



**GMES  
AND AFRICA**



# MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean  
March 2021



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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 March 2021, a relatively higher temperature was observed in the northern part of the Mozambique Channel and off the coast of Tanzania, while the temperature remained relatively lower off Somalia and below latitude 20°S.
- The average SST in the Mascarene region varied between 27 to 29 °C, while in the Mozambique Channel it exceeds 30 °C.
- A high SST anomaly was observed in the region east of Madagascar, being more prominent in the north-east region while unlike the previous month, a positive anomaly was observed in the Mascarene region.

### Chlorophyll-a Concentration

- A high Chl-*a* level was observed in the region south-east of Seychelles while the Chl-*a* concentration was comparatively lower in the Mascarene region.
- Similar to the previous month, the Chl-*a* concentration was relatively lower in the western side of Madagascar, as compared to the eastern side.
- The anomaly map for March 2021 does not show much deviation from the climatology except for the region in the south-east of Seychelles.

### 3.0 Sea Surface Temperature

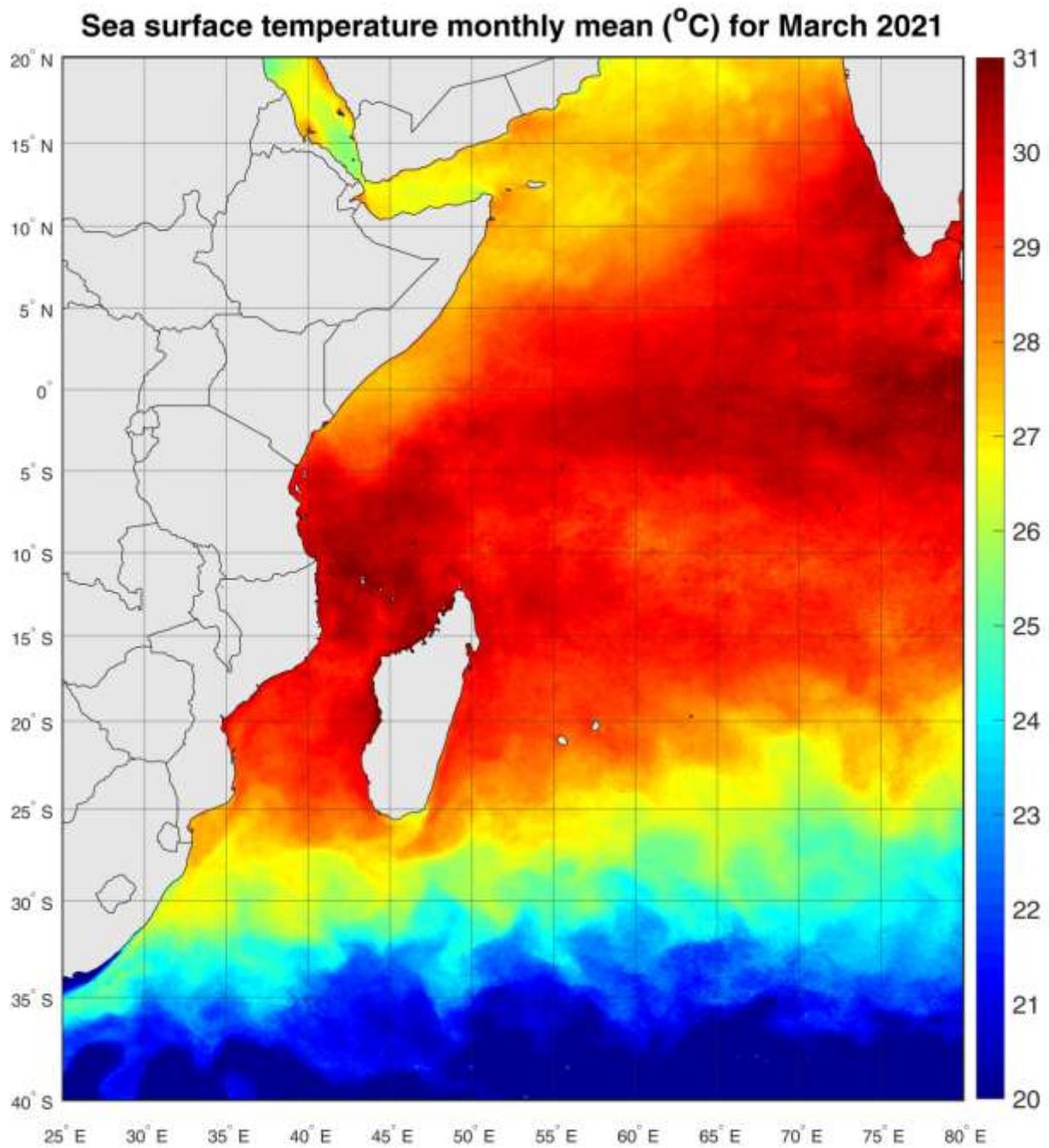
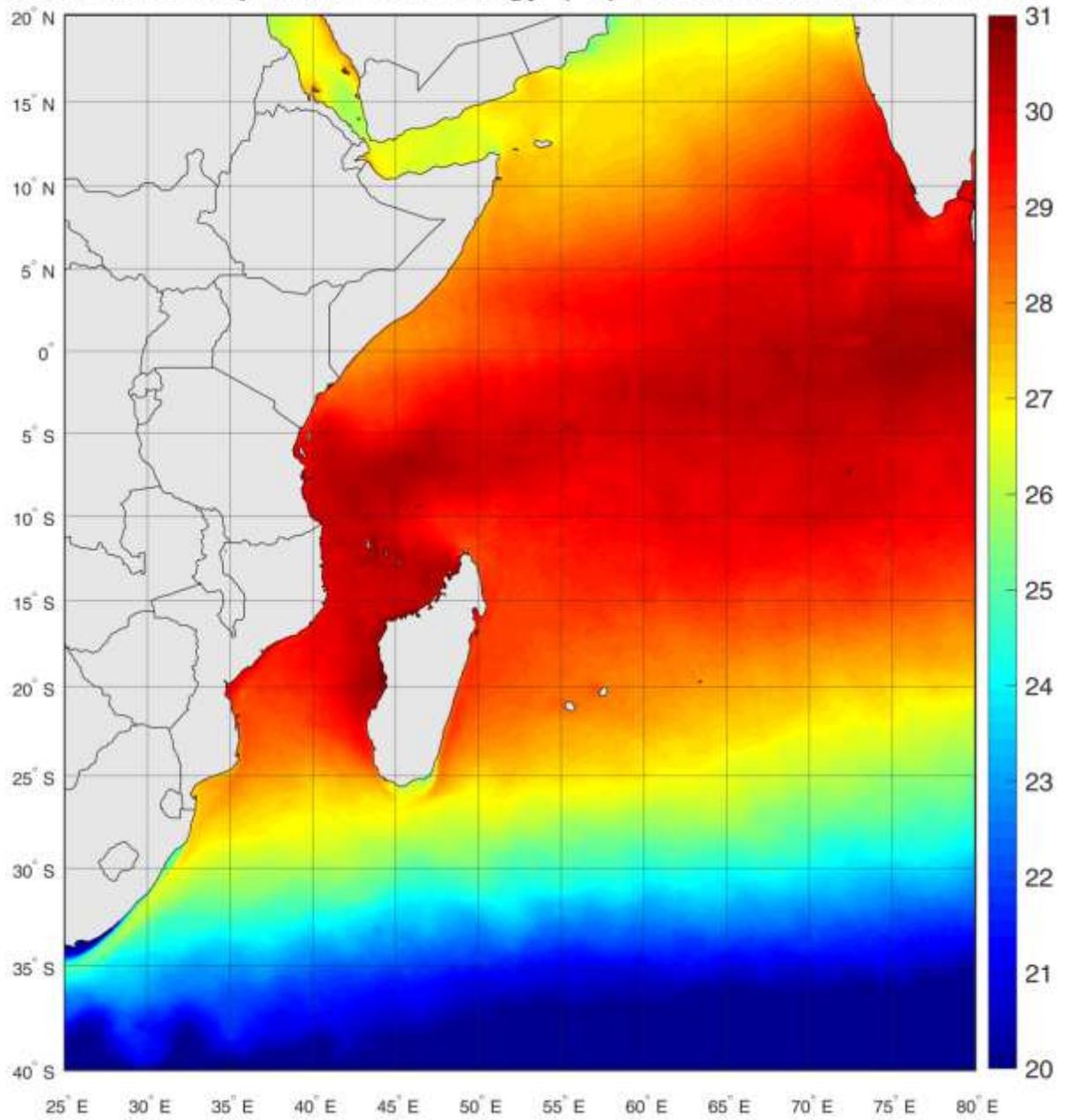
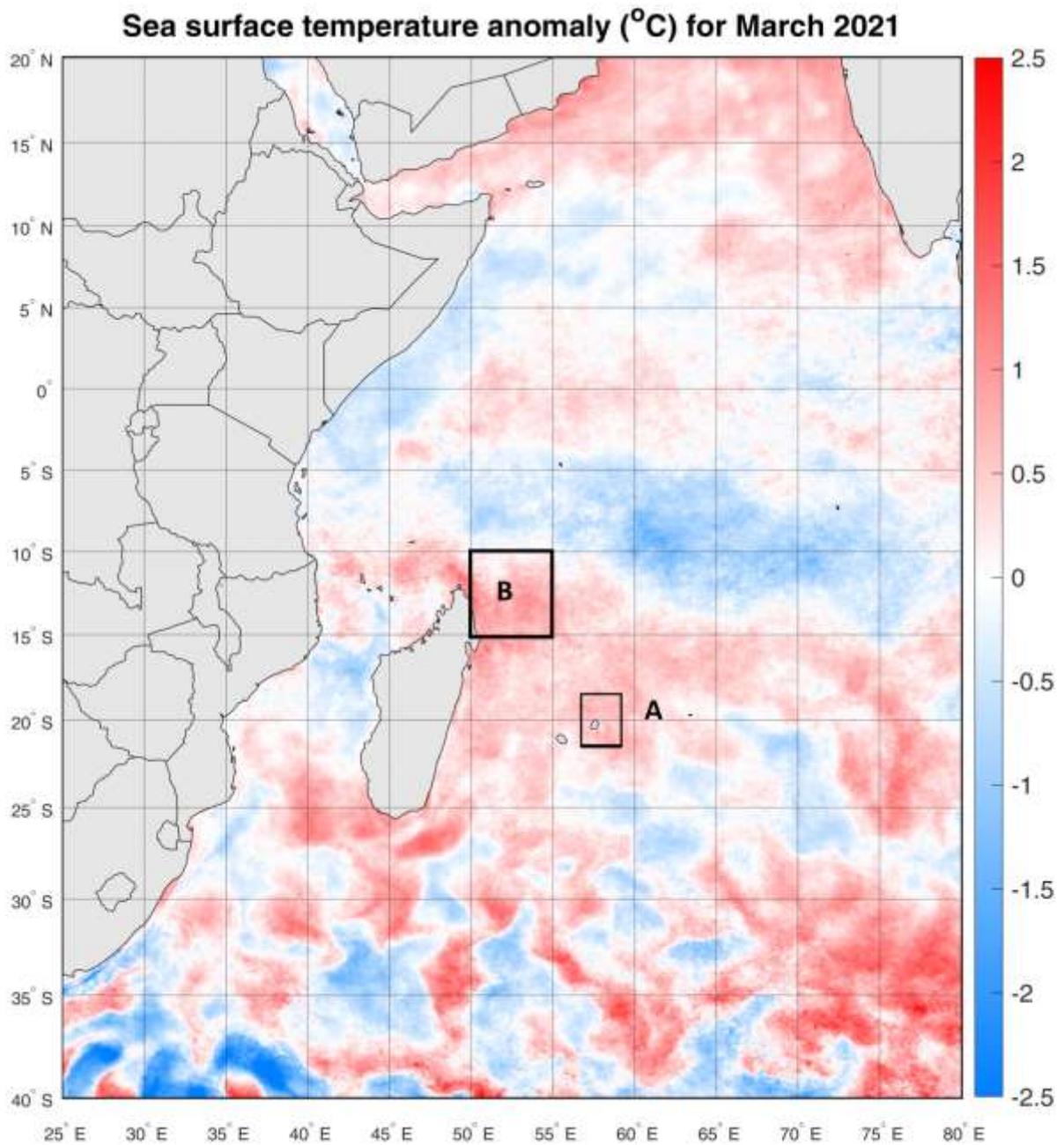


