



**GMES
AND AFRICA**



MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean
March 2020



Contents

LIST OF ACRONYMS	2
1.0 INTRODUCTION	3
2.0 HIGHLIGHTS	3
3.0 SEA SURFACE TEMPERATURE	4
3.1 DESCRIPTION OF SEA SURFACE TEMPERATURE	7
4.0 CHLOROPHYLL-A CONCENTRATION	8
4.1 DESCRIPTION OF CHLOROPHYLL-A	11
ACKNOWLEDGEMENTS	12



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 2020, sea surface temperature was warmer above latitude 15° S and relatively colder below this latitude.
- Temperature anomaly was seen to be higher than usual throughout the northern part of the Indian Ocean basin.
- The Mozambique Channel, more particularly Mozambique coastal region and western region of Madagascar were influenced by less warm surface waters during this period.

Chlorophyll-*a* Concentration

- In general, above normal values of chlorophyll-*a* concentration was observed in most of the SWIO region.
- A few localised positive chlorophyll-*a* anomaly were observed in SWIO regions, more particularly in waters of Mozambique, East and West Madagascar, Comoros, Tanzania and Kenya.
- The concentration of chlorophyll-*a* in the surrounding regions of Mauritius was a little higher than the average. Following this trend, the chlorophyll-*a* concentration is expected to increase for the coming months.

