GMES AND AFRICA

MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean

February 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 February 2020, sea surface temperature was higher than normal in the northern part of the Mozambique Channel.
- Positive SST anomalies were observed in the northern region and in the Mozambique Channel, with peak anomalies off the coast of Tanzania and Somalia.
- For the month of February 2020, monthly average temperature is lower than the climatological mean.

Chlorophyll-a Concentration

- Relatively higher Chl-a concentration were observed in the region below Madagascar and south of the Mascarene region.
- Compared to the monthly mean climatology for February, Chl-a concentrations was lower than normal in the northern part of Madagascar and near the equator.
- Time series analysis around the Mauritius shows slightly higher chlorophyll-a concentration than the mean for February 2020.

3.0 Sea Surface Temperature

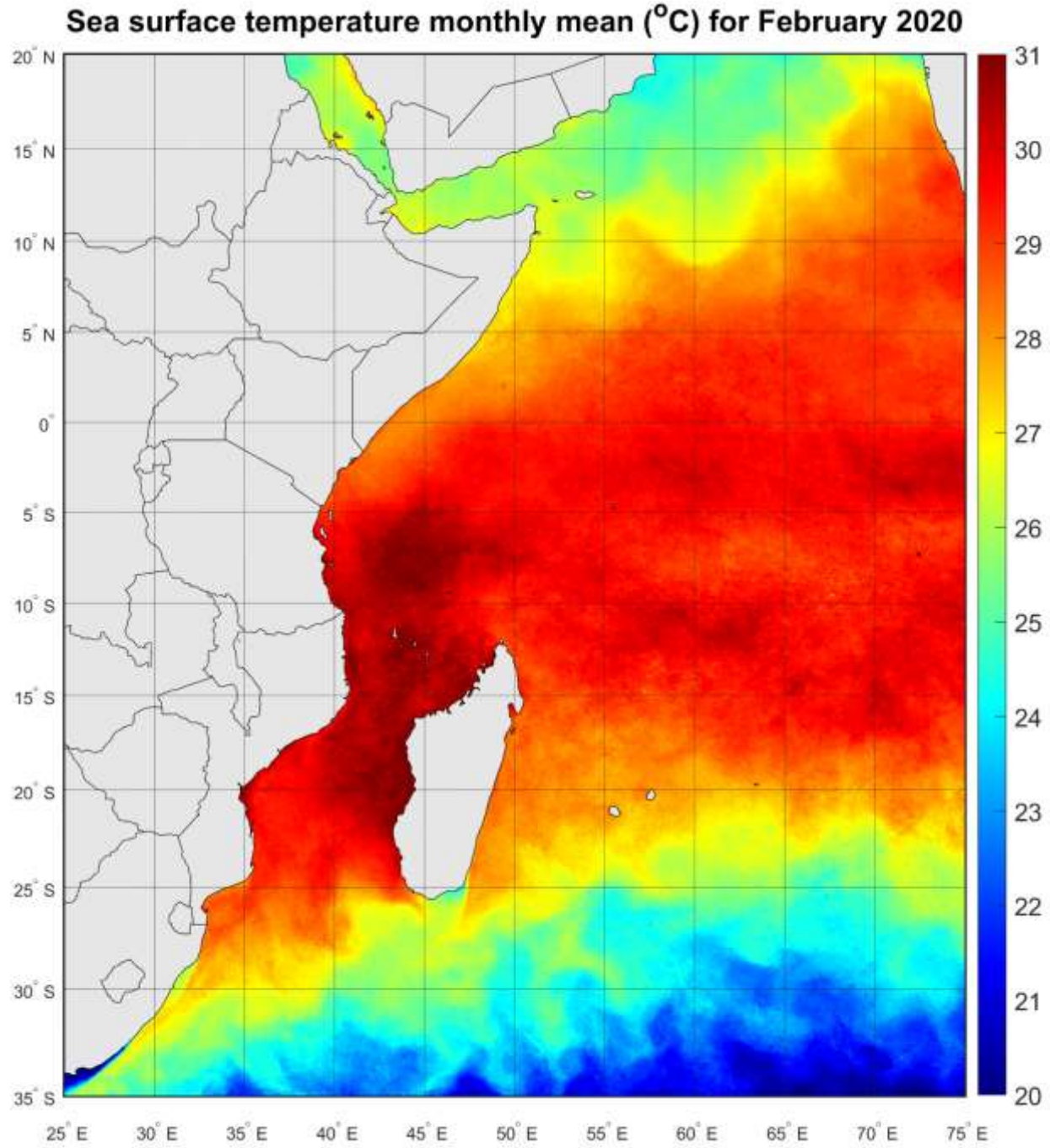

Figure 1: Mean sea surface temperature for the month of February 2020 (°C)

