



**GMES
AND AFRICA**



MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean

June 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

- The average SST in the Mascarene region was around 25 - 26 °C typical of a winter season prevailing.
- The observed SST for the period of June 2021 is similar to the climatological mean in the region of interest.
- Little deviation was observed from the climatology in the Mascarene region whereas SST was relatively colder in the Mozambique Channel.
- A positive SST was observed along the coast of Somalia.

Chlorophyll-a Concentration

- A relatively higher Chl-a content in June 2021 was observed as compared to the climatology across the Indian Ocean except for some localised regions such as off the coast of Somalia.
- The Chl-a concentration in the Mascarene region remained relatively low compared to other regions.
- A relatively higher Chl-a concentration was observed off the northern coast of Somalia, as observed in May 2021.

3.0 Sea Surface Temperature

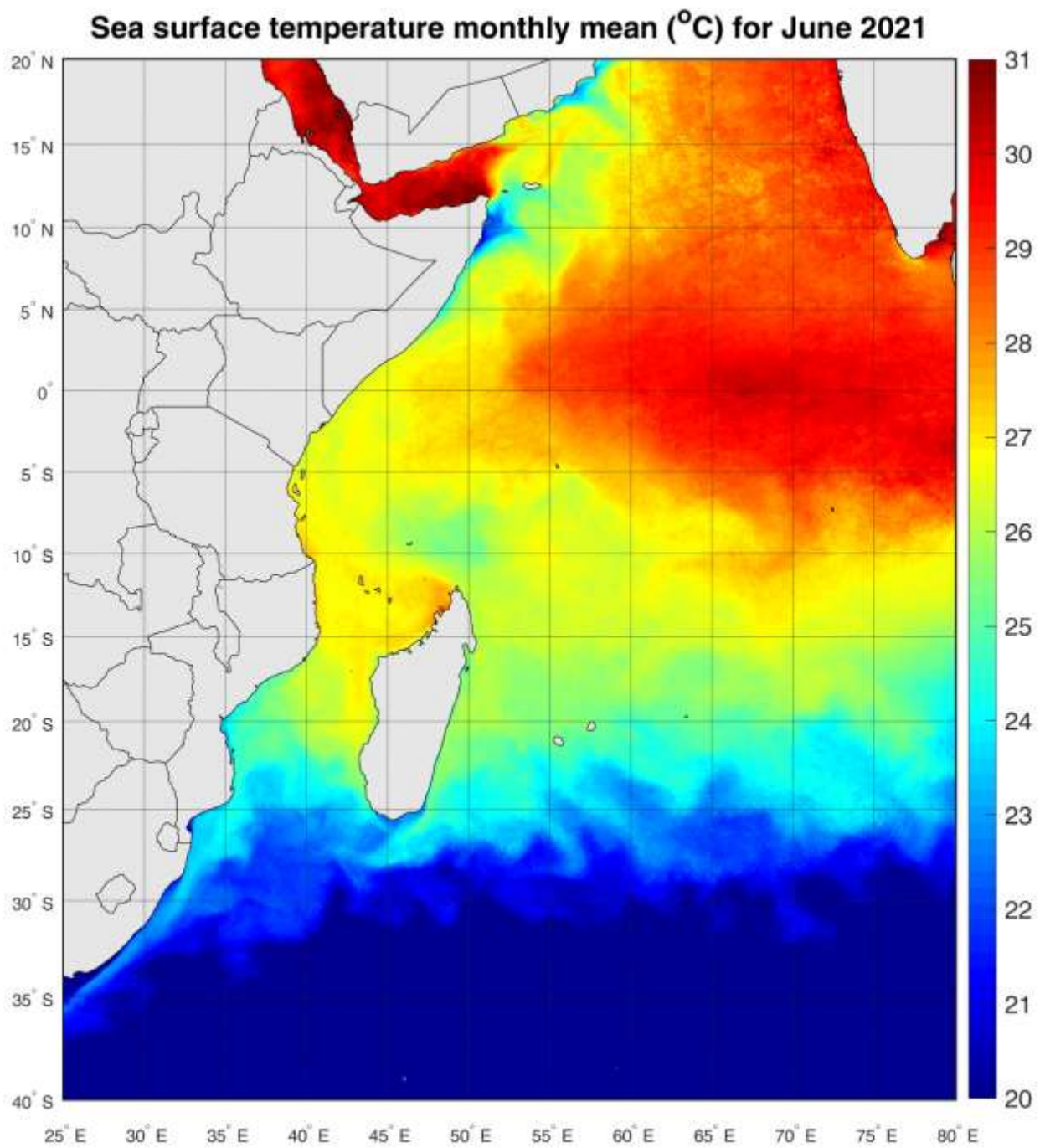


Figure 1: Mean sea surface temperature for the month of June 2021 (°C)