3.0 Sea Surface Temperature

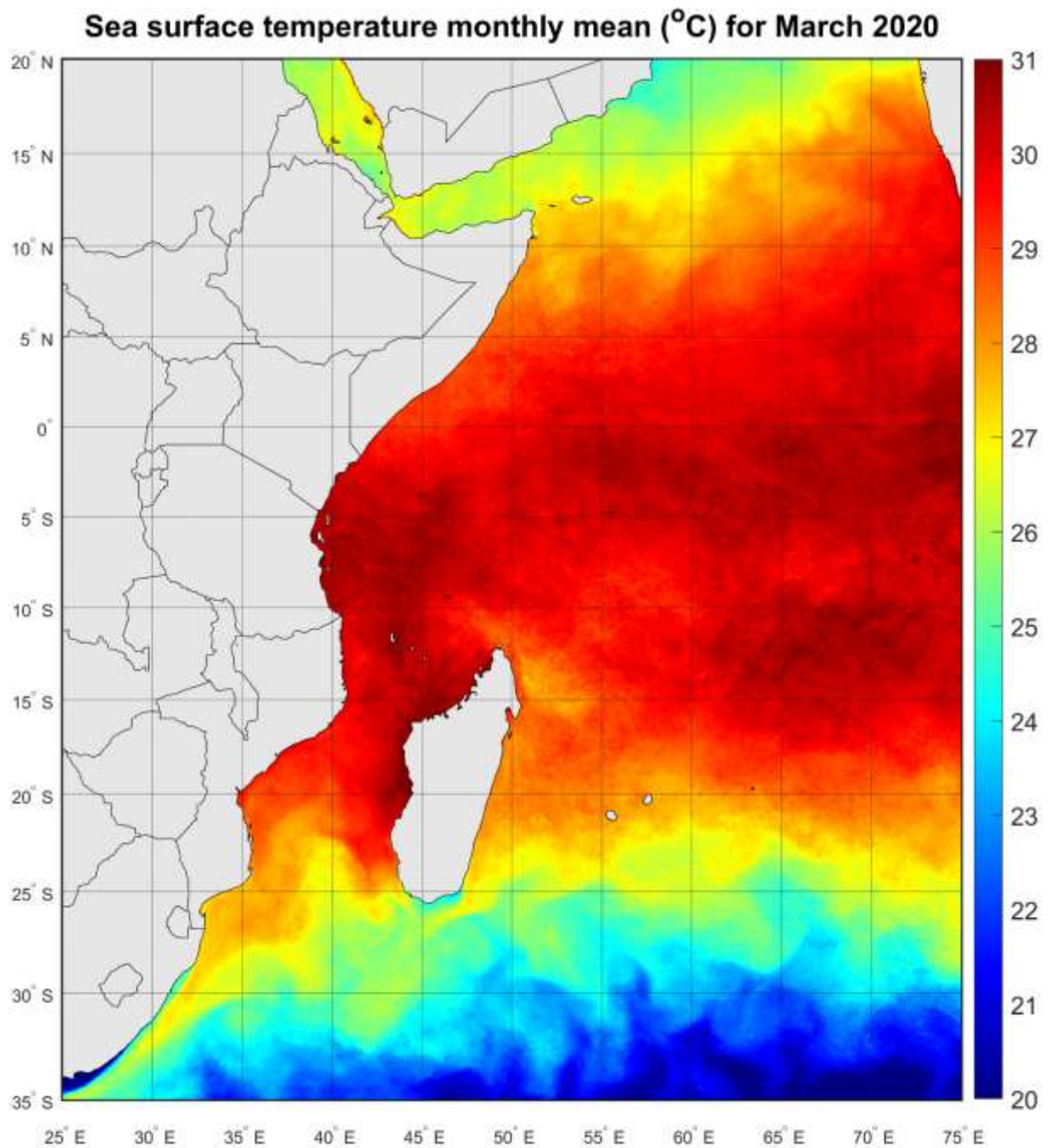


Figure 1: Mean sea surface temperature for the month of March 2020 (°C)

