



**GMES  
AND AFRICA**



# MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean

April 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

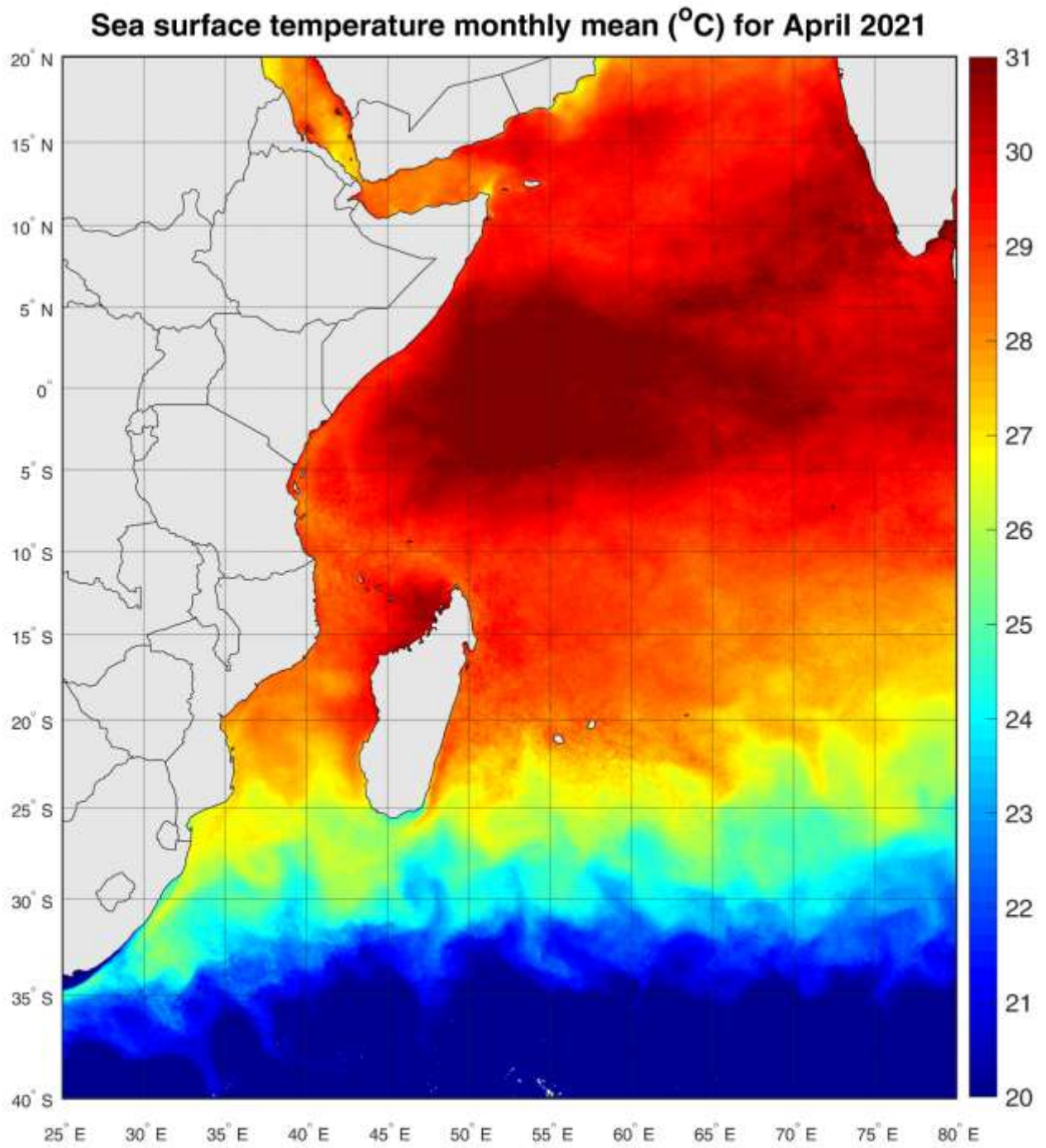
### Sea Surface Temperature

- For the month of April 2021, high temperature was observed in the southern hemisphere above latitude 20° S.
- The average SST in the Mascarene region varied between 28 to 29 °C.
- The observed SST for the period of April 2021 is similar to the climatological mean in the region of interest.
- A relatively higher SST anomaly was observed in the Mascarene region, in the north east of Madagascar and in the north of the Seychelles Islands.

### Chlorophyll-a Concentration

- A high Chlorophyll-a level was observed in the region around Cargados Carajos (St-Brandon) Island.
- The Chlorophyll-a concentration in the Mascarene region was relatively low.
- The Chlorophyll-a concentration across the region of interest was similar to the climatology except for some localised coastal regions.