Sea surface temperature climatology (°C) for June from 2003 to 2019

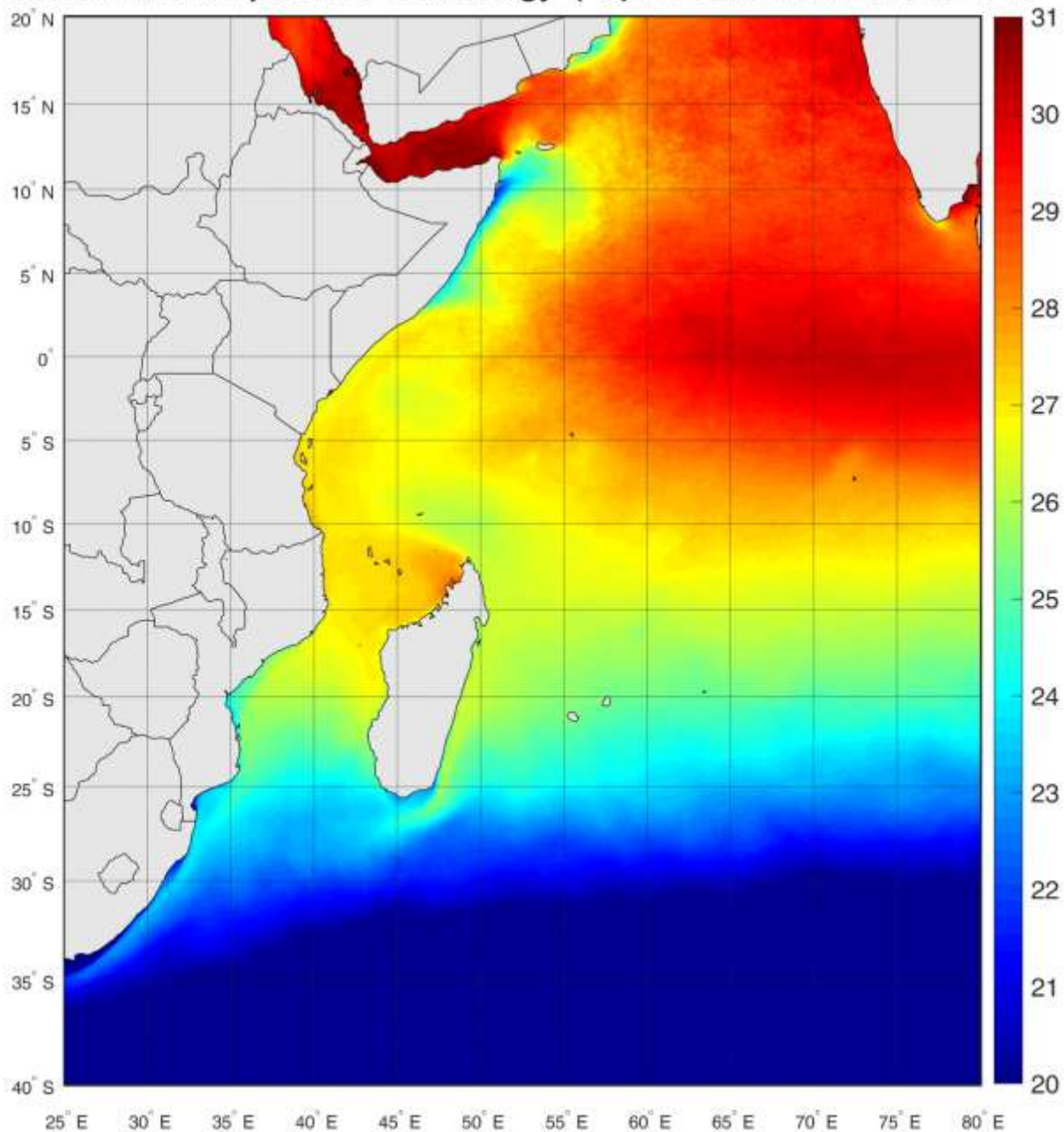


Figure 2: Sea Surface Temperature Climatology (°C) for the month of June (2003 -2019)

