GMES AND AFRICA

MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean

January 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

- It has been observed for the month of January 2020, sea surface temperature was relatively warm which corroborates with the long-term average temperature for January indicative of peak summer season.
- SST was seen to be relatively higher than normal for the period across the region with temperature of more than 2^{o} C than the climatology observed off the coast of Tanzania and Somalia
- Average SST around Mauritius was 1.5°C above the climatological mean.

Chlorophyll-a Concentration

- Higher Chl-*a* concentration were observed in the region below 20 ^{o}C from South Africa to the south of Madagascar.
- Since November 2019 a slight increase in chlorophyll-a was observed and will continue on the same trend in the coming month around the region of Mauritius.
- High positve anomaly in the southern region of Madagascar and Mozambique Channel, which is essential condition for fish aggregation and fish catch.

3.0 Sea Surface Temperature

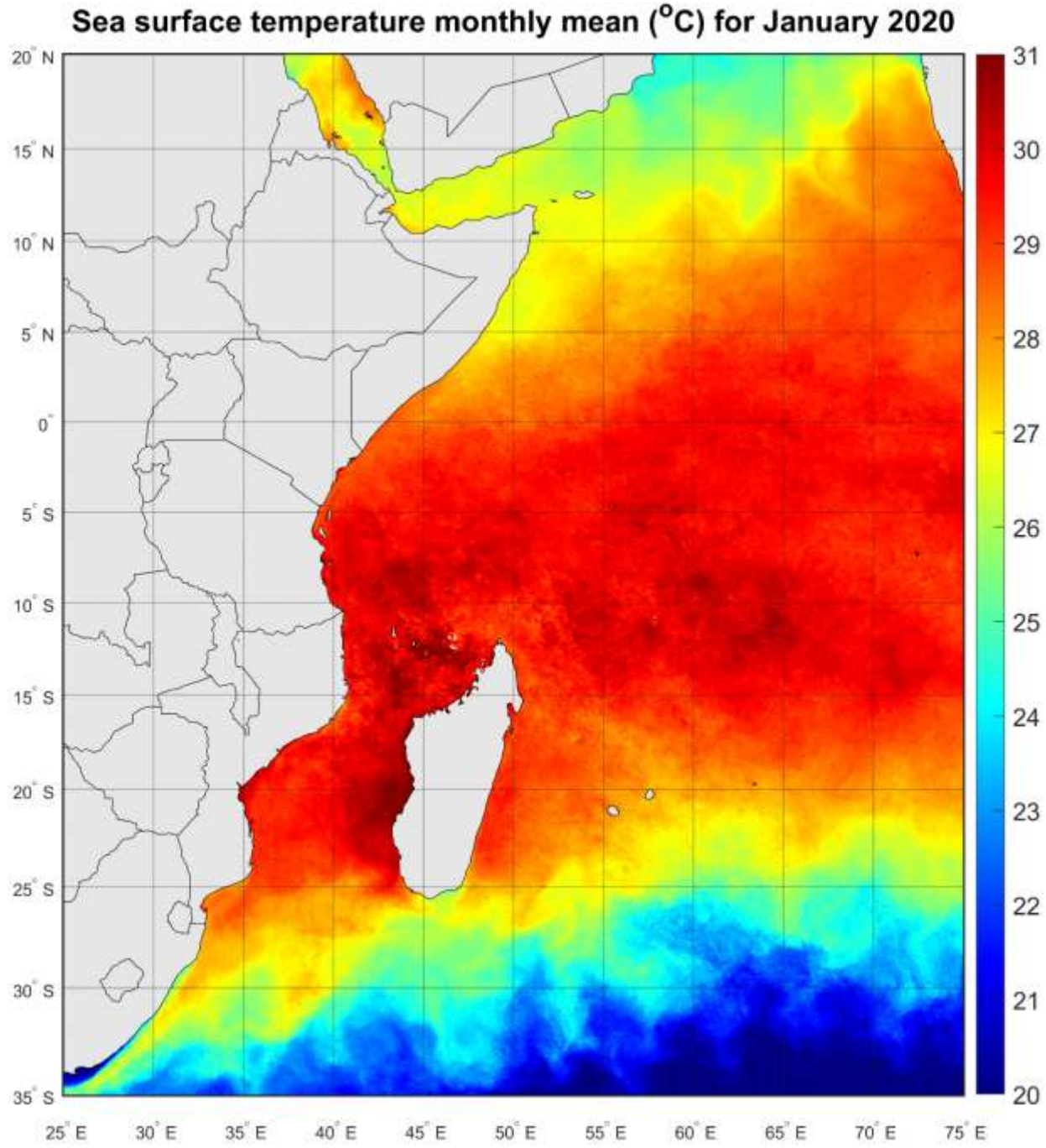

Figure 1: Mean sea surface temperature for the month of January 2020 (°C)

