GMES AND AFRICA

MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean

August 2021

Contents

List of Acronyms

AUC	African Union Commission
Chl-*a*	Chlorophyll-*a*
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

- SST was relatively low across the Indian Ocean, except for the region around the Chagos region.
- The average SST in the Mascarene region was similar to that of the previous month varying between 23 to 25 °C.
- The observed SST for the period of August 2021 was similar to the climatological mean across the region of interest.
- For the region around Mauritius, the sea surface temperature was slightly below the climatological mean.
- A relatively higher positive anomaly was observed off the northern coast of Somalia, unlike the trend that was prevailing for the previous couple of months, whereby it was around the climatological mean.

Chlorophyll-a Concentration

- The average Chl-a concentration for the month of August 2021 is comparable to the climatological mean except for some localised regions.
- Typically lower Chl-a concentration was recorded in the Mascarene region as compared to other regions of the Indian Ocean.
- The monthly time series analysis for the region around Mauritius Island shows that the positive Chl-a anomaly observed since mid-April 2021 is maintained.
- For the region around the Seychelles Islands, the Chl-a concentration observed for the month of August was more than 2.0 mg/m^3 below the climatological mean.

3.0 Sea Surface Temperature

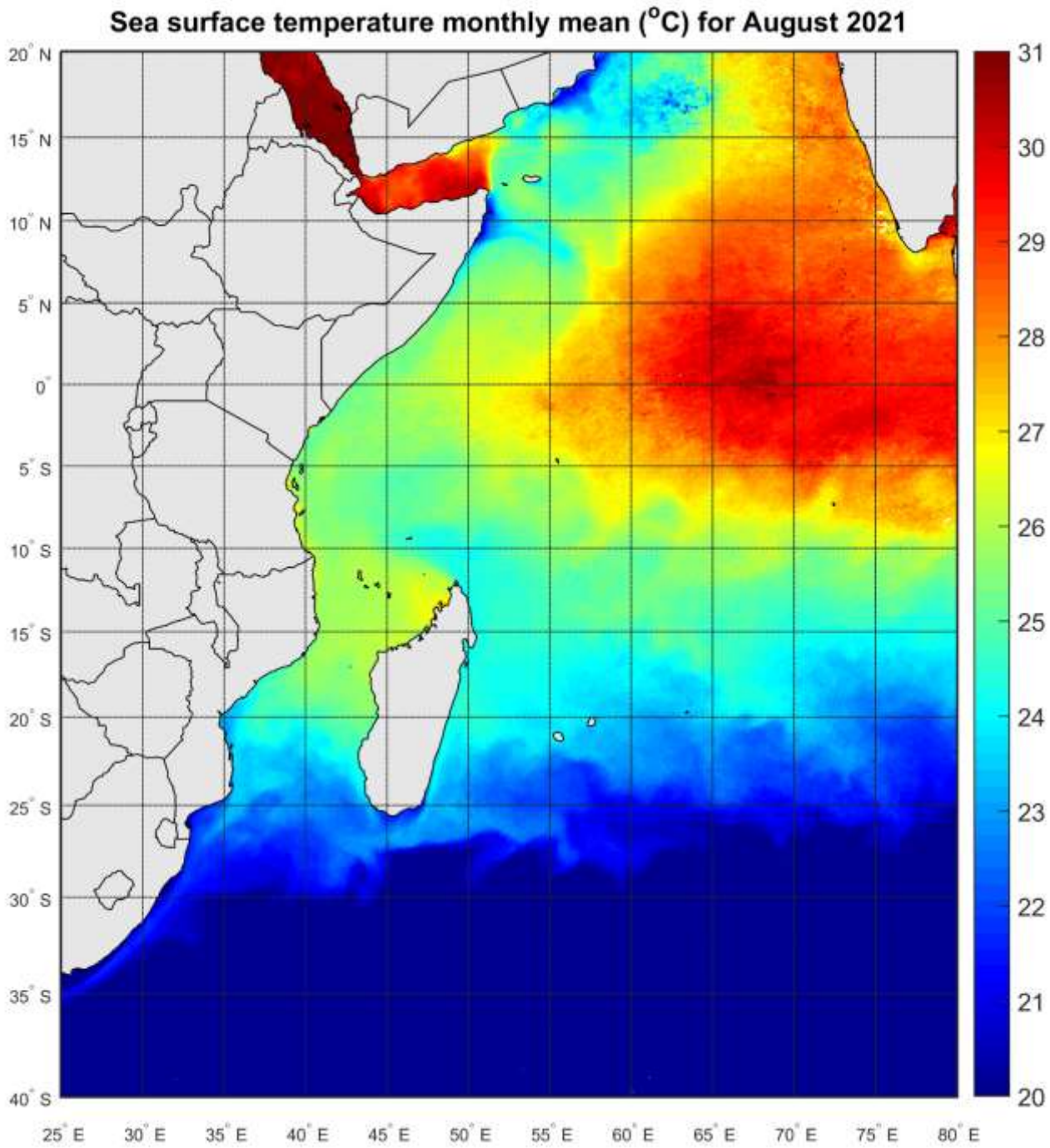

Figure 1: Mean sea surface temperature for the month of August 2021 (°C)