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

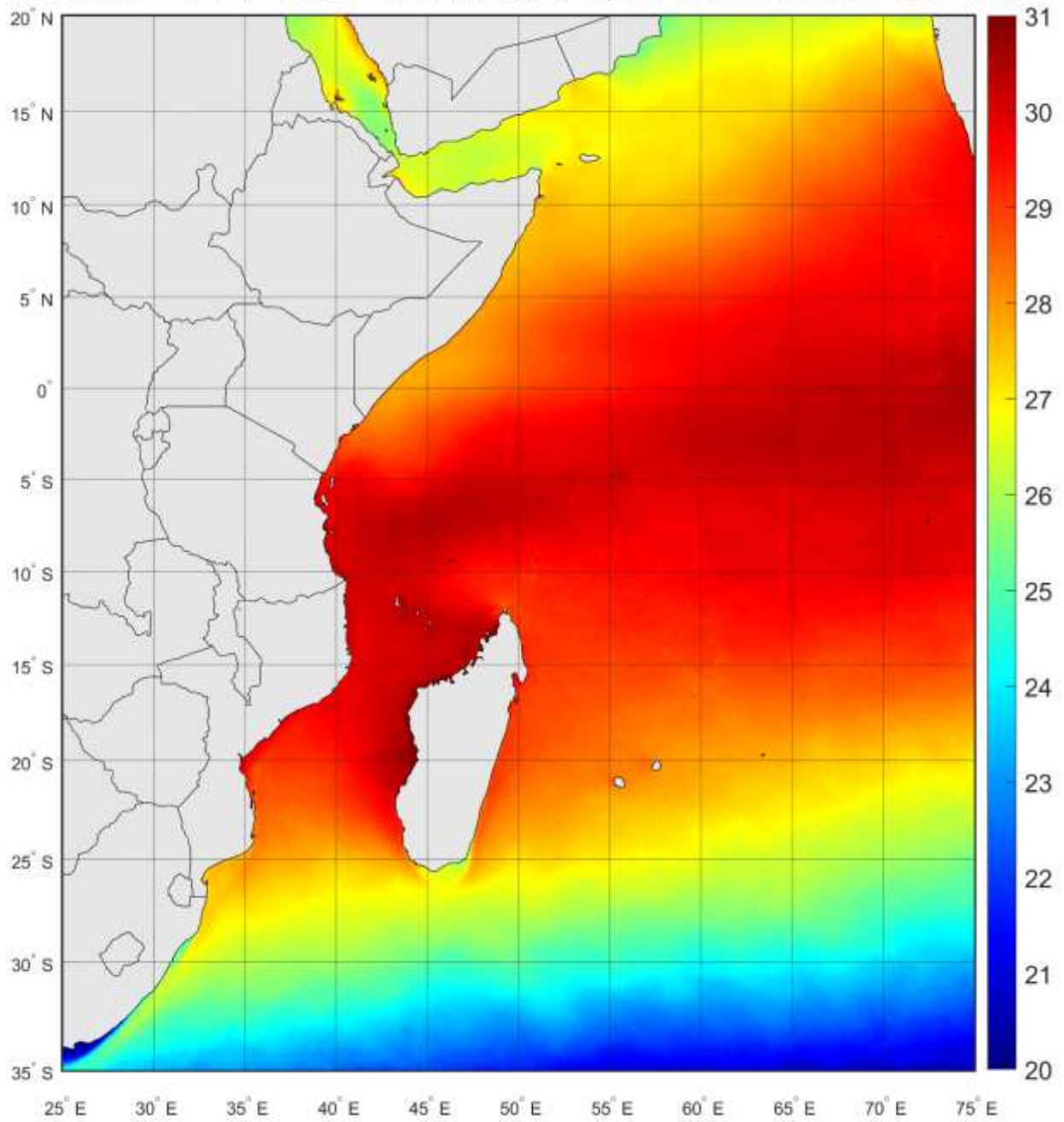


Figure 2: Climatology of sea surface temperature for March 2003 to March 2019 (°C)

