MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean

September 2020

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

- For the month of September, sea surface temperature was warm to much warmer above latitude 10° S and longitude 50° E while still relatively colder below and further west towards the coast of Africa.
- Compared to the previous month, it can be observed that the thermocline is moving further south, reminiscent of the summer season that is approaching.
- The time series analysis for the region around Mauritius shows that for the month of September 2020, the SST is still slightly lower than the monthly climatology, following this trend since mid-April.
- The temporal variation of SST for the region East of Somalia confirms the positive anomaly observed in the region showing that this phenomenon is persisting since the last year.

Chlorophyll-a Concentration

- High Chl-a level was observed in the region north of Madagascar and below latitude 30o S. Relatively lower chlorophyll-a concentration was detected between latitude 10 – 30o S.
- As it was the case for the previous months, the spatial distribution of Chl-a concentrations for the month of September was more or less similar to the monthly mean climatology.
- The monthly time series for Chl-a for the region around Mauritius shows that since January, a higher Chl-*a* than the climatology for this region is being observed.

3.0   Sea Surface Temperature
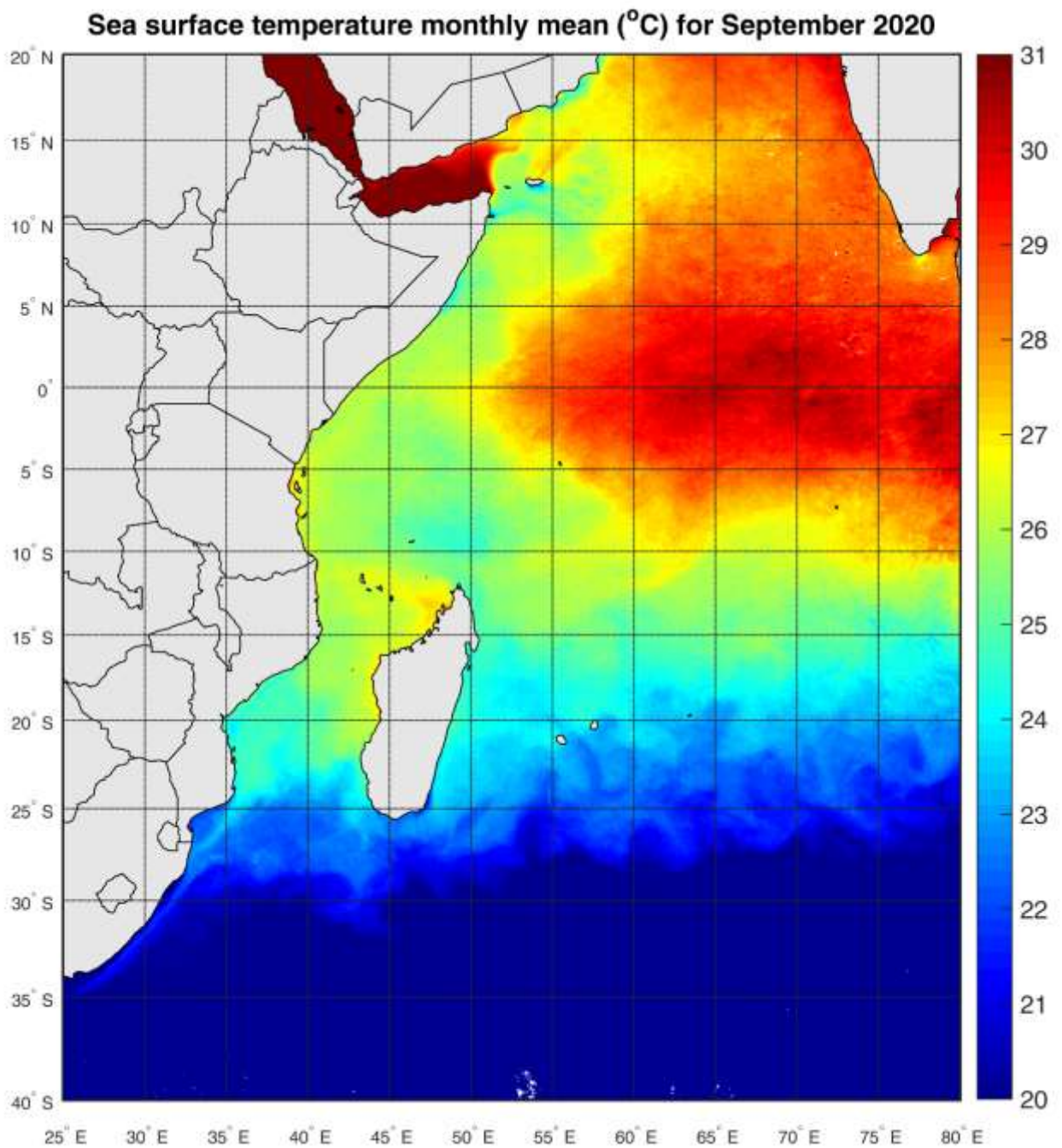
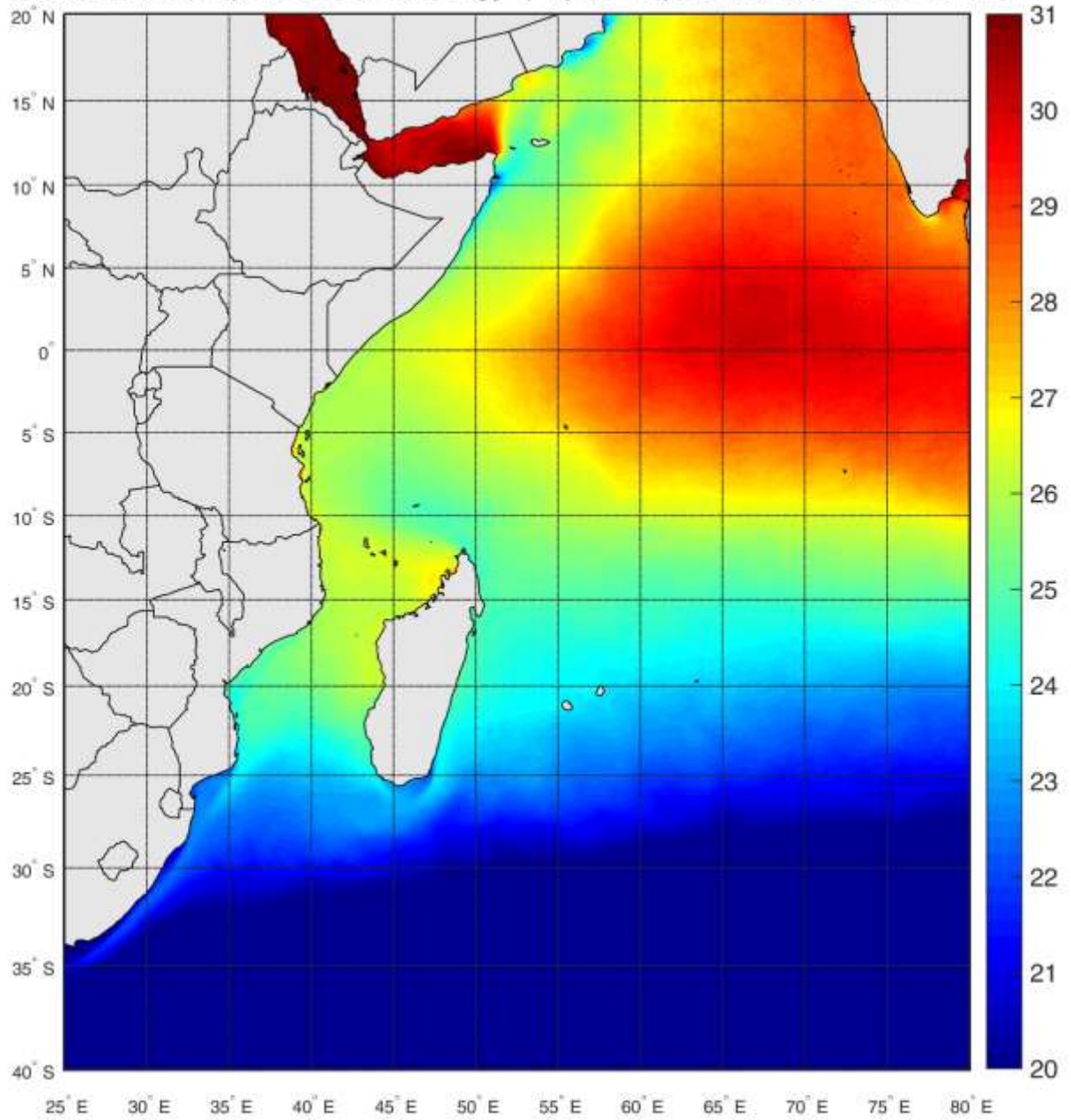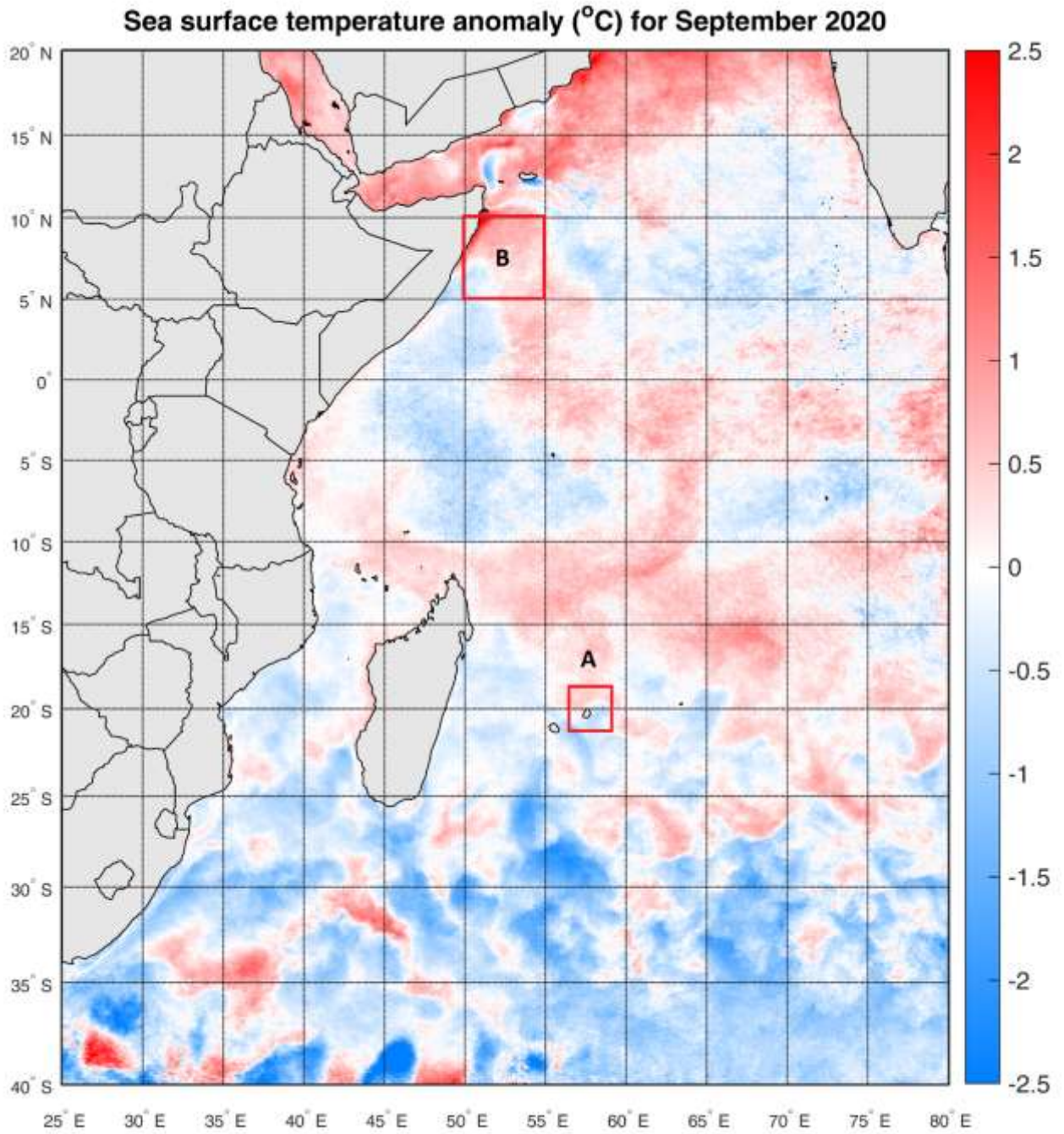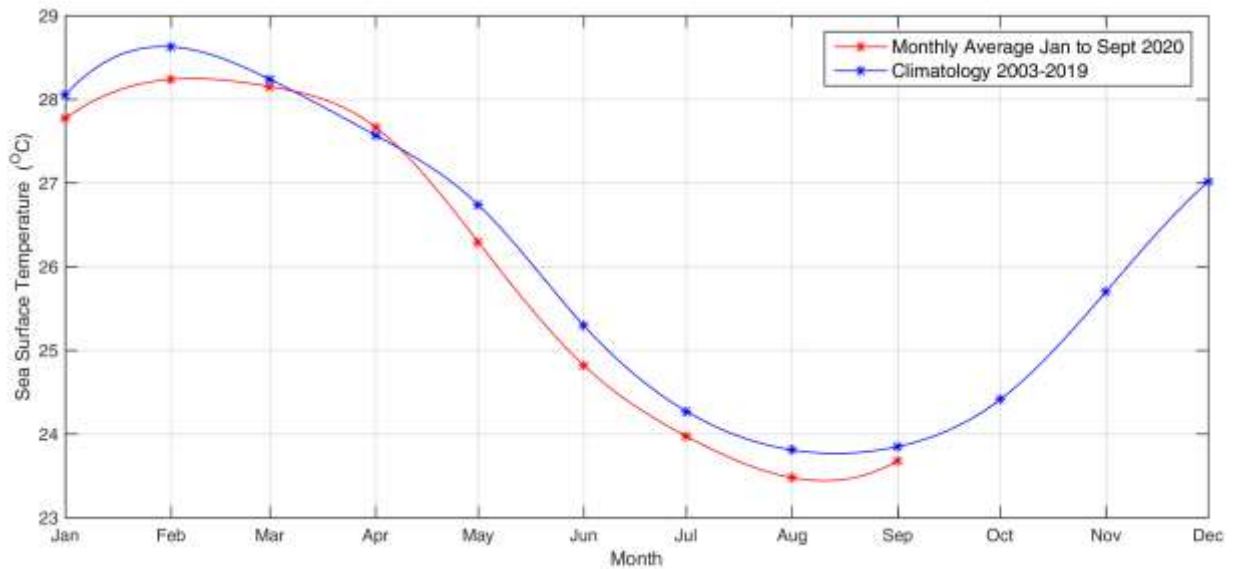**Figure 1:** Mean sea surface temperature for the month of September 2020 (°C)

