



**GMES
AND AFRICA**



MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean

May 2020



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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 May 2020, it can be observed that the surface temperature was warmer above latitude 17° S and relatively colder below this latitude.
- Relatively lower temperature was observed in the waters of the Mascarene Islands and the southern part of Madagascar compared to the previous months.
- The Mozambique Channel, more particularly Mozambique, Tanzania, West Madagascar, Comoros regions were under the influenced of warmer surface waters compared to the normal.

Chlorophyll-*a* Concentration

- Higher chlorophyll-*a* concentration were observed in general in the South West Indian Ocean region with less concentration along the coastal region of Somalia.
- Prevailing anti-cyclones in the southern region have contributed to the positive chlorophyll-*a* anomaly potentially caused by upwelling, that is, the upward flow of bottom water nutrients to the surface.
- The region of low concentrations near Saya de Malha region could potentially be attributed to the high temperature recorded in the same area.

3.0 Sea Surface Temperature

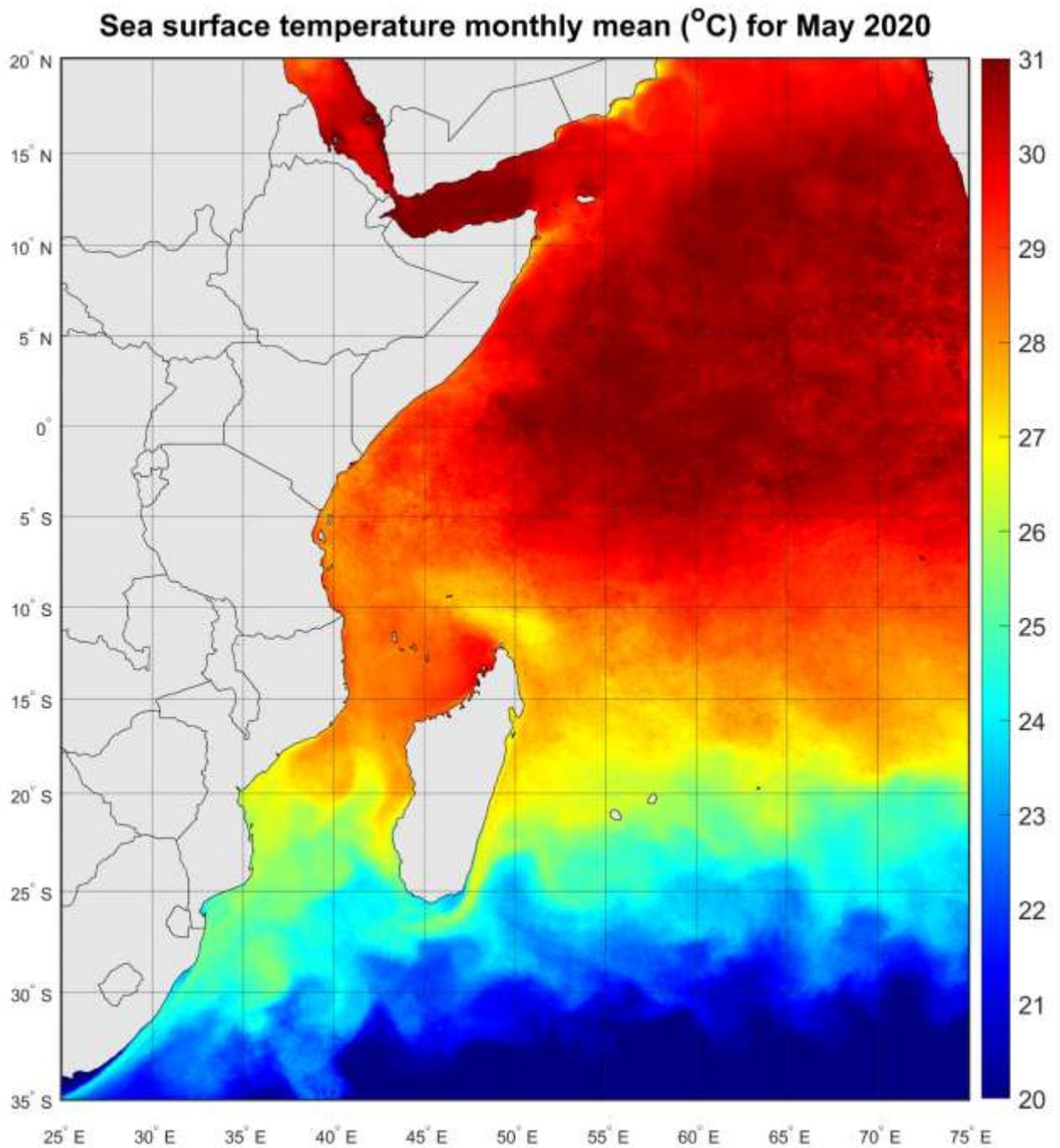


Figure 1: Mean sea surface temperature for the month of May 2020 ($^{\circ}\text{C}$)