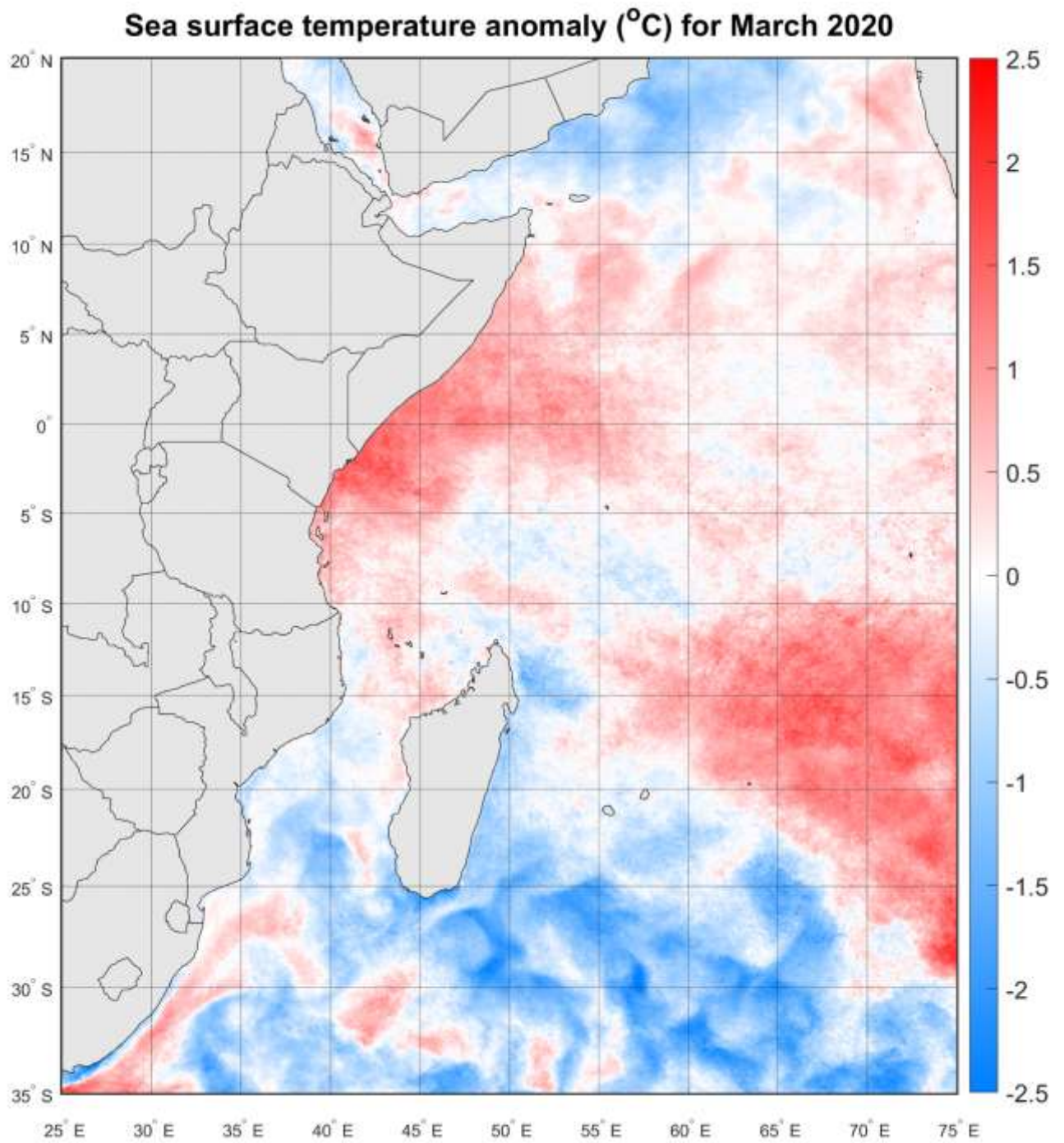


Figure 3: Anomaly of sea surface temperature for March 2020 ($^{\circ}\text{C}$)

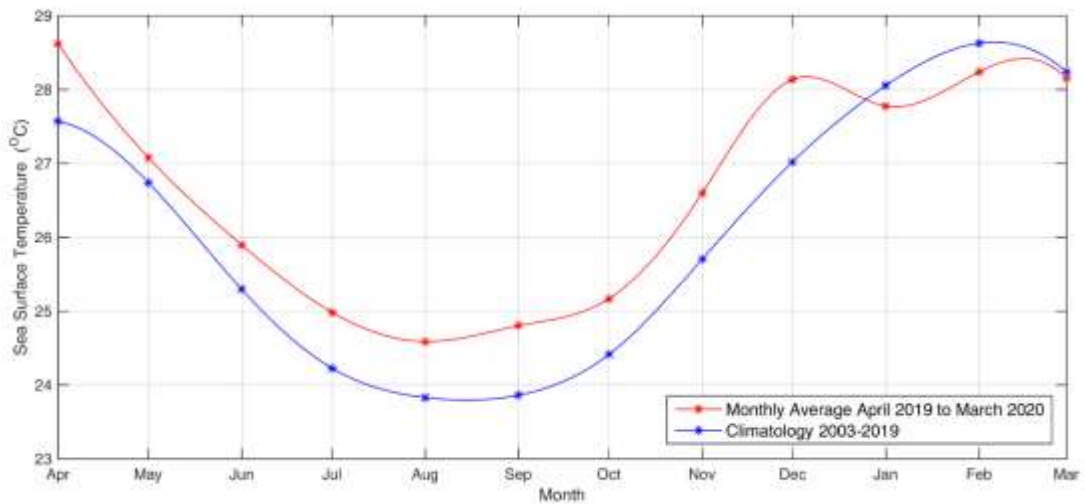


Figure 4: Temporal variation of sea surface temperature (°C) surrounding Mauritius

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 represents the SST variation for the month of March 2020. From Figure 1, it can be observed that for the month of March 2020, sea surface temperature was warm to much warmer above latitude 15° S and relatively colder below. Figure 3 shows temperature anomaly for March 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 observations, the SST was seen to be higher than usual throughout the northern part of the Indian Ocean basin. The Mozambique Channel, more particularly Mozambique and Western region of Madagascar were influenced by less warm surface waters during this period. Figure 4 shows the temporal variation of sea surface temperature for the region surrounding Mauritius. From the time series analysis, it can be observed that March 2020 reflects the normal average for the month of March. The Sea surface temperature was higher than normal along the coast of Tanzania up to Somalia whereas from Mozambique to latitudes further down temperatures lower than normal were observed. Positive SST anomalies were observed in most

regions in the North of SWIO, with many regions having anomalies of +0.5°C. These anomalous variations in SST could have an impact on the primary productivity.