Figure 1: Mean sea surface temperature for the month of March 2021 (°C)

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

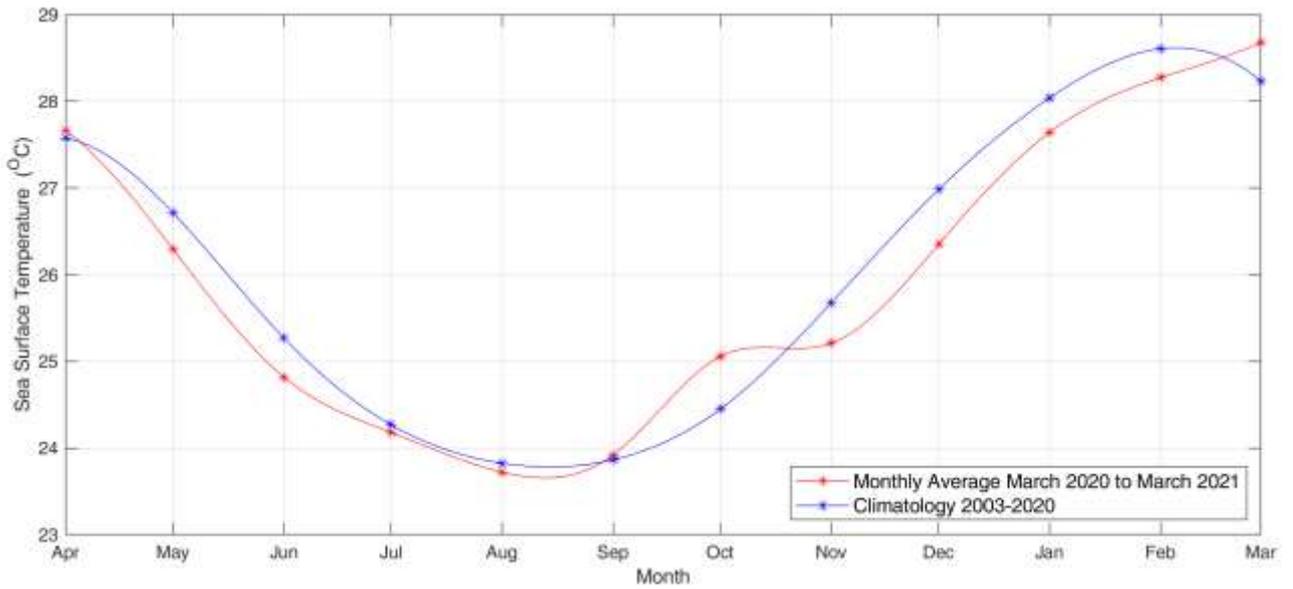


**Figure 2:** Sea Surface Temperature Climatology ( $^{\circ}\text{C}$ ) for the month of March (2003 -2019)

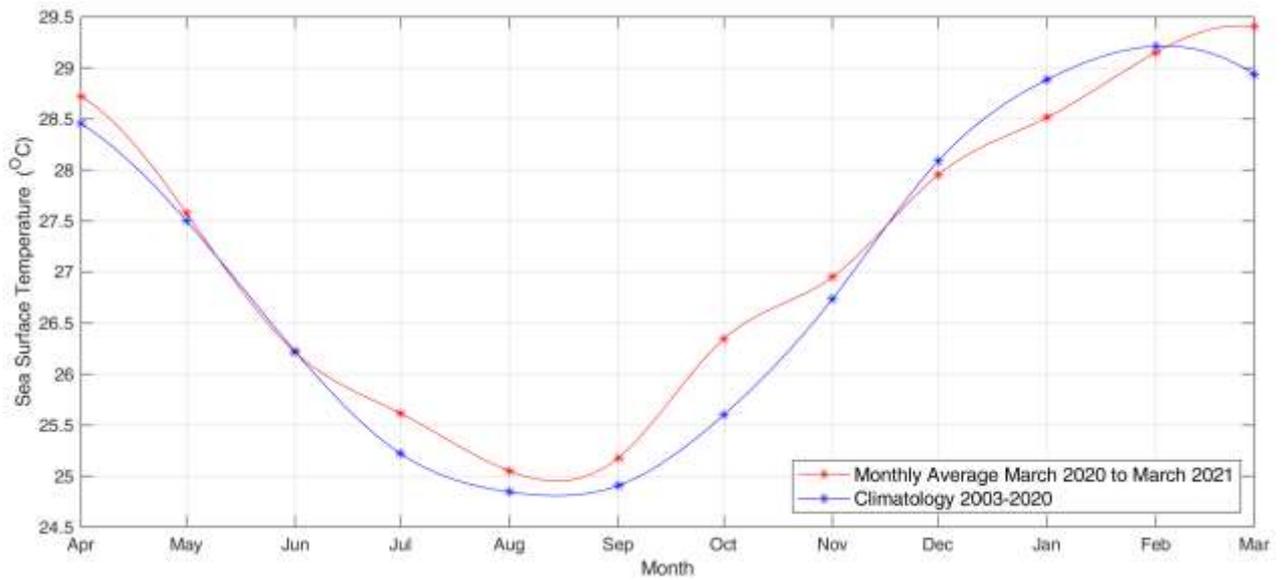


**Figure 3:** Anomaly of Sea Surface Temperature for March 2021 (°C)

Time series generated from the monthly average for March 2021 and the climatological mean for March 2021 in the region highlighted in Figure 3, namely Region A around Mauritius Island and Region B, north-east of Madagascar.



