



**GMES
AND AFRICA**



MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean
July 2020

Website: <http://moi.govmu.org/gmes>



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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 data for July 2020 and highlights any abnormality in these parameters. It is targeted at users from the marine and fisheries realm for monitoring purposes. It is also a source of information for researches and the scientific community.

2.0 Highlights

Sea Surface Temperature

- During the month of July, it was observed that the sea surface temperature was warm to much warmer above latitude 15° S and longitude 55° E while relatively colder below and further west towards the coast of Africa.
- SST was higher than usual throughout the northern part of the Indian Ocean basin except for the region north of Madagascar and off the coast of Kenya Tanzania and Somalia.
- A relatively lower temperature was observed in the waters of the Mascarene Islands and the southern part of Madagascar.

Chlorophyll-a Concentration

- Higher Chl-*a* concentration were observed in the Mozambique canal and north of Madagascar compared to the Mascarene region where Chl-*a* concentration was relatively lower.
- The spatial distribution of Chl-*a* concentrations for the month of July was more or less similar to the monthly mean climatology.
- There was positive anomaly of Chl-*a* in July 2020 across the region below the equator.

2.1 Sea Surface Temperature

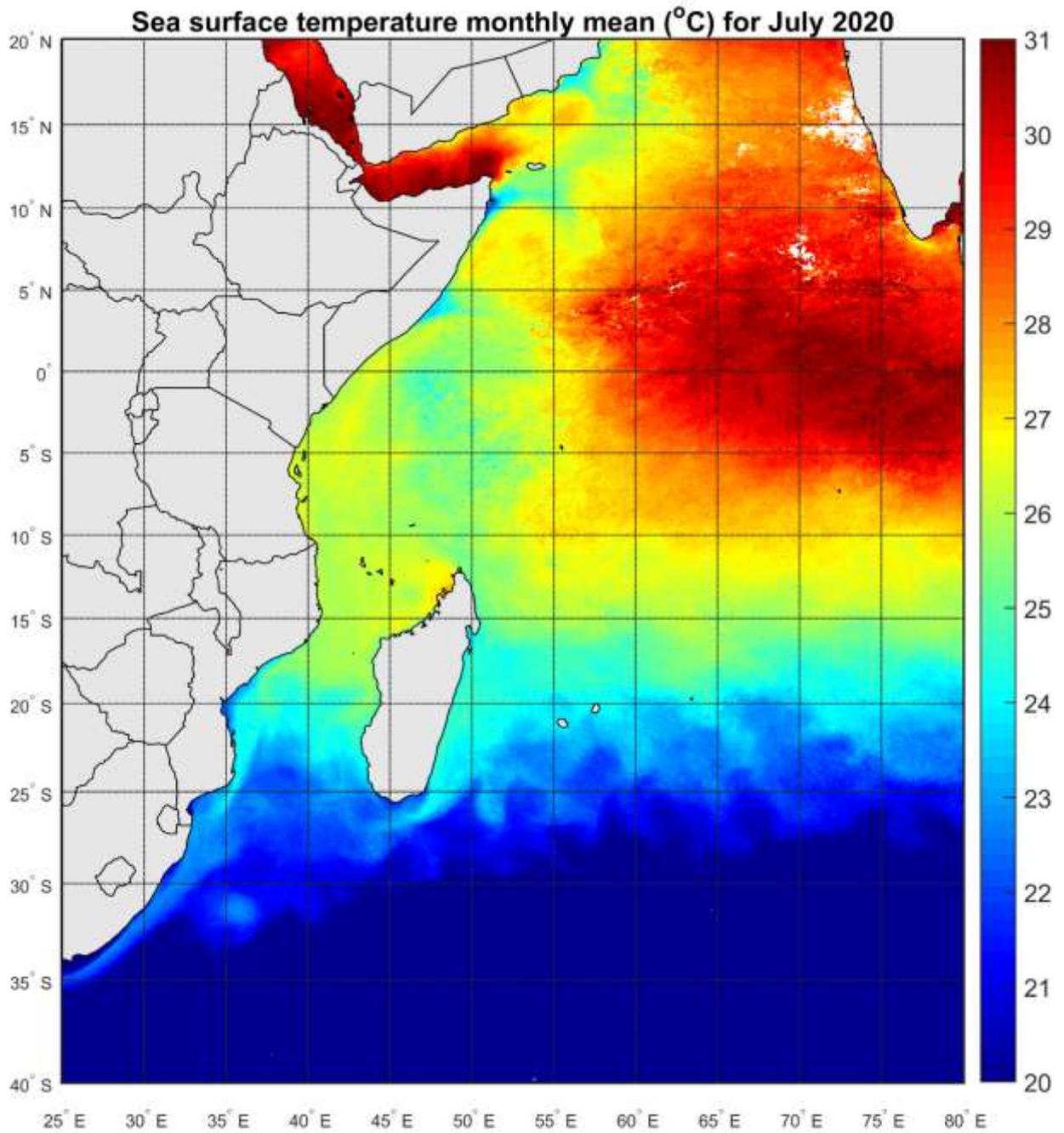


Figure 1: Mean sea surface temperature for the month of July 2020 ($^{\circ}\text{C}$)