Figure 2: Sea Surface Temperature Climatology (°C) for the month of September (2003 -2019)
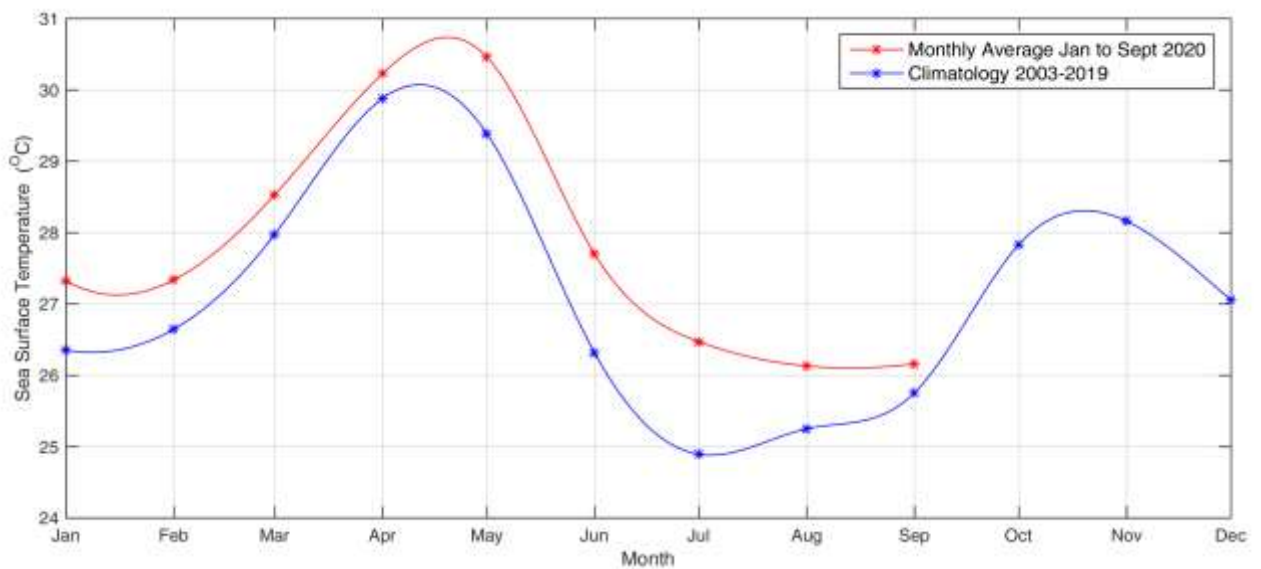
Figure 3: Anomaly of Sea Surface Temperature for September 2020 (°C)

