



**GMES
AND AFRICA**



MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean
December 2020



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List of Acronyms

AUC	African Union Commission
Chl- <i>a</i>	Chlorophyll- <i>a</i>
EU	European Union
GMES	Global Monitoring for Environment and Security
JRC	Joint Research Centre
MODIS	Moderate Resolution Imaging Spectrometer
MOI	Mauritius Oceanography Institute
SMI	Standard Mapped Image
SST	Sea Surface Temperature
SWIO	South West Indian Ocean



1.0 Introduction

This monthly bulletin is produced by the MOI under the GMES & Africa project and provides satellite based oceanographic observations of the South West Indian Ocean region. This issue focuses on remote sensing sea surface temperature and chlorophyll-*a* concentration. It is targeted at users from the marine and fisheries realm for monitoring purposes. It is also a source of information for researchers and the scientific community.

2.0 Highlights

Sea Surface Temperature

- For the month of December 2020, high temperature was observed in the southern hemisphere.
- The average SST in the Mascarene region remained above 25°C and there was no significant deviation from the climatological mean in comparison with monthly mean for the month of December 2020.
- Temperature was relatively higher in the Mozambique Channel and the Chagos region while a negative anomaly was observed in the Mascarene region similar to the previous month.

Chlorophyll-*a* Concentration

- For the month of December 2020, high Chl-*a* level was again observed in the region around the Seychelles Islands and off Somalia.
- Relatively lower Chl-*a* concentration was detected between latitude 12 °S – 33 °S and longitude above 50 °E.
- Chl-*a* concentration was relatively higher than the climatological mean throughout the South West Indian Ocean region.
- The monthly time series for the region around Mauritius Island shows that the positive Chl-*a* anomaly observed since the beginning of the year is being maintained.

3.0 Sea Surface Temperature

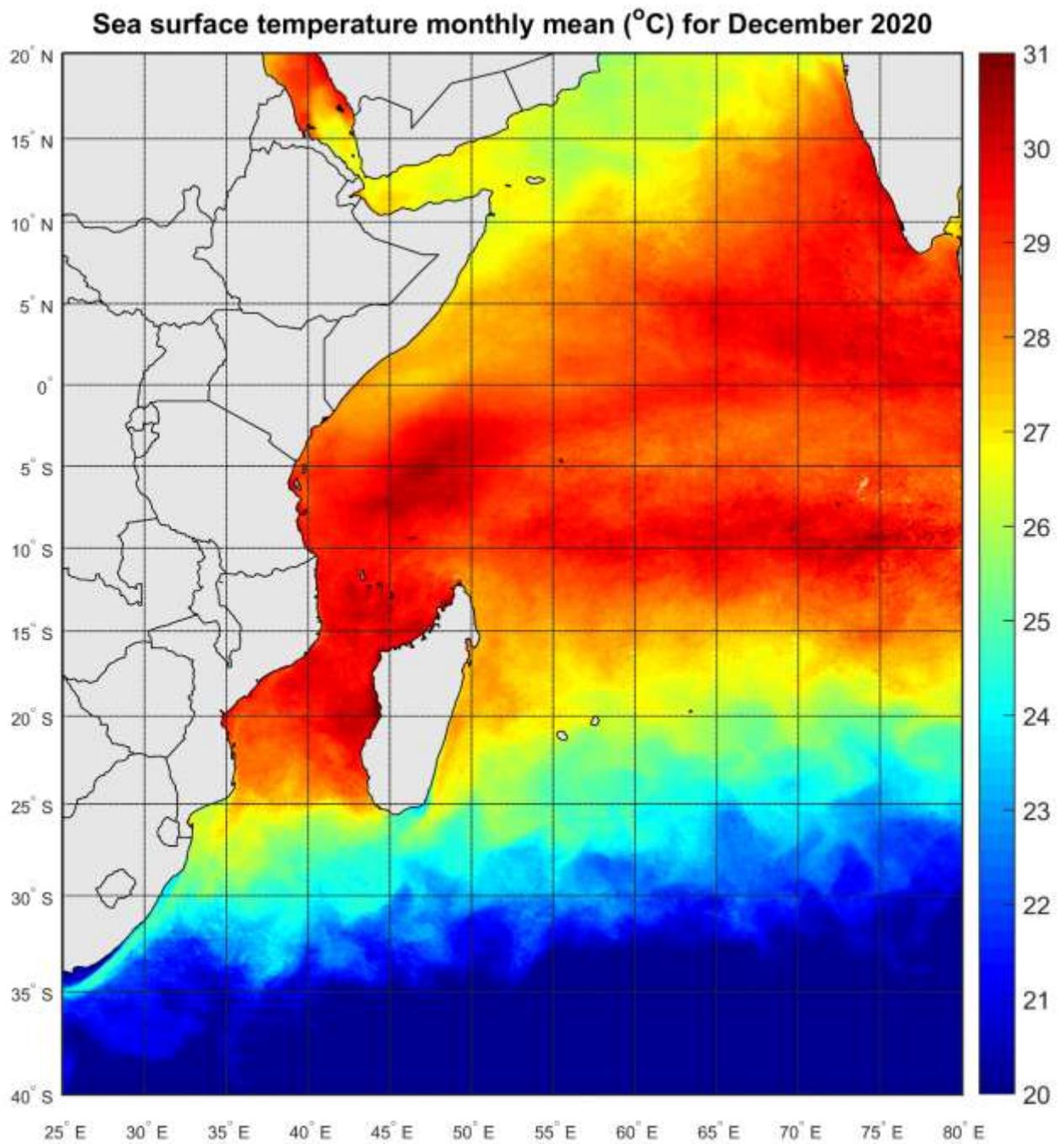


Figure 1: Mean sea surface temperature for the month of December 2020 ($^{\circ}\text{C}$)