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

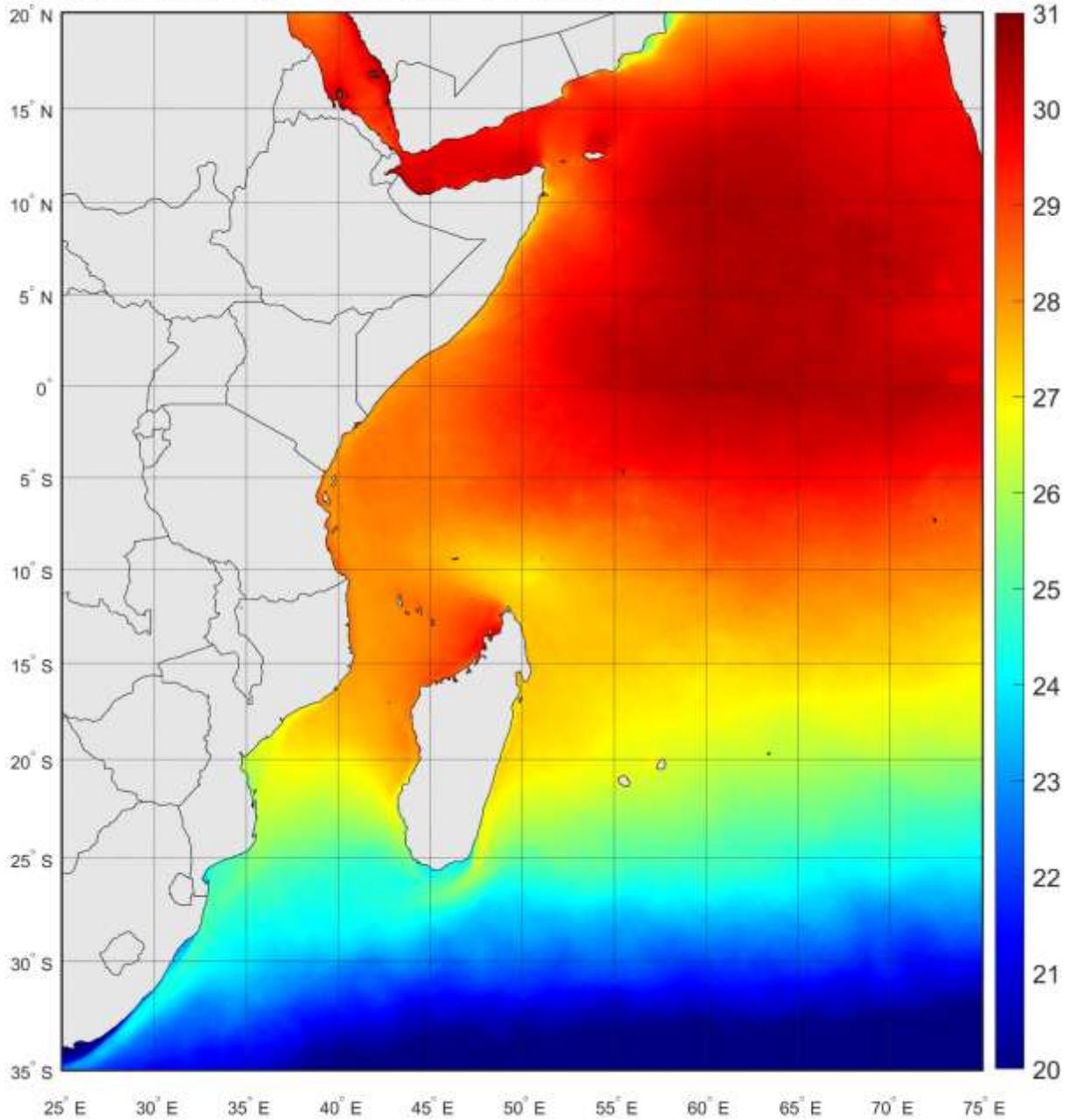


Figure 2: Climatology of sea surface temperature for May 2003 to May 2019 (°C)