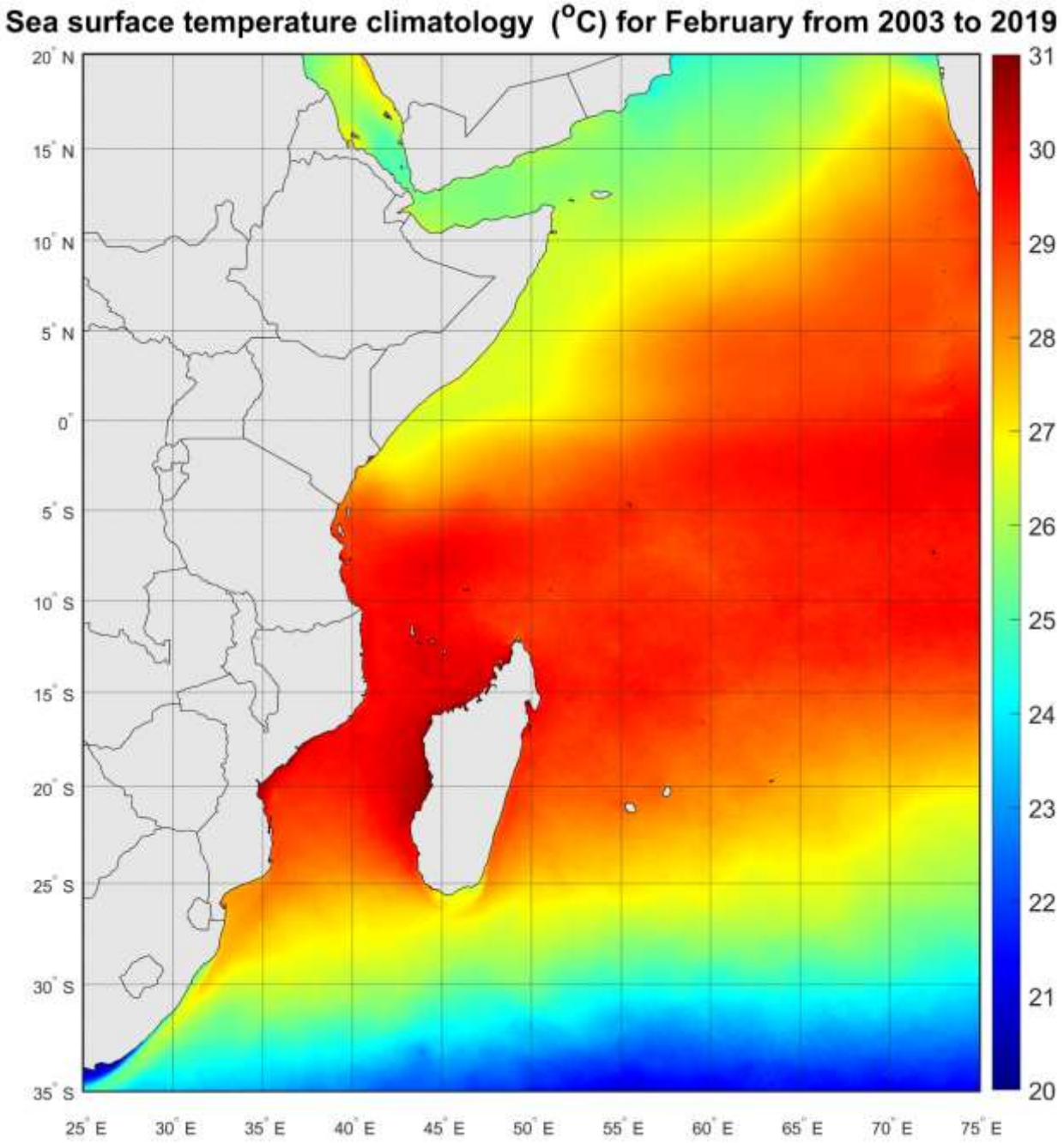

Figure 2: Climatology of sea surface temperature for July 2003 to February 2019 (°C)