Sea surface temperature anomaly ($^{\circ}\text{C}$) for June 2021

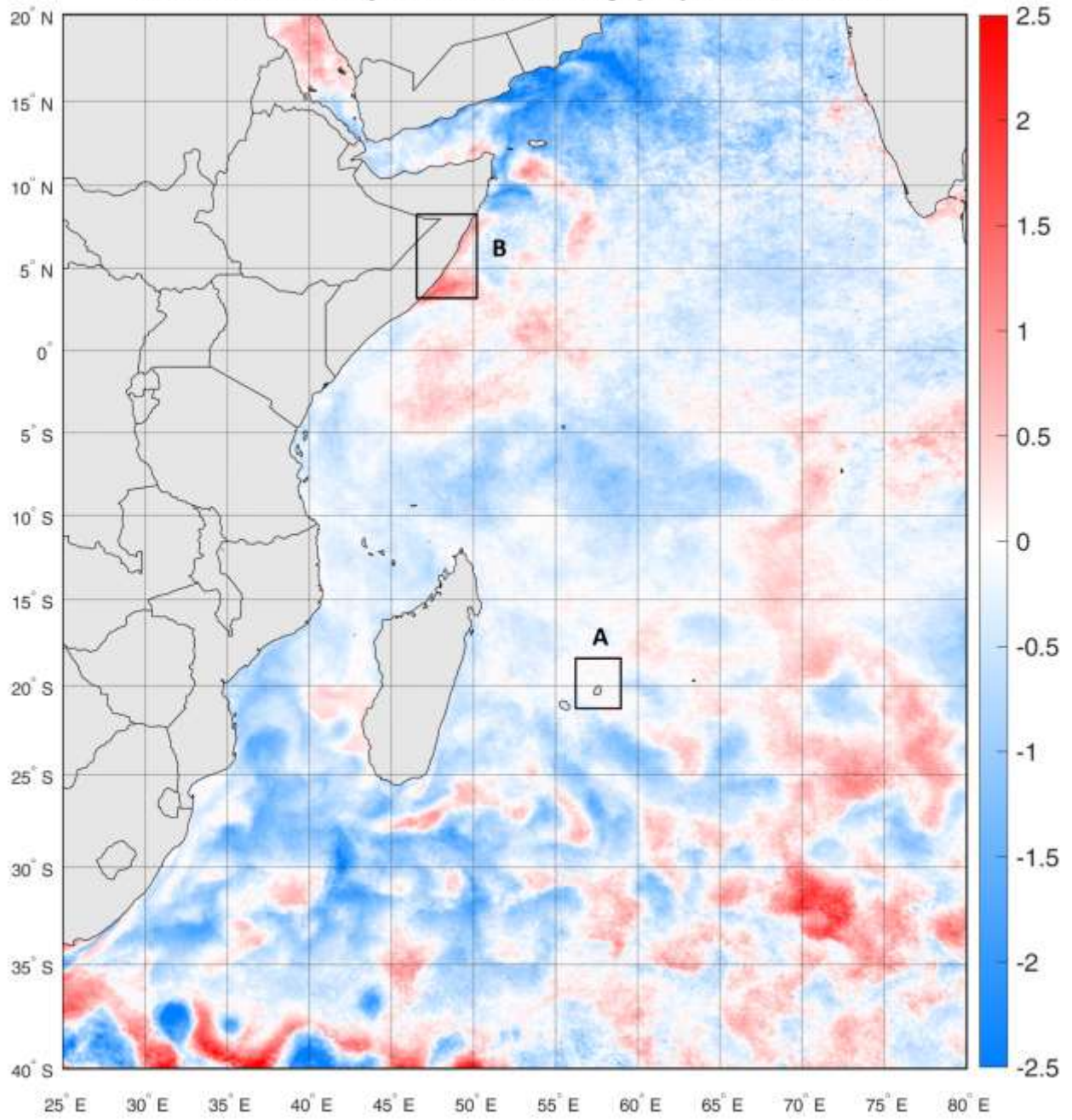


Figure 3: Anomaly of Sea Surface Temperature for June 2021 ($^{\circ}\text{C}$)

Time series generated from the monthly average for June 2021 and the climatological mean for June 2021 in the region highlighted in Figure 3, namely Region A around Mauritius Island and Region B, off the Somalian coast.