Sea surface temperature anomaly ($^{\circ}\text{C}$) for May 2020

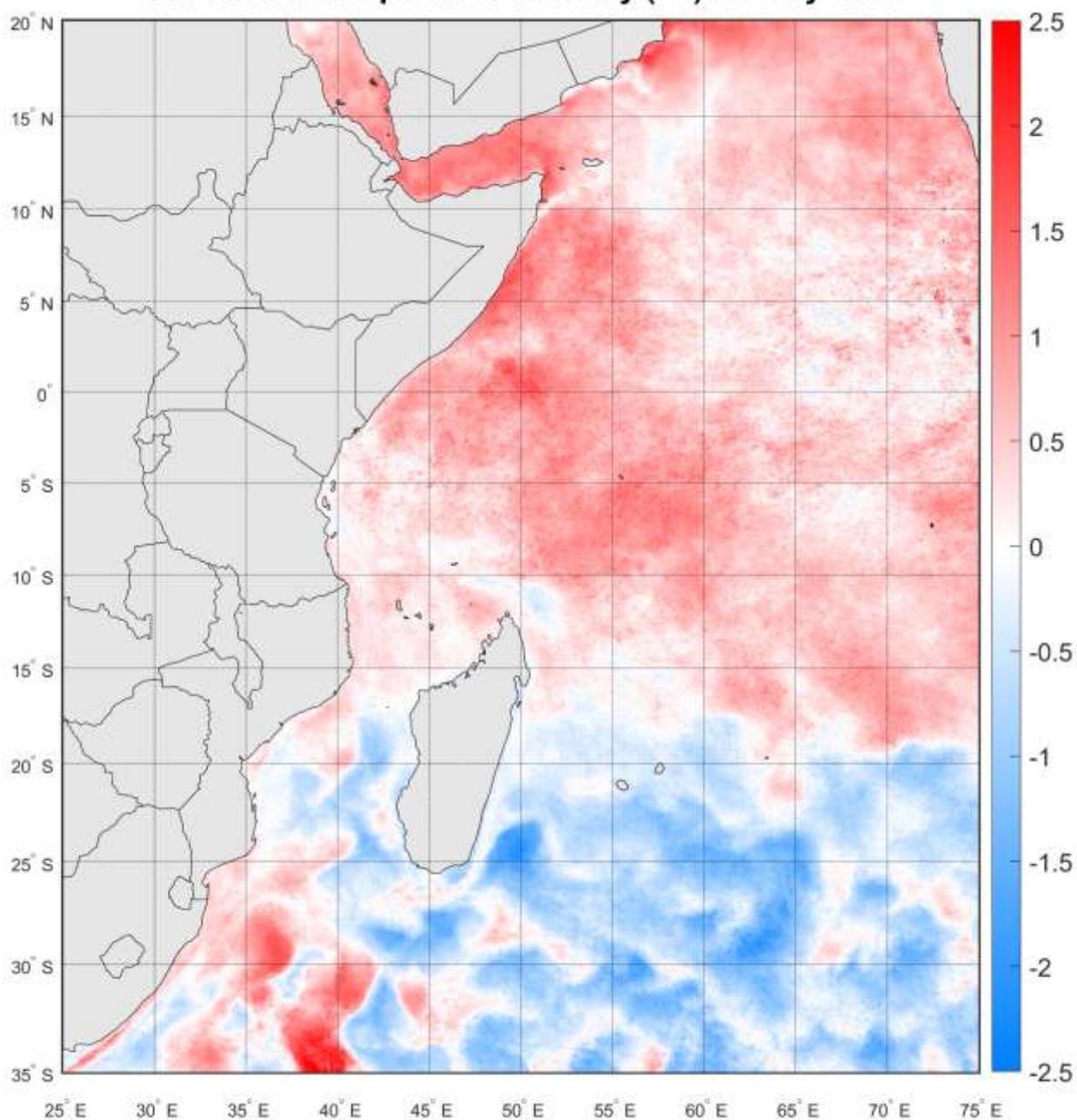


Figure 3: Anomaly of sea surface temperature for May 2020 ($^{\circ}\text{C}$)

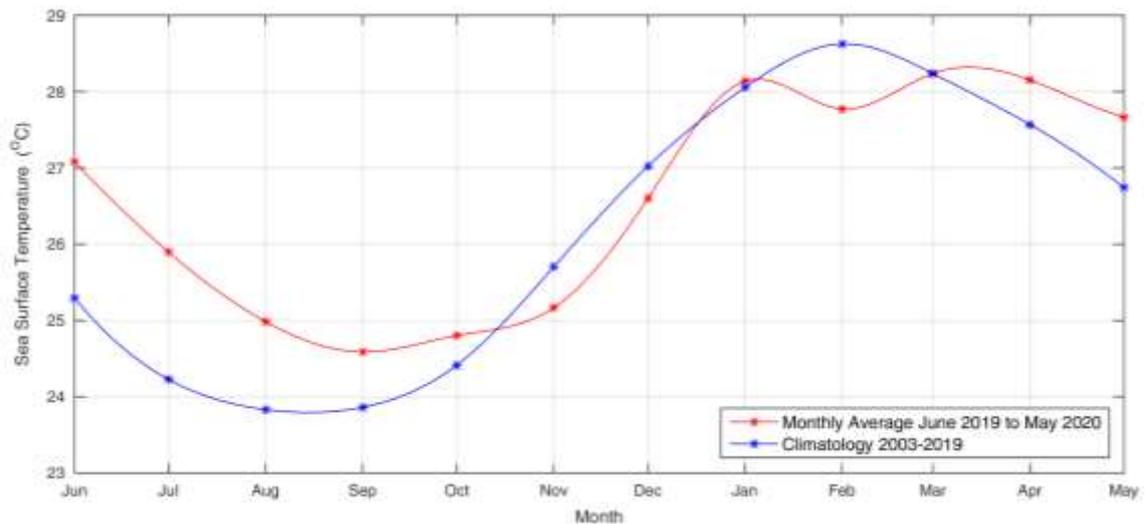


Figure 4: Temporal variation of sea surface temperature (°C) for the region around Mauritius

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 displays the SST variation for the month of May 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. From Figure 1, it can be observed that for the month of May 2020, SST was warmer above latitude 17° S and relatively colder for latitudes below this thermocline.

From observation, the SST was seen to be higher than usual throughout the northern part of the Indian Ocean basin. For instance, SST in the range of 30° C was recorded in the region Seychelles compared to an average of around 28-29° C for the same region. Relatively lower temperature was observed in the waters of the Mascarene Islands and the southern part of Madagascar compared to the previous months. This phenomenon could be attributed to the formation of anti-cyclones during the month of May 2020. From the time series analysis (Figure 4), it can be observed that since April 2020, temperature at this region is above average in this region in the range of 1° C, which is considerable for the ecosystem near coastal areas. The Mozambique Channel, more particularly Mozambique, Tanzania, West Madagascar, Comoros regions were influenced by warm surface waters and temperatures reaching 30°C. These anomalous variations in SST could have an impact on the primary productivity. Considering the pattern of evolution of the SST, it can be deduced that there is seasonal variation and in the following months, the SST is expected to be higher. Comparing the SST with that of May 2019, the temperature in May 2020 is higher than May 2019.