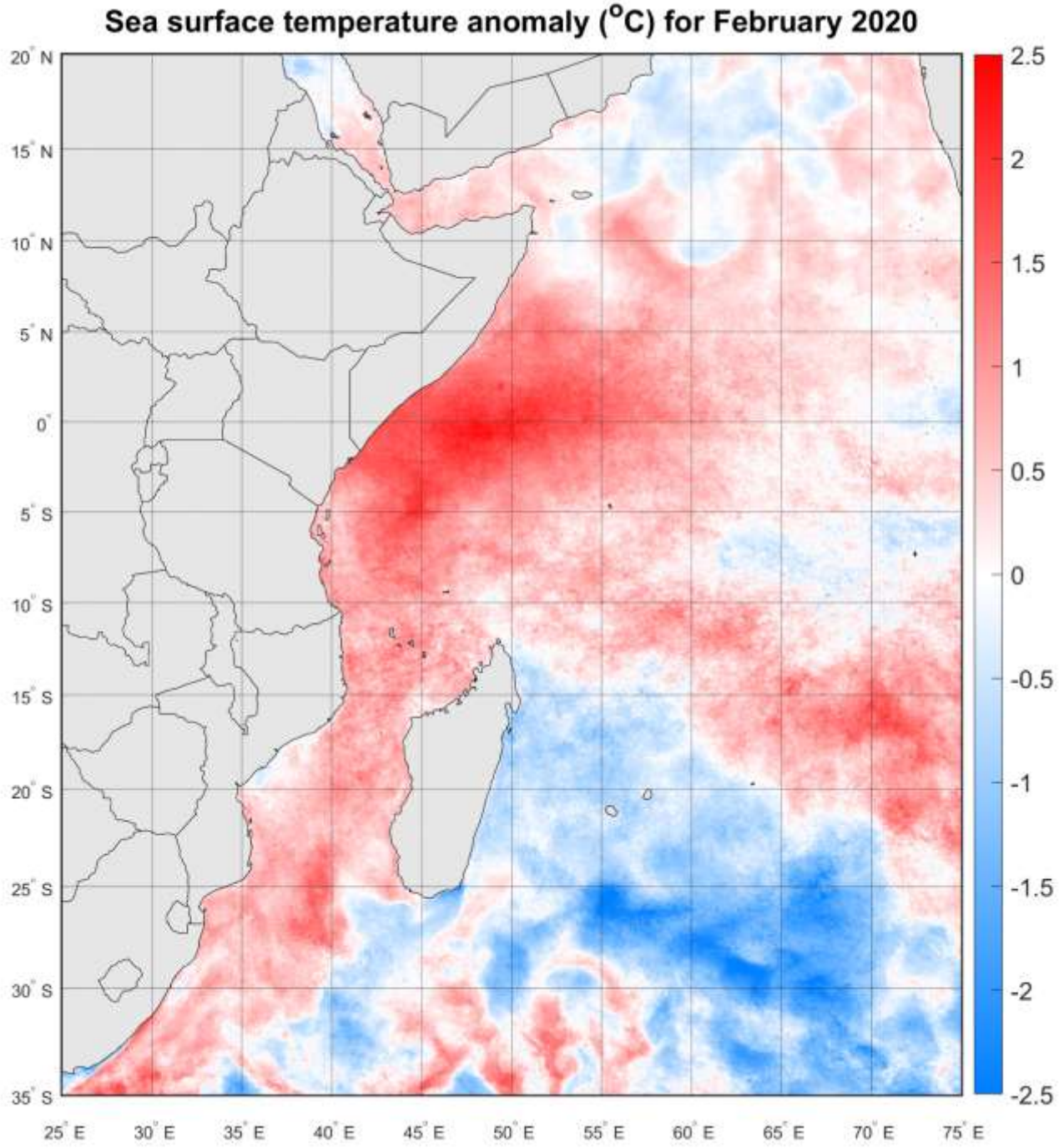

Figure 3: Anomaly of sea surface temperature for February 2020 (°C)

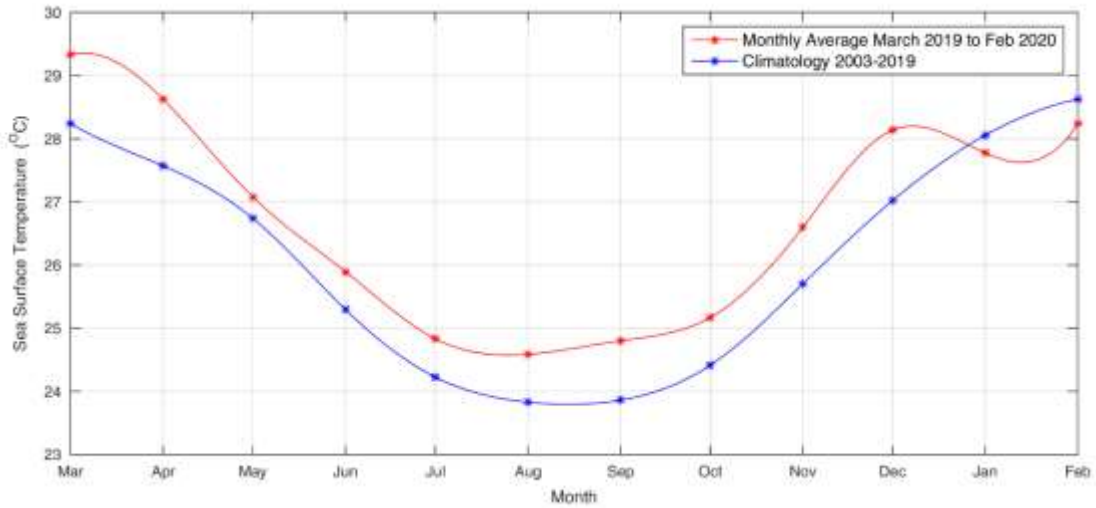

Figure 4: Temporal variation of sea surface temperature (°C) for the region around Mauritius

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 June 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 February 2020, sea surface temperature was higher than normal in the northern part of the Mozambique Channel. Figure 3 shows temperature anomaly for June 2020 compared to the long-term average temperature (climatology) of that month from 2003 through 2019 (Figure 2). The blue colour in the SST anomaly 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, it can be seen that positive SST anomalies were observed in the northern region and in the Mozambique Channel, with peak anomalies off the coast of Tanzania and Somalia. 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 around Mauritius Island. From the graph, it can be observed that unlike the trend that was prevailing over the last year, monthly average temperature is lower than the climatological mean since January 2020.