### 3.0 Sea Surface Temperature



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

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

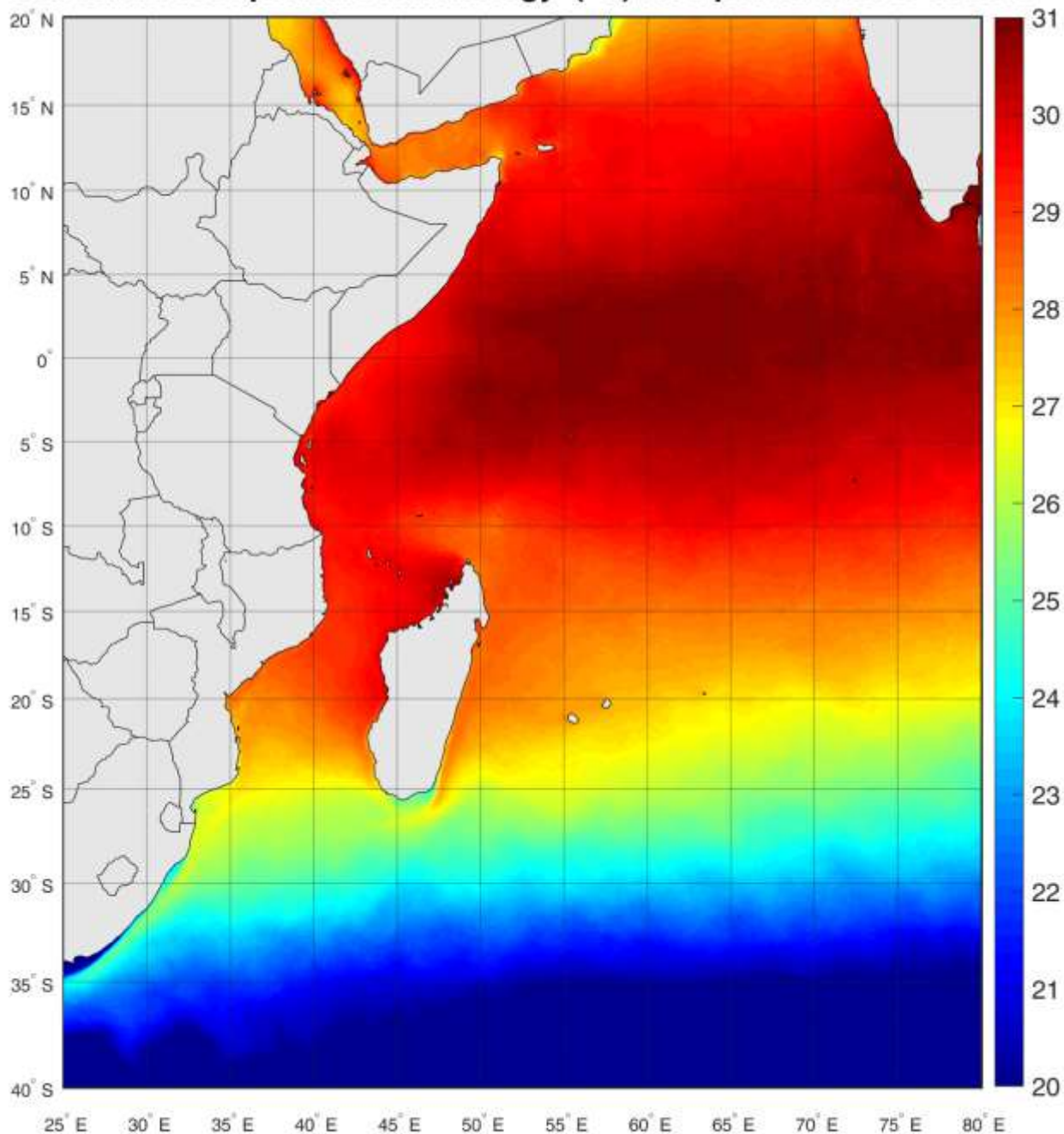
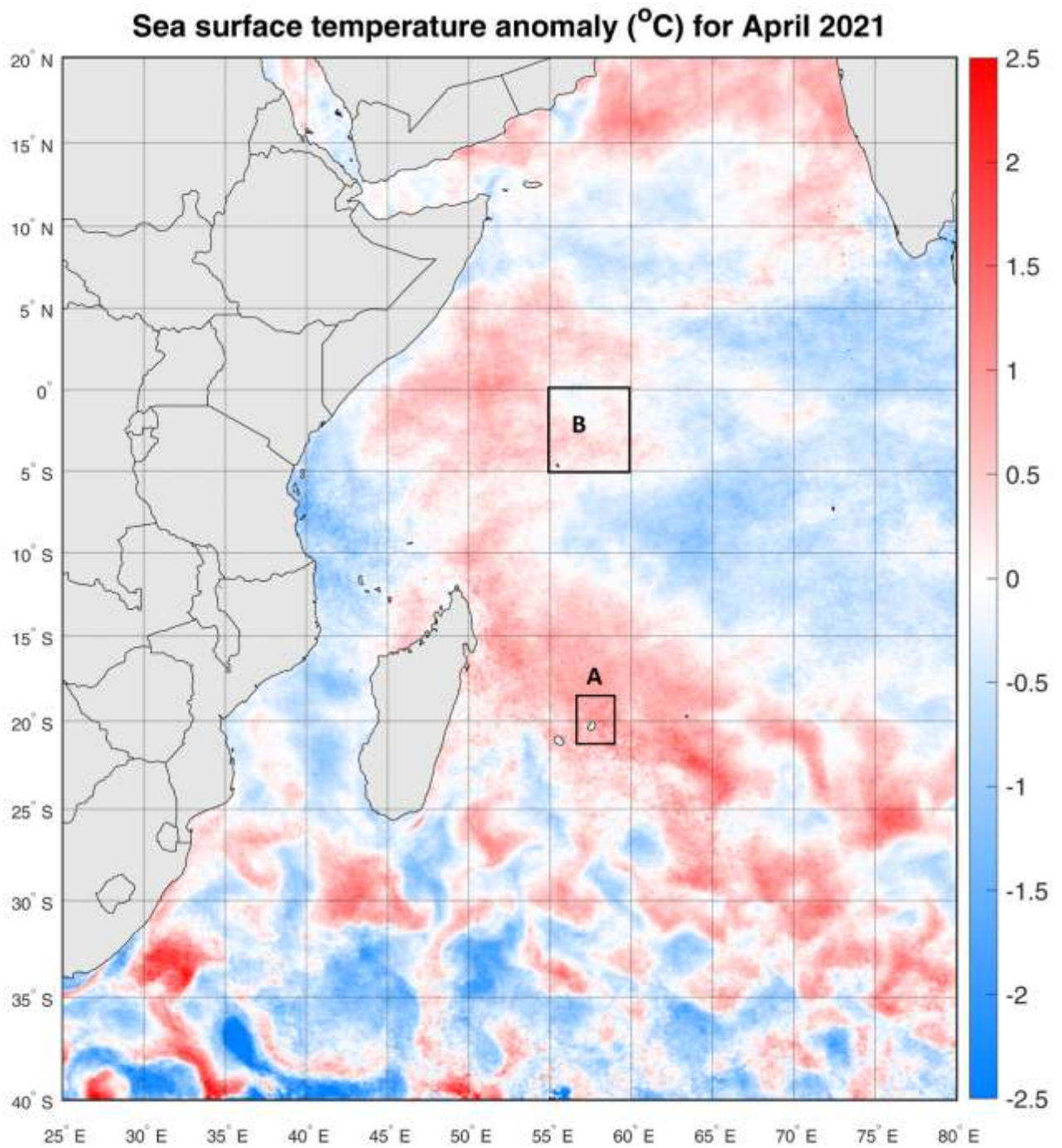
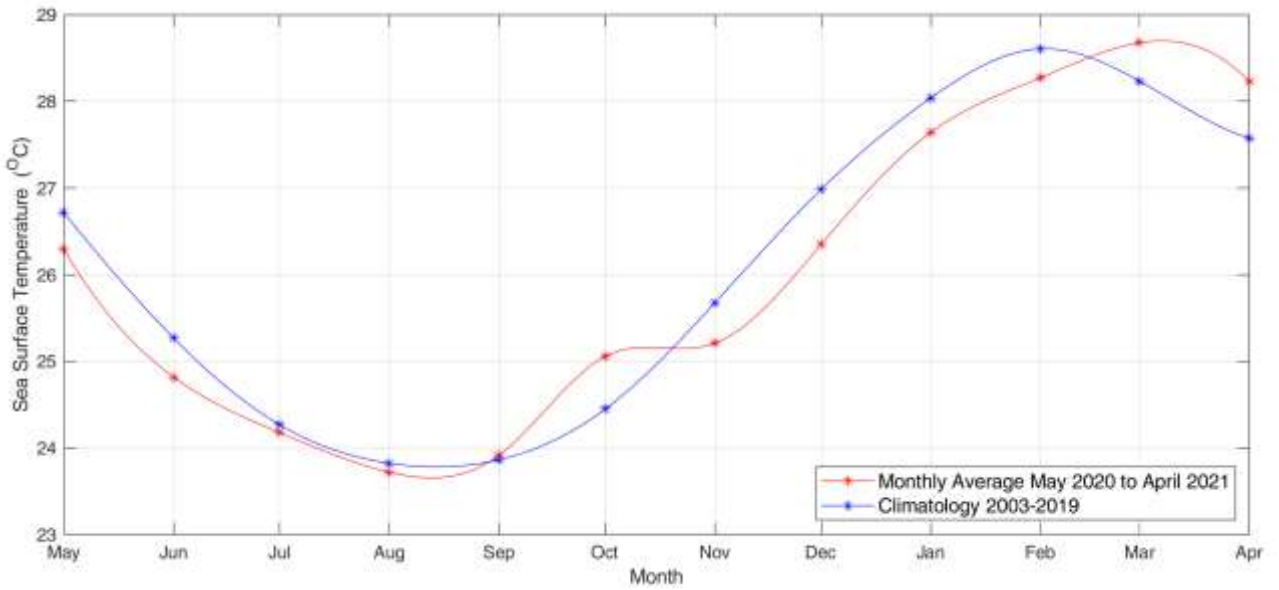