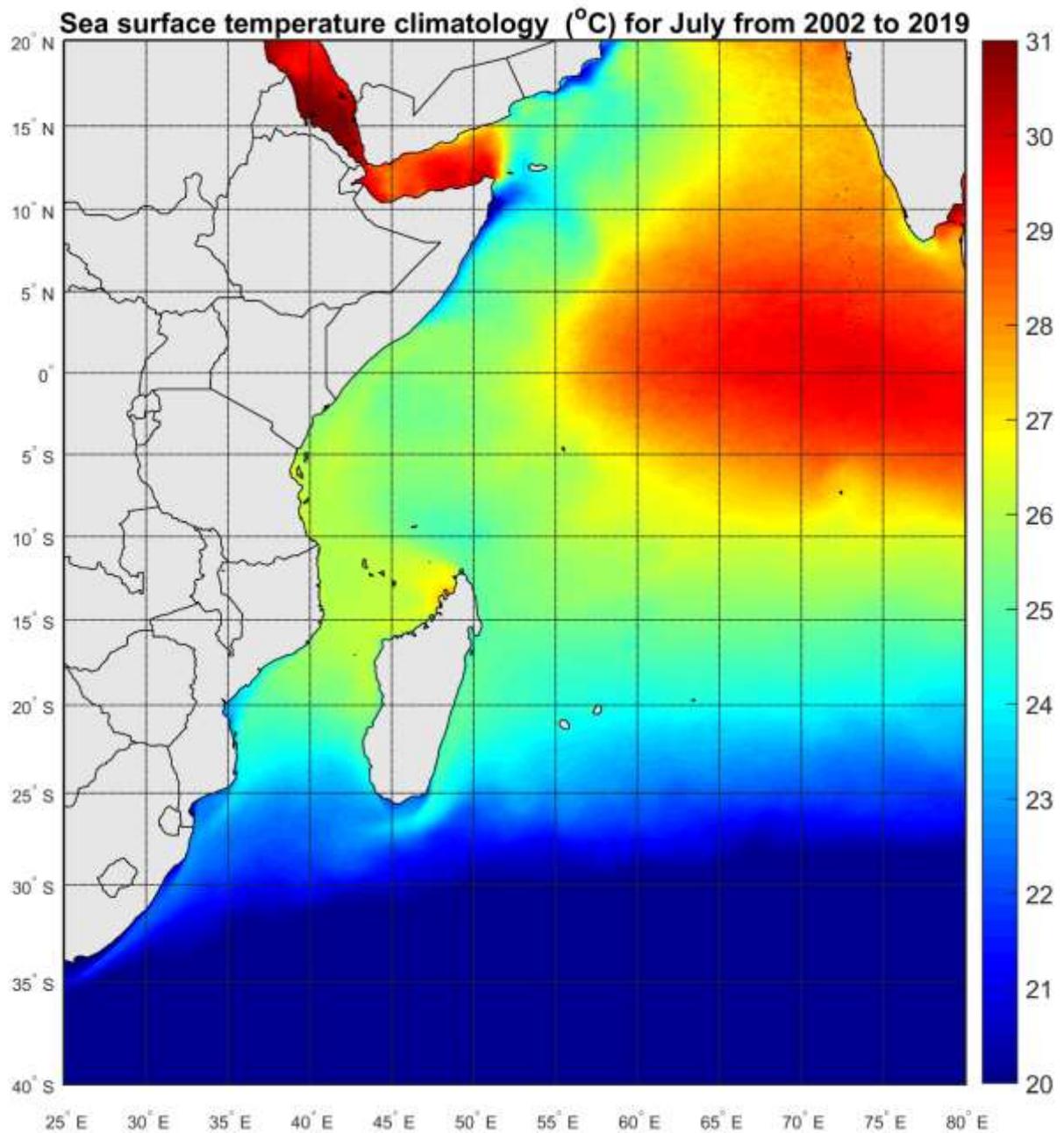


Figure 2: Climatology of sea surface temperature for July 2002 to July 2019 (°C)