**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 region north-east of Madagascar (Region B)

### 3.1 Description of Sea Surface Temperature

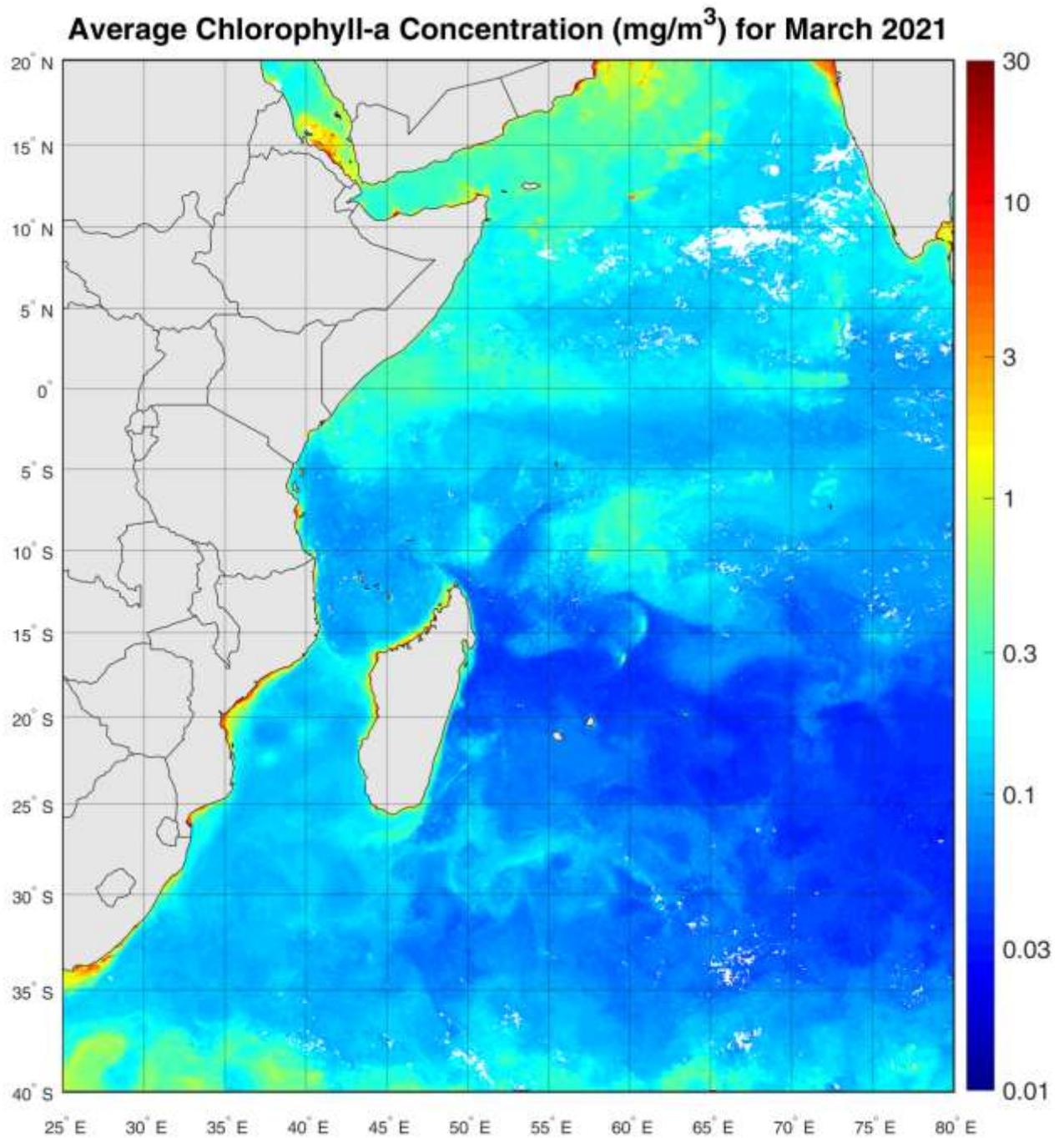
Sea surface temperature (SST) is the temperature of the top millimetre of the ocean's surface. Figure 1 displays the SST variation for the month of March 2021. Warmer temperatures are represented in red and yellow, while relatively cooler temperatures are shown in green and blue. SST anomaly is a departure from average conditions.

For the month of March 2021, a relatively higher temperature was observed in the northern part of the Mozambique Channel and off the coast of Tanzania, while the temperature remained relatively lower off Somalia and below latitude 20°S. The average SST in the Mascarene region varied between 27 to 29 °C, while in the Mozambique Channel it exceeds 30 °C. Figure 2 represents the climatology for the month of March based on average SST calculated from 2003 to 2019. As depicted in the two figures, the observed SST for the period of March 2021 follows the typical trend for this month, except for some localised regions.

Figure 3 shows a 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. A high SST anomaly was observed in the region east of Madagascar, being more prominent in the north-east region while unlike the previous month, a positive anomaly was observed in the Mascarene region. This observation is confirmed by the time series analysis for the region around Mauritius (Figure 4, depicted by 'Region A' in Figure 3) which shows that for the first time since October 2020, the SST is higher than the climatology.