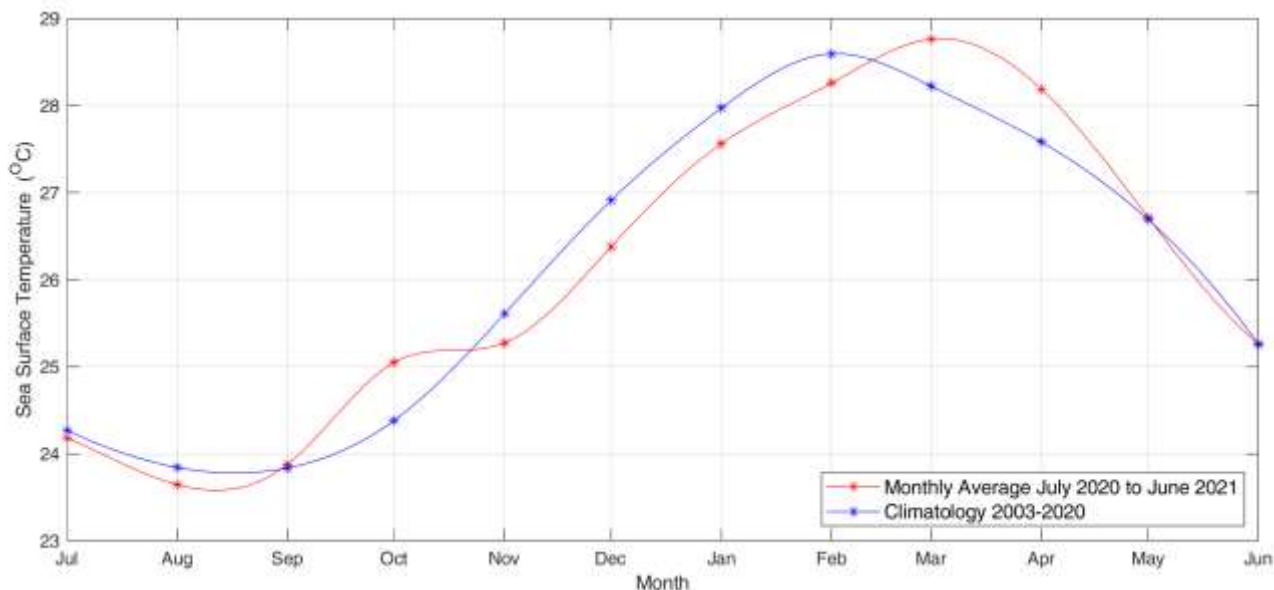


Figure 4: Temporal variation of sea surface temperature (°C) around Mauritius Island (Region A)

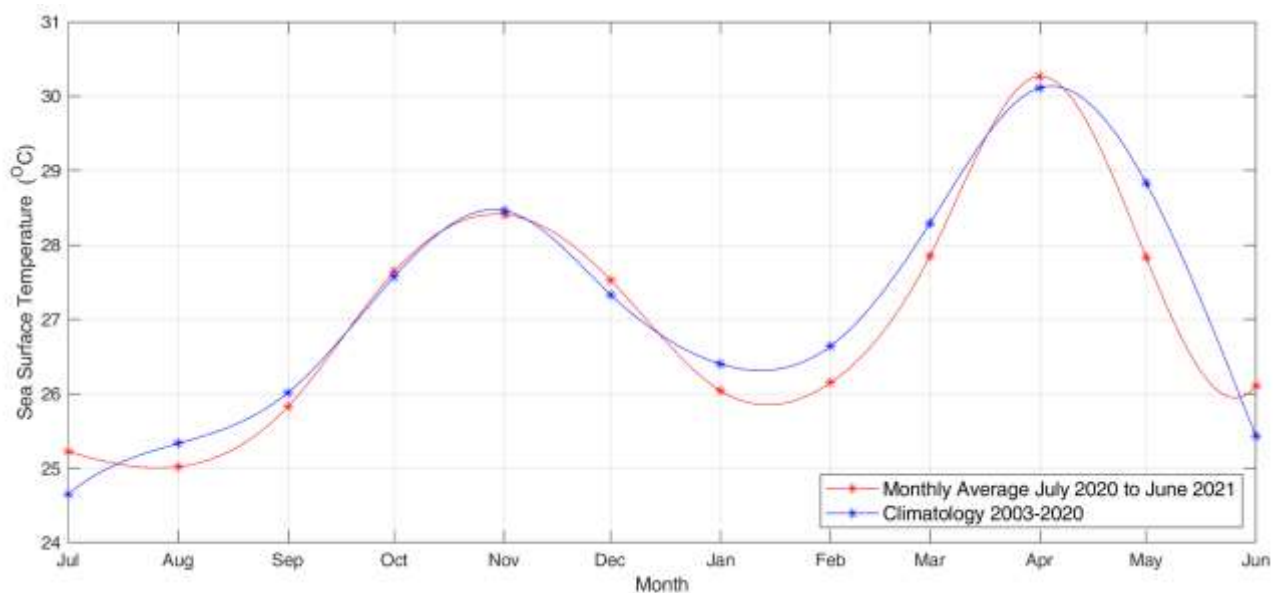


Figure 5: Temporal variation of sea surface temperature (°C) off Somalia (Region B)

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 June 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 June 2021, SST was relatively lower below latitude -20° S as compared to the northern part of the Indian Ocean. The average SST in the Mascarene region was around $25 - 26^{\circ}\text{C}$ typical of a winter season prevailing. Figure 2 represents the climatology for the month of June based on the average SST calculated from 2003 to 2019. The observed SST for the period of June 2021 is similar to the climatological mean in the region of interest, as shown in Figures 1 and 2.