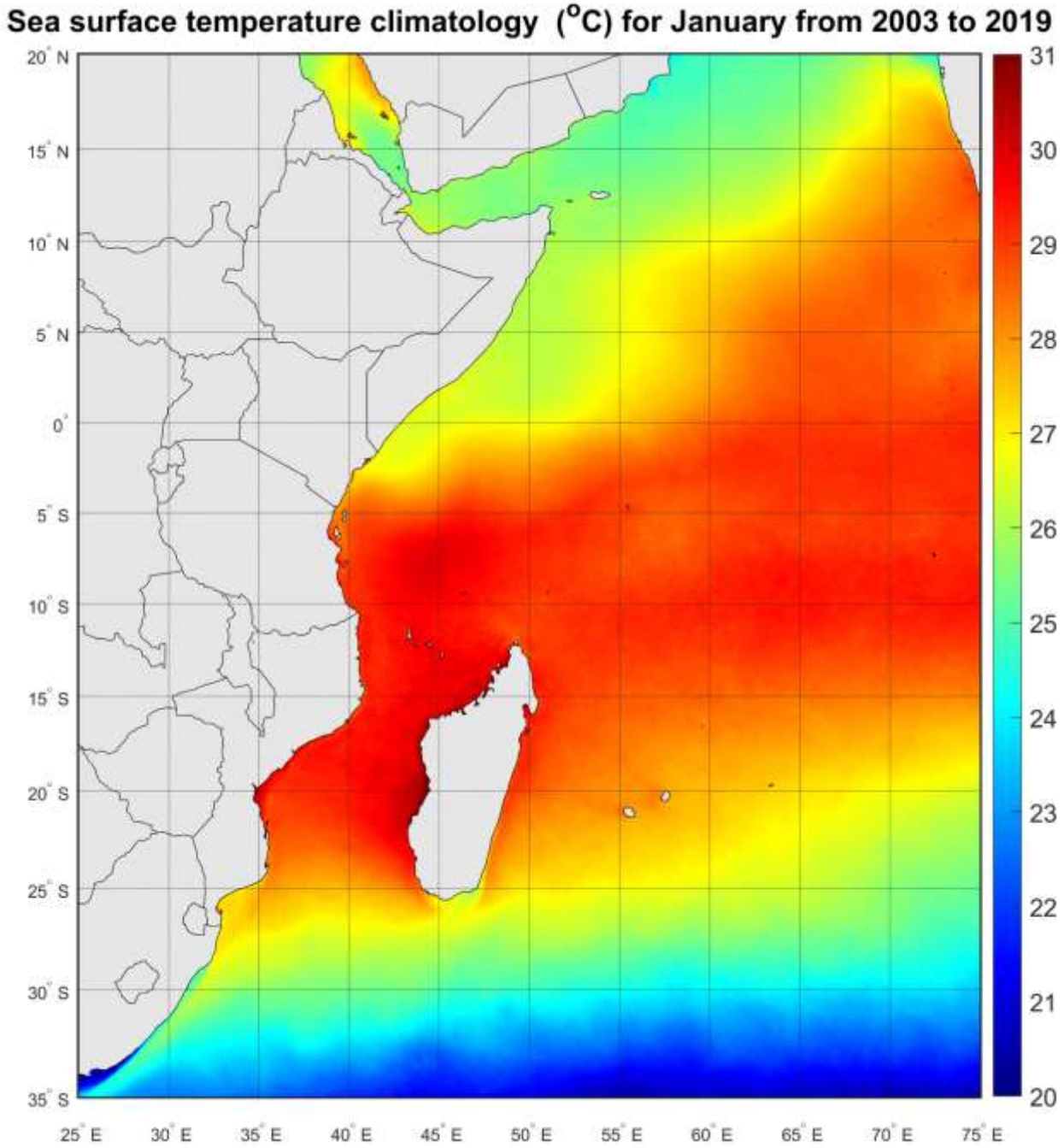

Figure 2: Climatology of sea surface temperature for July 2003 to January 2019 (°C)