Sea surface temperature climatology ($^{\circ}\text{C}$) for December from 2003 to 2019

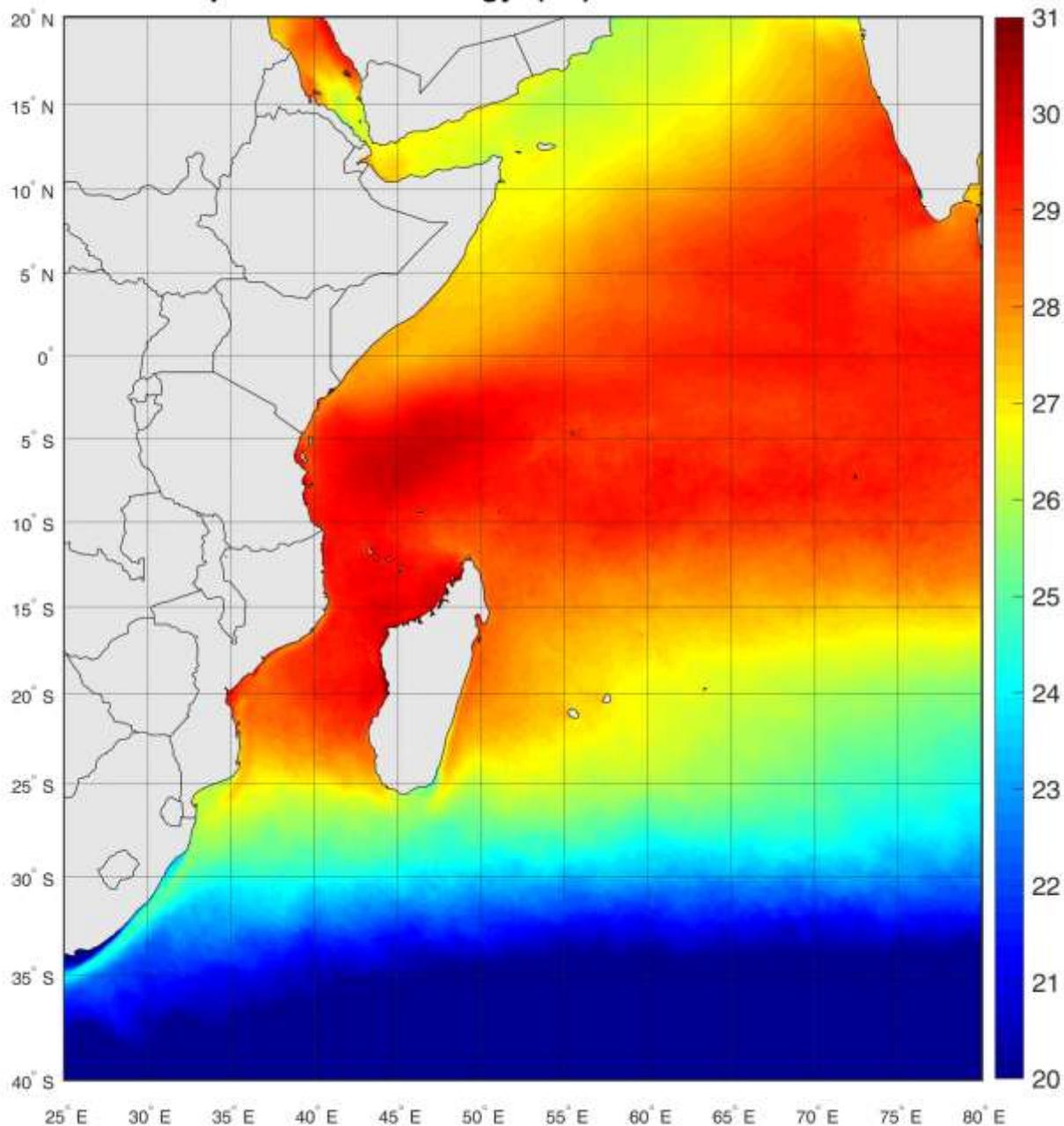


Figure 2: Sea Surface Temperature Climatology ($^{\circ}\text{C}$) for the month of December (2003 -2019)