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 the average. As it was the case the previous month, the image shows that the sea surface temperature fluctuated around zero in the Mascarene region but was relatively colder in the Mozambique Channel. 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 off the coast of Somalia, between latitude 3°N to 8°N and longitude 46°E to 50°E (Region B in Figure 3). The graph reinforces the positive anomaly observed around that specific region. The graph also shows that for that region, the average temperature follows the same trend as the climatological mean with minor deviations monitored since last year.

4.0 Chlorophyll-a Concentration

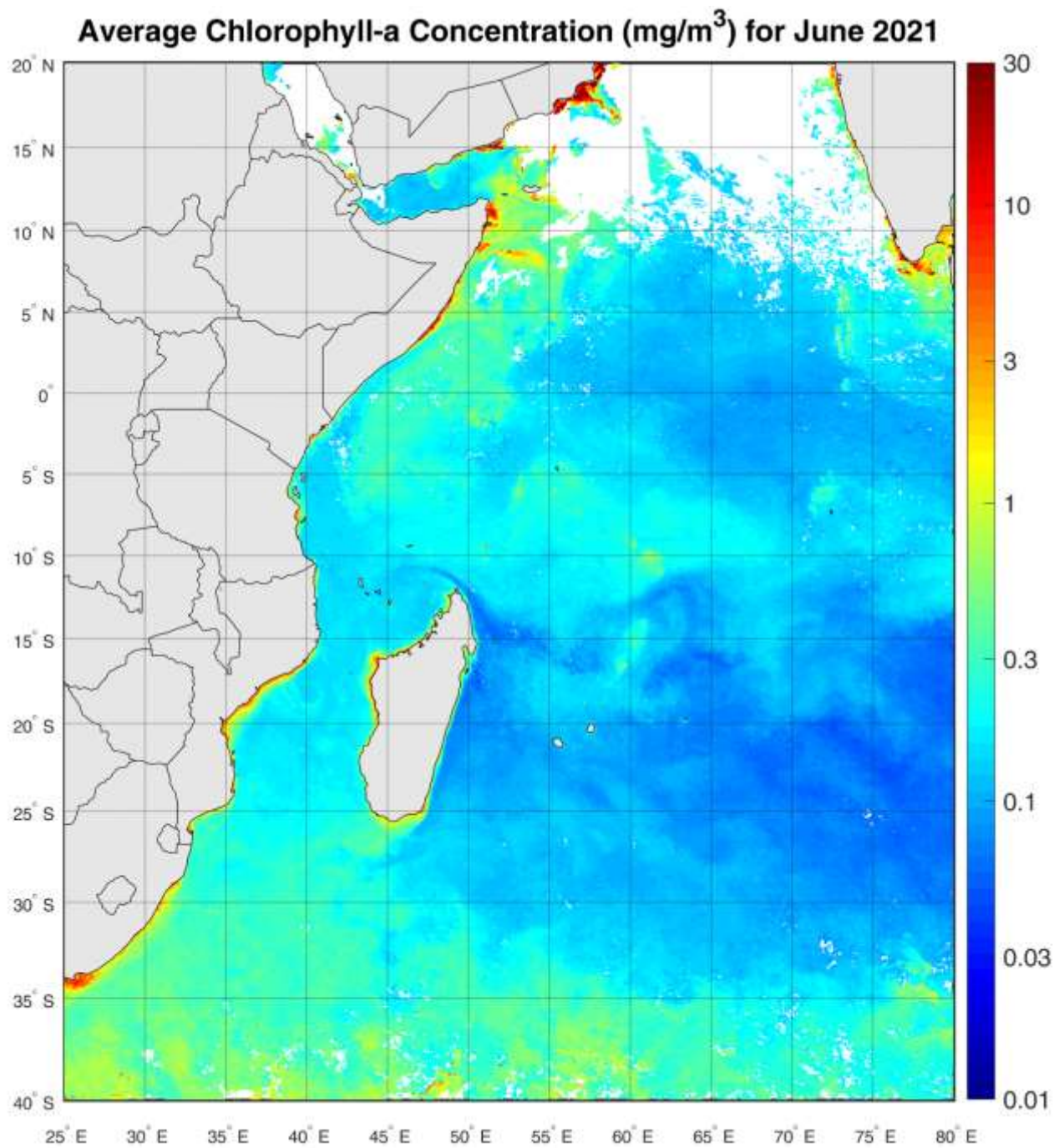


Figure 6: Mean chlorophyll-*a* concentration for the month of June 2021 (mg/m^3)