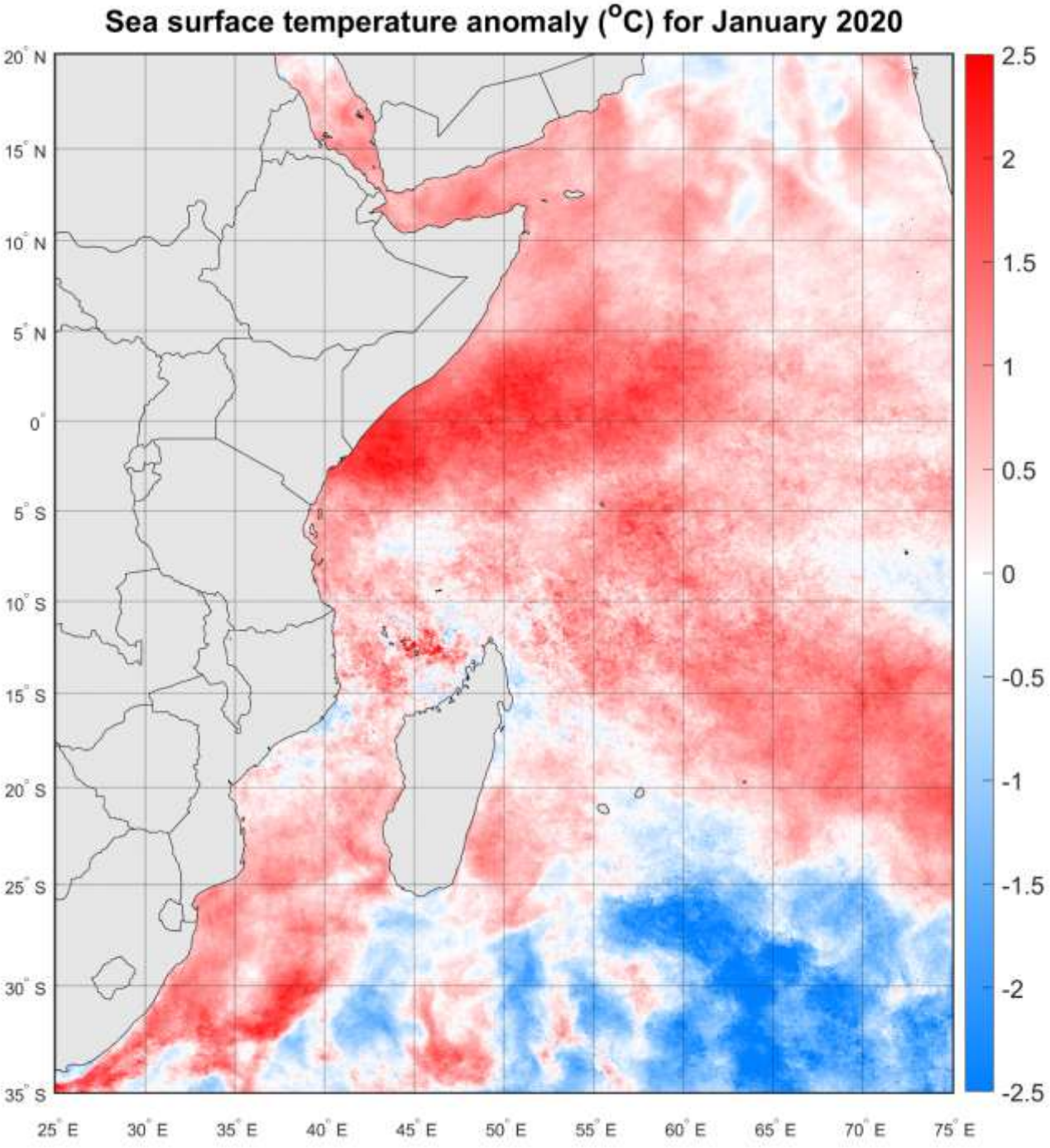

Figure 3: Anomaly of sea surface temperature for January 2020 (°C)