4.0 Chlorophyll-a Concentration

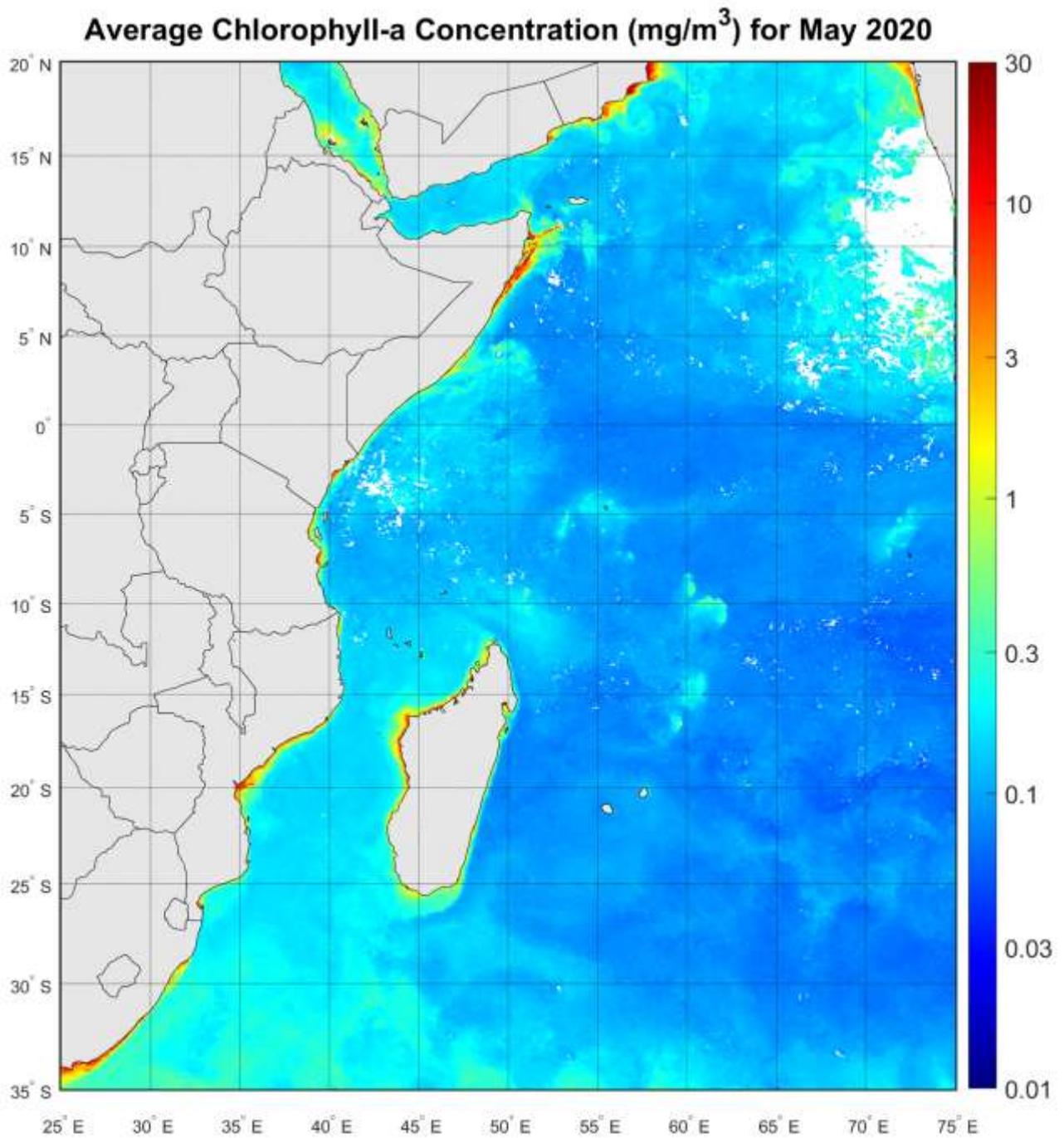


Figure 5: Mean chlorophyll-*a* concentration for the month of May 2020 (mg/m^3)

