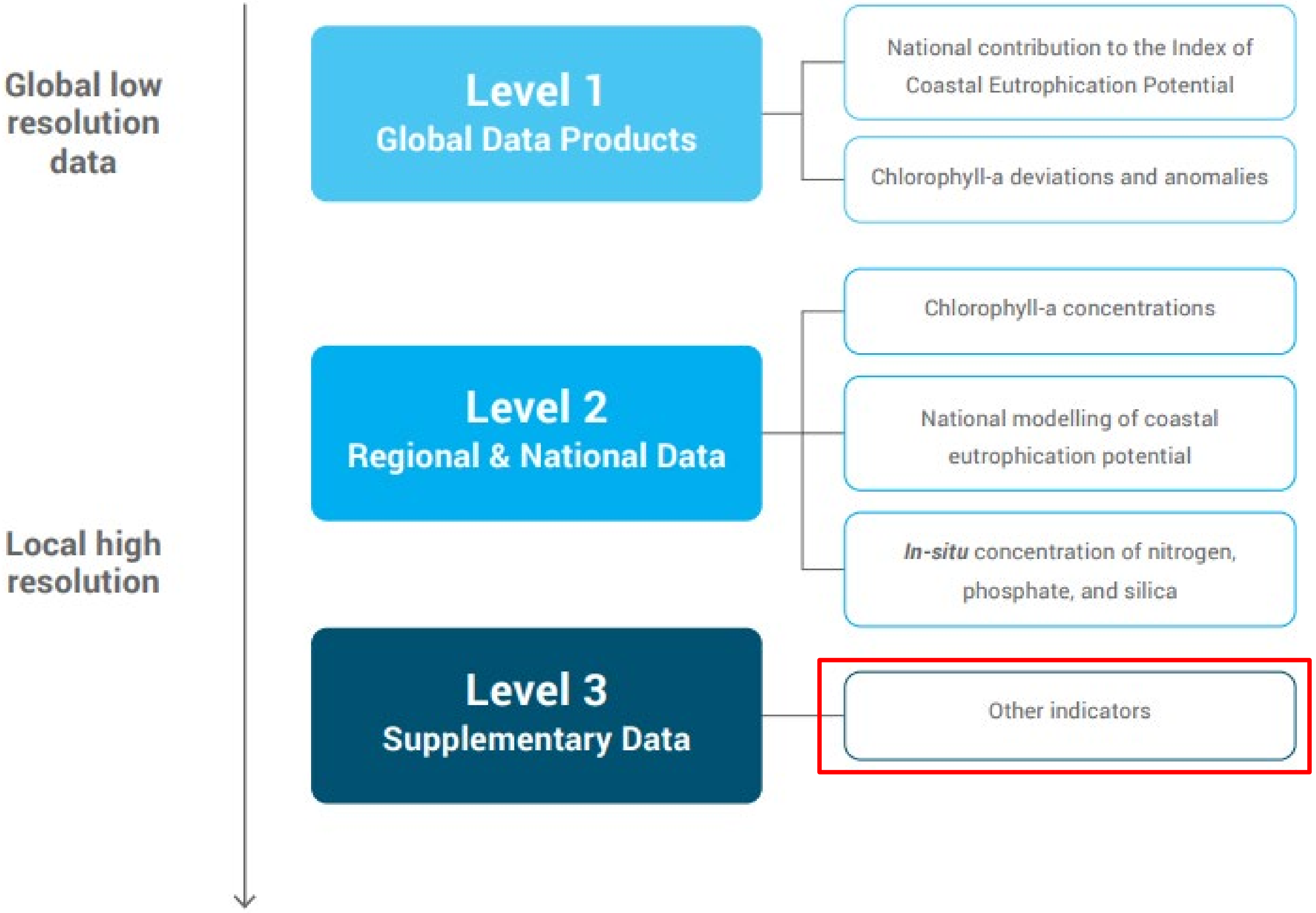
Potential eutrophic and oligotrophic areas in the European Seas derived for each year and basin using satellite-derived chlorophyll-a concentration from the corresponding CMEMS MY Ocean Colour datasets





Brando et al., 2022 JOO OSR6 (in press)

Methodology



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