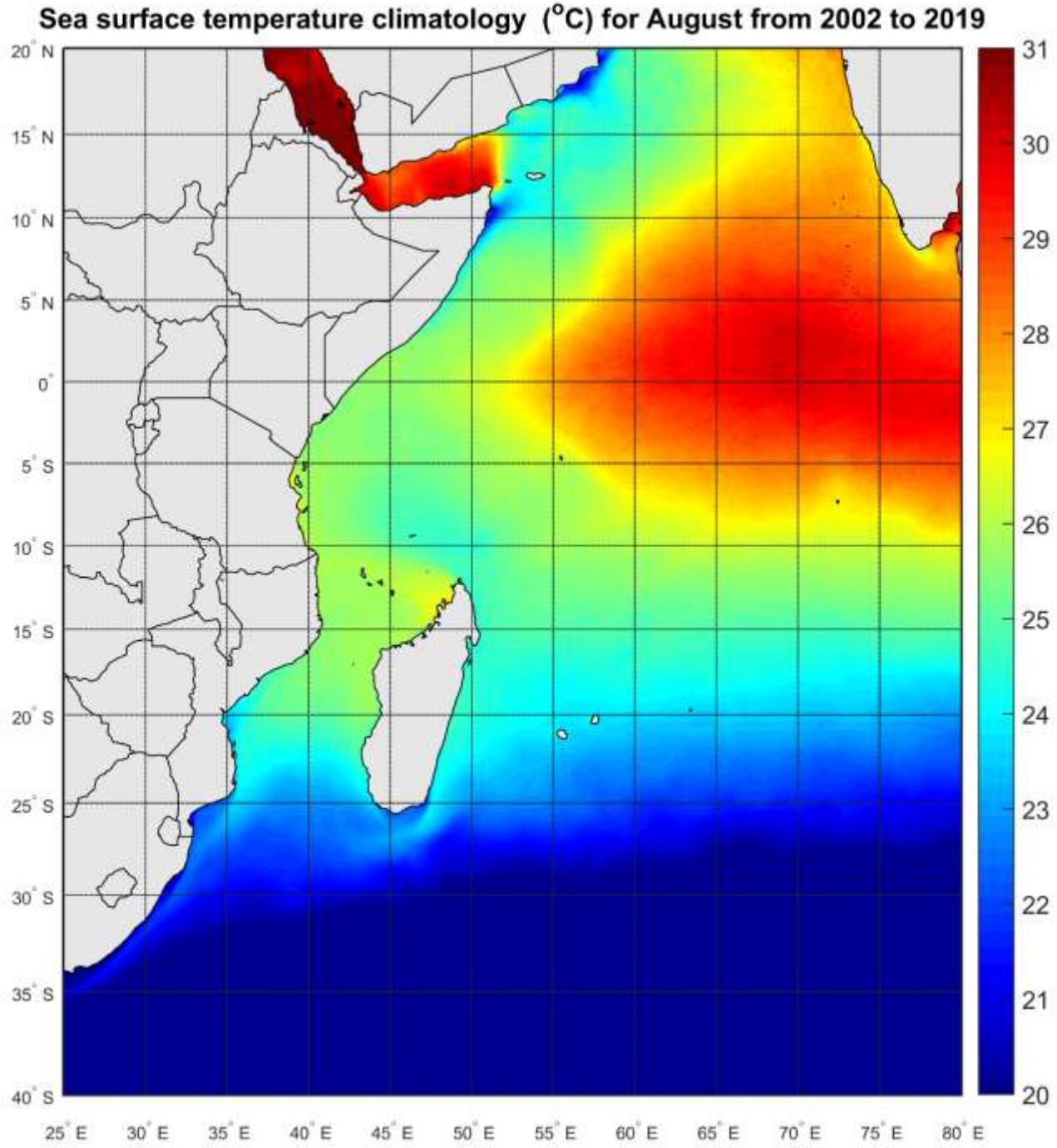

Figure 2: Sea Surface Temperature Climatology (°C) for the month of August (2002 - 2019)