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

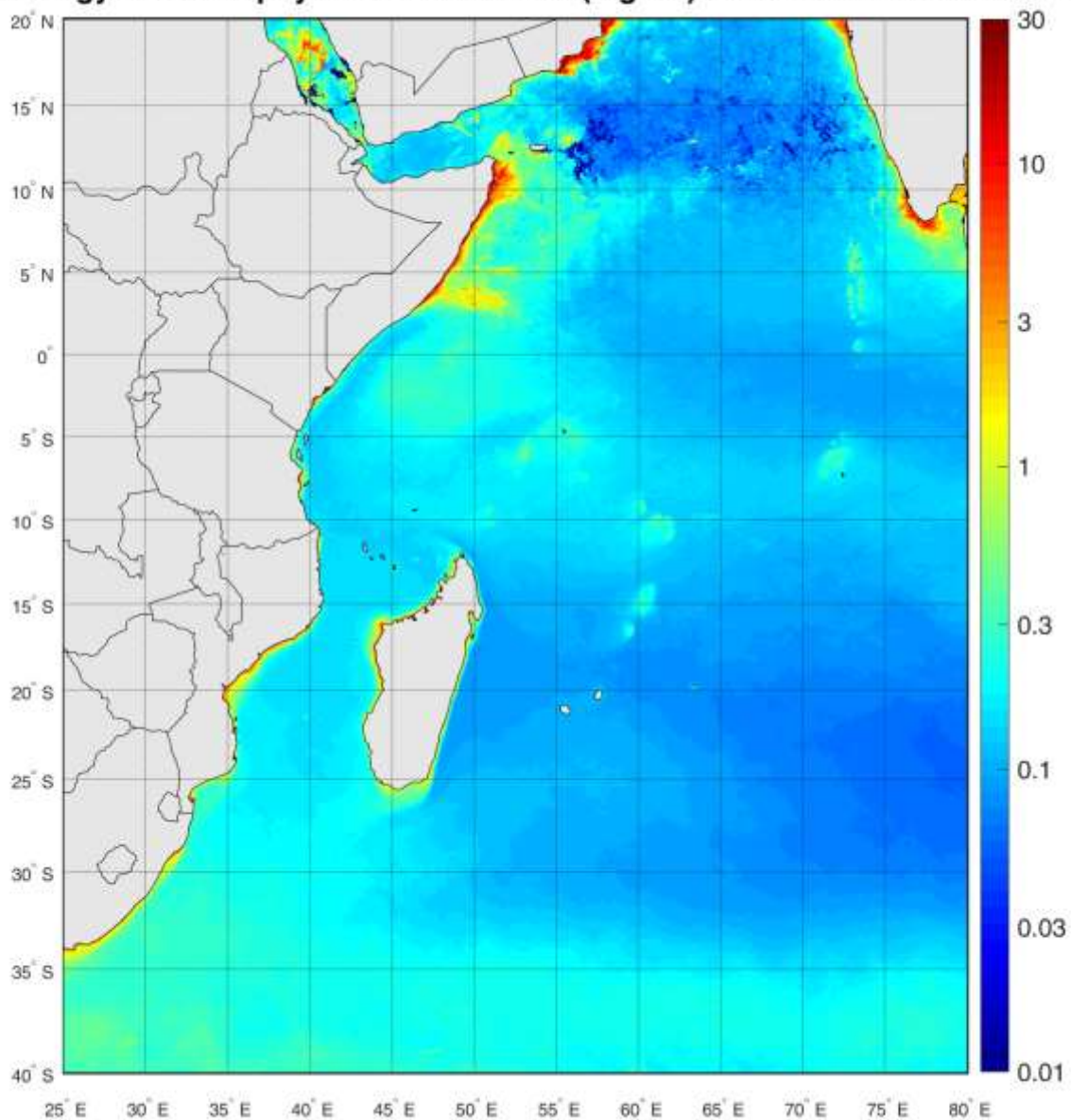


Figure 7: Chlorophyll-a Climatology (mg/m^3) for the month of June (2003 -2019)