Time series generated from the monthly average for September 2020 and the climatological normal for September in the region highlighted in Figure 3, namely region A around Mauritius and region B located off the 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) for the region East 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 September 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. For the month of September, it was observed that the sea surface temperature was warm to much warmer above latitude 10° S and longitude 50° E while still relatively colder below and further west towards the coast of Africa. Compared to the previous month, it can be observed that the thermocline is moving further south, reminiscent of the summer season in the southern hemisphere that is approaching. Figure 2 represents the climatology for the month of September based on average calculated from 2003 to 2019. Figure 3 shows temperature anomaly for the period covered in this bulletin. The blue colour on the map 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 above the Mascarene Islands and relatively lower below the latitude 20° S. Meanwhile in the Gulf of Aden, the Red Sea and off the coast of Somalia, the temperature was observed to be higher than average.

The time series analysis for the region around Mauritius (Figure 4) depicted by Region A on Figure 3, shows that for the month of September 2020, the SST is still slightly lower than the monthly climatology, following this trend since mid-April. Figure 5 shows the temporal variation of sea surface temperature for the region East of Somalia, between latitude 5 -10° N and longitude 50 - 55° E (Region B on Figure 3). The graph confirms the positive anomaly observed in the region showing that this phenomenon is persisting since the last year.
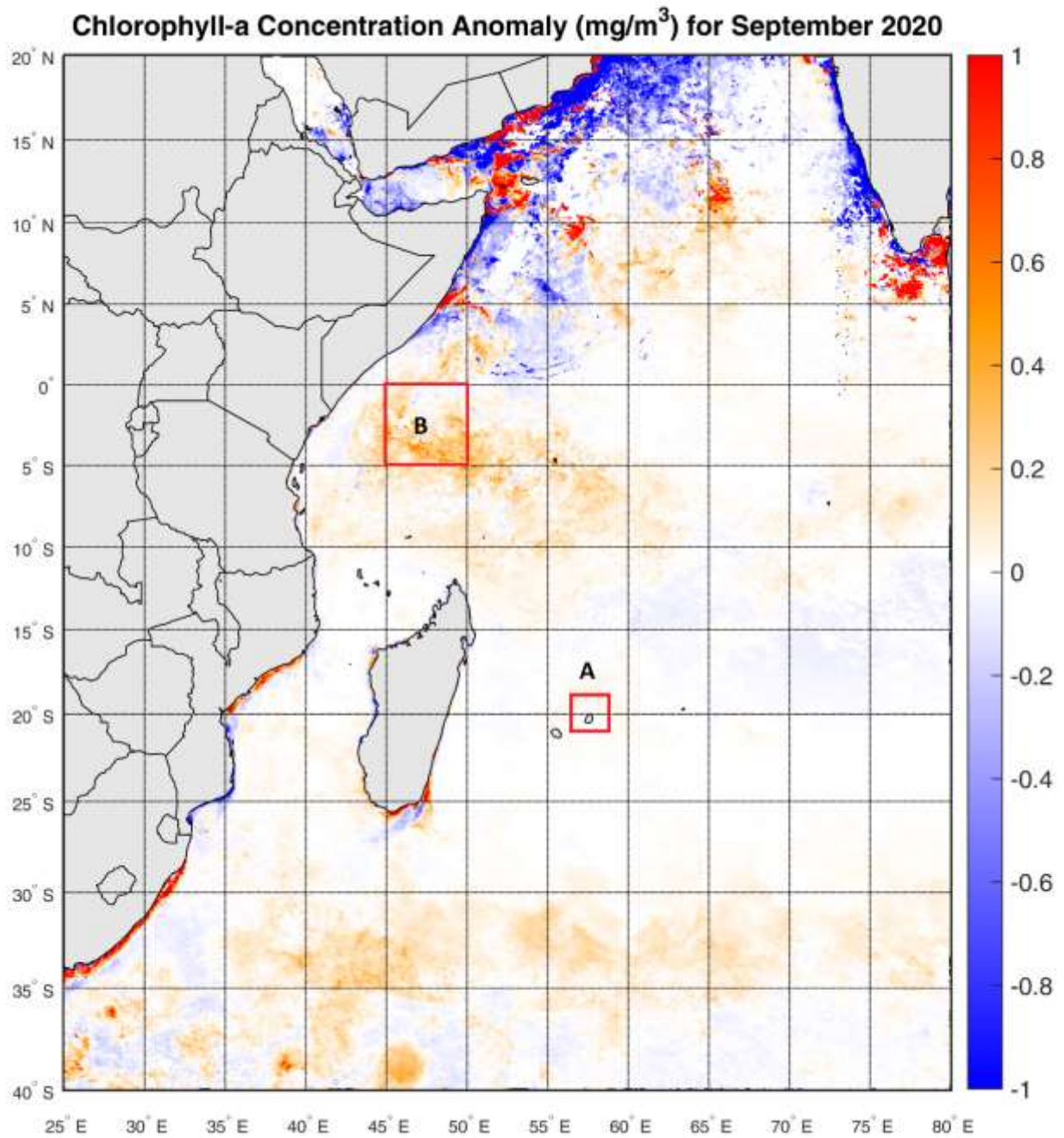
4.0   Chlorophyll-a Concentration
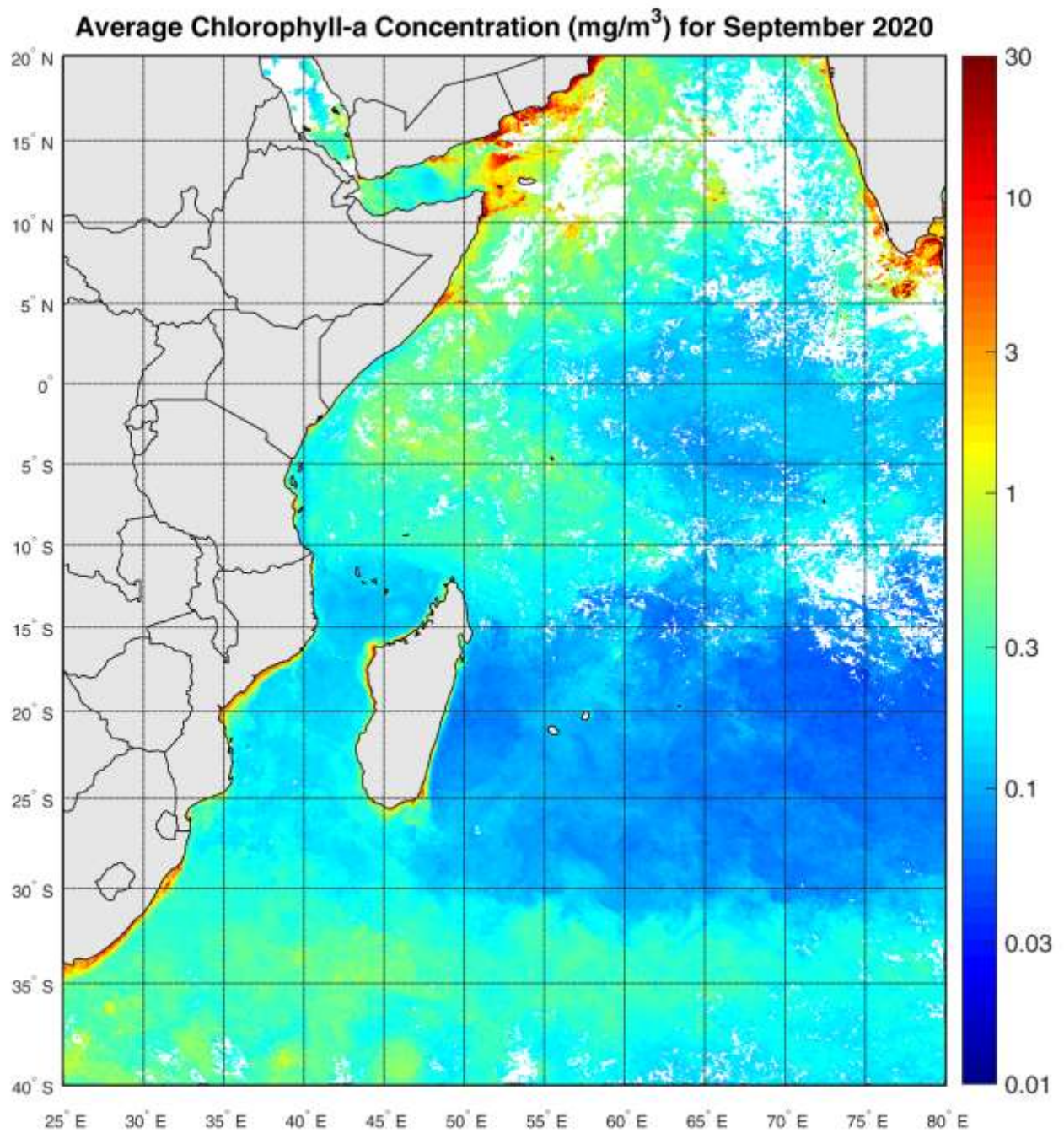
Figure 6: Mean chlorophyll-*a* concentration for the month of September 2020 (mg/m³)
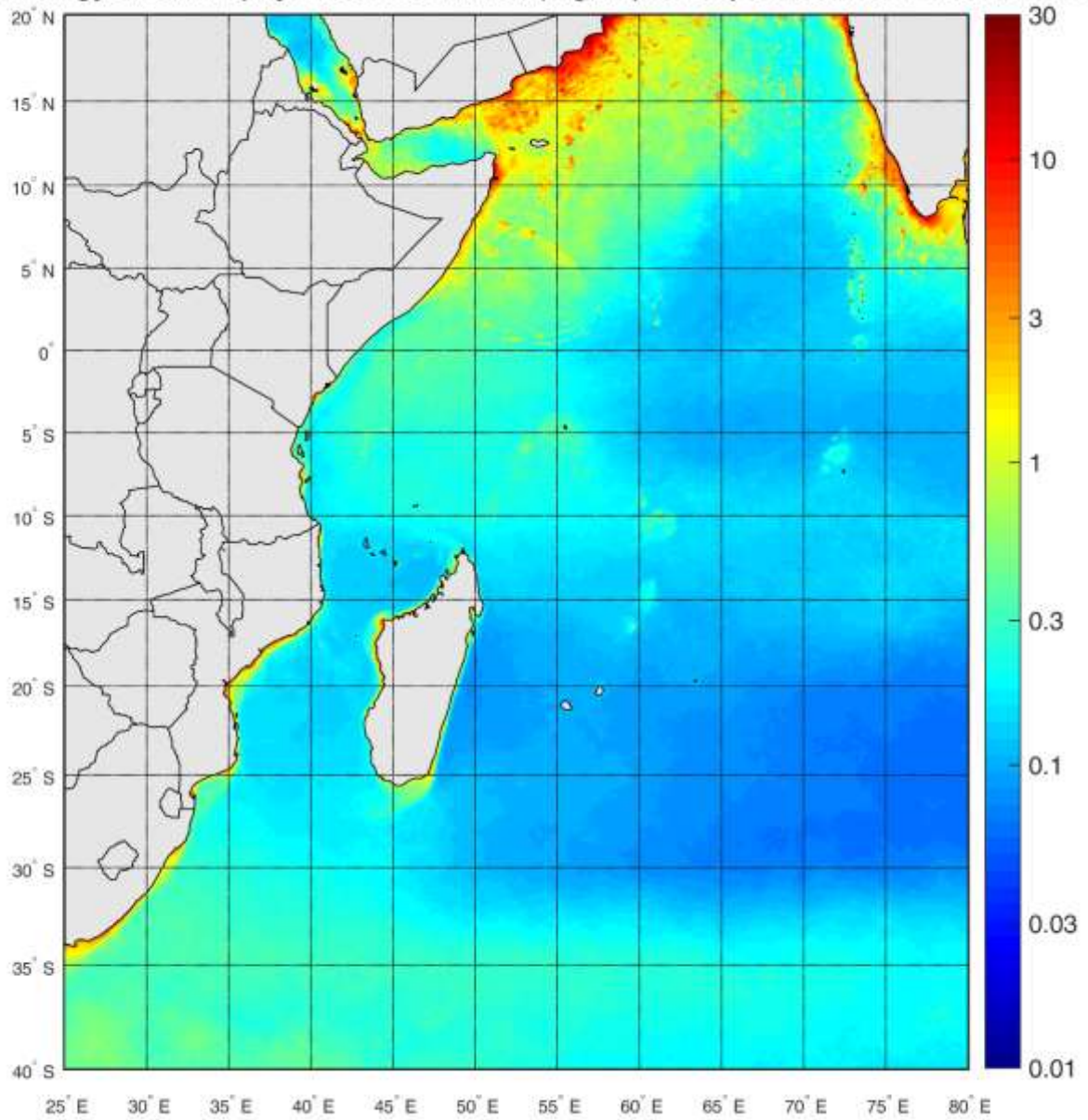
**Figure 7:** Chlorophyll-*a* Climatology (mg/m³) for the month of September (2003 -2019)