Figure 2: Sea Surface Temperature Climatology ( $^{\circ}\text{C}$ ) for the month of April (2003 -2019)

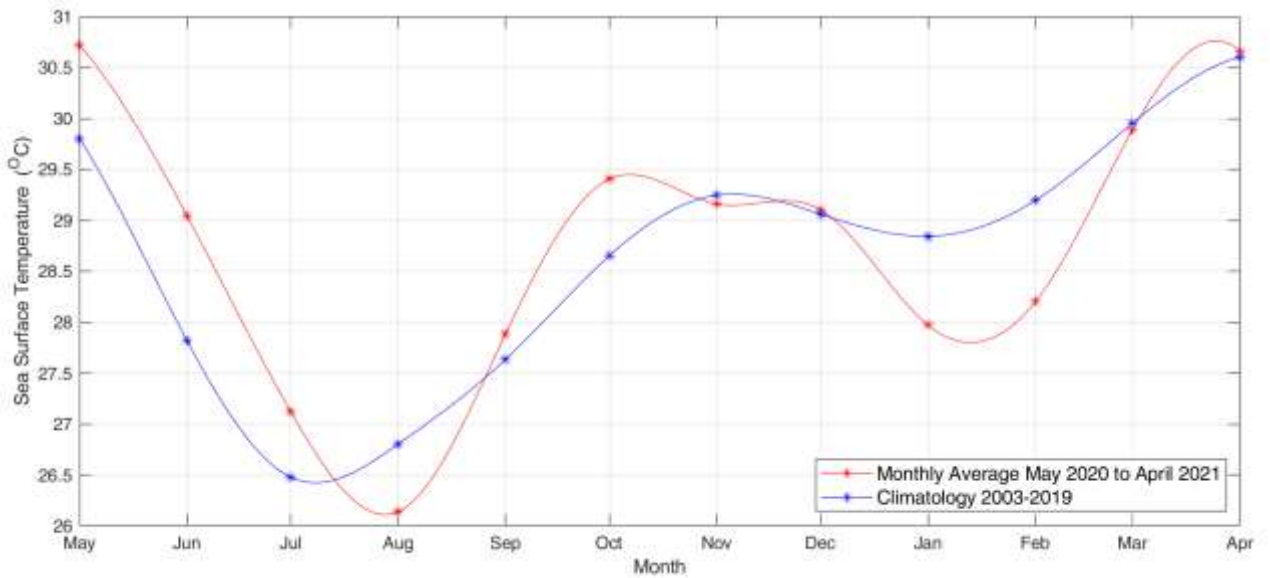


**Figure 3:** Anomaly of Sea Surface Temperature for April 2021 ( $^{\circ}\text{C}$ )

Time series generated from the monthly average for April 2021 and the climatological mean for April 2021 in the region highlighted in Figure 3, namely Region A around Mauritius Island and Region B, around the Seychelles Islands.