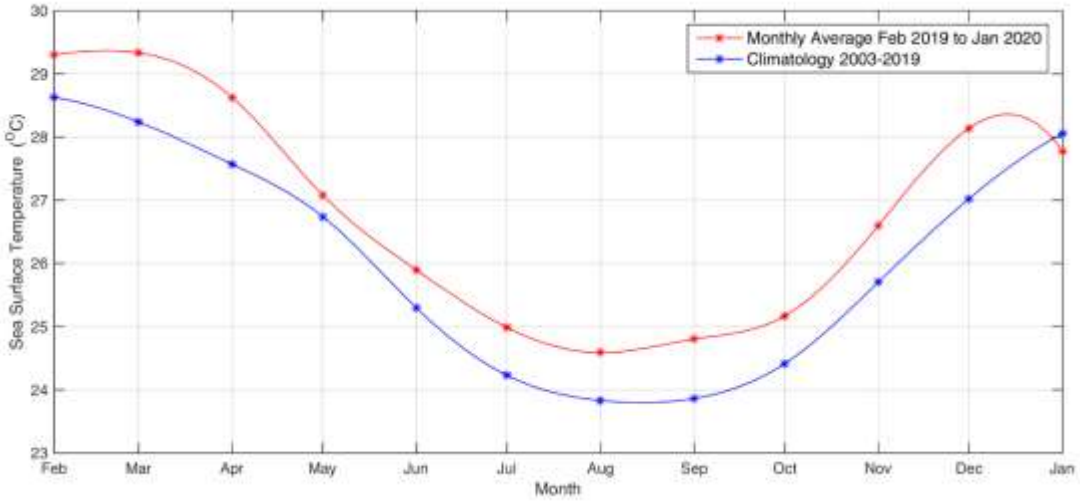

Figure 4: Temporal variation of sea surface temperature (°C) surrounding Mauritius

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 displays the SST variation for the month of January 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 January 2020, sea surface temperature was relatively warm which corroborates with the long-term average temperature (Climatology – Figure 2) for January indicative of peak summer season. Figure 3 shows temperature anomaly for January 2020 compared to the climatology of that month from 2003 through 2019. 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 relatively higher than normal for the period across the region with temperature of more than 2^{o} C than the norm observed off the coast of Tanzania and Somalia while the average SST around Mauritius was 1.5°C above the climatological mean. These anomalous variations in SST could have an impact on the primary productivity. Figure 4 shows the temporal variation of sea surface temperature for the region of Mauritius. From the graph, it can be observed that the temperature has been above the climatological mean for the past months with a slight drop in January 2020.