4.0 Chlorophyll-a Concentration

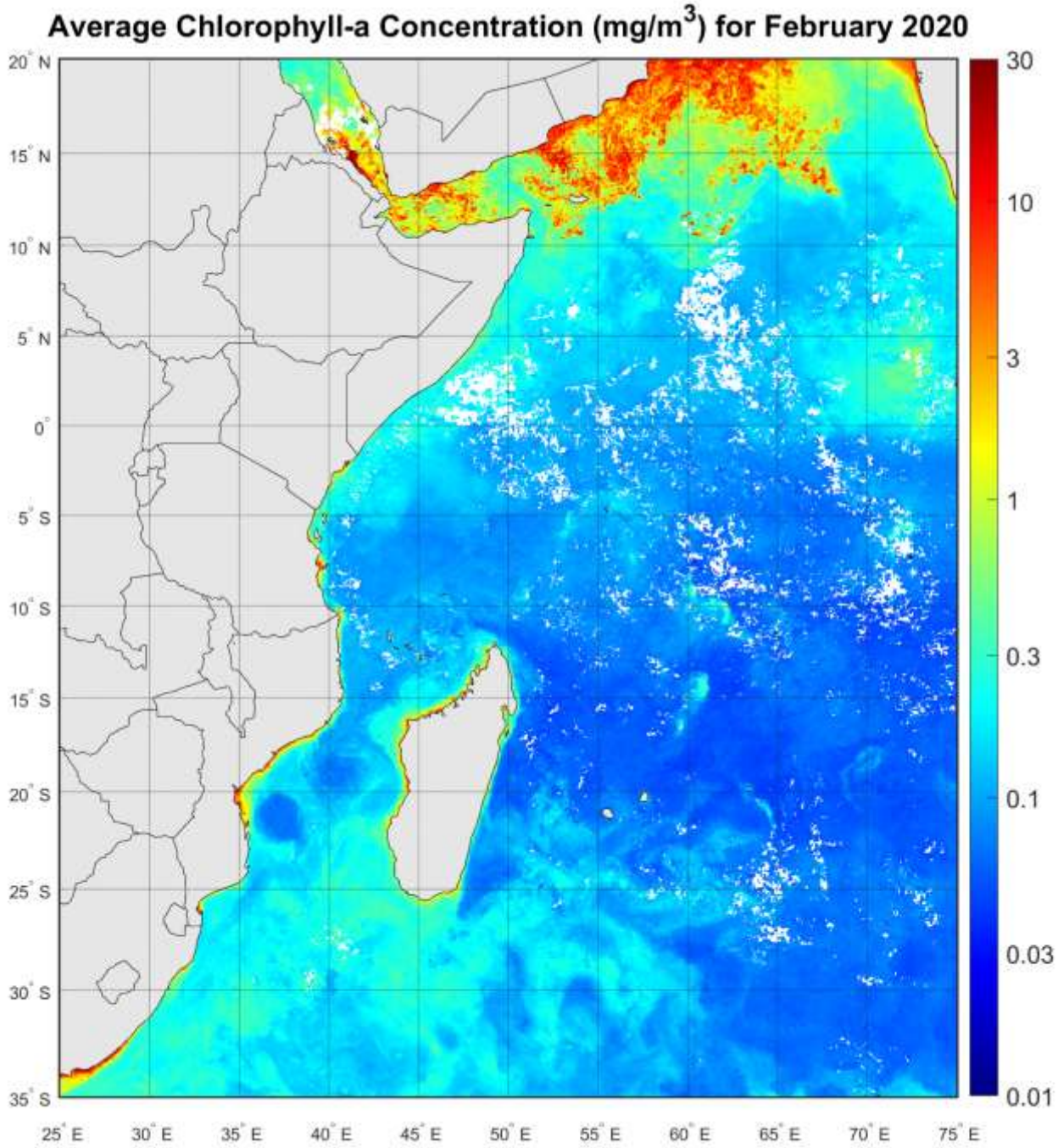

Figure 5: Mean chlorophyll-*a* concentration for the month of February 2020 (mg/m^3)