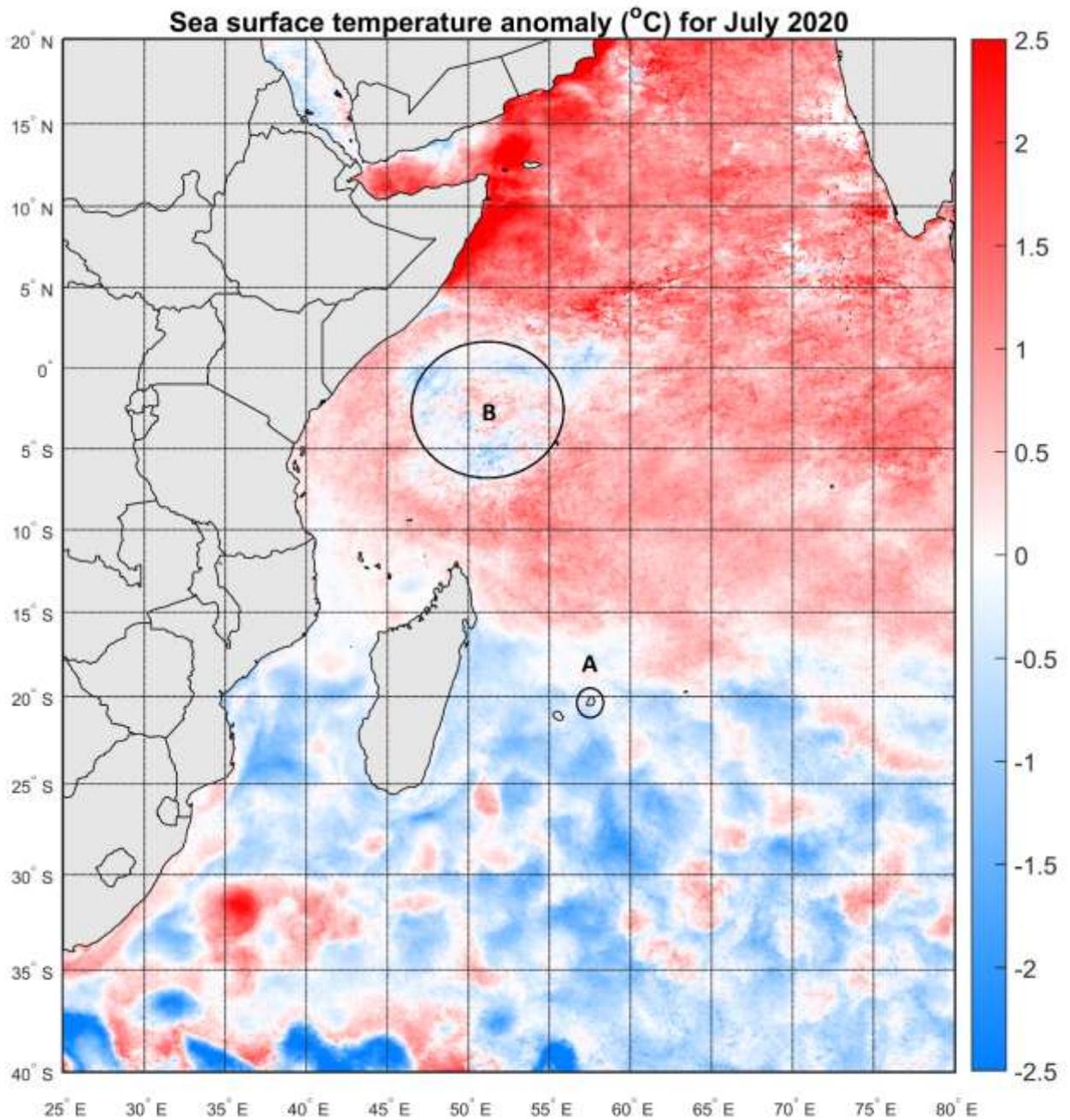


Figure 3: Anomaly of sea surface temperature for July 2020 (°C)

Time series generated from the monthly average for July 2020 and the climatological normal for July in the region encircle above namely region A around Mauritius and region B located in the western part of the Seychelles EEZ.