Chlorophyll-a Concentration Anomaly (mg/m^3) for June 2021

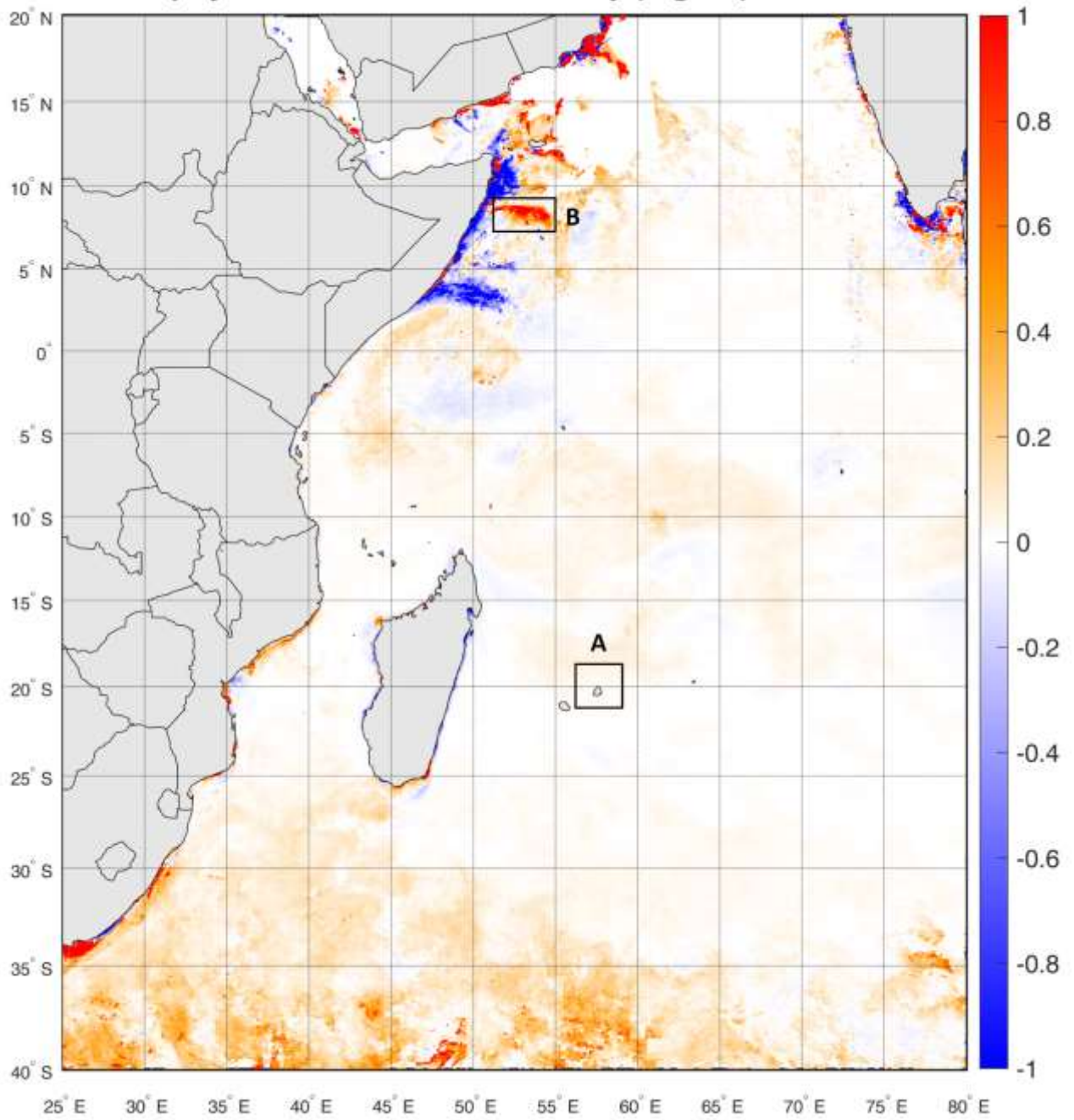


Figure 8: Anomaly of chlorophyll-a for June 2021 (mg/m^3)

Chlorophyll-a time series generated from the monthly average for June 2021 and the climatological normal for June 2021 in the regions encircle in Figure 8, namely region A around Mauritius and region B, off the Somalian coast.