4.0 Chlorophyll-a Concentration

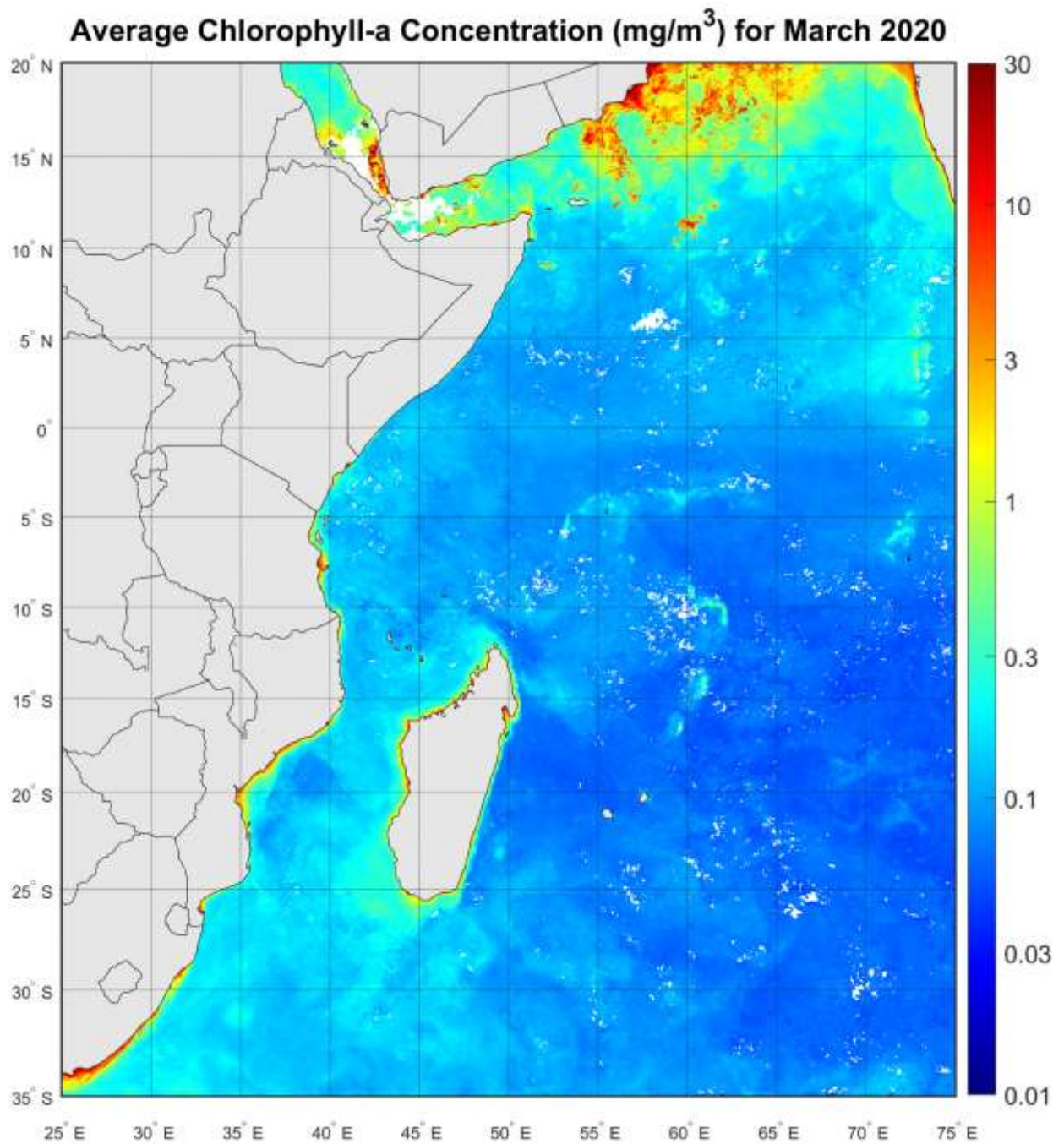


Figure 5: Mean chlorophyll-*a* concentration for the month of March 2020 (mg/m³)