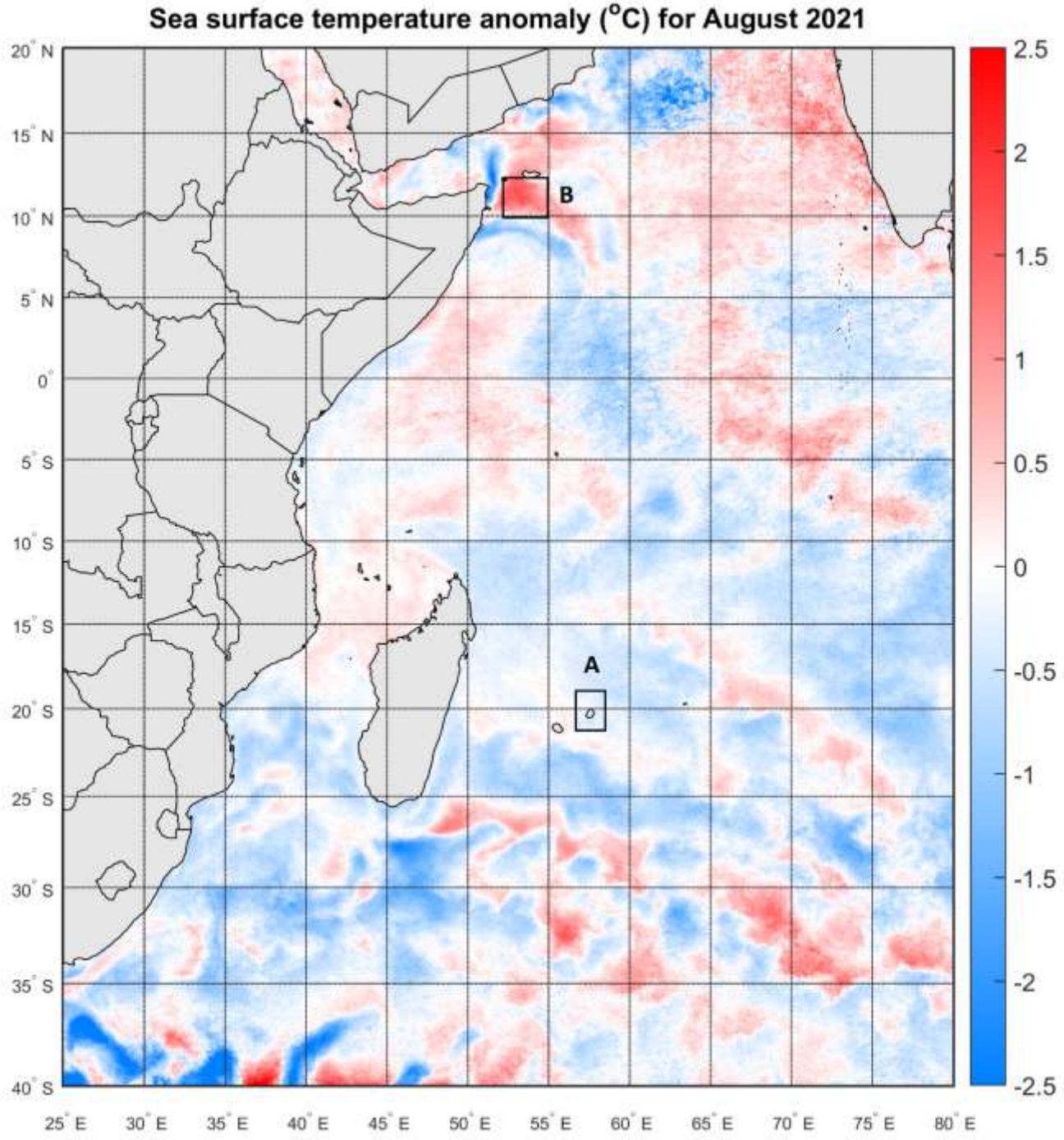

Figure 3: Anomaly of Sea Surface Temperature for August 2021 (°C)