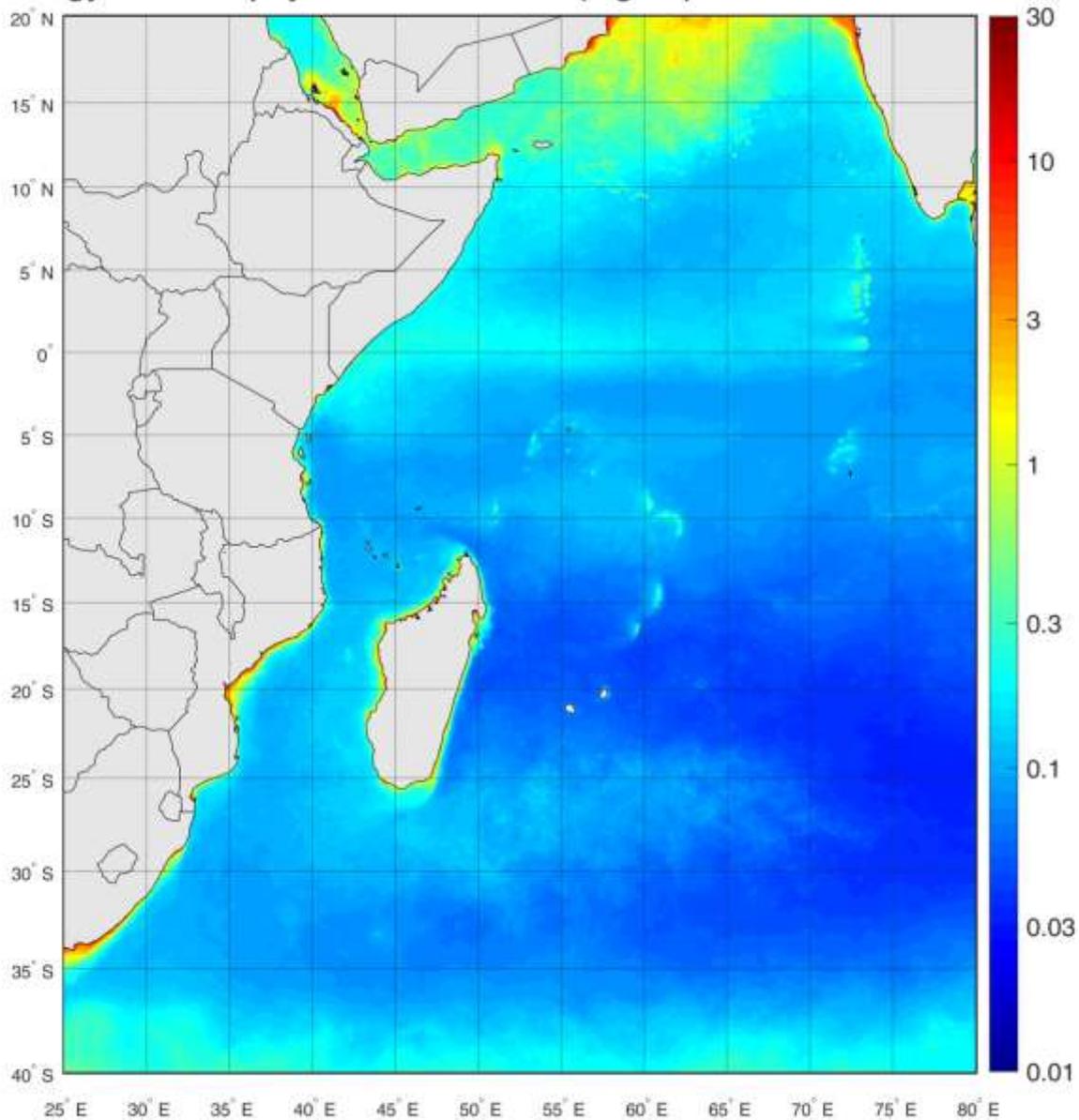
Figure 5 shows the temporal variation of SST in the region north-east of Madagascar, between latitude 10 °S to 20 °S and longitude 50 °E to 55 °E (Region B in Figure 3). Although a general climatological trend was followed, the graph shows that the highest SST observed for this region (29.4 °C) for the last 12 months has been recorded for this month.