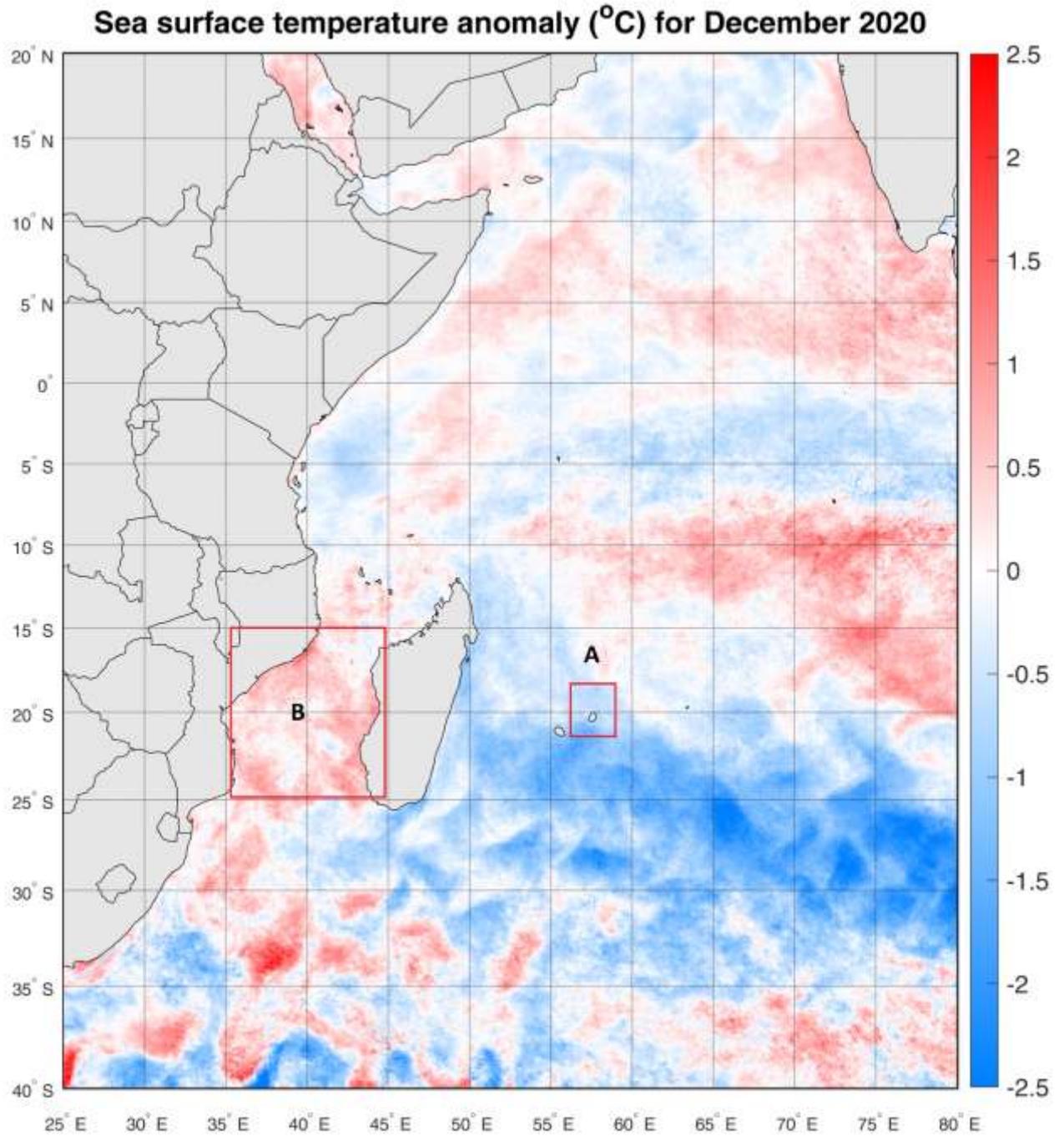


Figure 3: Anomaly of Sea Surface Temperature for December 2020 ($^{\circ}\text{C}$)

Time series generated from the monthly average for December 2020 and the climatological mean for December 2020 in the region highlighted in Figure 3, namely region A around Mauritius and region B in the Mozambique Channel.