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

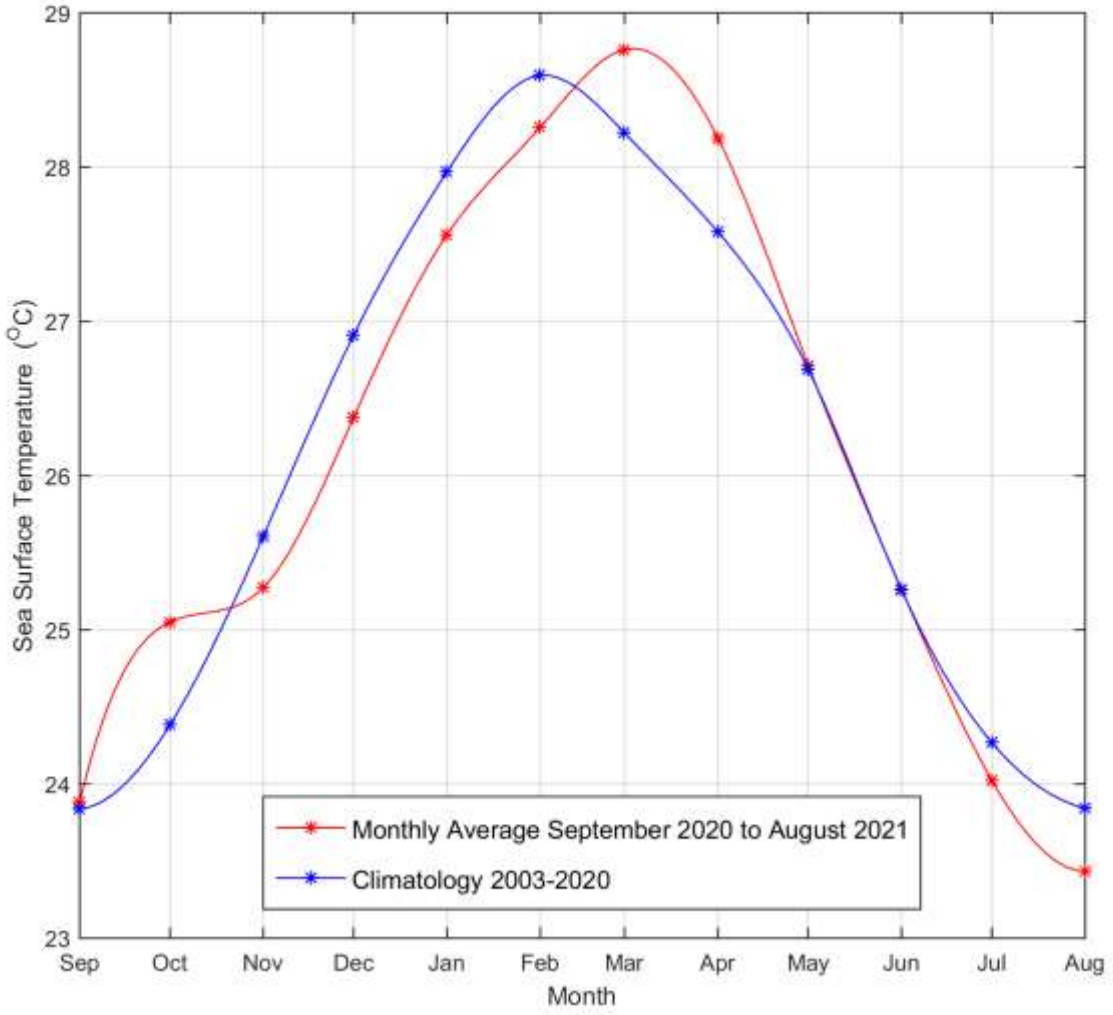

Figure 4: Temporal variation of sea surface temperature (°C) around Mauritius Island (Region A)

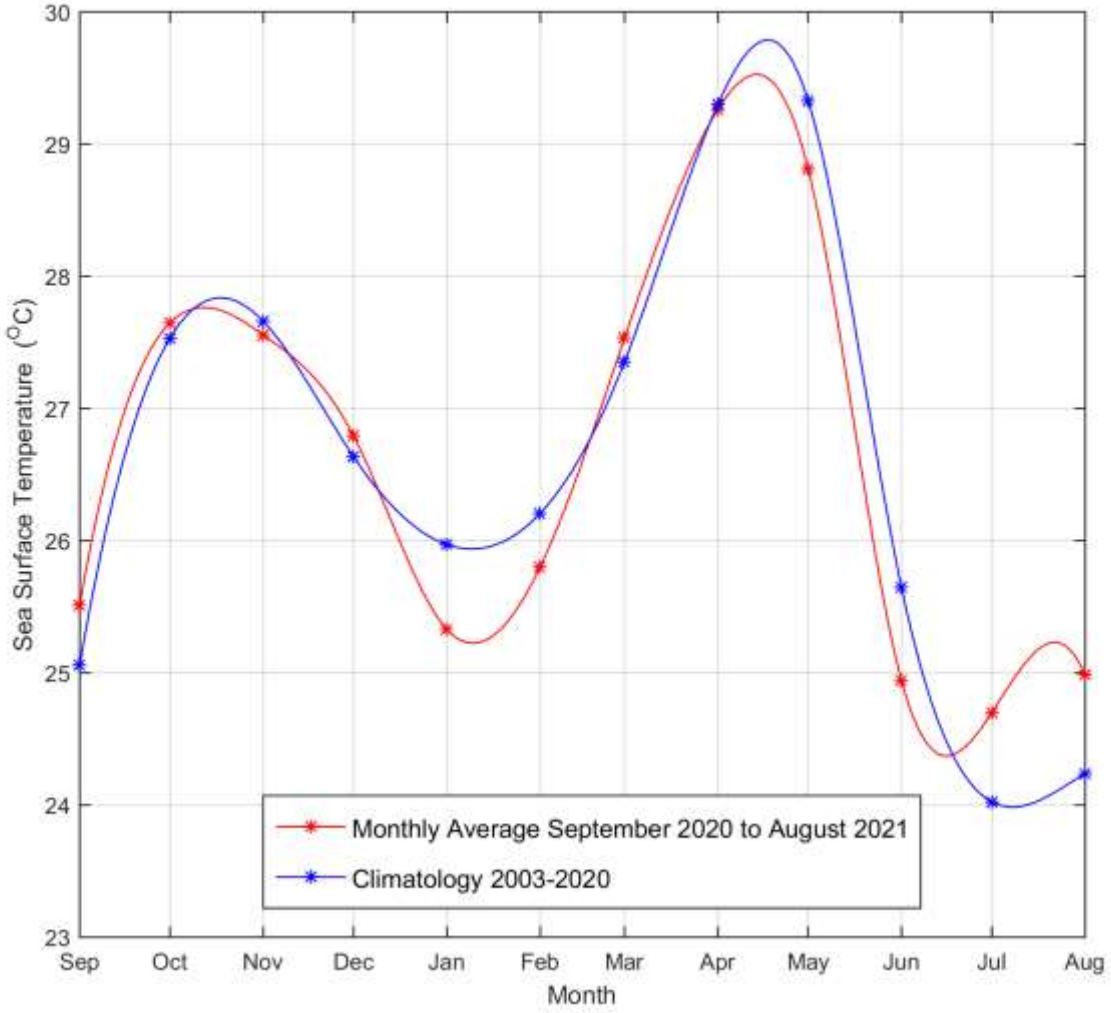

Figure 5: Temporal variation of sea surface temperature (°C) off the northern coast of Somalia (Region B)

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 August 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.

During the month of August 2021, SST was relatively low across the Indian Ocean, except for the region around the Chagos Archipelago. The average SST in the Mascarene region was nearly similar to that of the previous month varying between 23 to 25 °C. Figure 2 represents the climatology for the month of August based on the average SST calculated from 2002 to 2019. The observed SST for the period of August 2021 was similar to the climatological mean in the region of interest, as shown in the respective Figures 1 and 2.

Figure 3 shows a temperature anomaly chart for the month of August 2021. 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. For the region around Mauritius Island, the sea surface temperature was slightly below the climatological mean as confirmed by the time series analysis (Figure 4, depicted by 'Region A' in Figure 3).