4.0 Chlorophyll-a Concentration

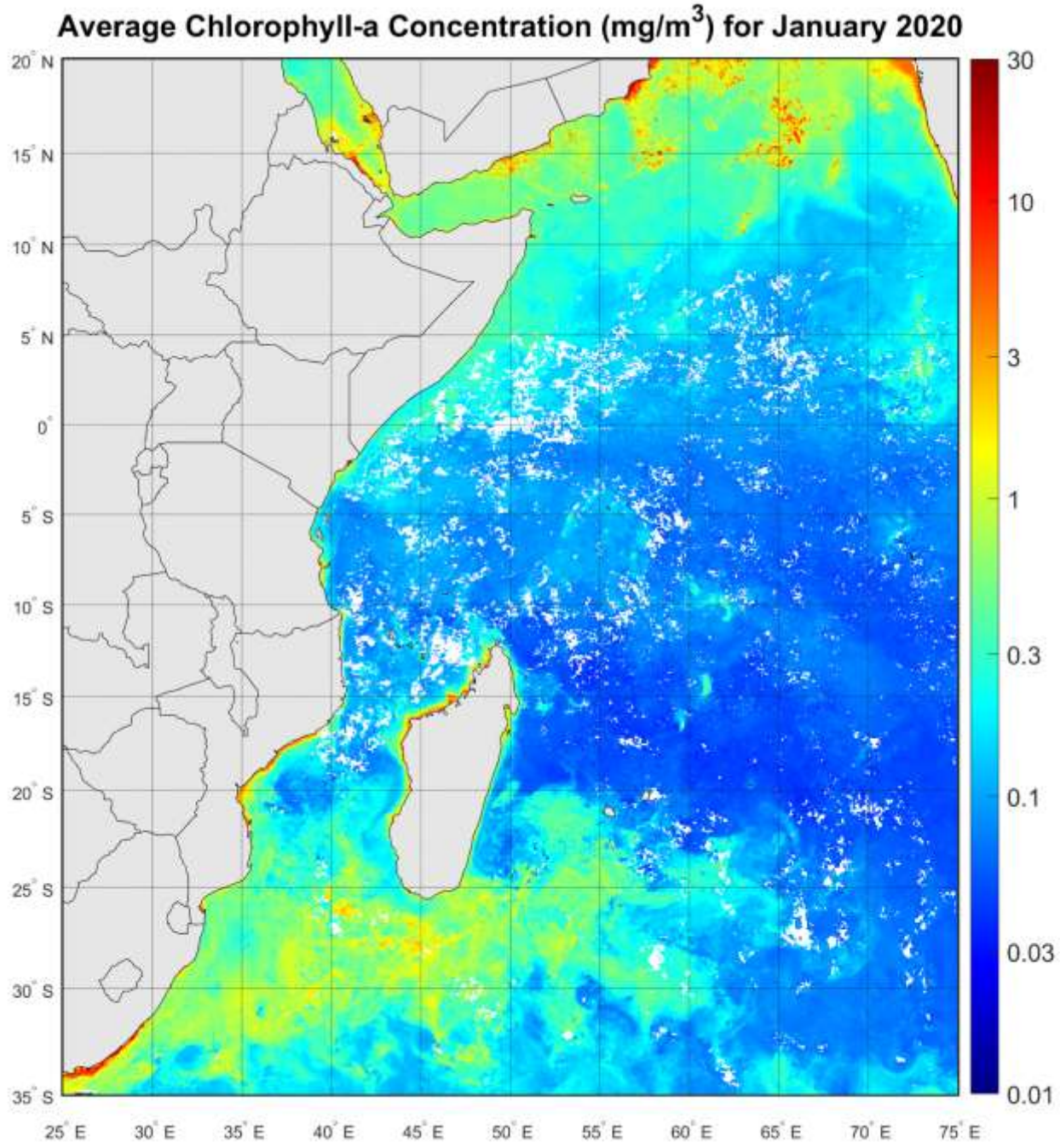

Figure 5: Mean chlorophyll-*a* concentration for the month of January 2020 (mg/m^3)