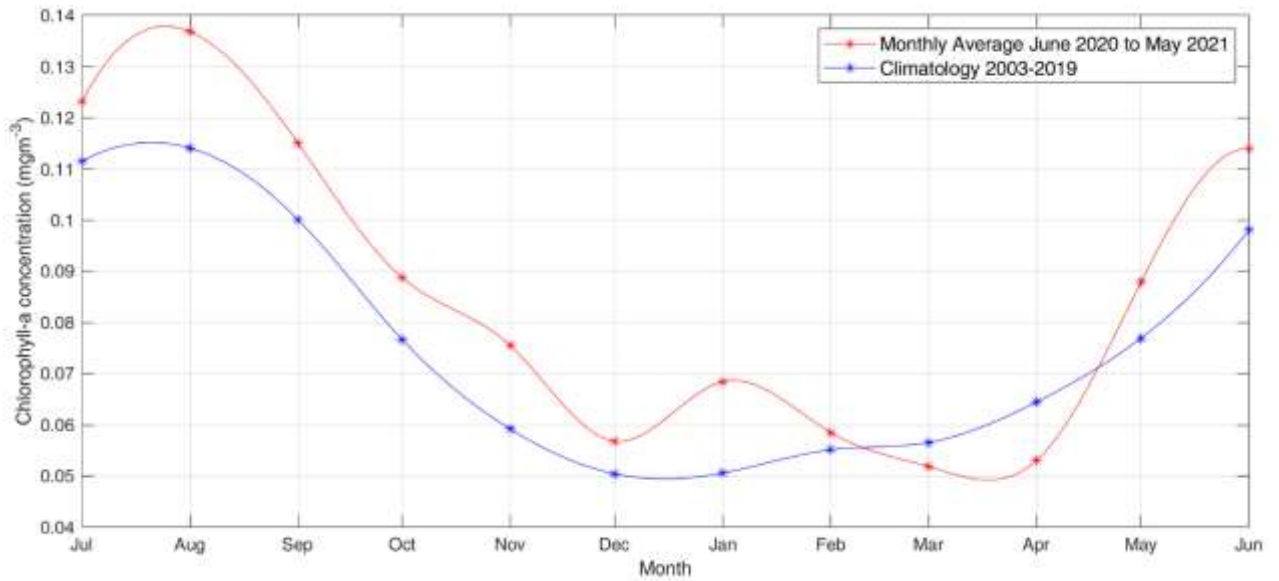


Figure 9: Temporal variation of chlorophyll-a (mg/m^3) around Mauritius Island (Region A)

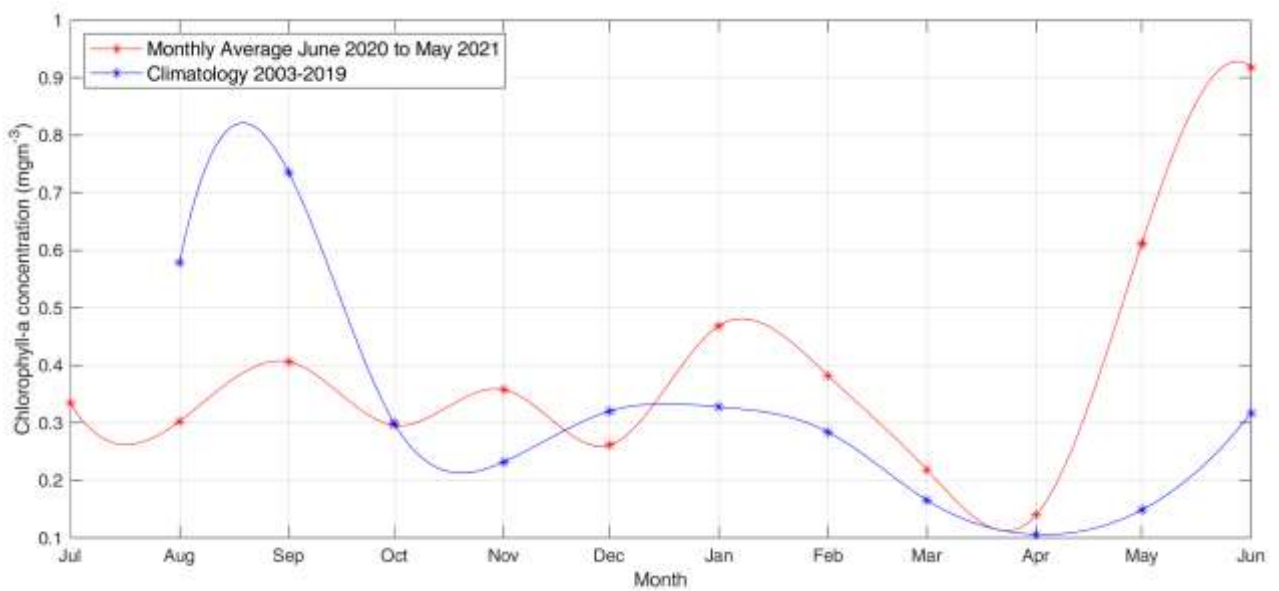


Figure 10: Temporal variation of chlorophyll-a (mg/m^3) for the region off Somalia (Region B)

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 June 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.

Figure 6 shows the average chlorophyll-a concentration for the month of June 2021 in mg/m^3 . The average chlorophyll-a concentration is generally similar to the climatological mean (Figure 7). The anomaly map in Figure 8, however, shows a relatively higher chlorophyll-a content in June 2021 as compared to the climatology across the Indian Ocean except for some localised regions such as off the coast of Somalia.

Figure 9 shows the monthly time series for the region around Mauritius Island (region A in Figure 8). The graph shows a positive Chl-a anomaly observed last month is being maintained.

Figure 10 shows the temporal variation of Chl-a for region B in Figure 8, that is, off the northern coast of Somalia. The graph shows a net increase of more than $0.6 \text{ mg}/\text{m}^3$ in Chl-a concentration in that region for this month. With a negative SST anomaly observed in that particular region, this phenomenon could be potentially attributed to an upwelling or eddy formation.

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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.