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

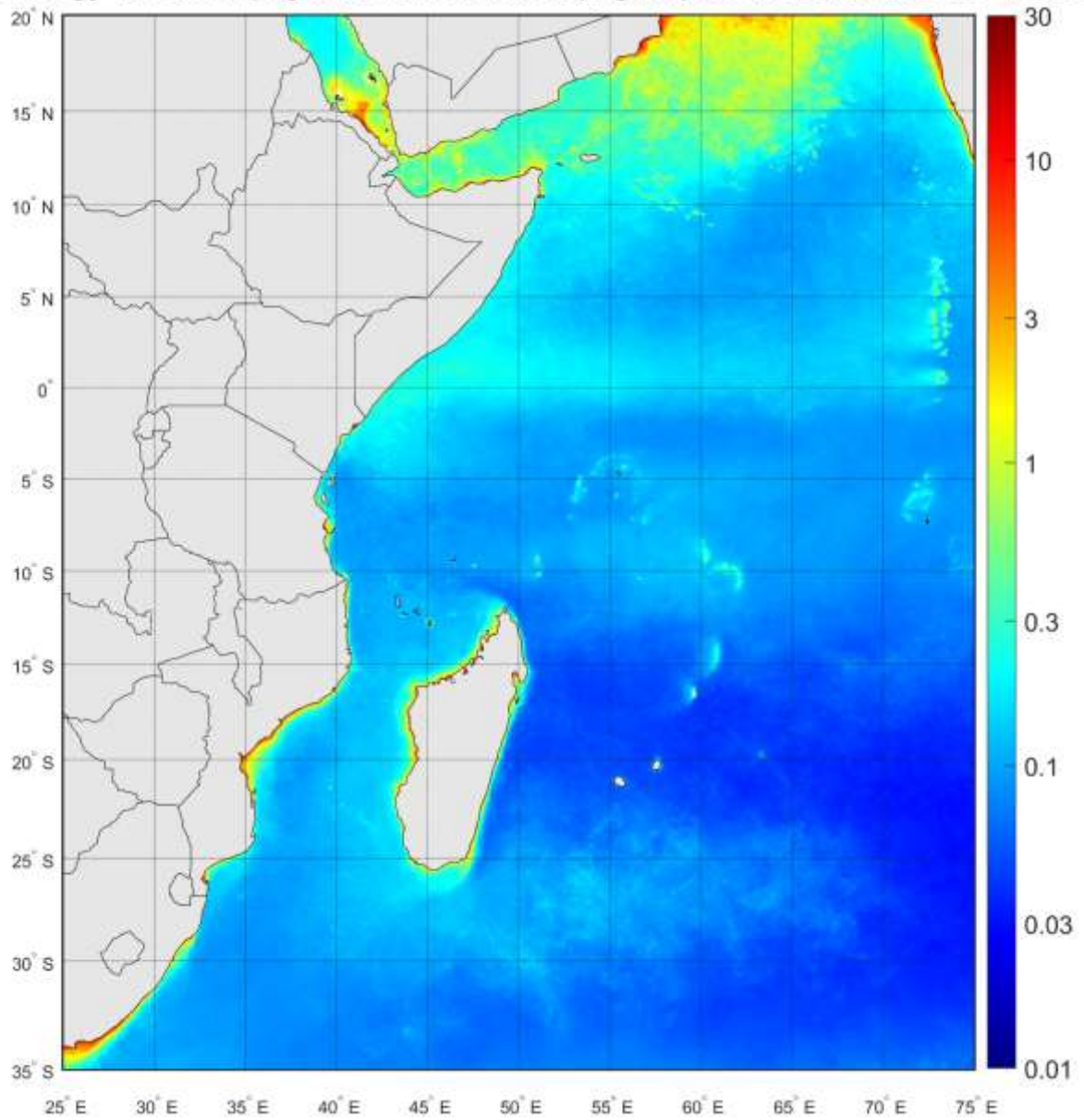


Figure 6: Climatology of chlorophyll-*a* for March 2003 to March 2019 (mg/m^3)