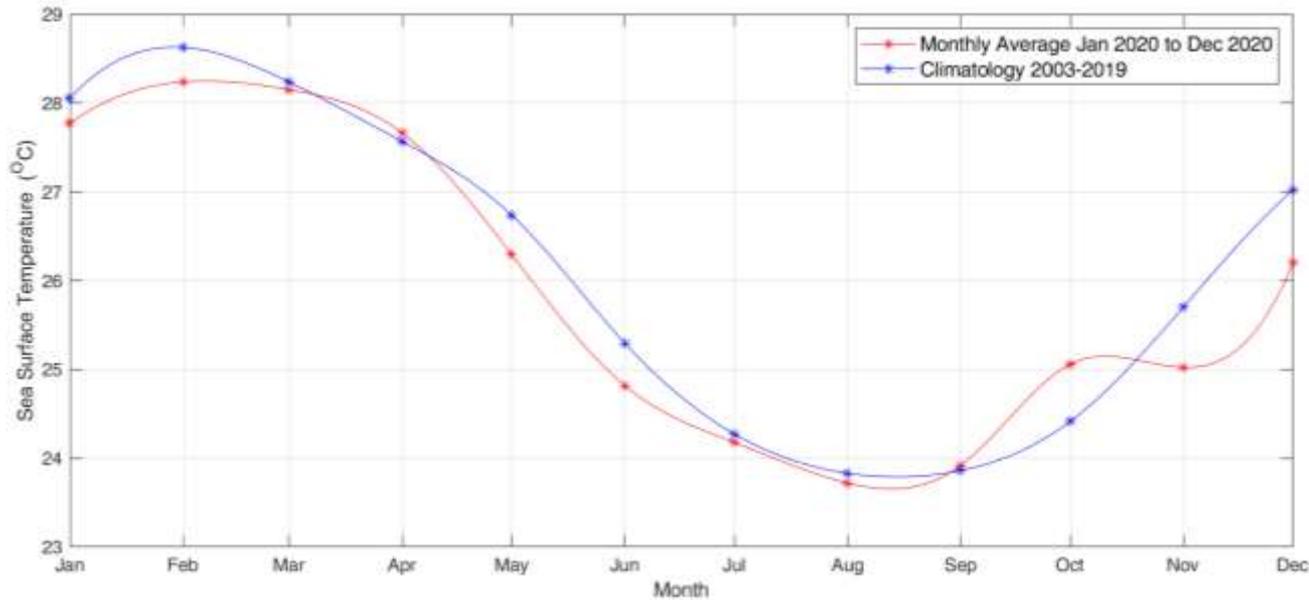


Figure 4: Temporal variation of sea surface temperature (°C) around Mauritius Island (Region A)

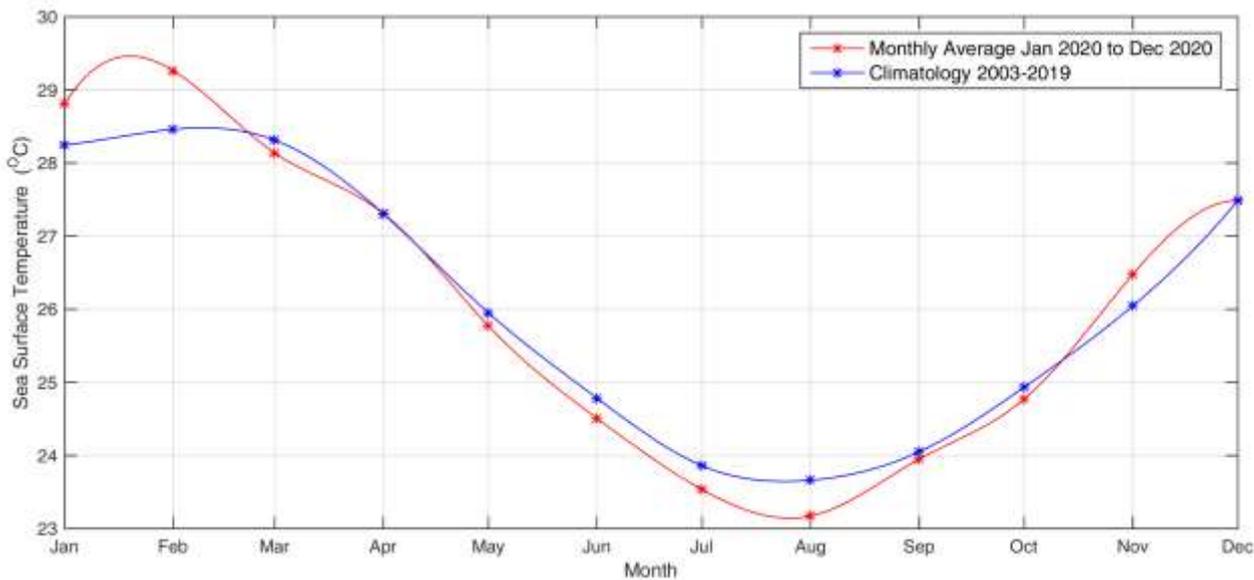


Figure 5: Temporal variation of sea surface temperature (°C) in the Mozambique Channel (Region B)

3.1 Description of Sea Surface Temperature

Sea surface temperature (SST) is the temperature of the top millimetre of the ocean's surface. Figure 1 displays the SST variation for the month of December 2020. Warmer temperatures are represented in red and yellow, while relatively cooler temperatures are shown in green and blue. SST anomaly is a departure from average conditions.

For the month of December 2020, high temperature was observed in the southern hemisphere. The average SST in the Mascarene region remained above 25°C. Figure 2 represents the climatology for the month of December based on average SST calculated from 2003 to 2019. As observed, there was no significant deviation from the climatological mean in comparison with monthly mean for the month of December 2020.

Figure 3 shows temperature anomaly for the period covered in this bulletin. The blue colour on the map represents temperatures that were cooler than the average, the white colour shows near-average temperatures, while the red colour shows temperatures that were warmer than average. The image obtained (Figure 3) shows that the temperature was relatively higher in the Mozambique Channel and the Chagos region while a negative anomaly was observed in the Mascarene region similar to the previous month. This is confirmed by the time series analysis for the region around Mauritius (Figure 4, depicted by 'Region A' in Figure 3).

Figure 5 shows the temporal variation of SST in the Mozambique Channel, between latitude 15 °S to 25 °S and longitude 35 °E – 45 °E (Region B in Figure 3).