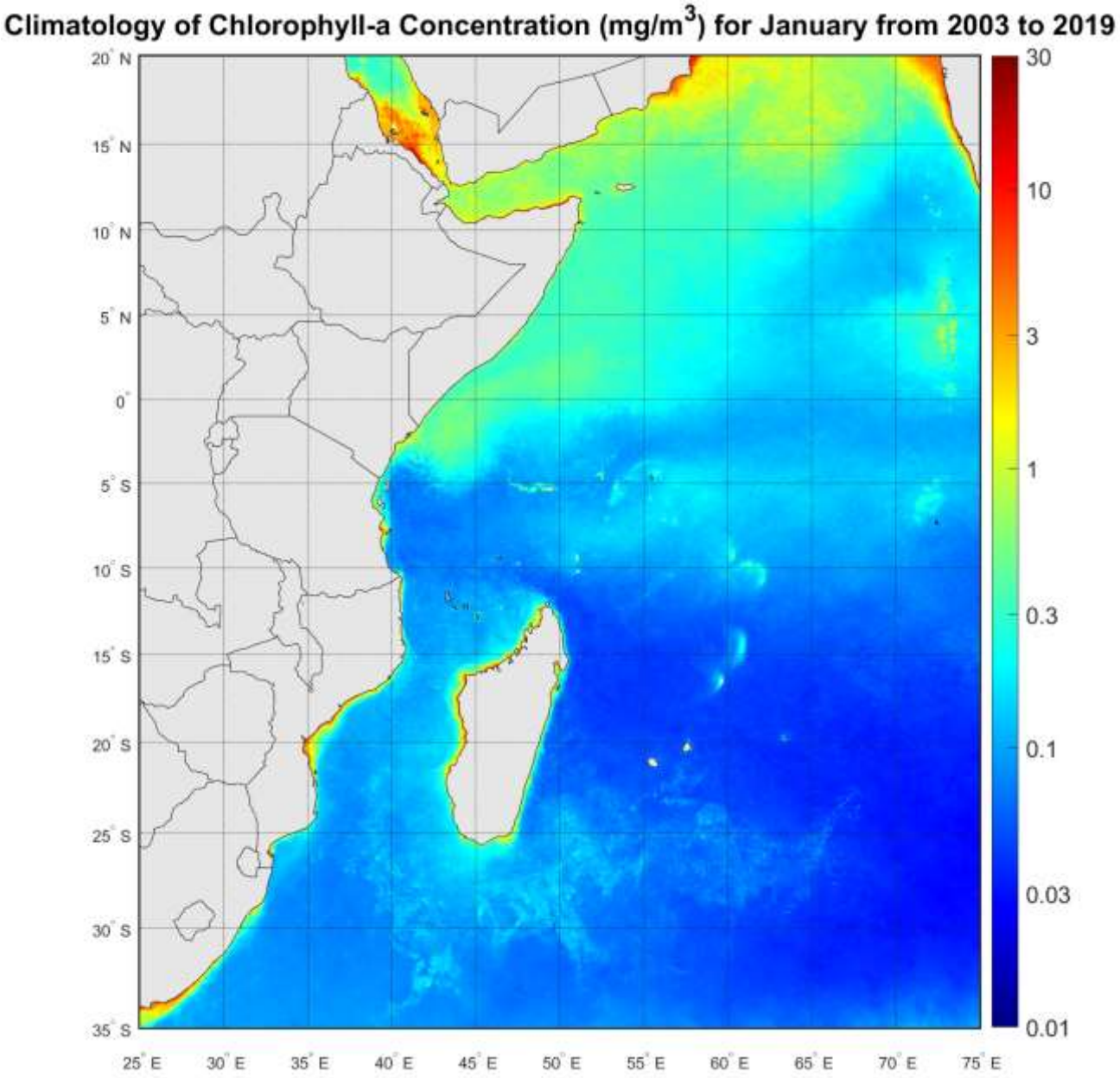

Figure 6: Climatology of chlorophyll-*a* for July 2003 to January 2019 (mg/m^3)