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

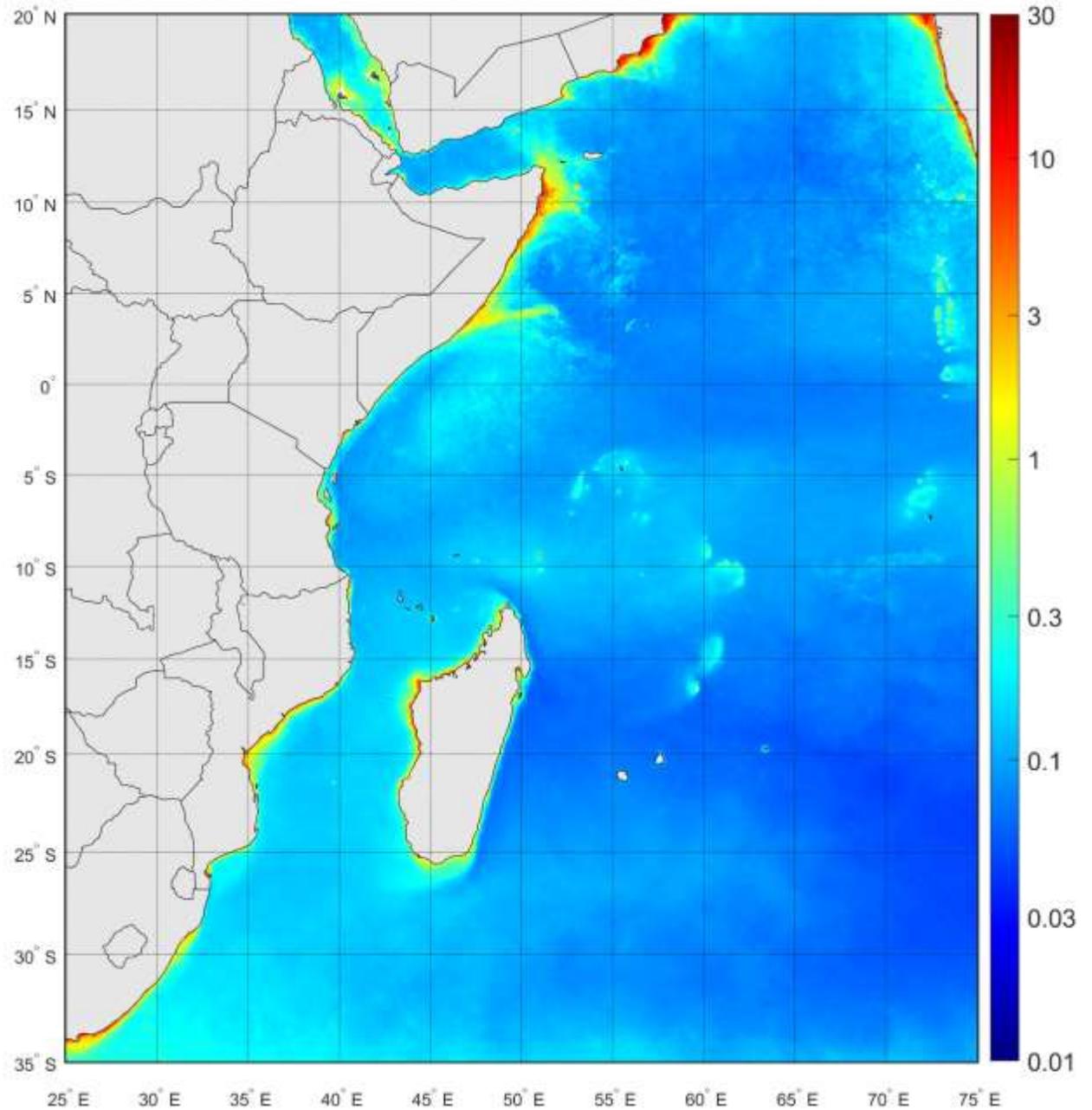


Figure 6: Climatology of chlorophyll-*a* for May 2003 to May 2019 (mg/m^3)