4.0 Chlorophyll-a Concentration

Average Chlorophyll-a Concentration (mg/m^3) for December 2020

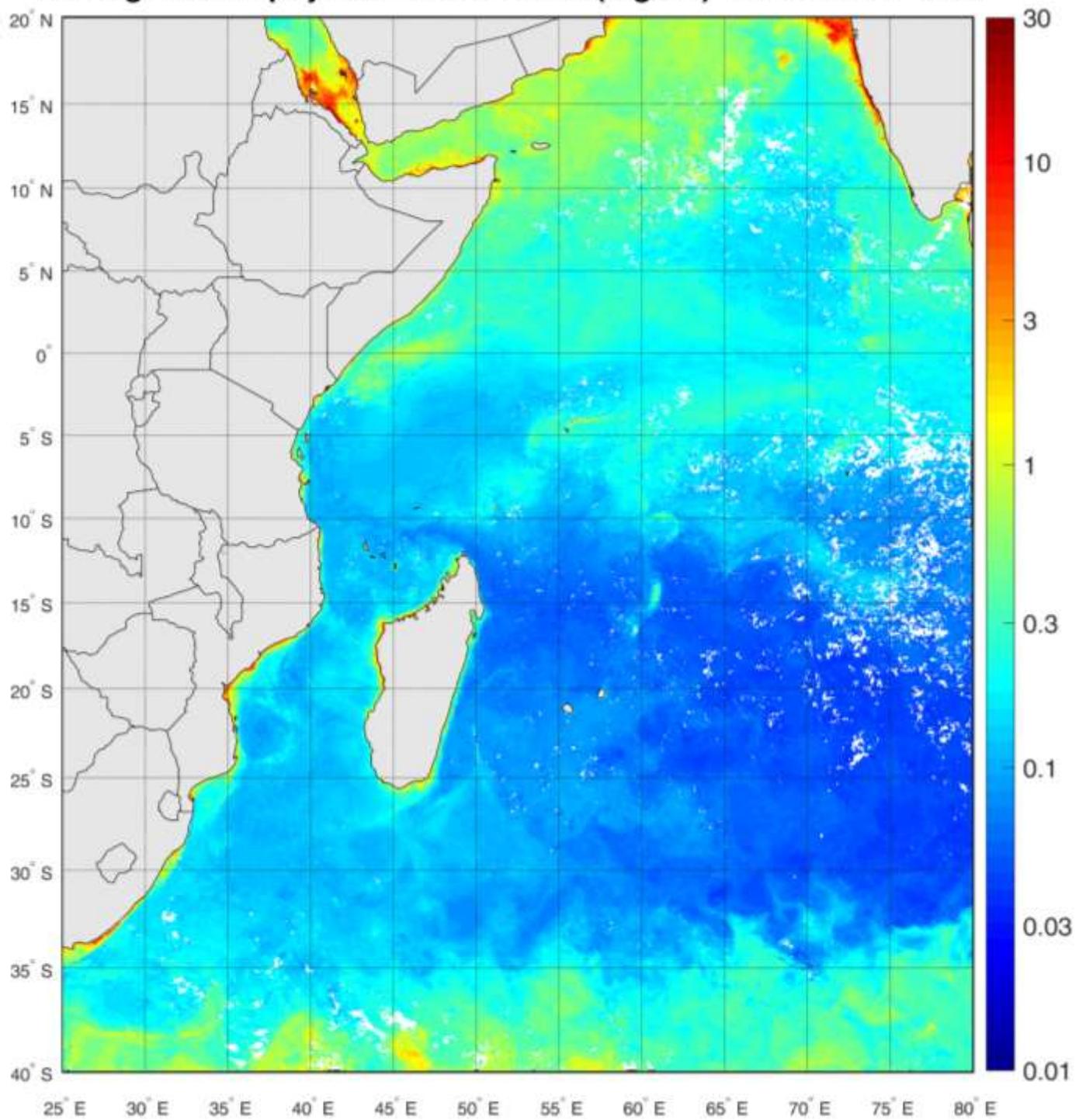


Figure 6: Mean chlorophyll-*a* concentration for the month of December 2020 (mg/m^3)

Climatology of Chlorophyll-a Concentration (mg/m^3) for December from 2003 to 2019