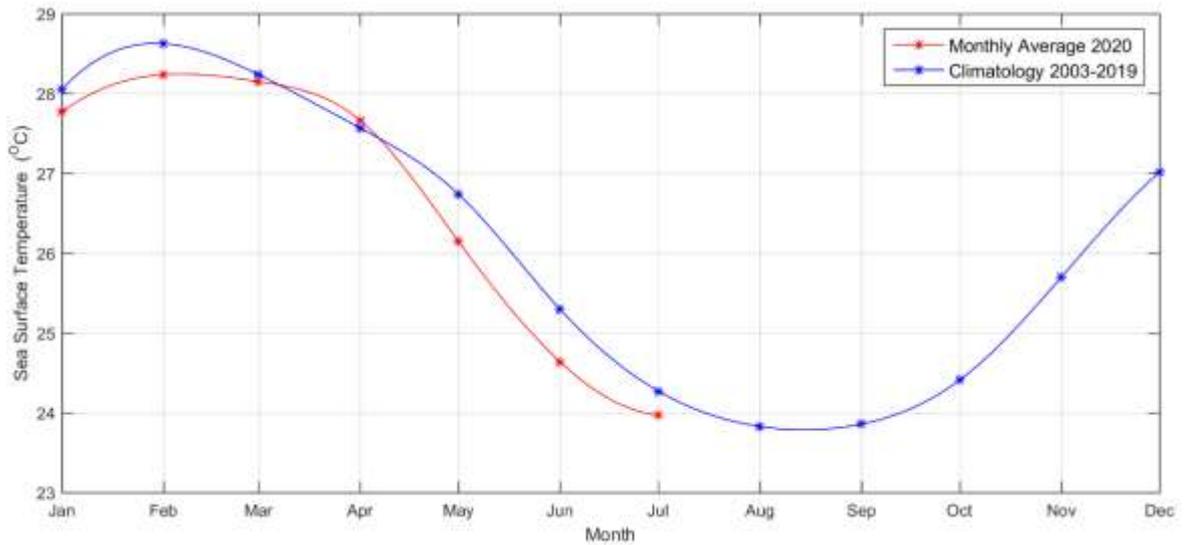


Figure 4: Temporal variation of sea surface temperature (°C) around Mauritius Island (Region A)

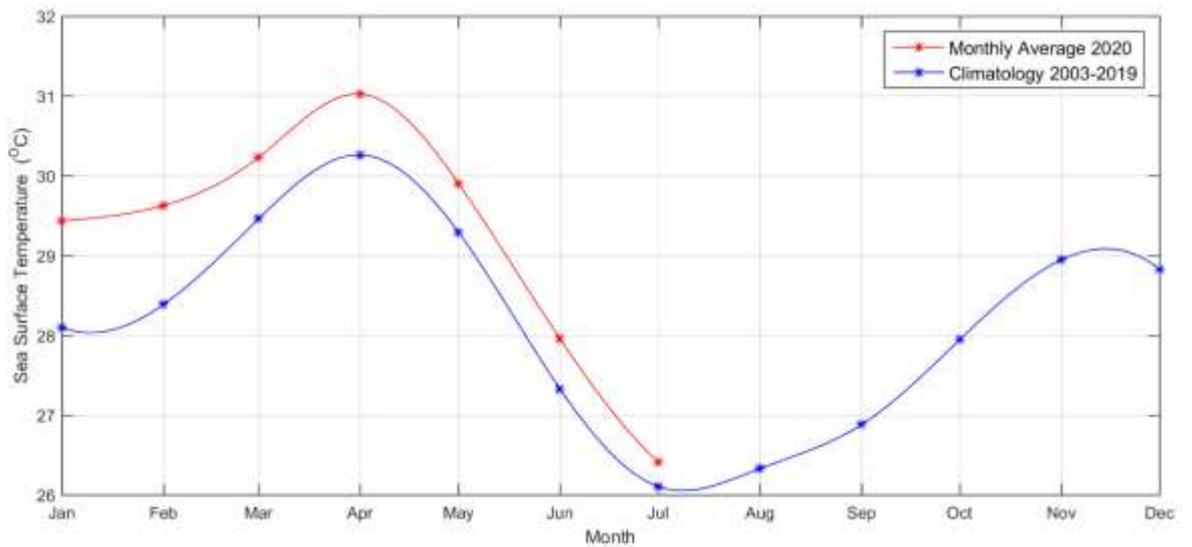


Figure 5: Temporal variation of sea surface temperature (°C) for the region West of Seychelles (Region B)

2.2 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 July 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. During the month of July (Figure 1), it was observed that the sea surface temperature was warm to much warmer above latitude 15° S and longitude 55° C while relatively colder below and further west towards the coast of Africa. Figure 3 shows temperature anomaly for July 2020 compared to the long-term average temperature (climatology) of that month from 2003 through 2019 (Figure 2). From the SST anomaly map, the blue colour represents temperatures that were cooler than average, the white colour shows near-average temperatures, while the red colour shows temperatures that were warmer than average.

From observation, the SST was seen to be higher than usual throughout the northern part of the Indian Ocean basin except for the region north of Madagascar and off the coast of Kenya, Tanzania and Somalia. Temperature above 30° C was recorded in the region north of Chagos Archipelago compared to an average of around 28° C for the same region while in the Gulf of Aden and the Red Sea the high temperature is similar to the climatology. Due to the winter conditions prevailing in the southern hemisphere, a relatively lower temperature was observed in the waters of the Mascarene Islands and the southern part of Madagascar.