**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 around Seychelles Islands (Region B)



### 3.1 Description of Sea Surface Temperature

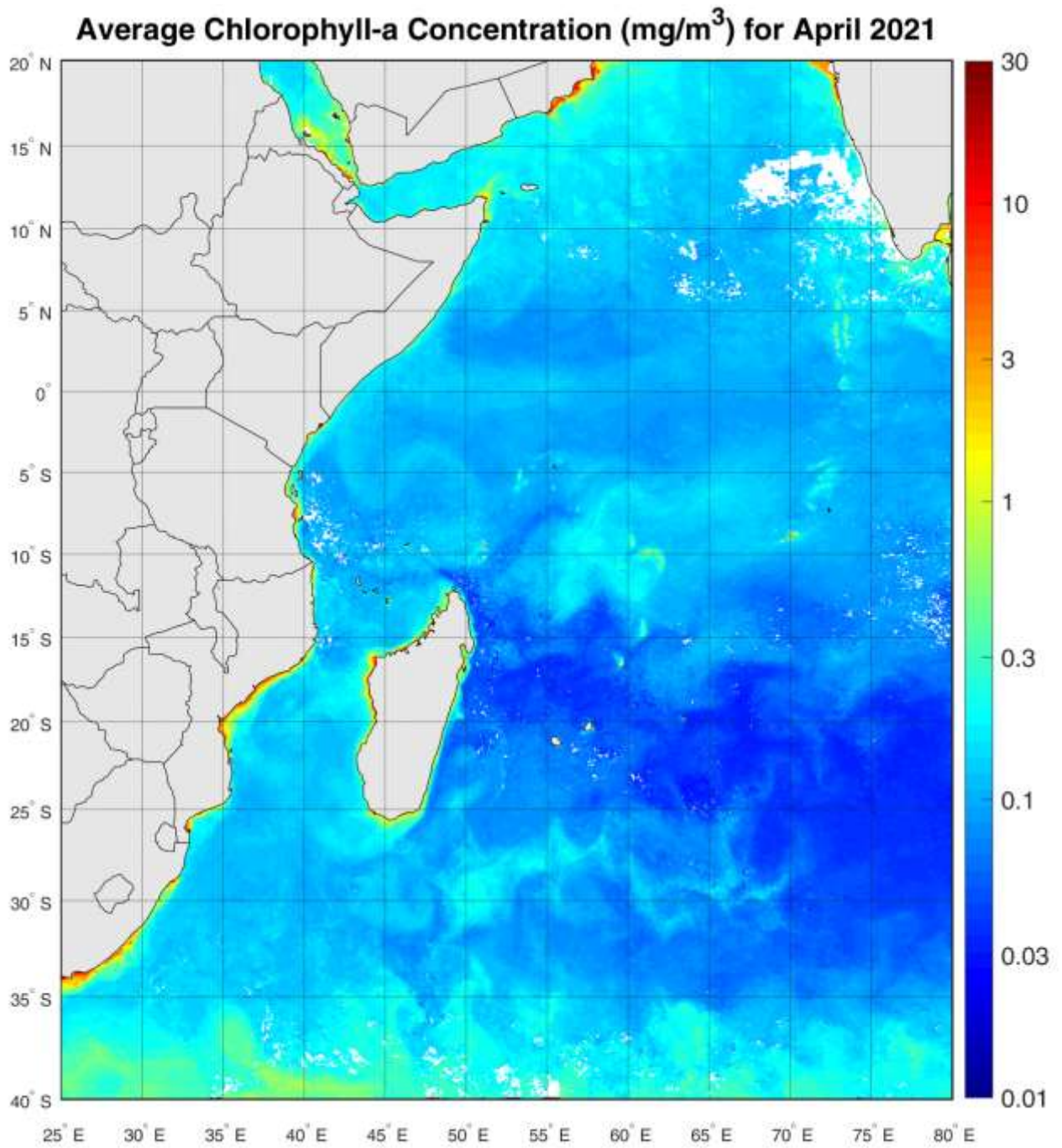
Sea surface temperature (SST) is the temperature of the top millimetre of the ocean's surface. Figure 1 displays the SST variation for the month of April 2021. Warmer temperatures are represented in red and yellow, while relatively cooler temperatures are shown in green and blue. SST anomaly is a departure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

For the month of April 2021, high temperature was observed in the southern hemisphere above latitude 20° S. The average SST in the Mascarene region varied between 28 to 29 °C. Figure 2 represents the climatology for the month of April based on the average SST calculated from 2003 to 2019. As depicted in the Figures 1 and 2, the observed SST for the period of April 2021 is similar to the climatological mean in the region of interest.

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 relatively higher SST anomaly was observed in the Mascarene region, through the north east of Madagascar up to the north of the Seychelles Islands. The time series analysis for the region around Mauritius (Figure 4, depicted by 'Region A' in Figure 3) confirms this observation.