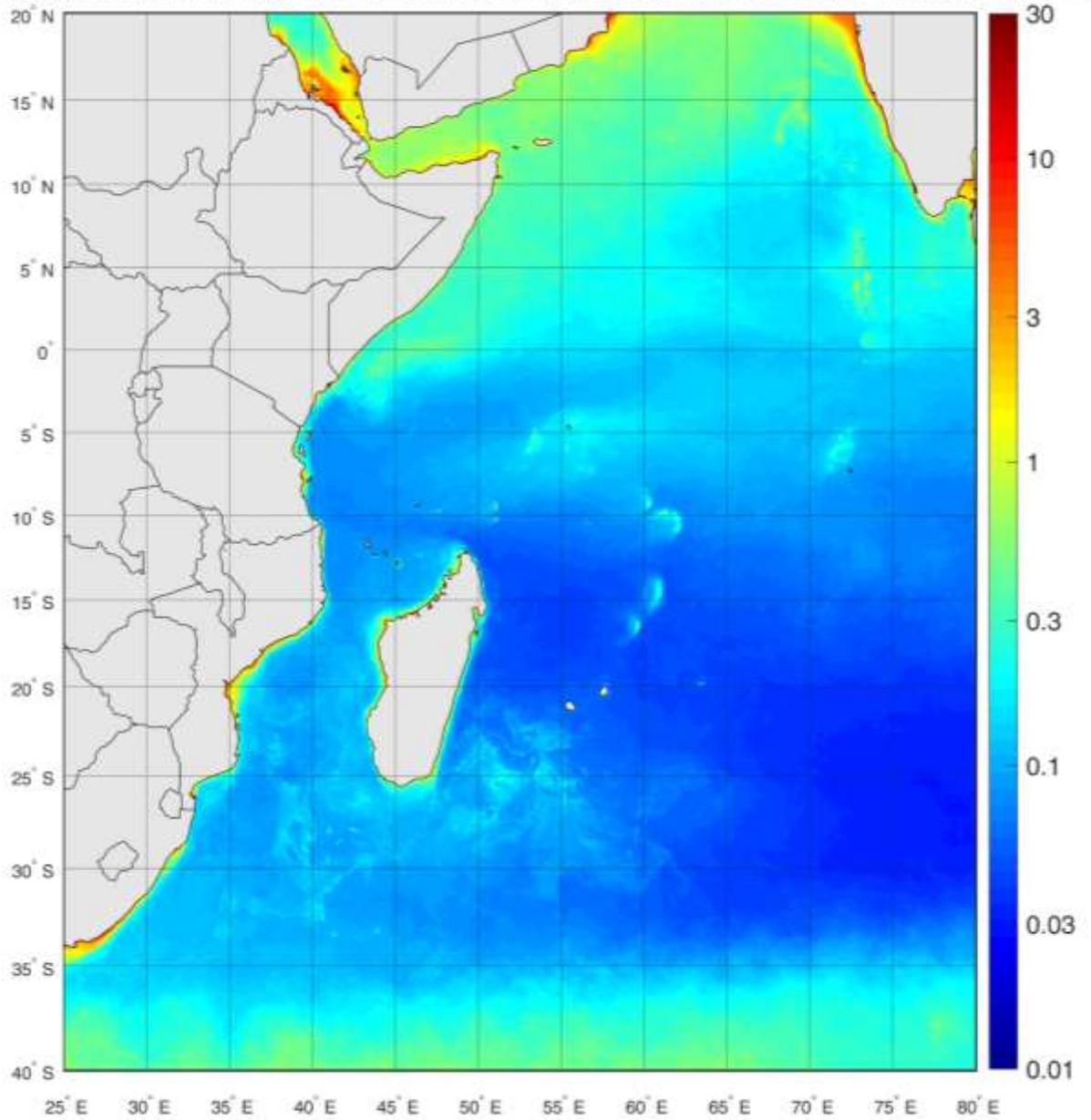


Figure 7: Chlorophyll-a Climatology (mg/m^3) for the month of December (2003 -2019)