Figure 5 shows the temporal variation of SST off the northern coast of Somalia between latitude 10 °N to 12 °N and longitude 53 °E to 55 °E (Region B in Figure 3). The graph shows a relatively higher positive anomaly around that specific region, unlike the trend that was prevailing for the previous couple of months, where it was around the climatological mean.

4.0 Chlorophyll-a Concentration

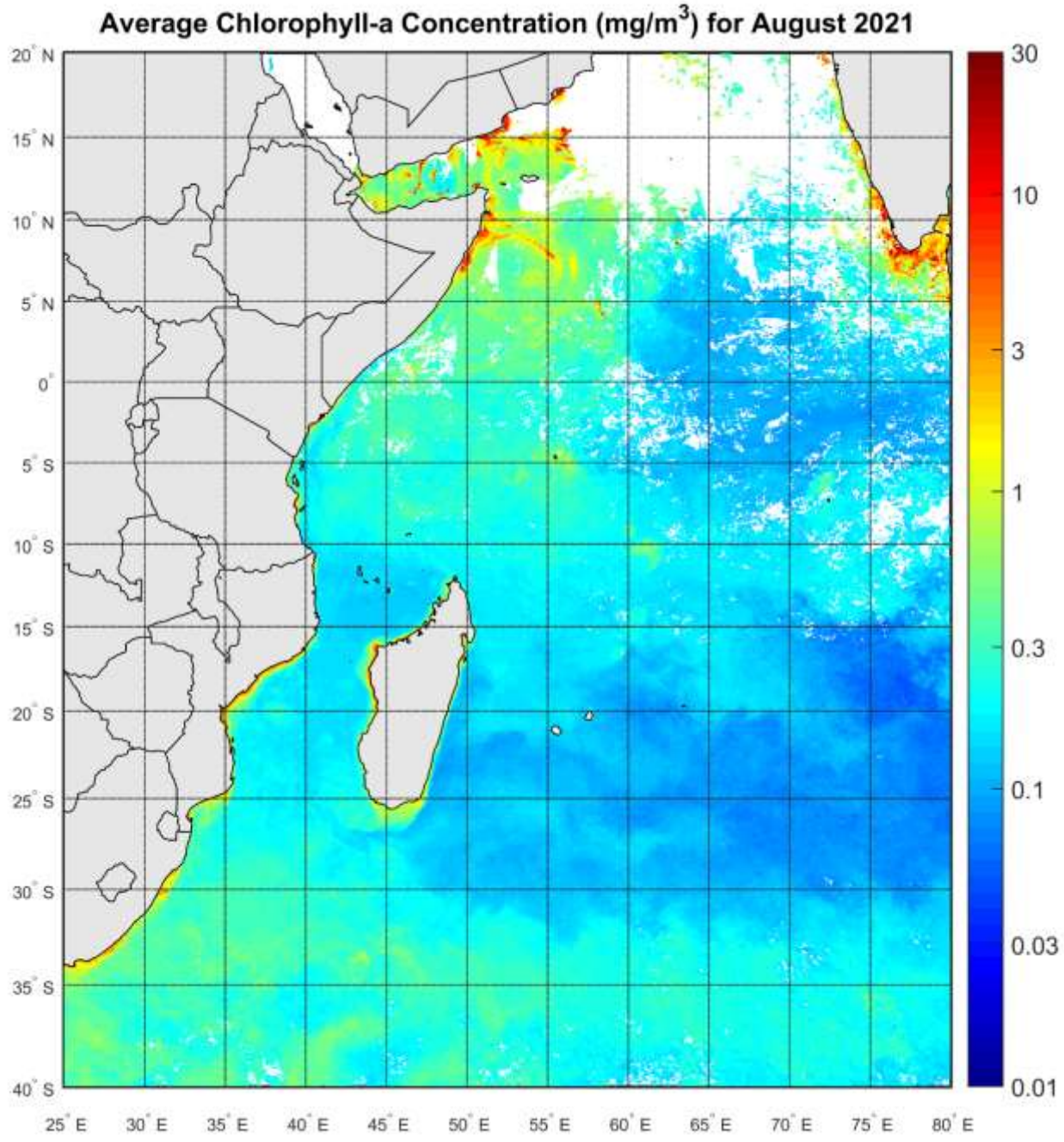

Figure 6: Mean chlorophyll-*a* concentration for the month of August 2021 (mg/m^3)