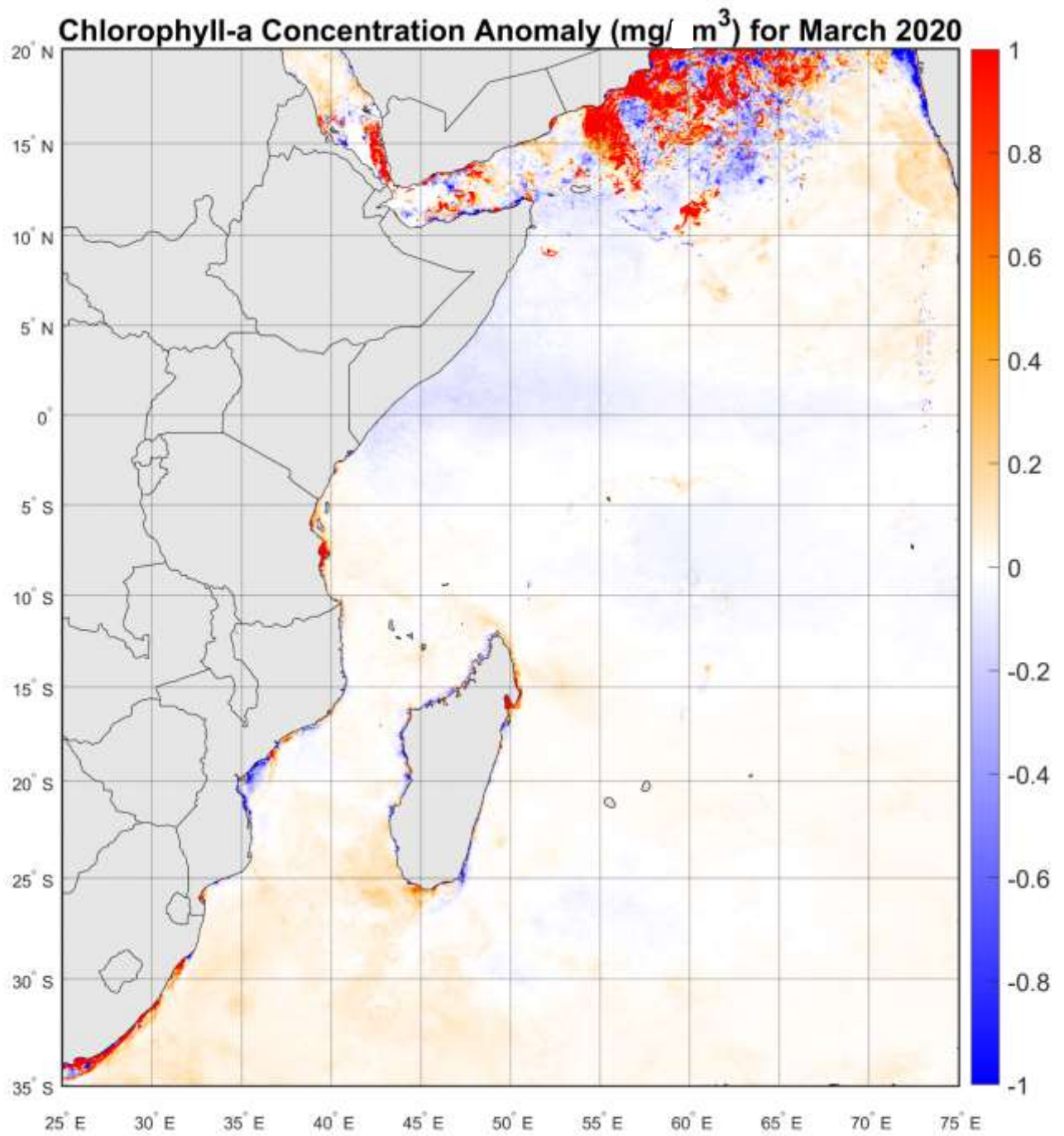


Figure 7: Anomaly of chlorophyll-*a* for March 2020 (mg/m³)

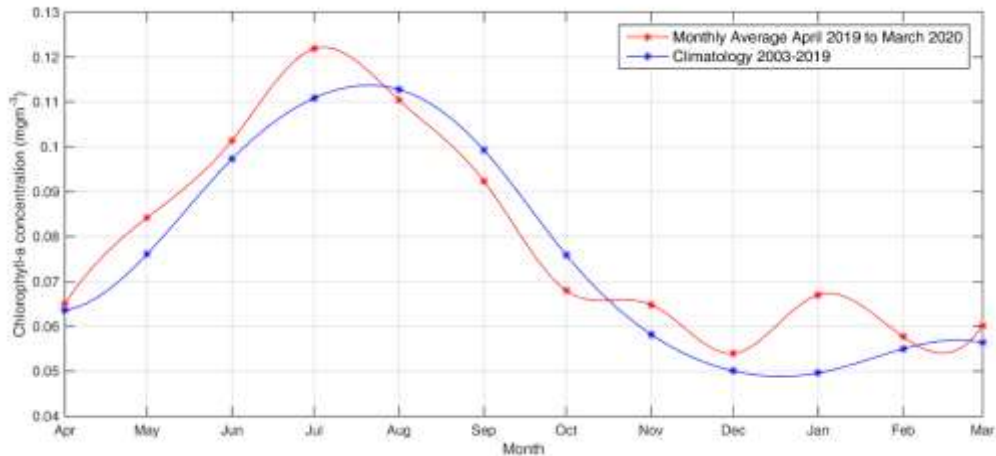


Figure 8: Temporal variation of chlorophyll-*a* (mg/m³) surrounding Mauritius

4.1 Description of chlorophyll-*a*

Figure 5 shows chlorophyll-*a* concentration in milligrams of chlorophyll-*a* per cubic metre of seawater for the month of March 2020.

Above normal values of chlorophyll-*a* concentration was observed in most of the SWIO region. Chlorophyll-*a* concentration below 1 mgm⁻³ were observed in the waters of Mozambique, Tanzania, and Seychelles except for lower Madagascar where the concentration is higher than normal. Low concentrations of chlorophyll-*a* indicate unfavourable conditions for the growth and development of pelagic fishes.

The monthly average chlorophyll-*a* concentration anomaly map showed anomalies for the month of March 2020 compared to the average conditions during that period of 2002-2019. Places that were warmer than average is red/orange, places that were near normal are white, and places that were cooler than average are blue. A few localised positive chlorophyll-*a* anomaly were observed in SWIO regions, more particularly in waters of Mozambique, East and West Madagascar, Comoros, Tanzania and Kenya.

The concentration of chlorophyll-*a* in the surrounding regions of Mauritius was a little higher than the average. Following this trend, the chlorophyll-*a* concentration is expected to increase for the coming months.

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Disclaimer

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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 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.

Chlorophyll-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 chlorophyll-*a* anomalies were calculated from the monthly average and the monthly climatology based on the interval from 2003 to 2019.