Chlorophyll-a Concentration Anomaly (mg/m^3) for December 2020

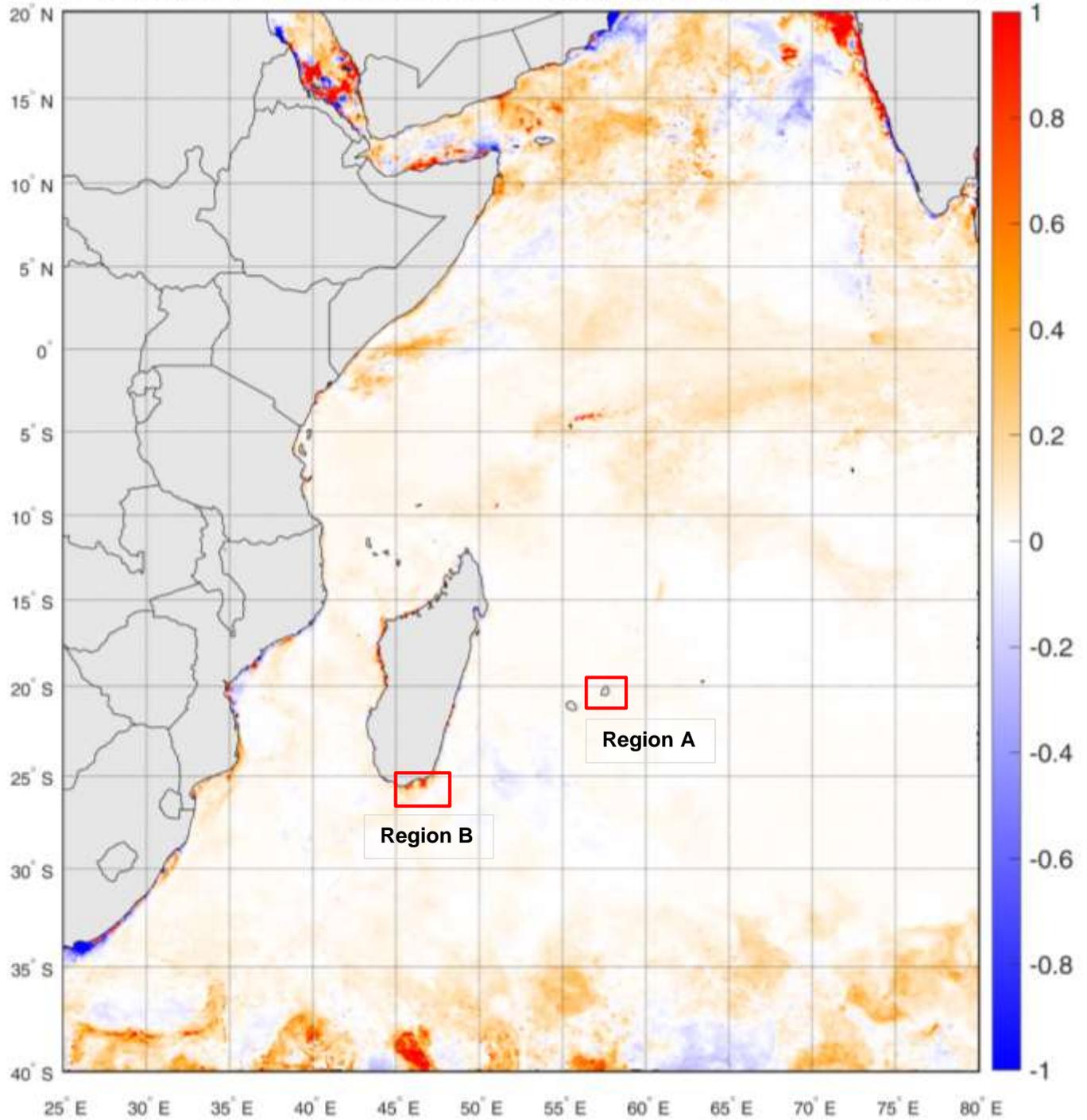


Figure 8: Anomaly of chlorophyll-a for December 2020 (mg/m^3)

Chlorophyll-a time series generated from the monthly average for December 2020 and the climatological normal for December in the region encircle in Figure 8, namely region A around Mauritius and region B around south of Madagascar Island.

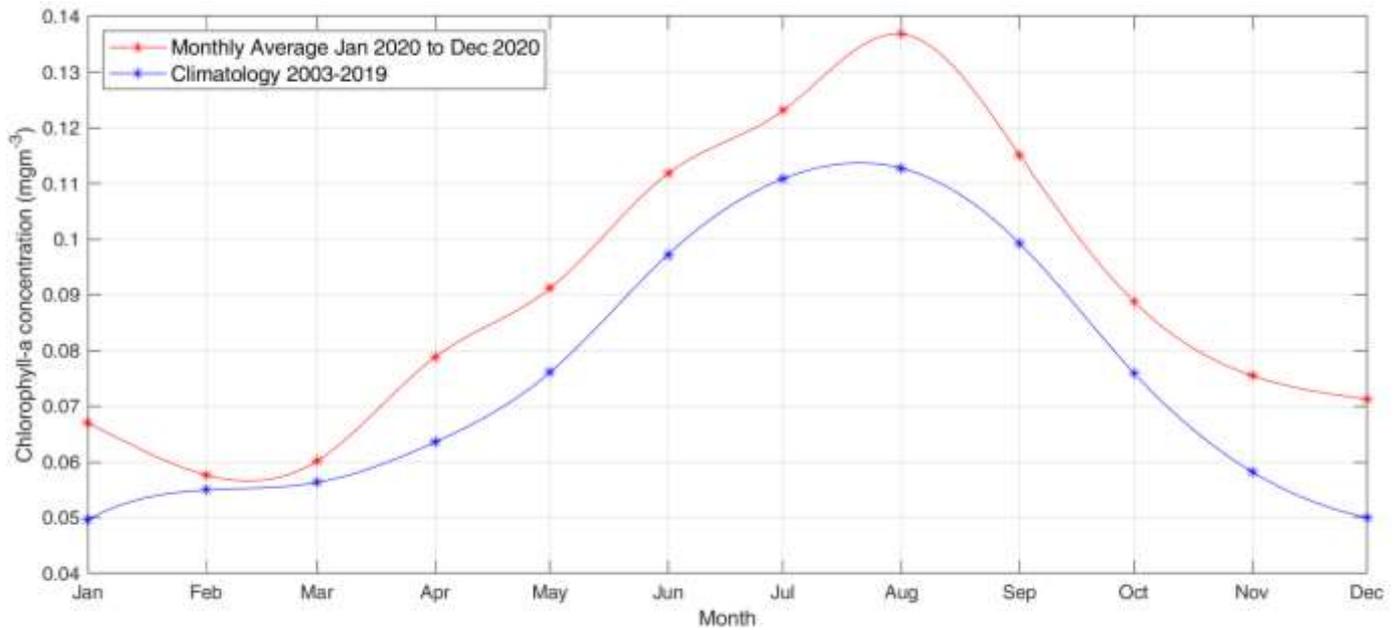


Figure 9: Temporal variation of chlorophyll-a (mg/m^3) around Mauritius Island (Region A)