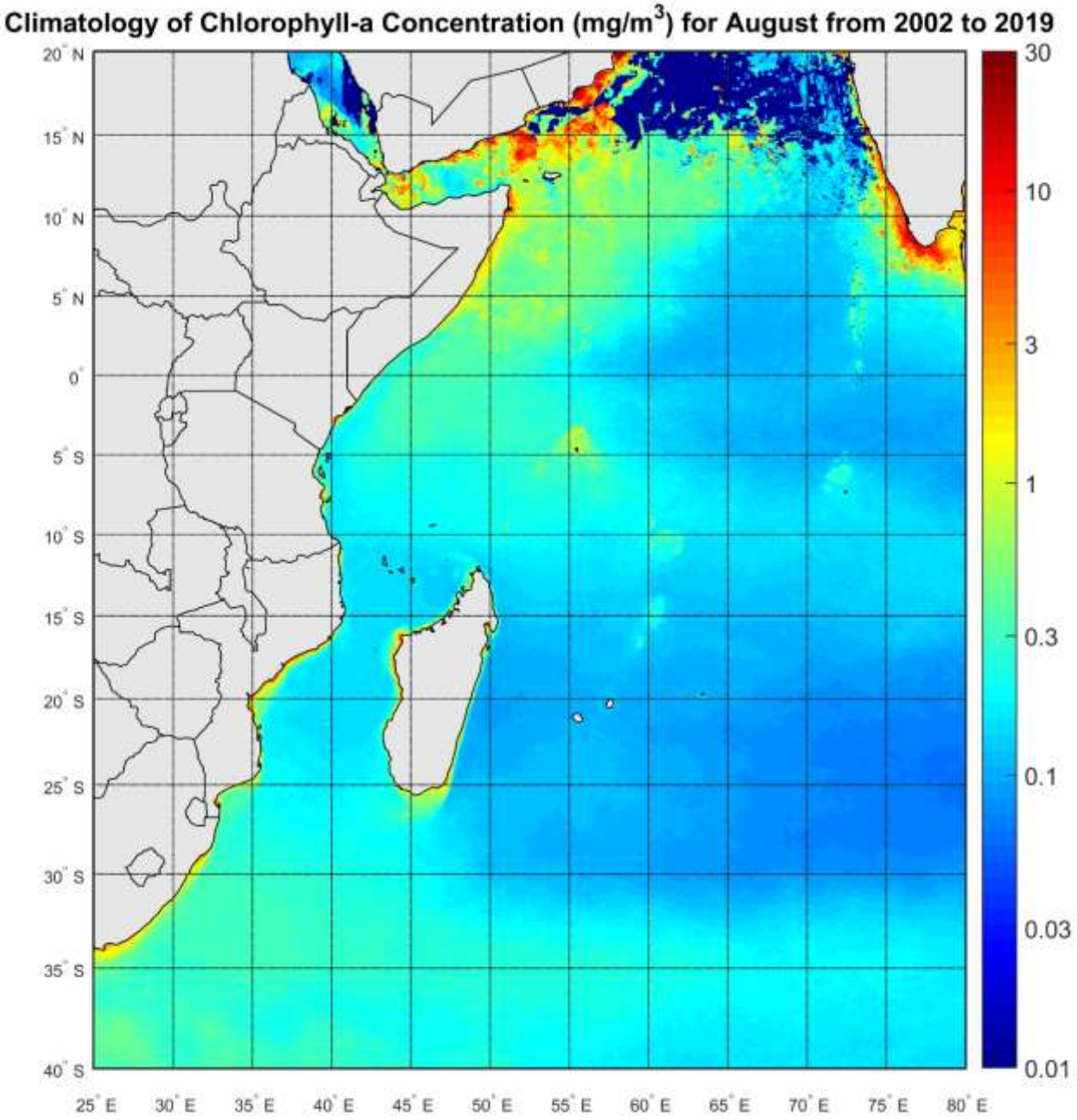

Figure 7: Chlorophyll-*a* Climatology (mg/m^3) for the month of August (2002 -2019)