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

Chlorophyll-a time series generated from the monthly average for September 2020 and the climatological normal for September in the region encircle in Figure 8, namely region A around Mauritius and region B located in the east of Kenya.
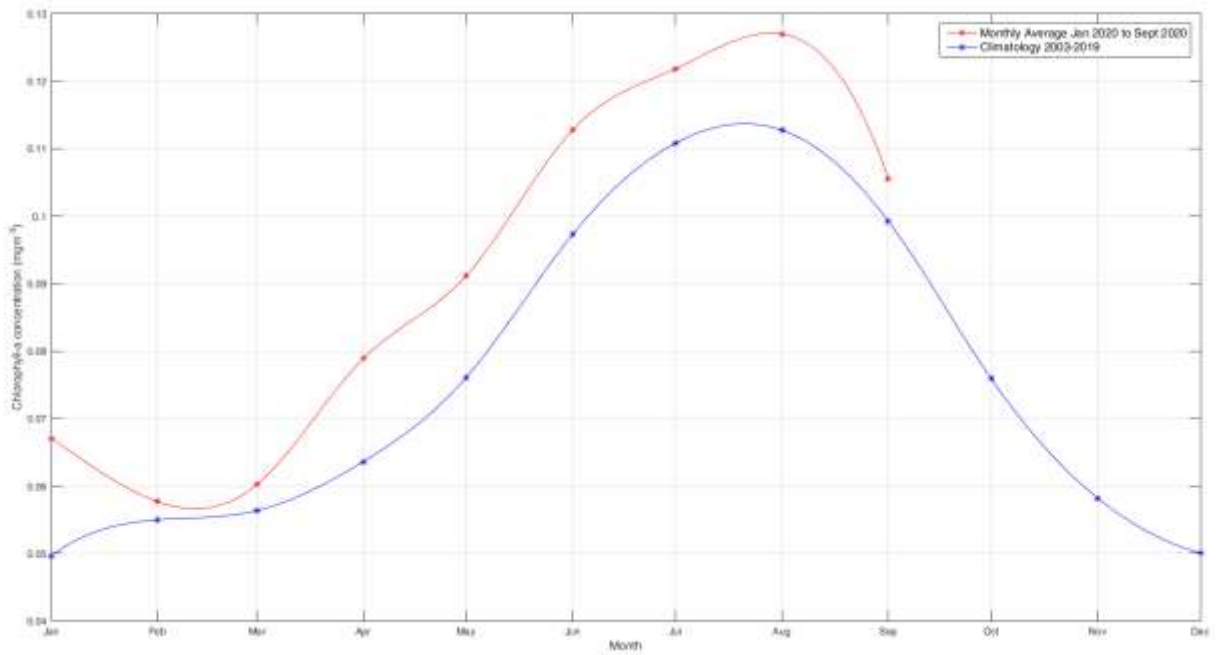
Figure 9: Temporal variation of chlorophyll-*a* (mg/m³) around Mauritius Island (Region A)
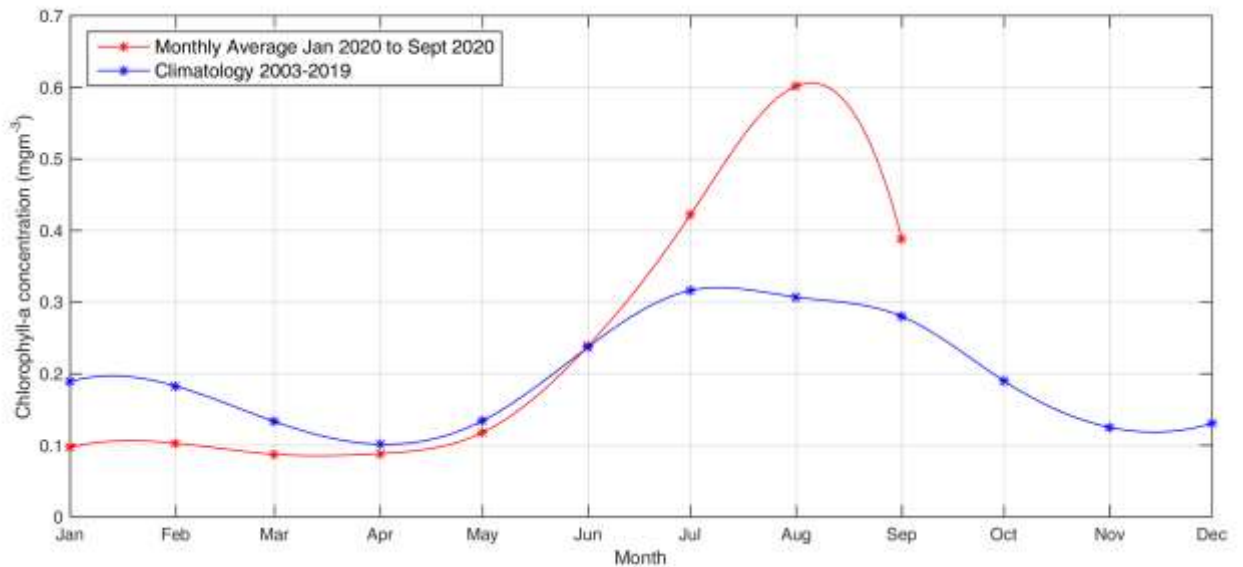
Figure 10: Temporal variation of chlorophyll-*a* (mg/m³) for the region east of Kenya (Region B)

4.1   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 September 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 (cloud cover) is represented in white.

A high Chl-*a* concentration 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.

High Chl-*a* level was observed in the region north of Madagascar and below latitude 30° S. Relatively lower Chl-*a* concentration was detected between latitude $10 - 30^o$ S.   As was the case for the previous months, the spatial distribution of Chl-*a* concentrations for the month of September was more or less similar to the monthly mean climatology.

Figure 9 shows the monthly time series for the region around Mauritius (region A on Figure 8). The trend observed since January, that is, higher Chl-*a* than the climatology for this region remain on a constant increase.

Figure 10 shows the temporal variation of Chl-*a* for the region bordering the eastern coast of Kenya (region B on Figure 8). The graph shows that the peak observed in August 2020 (0.6 mg/m^3) has decreased to approximately 0.4 mg/m^3 whoch os still above the climatological mean for the period.

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://oceancolor.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.