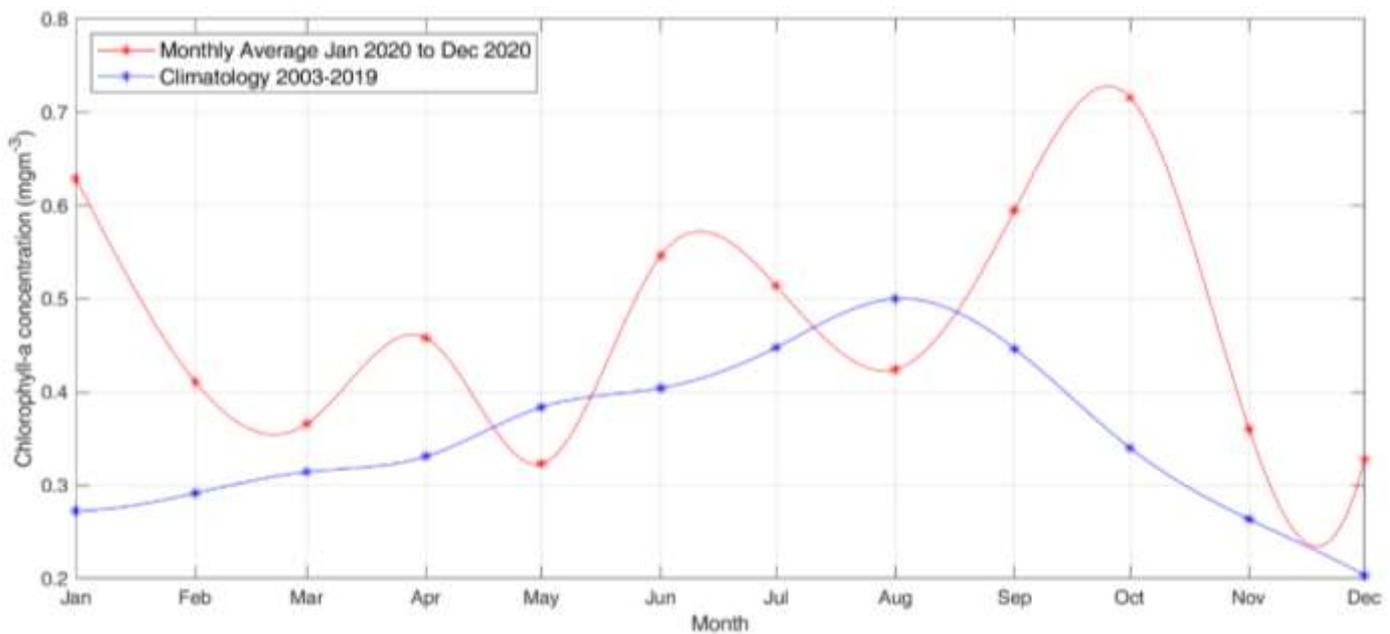


Figure 10: Temporal variation of chlorophyll-a (mg/m^3) for the region south of Madagascar. (Region B)

4.1 Description of chlorophyll-a

Figure 6 shows chlorophyll-*a* concentration in milligrams of Chl-*a* per cubic metre of seawater for the month of December 2020. The regions where the Chl-*a* concentration was very low, indicating a low abundance of phytoplankton, are in blue and those where Chl-*a* concentration was high are shown in red. Land is light grey, and places where there is no data (cloud cover) is represented in white.

A high Chl-*a* concentration usually indicates high primary productivity, an essential condition for fish aggregation and fish catch, while positive Chl-*a* anomaly shows a higher concentration of Chl-*a* than the average observed for the same period.

A high Chl-*a* level was observed in the region around the Seychelles Islands and off Somalia; same observation made in November 2020. A relatively lower Chl-*a* concentration was detected between latitude 12 °S – 33 °S and longitude above 50 °E. Based on the anomaly map for December 2020 (Figure 8), it was observed that Chl-*a* concentration was relatively higher than the climatological mean throughout the South West Indian Ocean region.

Figure 9 shows the monthly time series for the region around Mauritius Island (region A on Figure 8). The graph shows that the positive Chl-*a* anomaly observed since the beginning of the year is being maintained.

Figure 10 shows the temporal variation of Chl-*a* for the region south of Madagascar (region B on Figure 8). The graph shows that the average Chl-*a* content fluctuates considerably in the region as compared to the climatology.

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Disclaimer

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Description of Environmental Indicators

Sea Surface Temperature (SST) reflects the storage of thermal energy in the upper mixed layer of the oceans. Sea surface temperature anomalies have practical applications to fisheries and coastal waters management, including coral reef monitoring and prediction of red tides or other harmful algal blooms.

SST Anomaly means a departure from a reference value or long-term average. A positive anomaly indicates that the observed temperature was warmer than the reference value, while a negative anomaly indicates that the observed temperature was cooler than the reference value.

Chlorophyll-a (Chl-a) is the light-harvesting pigment found in marine microscopic photosynthetic plants, known as phytoplankton. Its concentration is widely used as an index of phytoplankton biomass and is also used as a proxy for primary production. *Chl-a* absorbs most visible light but reflects some green and near-infrared light. By measuring what kind of light is absorbed and reflected, satellites can measure chlorophyll-*a* concentrations in the ocean, thus providing valuable insights on the health of the ocean.

Chl-a Anomaly is a variation from the mean chlorophyll-*a* concentration.

Datasets

Level 3 SST and *Chl-a* Standard Mapped Image (SMI) dataset was used from the Moderate Resolution Imaging Spectrometer (MODIS) data, with a spatial resolution of 4 km. The Level 3 SMI products are image representations of binned data products obtained from OceanColor (<https://oceandata.sci.gsfc.nasa.gov/>).

Indicator Calculation

Monthly SST anomaly images were created using the processed monthly satellite data and the monthly climatology data. The monthly anomalies were calculated relative to the respective monthly mean. The SST climatology was obtained from MODIS data (2003-2019). The nominal pixel resolution is 4 km. The SST anomalies were calculated from the difference of the monthly composite with its respective monthly climatology based on the interval from 2003 to 2019.

Similarly, the *Chl-a* anomalies were calculated from the monthly average and the monthly climatology based on the interval from 2003 to 2019.