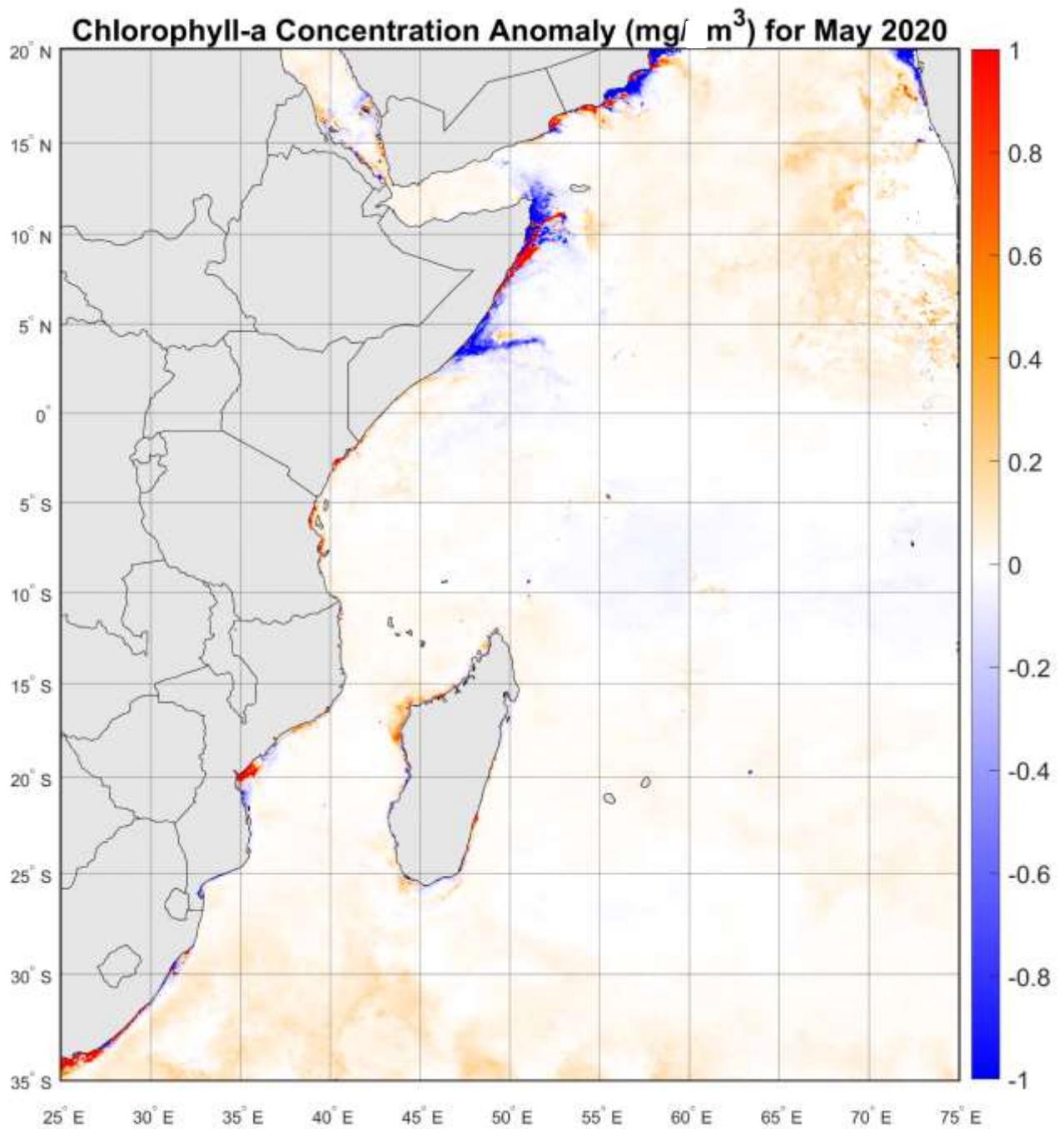


Figure 7: Anomaly of chlorophyll-*a* for May 2020 (mg/m^3)

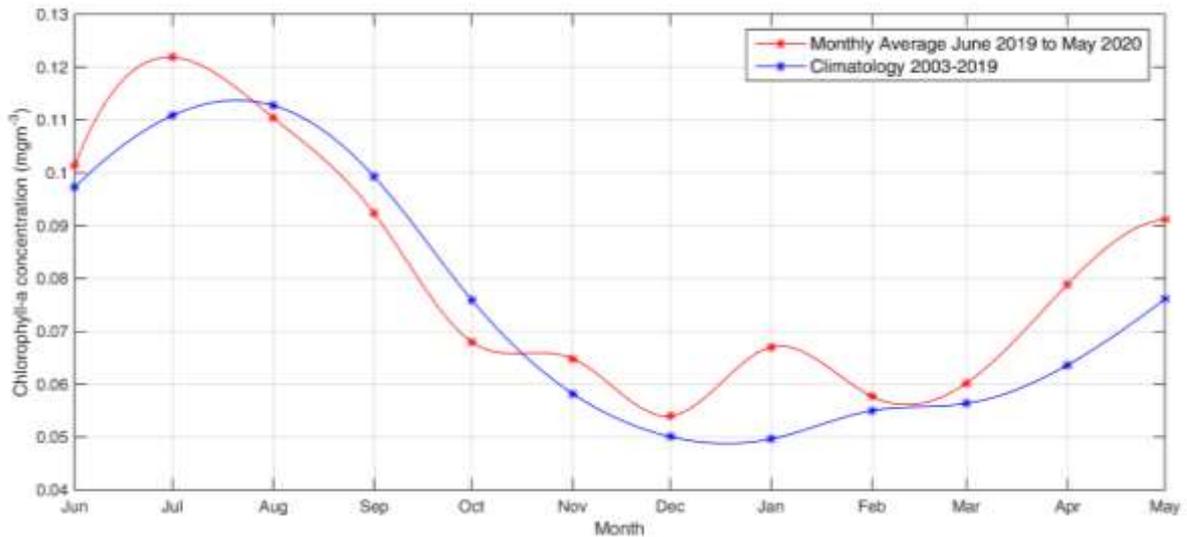


Figure 8: Temporal variation of chlorophyll-*a* (mg/m³) surrounding Mauritius

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 May 2020. Regions where chlorophyll-*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 chlorophyll-*a* concentration were observed in general in the South West Indian Ocean region with less concentration along the coastal region of Somalia. Compared to the monthly mean climatology for May, chlorophyll-*a* concentrations was higher than normal in the western coast of Madagascar and near the islands of Tanzania (Figure 7). High chlorophyll-*a* indicates high primary production, an essential condition for fish aggregation and fish catch.

The region of low concentrations near Saya de Malha region could potentially be attributed to the high temperature recorded in the same area. In addition, prevailing anti-cyclones in the southern region could also explain the positive chlorophyll-*a* anomaly potentially caused by upwelling, that is, the upward flow of bottom water nutrients to the surface.

Figure 8 shows the temporal variation of chlorophyll-*a* surrounding Mauritius where the deviation from the monthly mean were significant since a couple of months. The graph shows that since November 2019 a higher concentration of chlorophyll-*a* than the monthly climatology was observed, with a difference of +0.01 mg/m³ in May 2020.

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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 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 Chlorophyll-*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.