A time series analysis has been carried out for the region around Mauritius as shown in Figure 4 (region A on Figure 3). The graph shows that for the month of July 2020, the SST in this region is slightly lower than the monthly climatology. Figure 5 shows the temporal variation of sea surface temperature for the region north of Madagascar and east of Tanzania, between latitude 5° N and 10° S and longitude 45° E to 60° E (region B on Figure 3). From the graph, it can be observed that since the beginning of the year 2020, temperature at this region is slightly above the normal for the selected region.

3.0 Chlorophyll-a Concentration

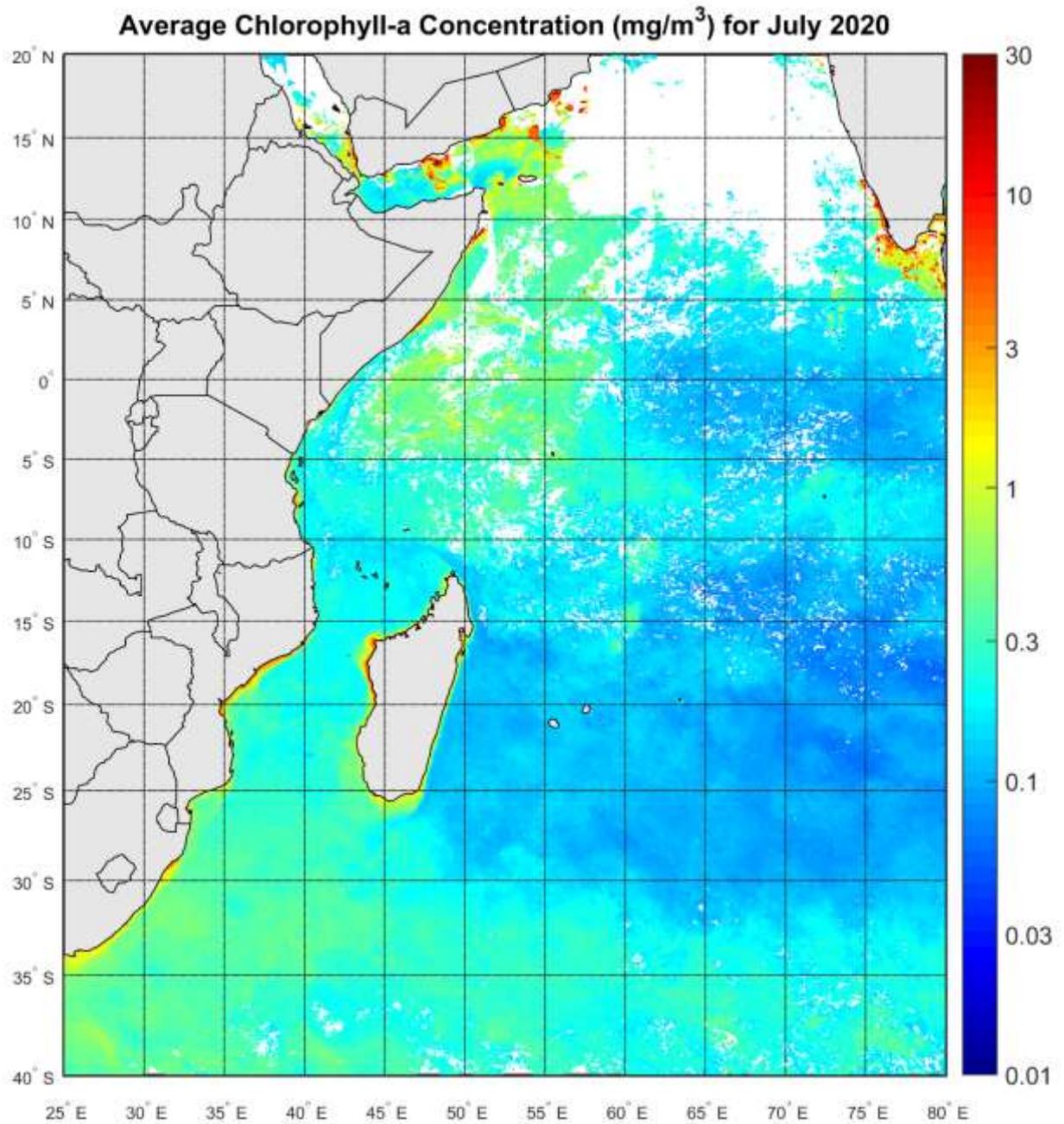


Figure 6: Mean chlorophyll-a concentration for the month of July 2020 (mg/m^3)