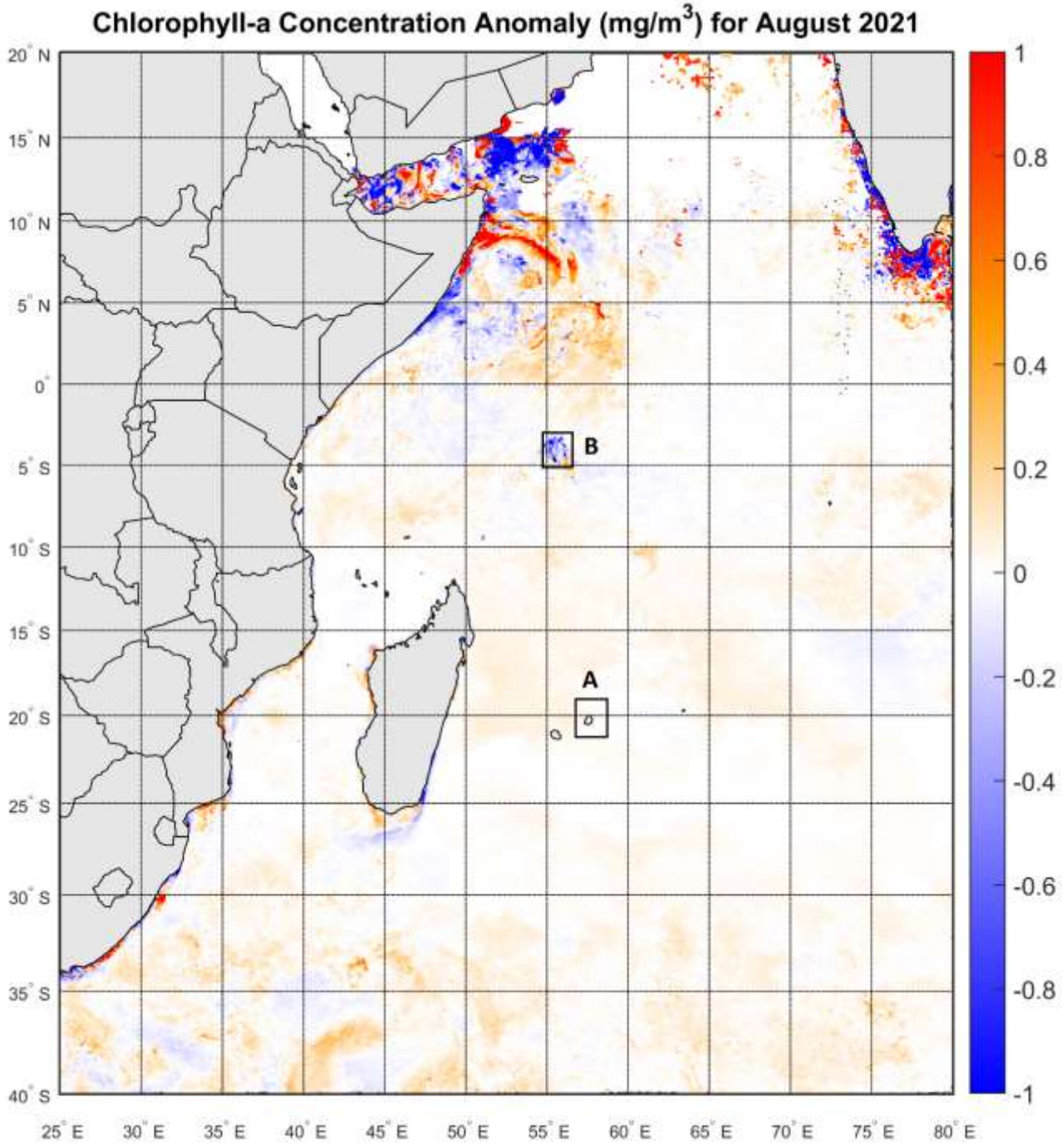

Figure 8: Anomaly of chlorophyll-*a* for August 2021 (mg/m^3)

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

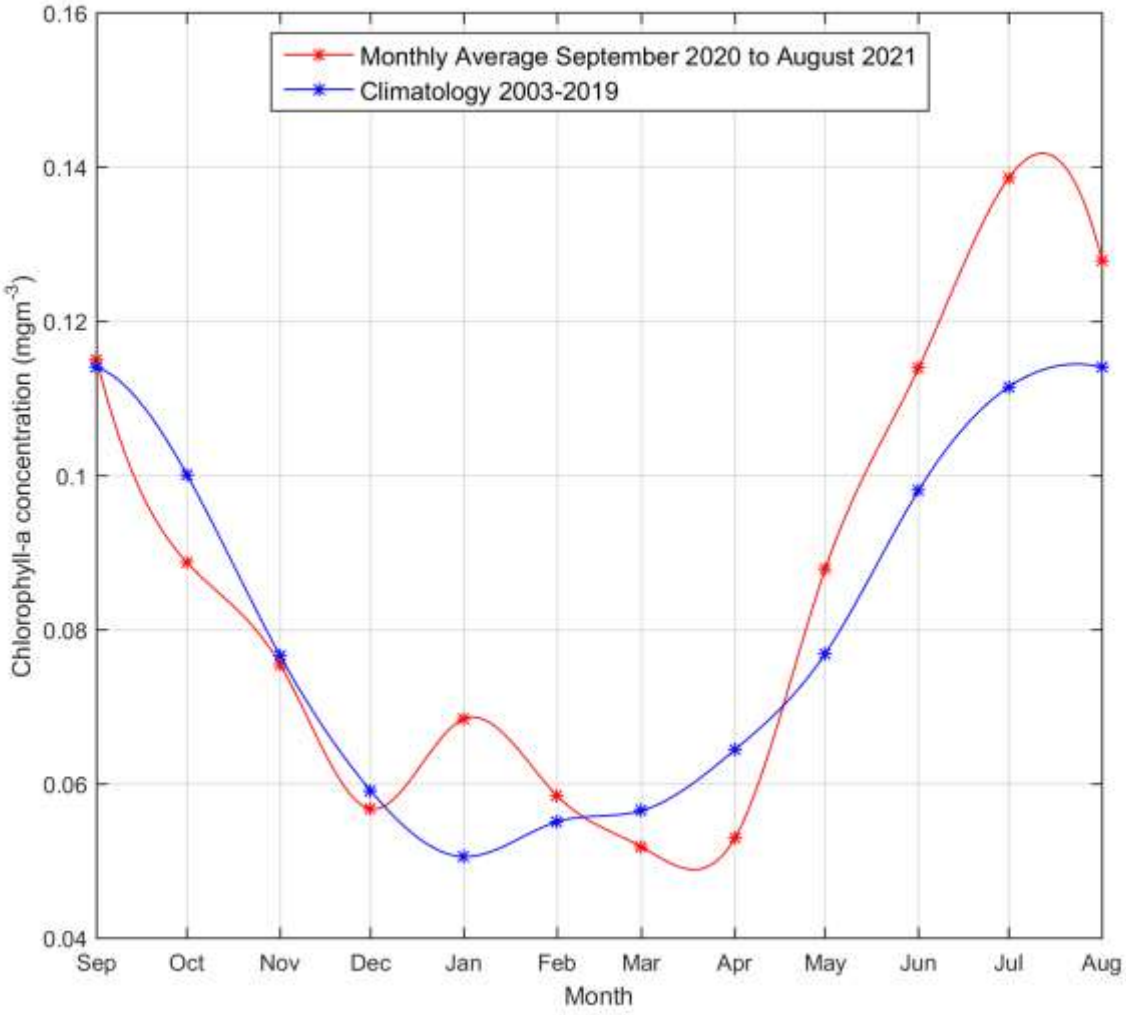

Figure 9: Temporal variation of chlorophyll-*a* (mg/m^3) around Mauritius Island (Region A)