## 4.0 Chlorophyll-a Concentration

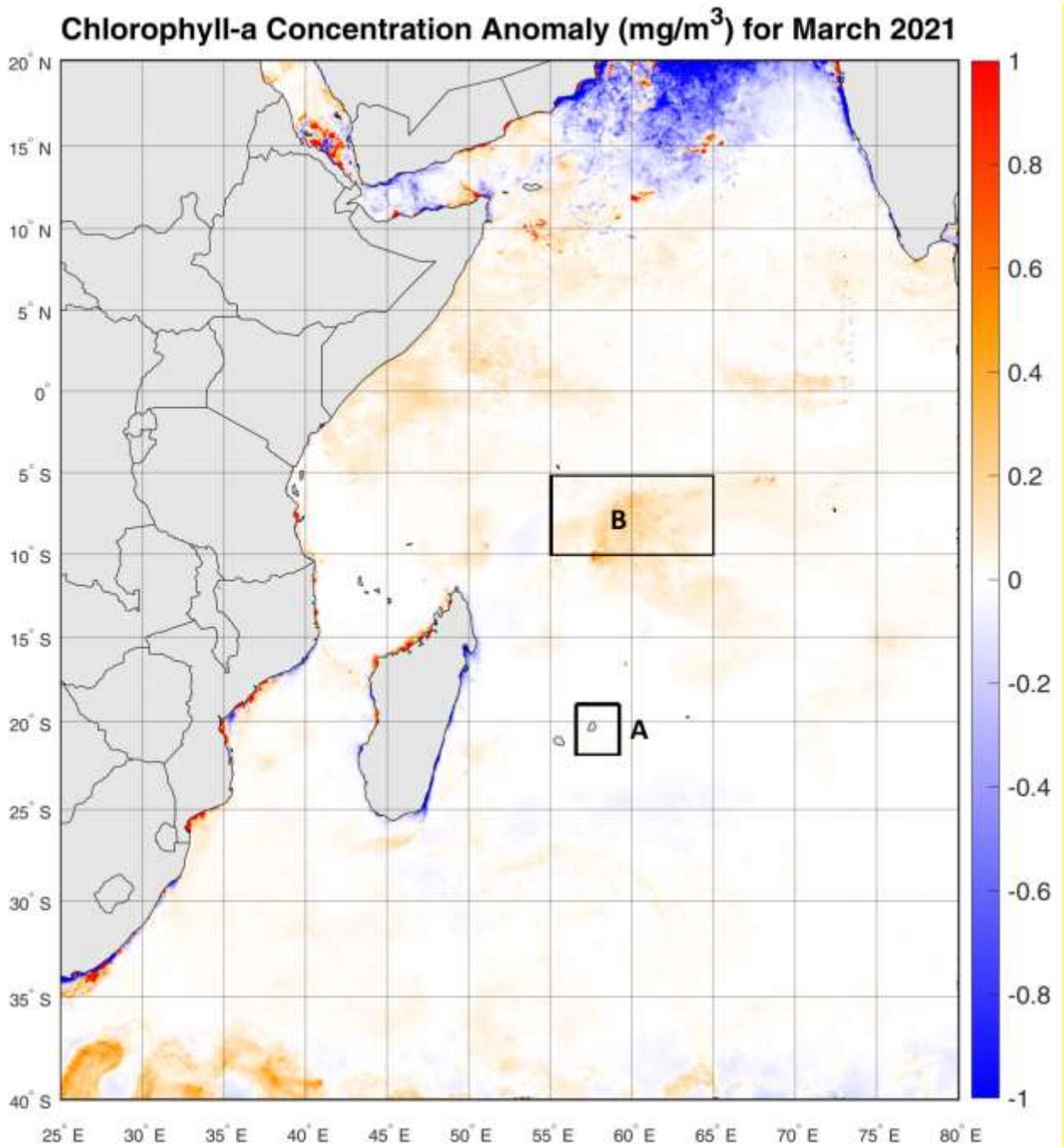


**Figure 6:** Mean chlorophyll-a concentration for the month of March 2021 (mg/m<sup>3</sup>)

### Climatology of Chlorophyll-a Concentration (mg/m<sup>3</sup>) for March from 2003 to 2019

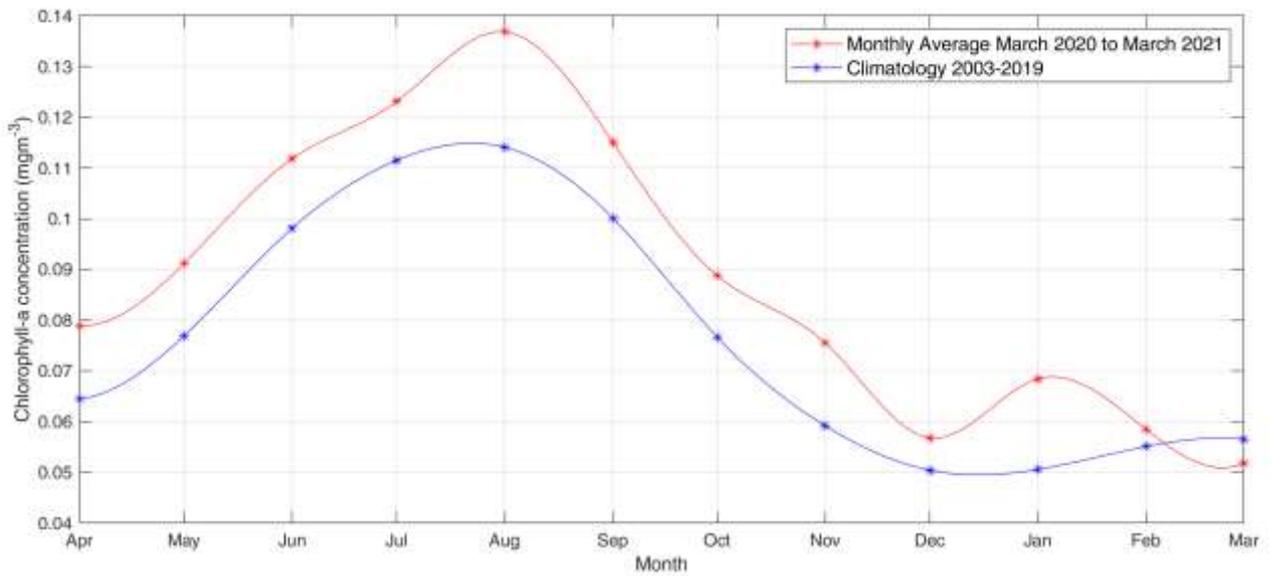


**Figure 7:** Chlorophyll-a Climatology (mg/m<sup>3</sup>) for the month of March (2003 -2019)

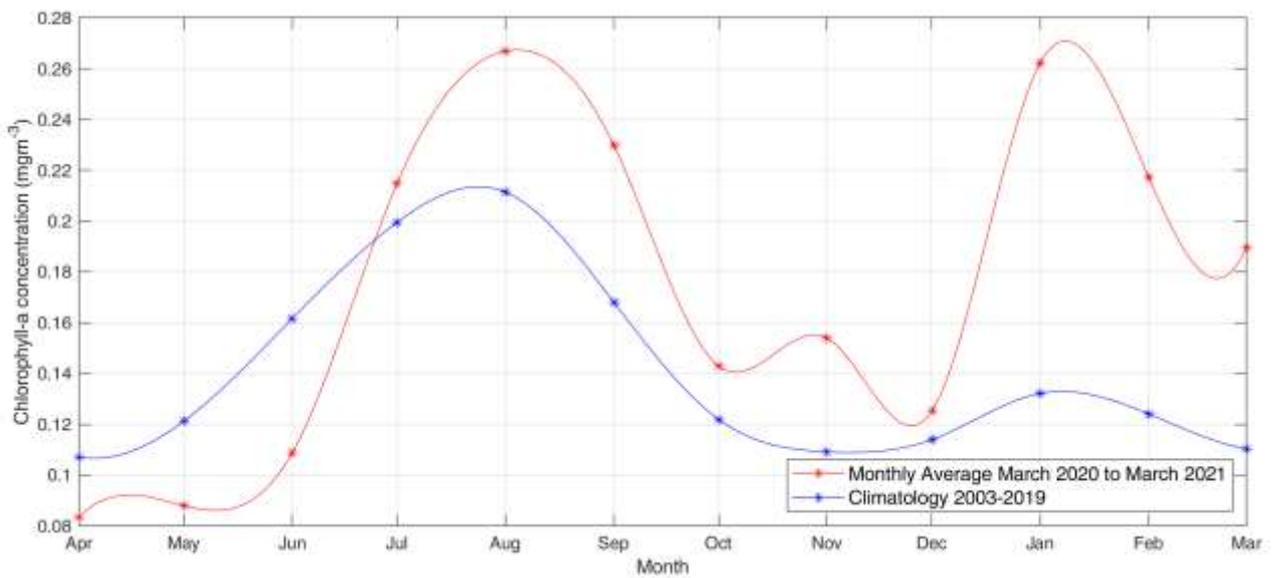


**Figure 8:** Anomaly of chlorophyll-a for March 2021 ( $\text{mg}/\text{m}^3$ )

Chlorophyll-a time series generated from the monthly average for March 2021 and the climatological normal for March 2021 in the region encircle in Figure 8, namely region A around Mauritius and region B, South-East of Seychelles Island.



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



**Figure 10:** Temporal variation of chlorophyll-a (mg/m<sup>3</sup>) for the region South-East of Seychelles Islands (Region B)

## 4.1 Description of chlorophyll-a

Figure 6 shows the chlorophyll-a concentration in milligrams of Chl-a per cubic metre of seawater for the month of March 2021. The regions where the Chl-a concentration was very low, indicating a low abundance of phytoplankton, are in blue and those where the Chl-a concentration was high are shown in red. Land is light grey, and places where there is no data (e.g. cloud cover) is represented in white.

A high Chl-a concentration usually indicates a high primary productivity, an essential condition for fish aggregation and fish catch, while a 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 south-east of Seychelles while the Chl-a concentration was comparatively lower in the Mascarene region. Similar to the previous month, the Chl-a concentration was relatively lower in the western side of Madagascar, as compared to the eastern side. The anomaly map for March 2021 (Figure 8) shows little deviation from the climatology except for the region of the south-east of Seychelles. This phenomenon could potentially be attributed to the upwelling caused by the formation of a tropical disturbance in the Intertropical Convergence Zone.

Figure 9 shows the monthly time series for the region around Mauritius Island (region A on Figure 8). The graph shows that for the first time since April 2020, a negative Chl-a anomaly was observed for this region this month.

Figure 10 shows the temporal variation of Chl-a for the region south-east of Seychelles Islands (region B on Figure 8). The graph shows that a relatively higher positive Chl-a anomaly is being observed for this region since December 2020.

## Acknowledgements

This bulletin was compiled within the framework of the GMES & Africa project. Data used for the processing was obtained from OceanColor. Mauritius Oceanography Institute (MOI) acknowledges the contribution of the Joint Research Centre (JRC) team as well as any other people who collaborated in the issue of this bulletin.

## 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.