Climatology of Chlorophyll-a Concentration (mg/m^3) for July from 2002 to 2019

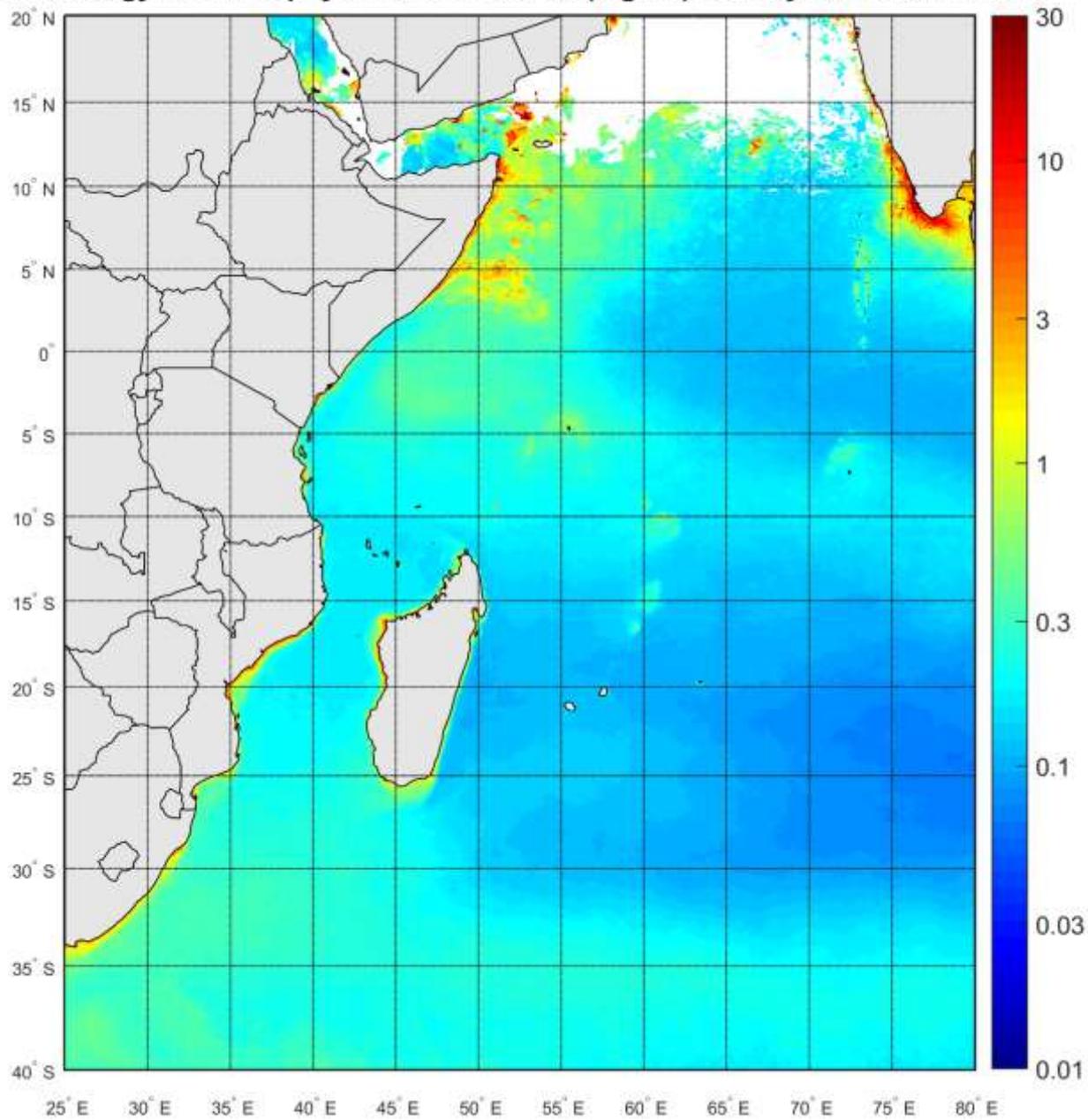


Figure 7: Climatology of chlorophyll-*a* for July 2002 to July 2019 (mg/m^3)