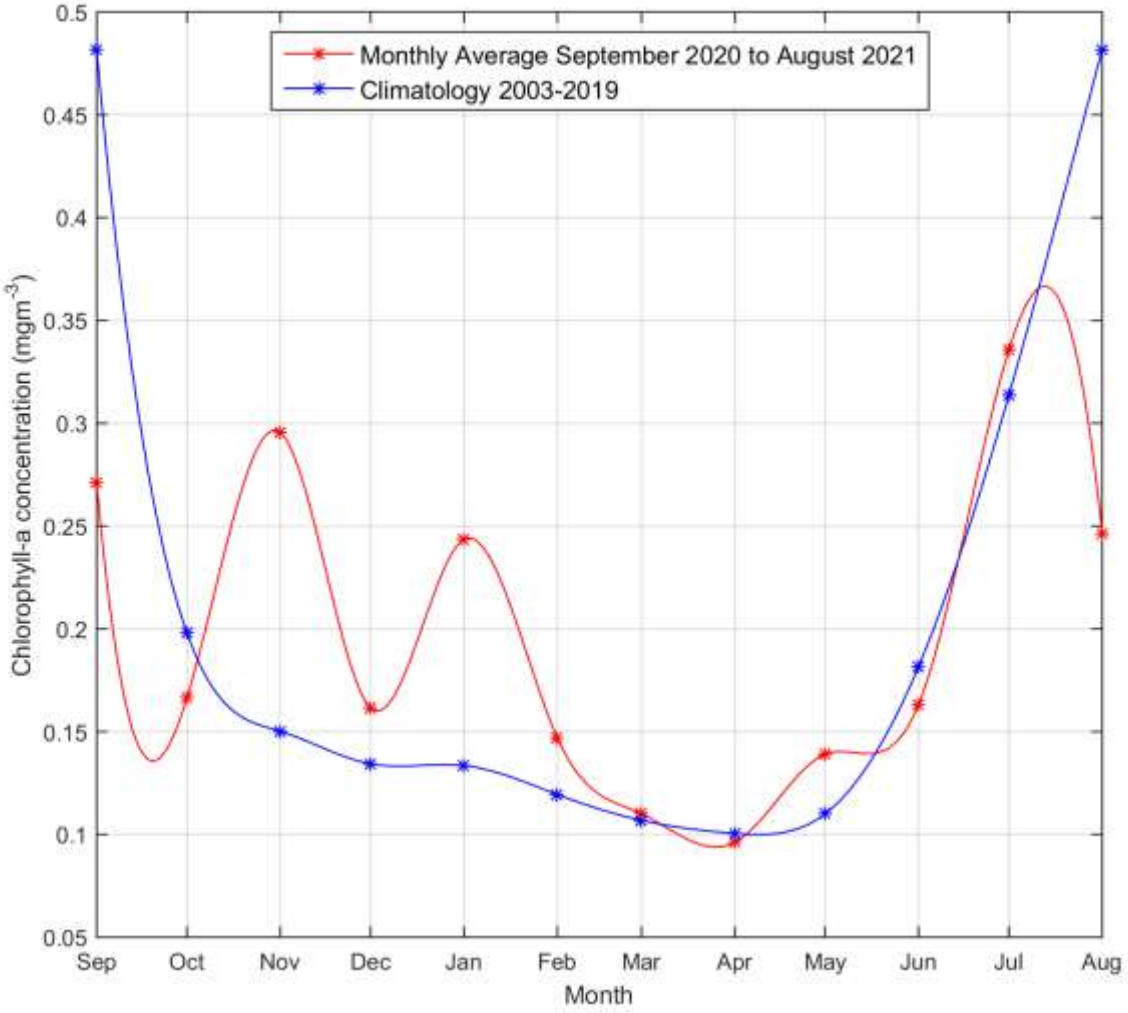

Figure 10: Temporal variation of chlorophyll-*a* (mg/m^3) for the region around Seychelles Islands (Region B)

4.1 Description of Chlorophyll-a

Figure 6 shows the Chlorophyll-a concentration in milligrams of Chl-a per cubic metre of seawater (mg/m^3) for the month of August 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.

No major significant deviation was observed between the average chlorophyll-a concentration observed for the month of August 2021 and the climatological mean (Figure 7) except for some localised regions. The general trend of lower Chl-a concentrations in the Mascarene region as compared to the northern and continental regions of the Indian Ocean is clearly visible in the image. The anomaly map (Figure 8) shows that for the month of August 2021, a relatively higher chlorophyll-a content was observed across the Indian Ocean as compared to the climatological mean with some localised exceptions.

Figure 9 shows the monthly time series for the region around Mauritius Island (region A in Figure 8). The graph shows that the positive Chl-a anomaly observed since mid-April 2021 is maintained.

Figure 10 shows the temporal variation of Chl-a for region B in Figure 8, that is, for the region around the Seychelles Islands. The graph shows a net decrease of around 1.0 mg/m^3 in Chl-a concentration in that region compared to July 2021. For this month however, the Chl-a concentration shows a difference of around 2.0 mg/m^3 below the climatological mean.

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.

Annex

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.