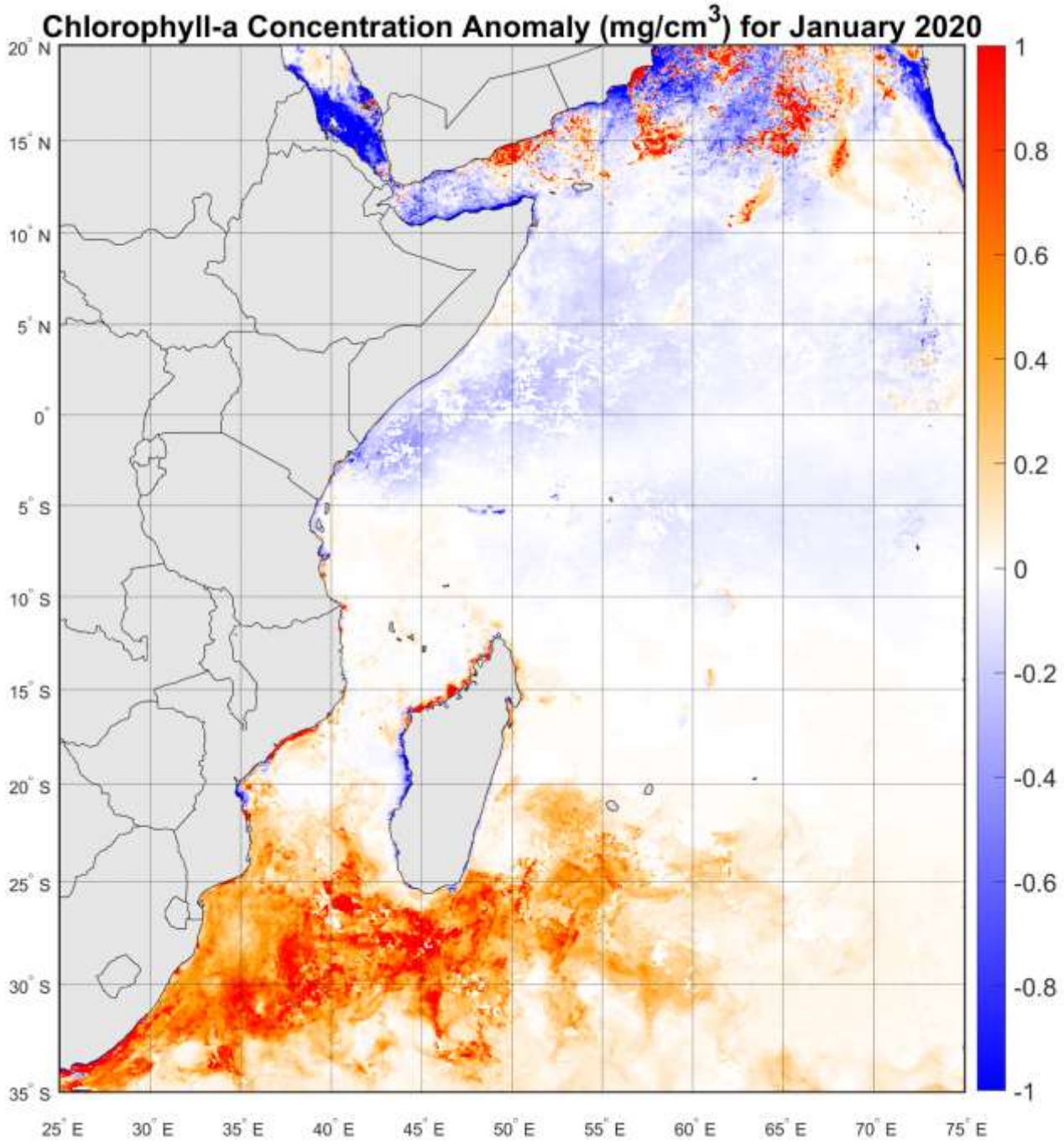

Figure 7: Anomaly of chlorophyll-*a* for January 2020 (mg/m^3)

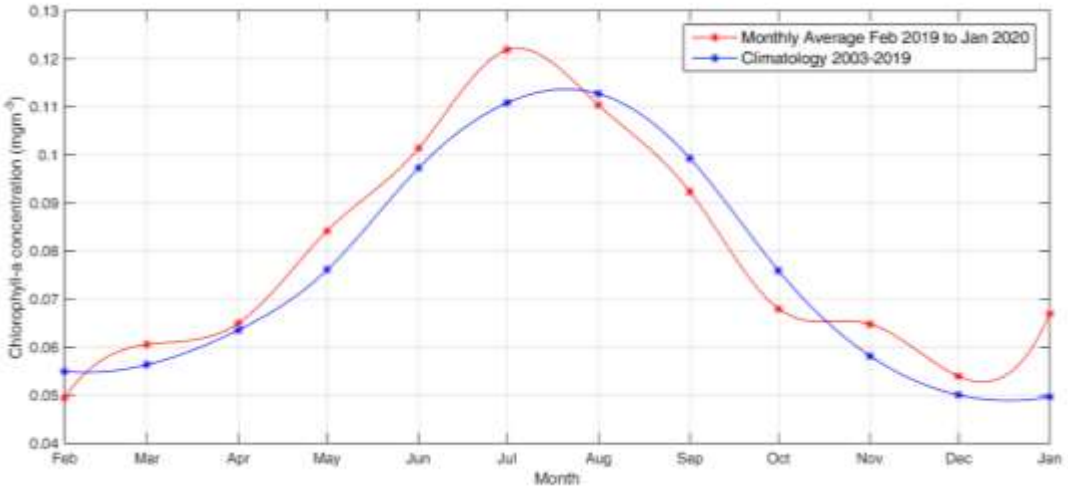

Figure 8: Temporal variation of chlorophyll-*a* (mg/m^3) surrounding Mauritius

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 January 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.

The region of low concentrations of Chlorophyll could potentially be attributed to the high temperatures recorded in the same area. 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.

Higher Chl-*a* concentration were observed in the region below 20 ^{o}C from South Africa to the south of Madagascar. Compared to the climatological mean for January (Figure 6), it can be seen that this phenomenon is unusual and may be potentially attributed to cyclones in the southern region causing upwellings, that is, the upward flow of bottom water nutrients to the surface.

Figure 8 shows the temporal variation of Chl-*a* for the region of Mauritius where the deviation from the monthly mean were significant since a couple of months. The graph shows that since November 2019 a slight increase in chlorophyll-a was observed and will continue on the same trend in the coming month.

Acknowledgements

This bulletin was compiled within the framework of the GMES & Africa project. Data used for the processing was obtained from Ocean Color. 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. 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.