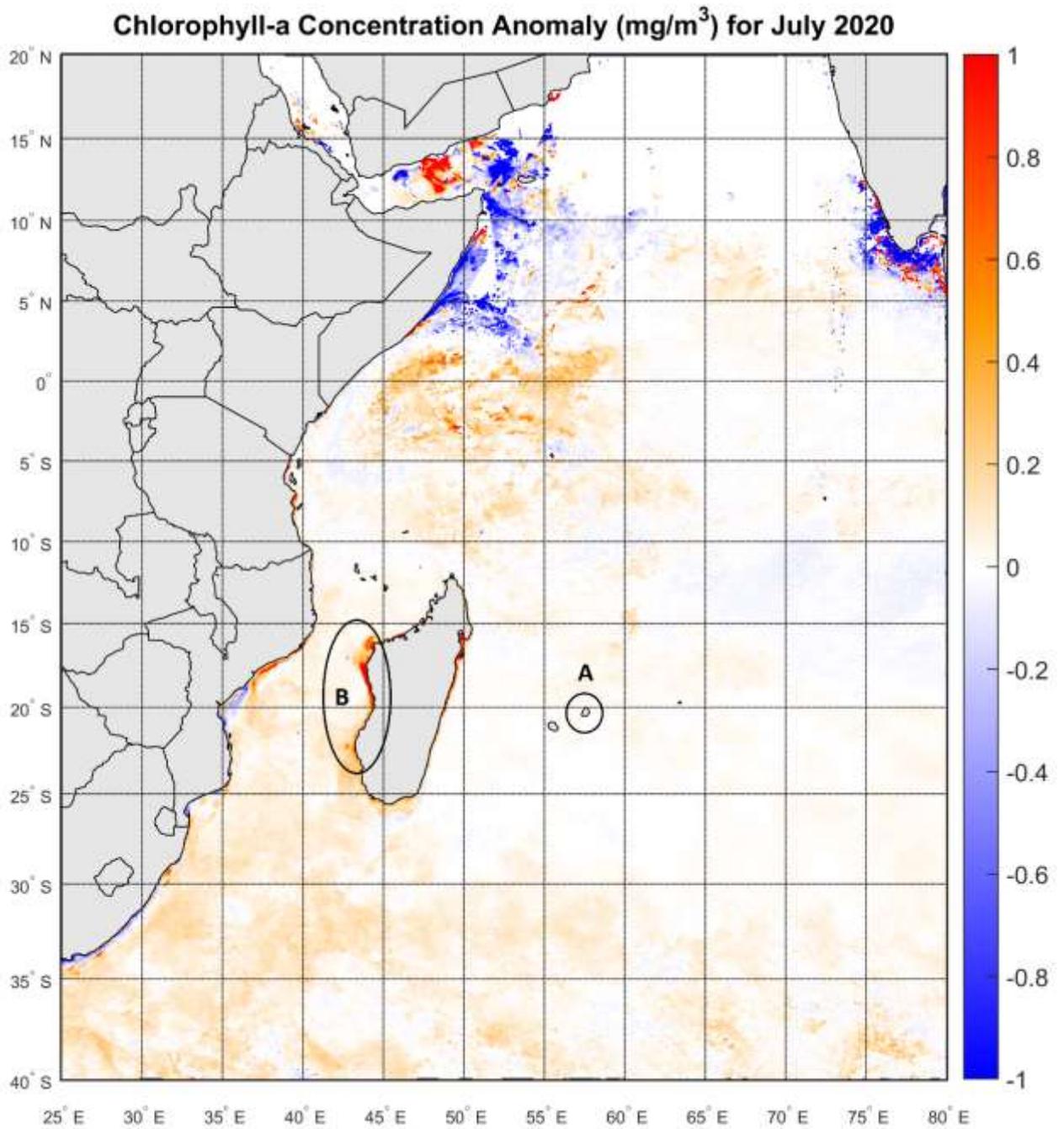


Figure 8: Anomaly of chlorophyll-*a* for July 2020 (mg/m³)

Time series generated from the monthly average for July 2020 and the climatological normal for July in the region encircle above namely region A around Mauritius and region B located in the western part of Madagascar.