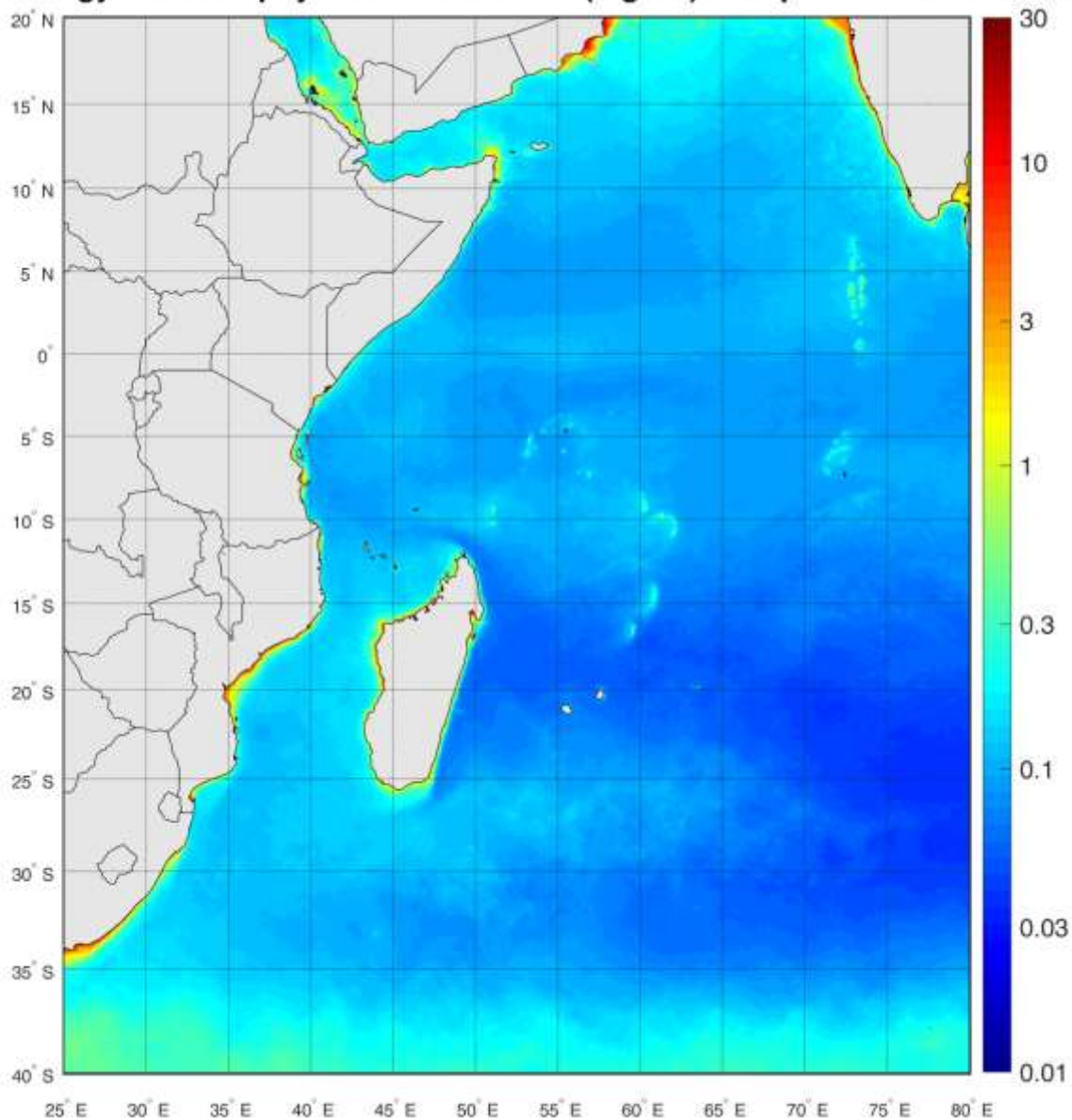
Figure 5 shows the temporal variation of SST in the region around the Seychelles, between latitude 0 °S to 5 °S and longitude 55 °E to 60 °E (Region B in Figure 3). The graph shows that the general climatological trend is being observed with some minor deviations.

## 4.0 Chlorophyll-a Concentration

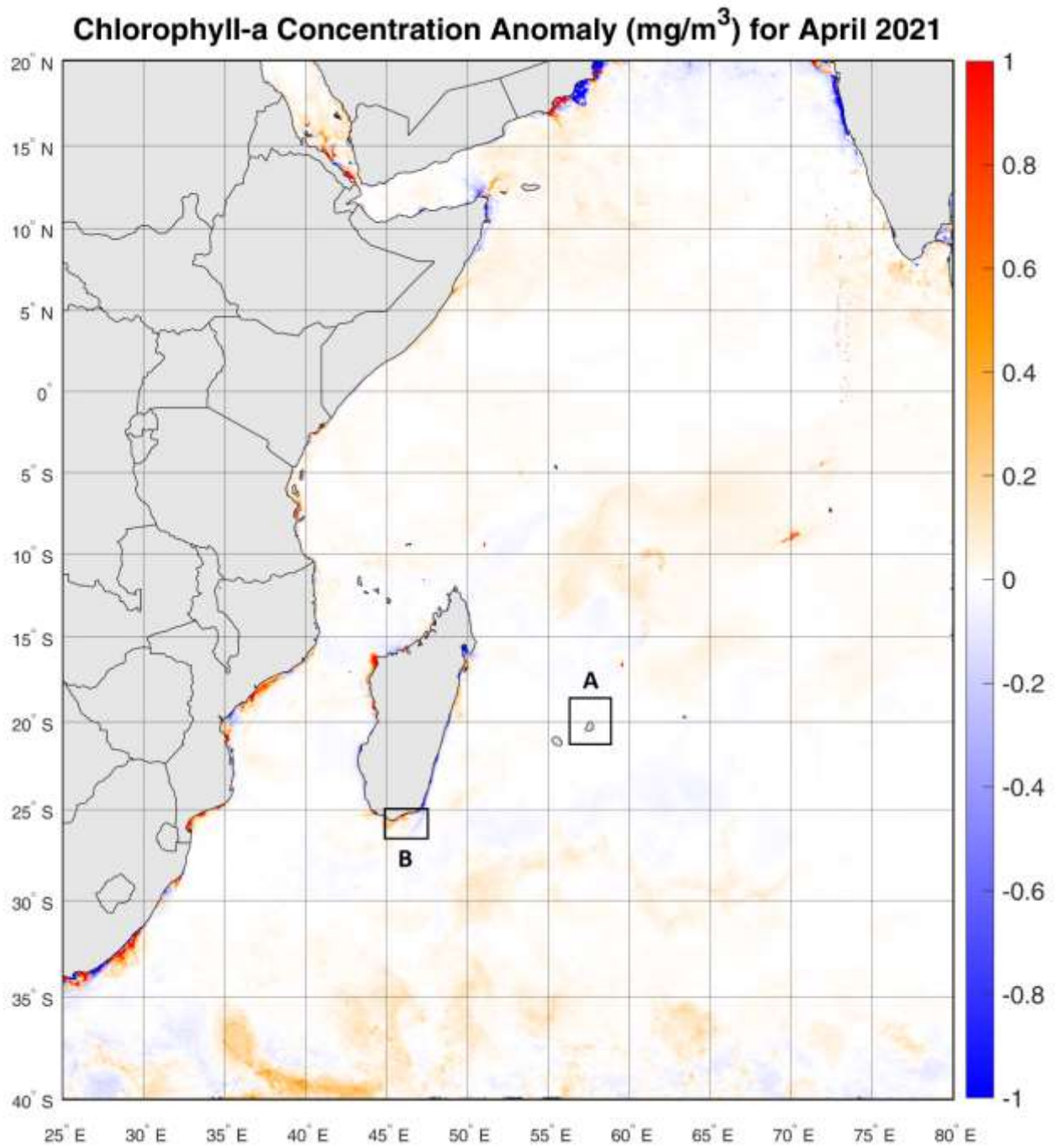


**Figure 6:** Mean chlorophyll-*a* concentration for the month of April 2021 ( $\text{mg}/\text{m}^3$ )

### Climatology of Chlorophyll-a Concentration ( $\text{mg}/\text{m}^3$ ) for April from 2003 to 2019

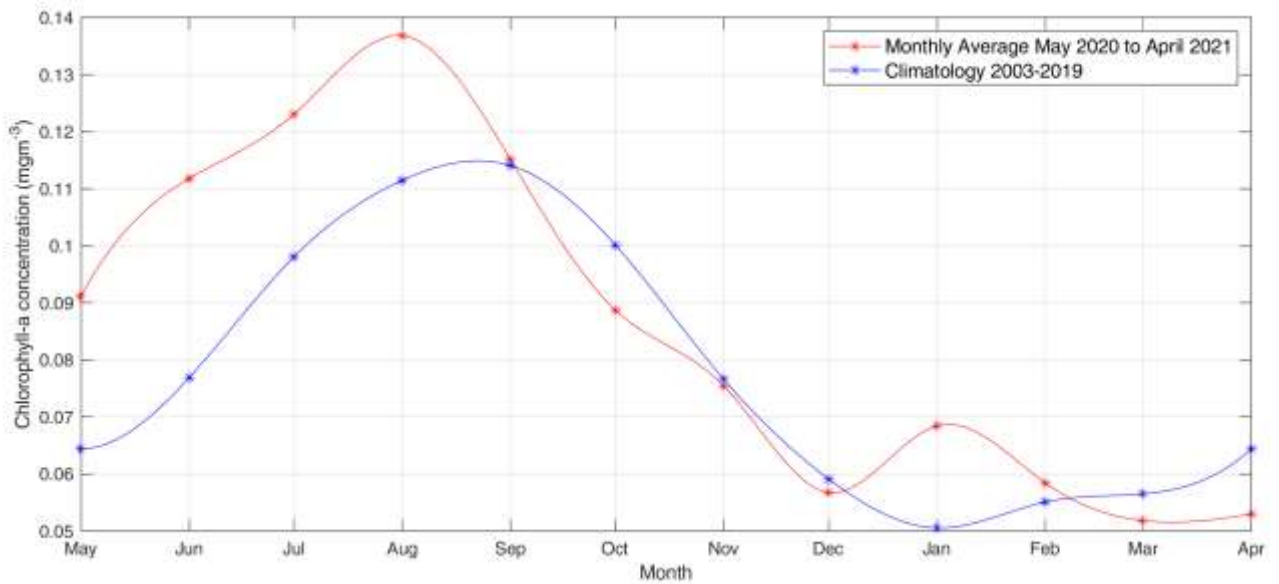


**Figure 7:** Chlorophyll-*a* Climatology ( $\text{mg}/\text{m}^3$ ) for the month of April (2003 -2019)

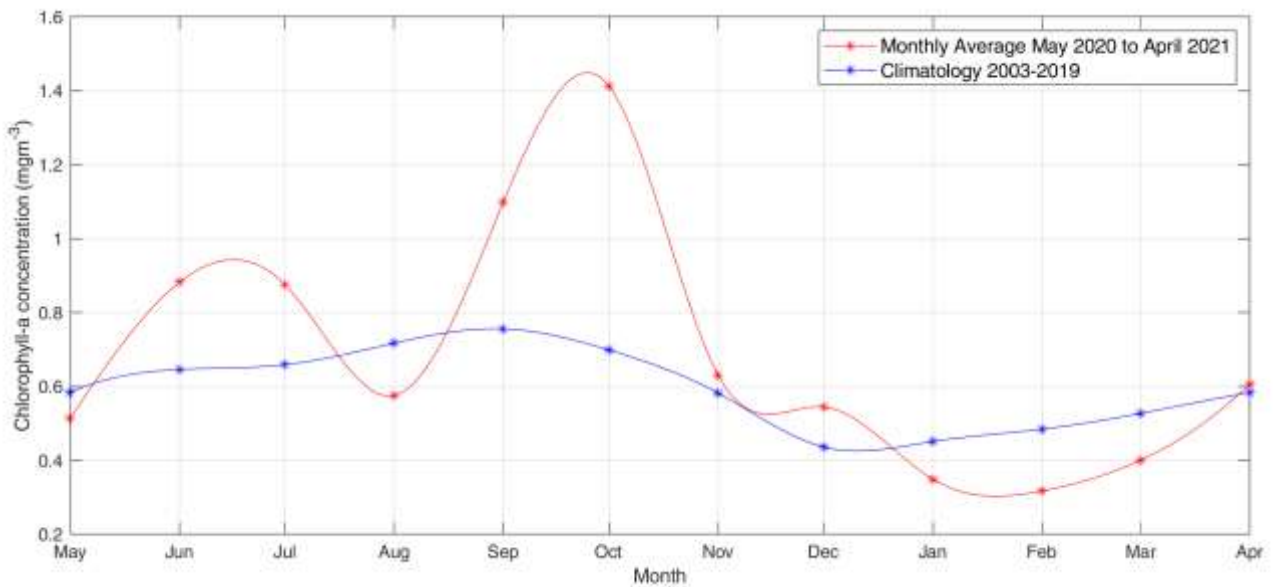


**Figure 8:** Anomaly of chlorophyll-*a* for April 2021 ( $\text{mg}/\text{m}^3$ )

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



**Figure 9:** Temporal variation of chlorophyll-a ( $\text{mg}/\text{m}^3$ ) around Mauritius Island (Region A)



**Figure 10:** Temporal variation of chlorophyll-a ( $\text{mg}/\text{m}^3$ ) for the region South of Madagascar. (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 April 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.

As it was the case the previous month, a high Chl-a level was observed in the region around Cargados Carajos (St-Brandon) Island while the Chl-a concentration was typically lower in the Mascarene region. Elsewhere, as seen in Figures 6 and 7, the Chl-a concentration was similar to the climatology. The anomaly map for April 2021 (Figure 8) shows little deviation from the norm ( $< \pm 0.1$ ) except for some localised coastal regions such as in the south of Madagascar depicted by region B on the map.

Figure 9 shows the monthly time series for the region around Mauritius Island (region A on Figure 8). The graph shows that the negative Chl-a anomaly observed since mid-February is being maintained.

Figure 10 shows the temporal variation of Chl-a for region B. The graph confirms the positive Chl-a anomaly is that region.

## Acknowledgements

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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.