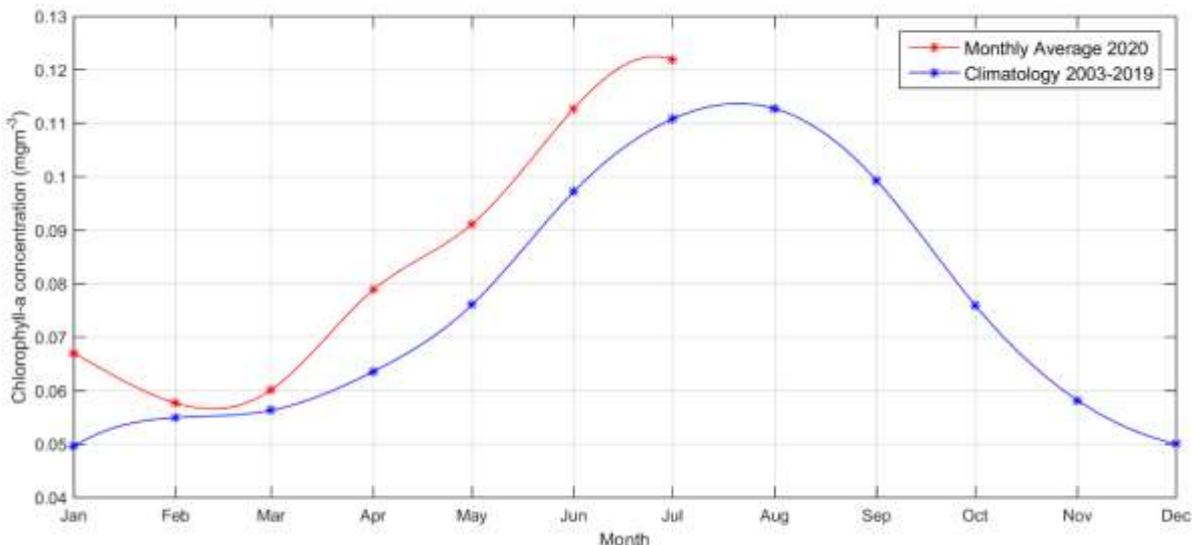


Figure 9: Temporal variation of chlorophyll-*a* (mg/m³) around Mauritius Island

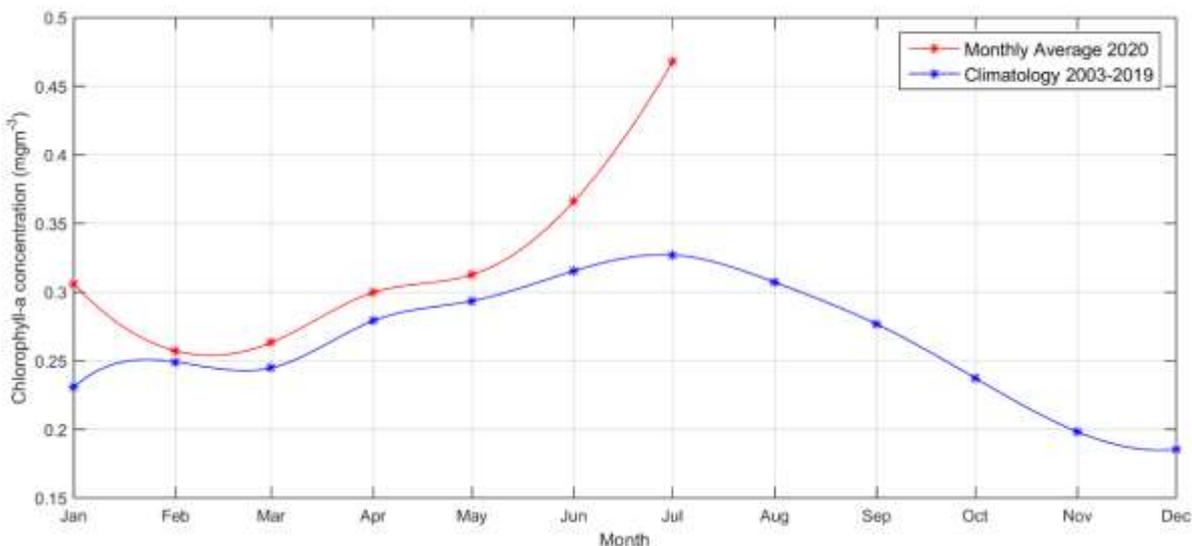


Figure 10: Temporal variation of chlorophyll-*a* (mg/m³) for the region bordering the western coast of Madagascar

3.1 Description of chlorophyll-a

Figure 6 shows chlorophyll-*a* concentration in milligrams of chlorophyll-*a* (Chl-*a*) per cubic metre of seawater for the month of July 2020. Regions where Chl-*a* concentration were very low, indicating very low numbers of phytoplankton, are blue; and those where chlorophyll-*a* concentrations were high are shown in red. Land is light grey, and places where there is no data is represented in white.

Higher Chl-*a* concentration were observed in the Mozambique canal and north of Madagascar compared to the Mascarene region where Chl-*a* concentration was relatively lower. The spatial distribution of Chl-*a* concentrations for the month of July was more or less similar to the monthly mean climatology.

High Chl-*a* indicates high primary production, an essential condition for fish aggregation and fish catch while positive Chl-*a* anomaly shows higher concentration of Chl-*a* than the average observed for the same period. In addition, prevailing anti-cyclones in the southern region could also explain the positive Chl-*a* anomaly potentially caused by upwelling, that is, the upward flow of bottom water nutrients to the surface. There was positive anomaly of Chl-*a* in July 2020 across the region below the equator.

Figure 9 shows a monthly time series for the region around Mauritius (region A on Figure 8). The graph shows that since mid-February, Chl-*a* in this region has been slightly higher than the monthly climatology.

Figure 10 shows the temporal variation of Chl-*a* for the region bordering the western coast of Madagascar (region B on Figure 8). The graph shows that since February, a higher concentration of Chl-*a* than the monthly climatology was observed. However, for the month of July 2020 a significant deviation from the monthly mean was noted, with a difference of more than 1 mg/m³ from the mean.

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. Chlorophyll-*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 Ocean Color.

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.