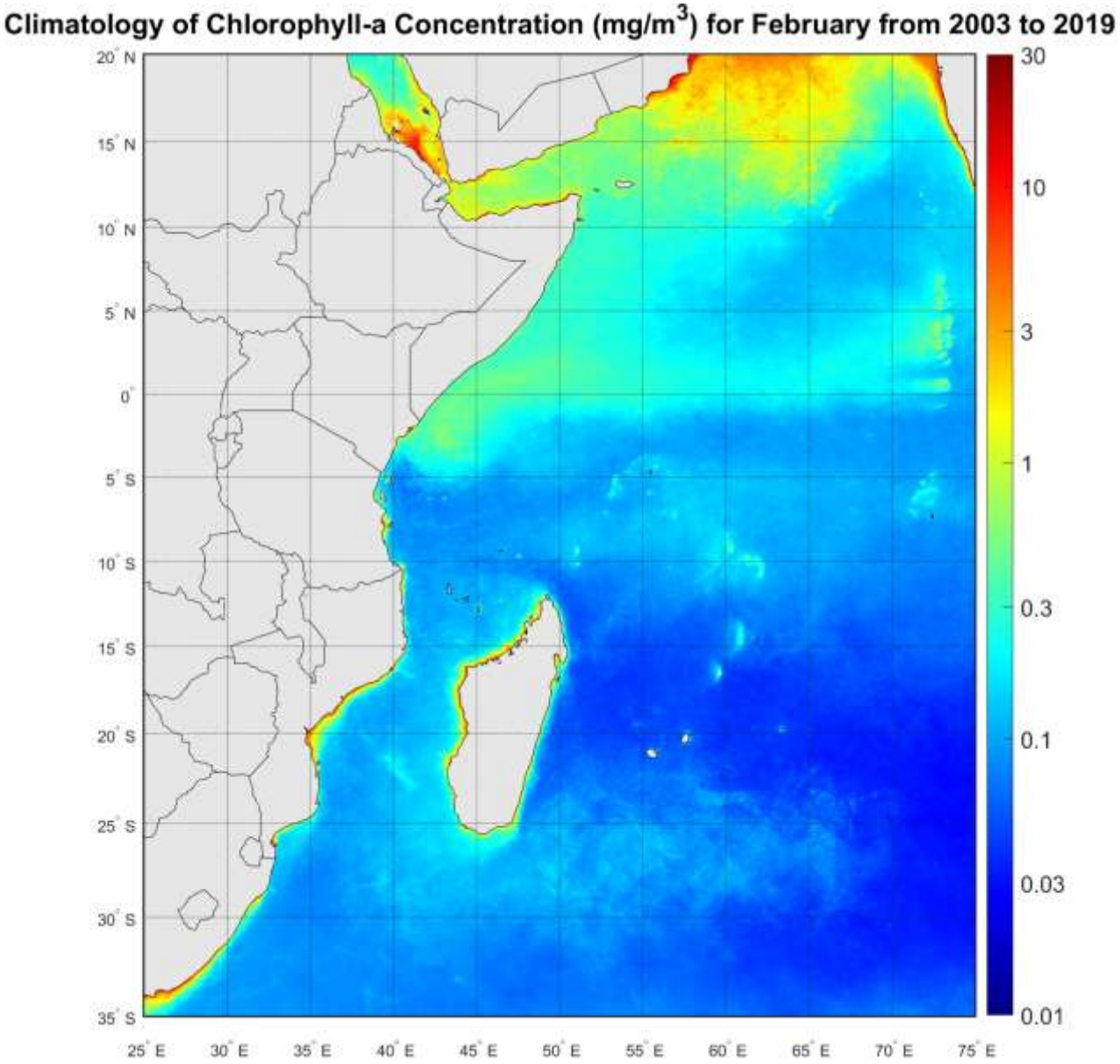

Figure 6: Climatology of chlorophyll-*a* for July 2003 to February 2019 (mg/m^3)

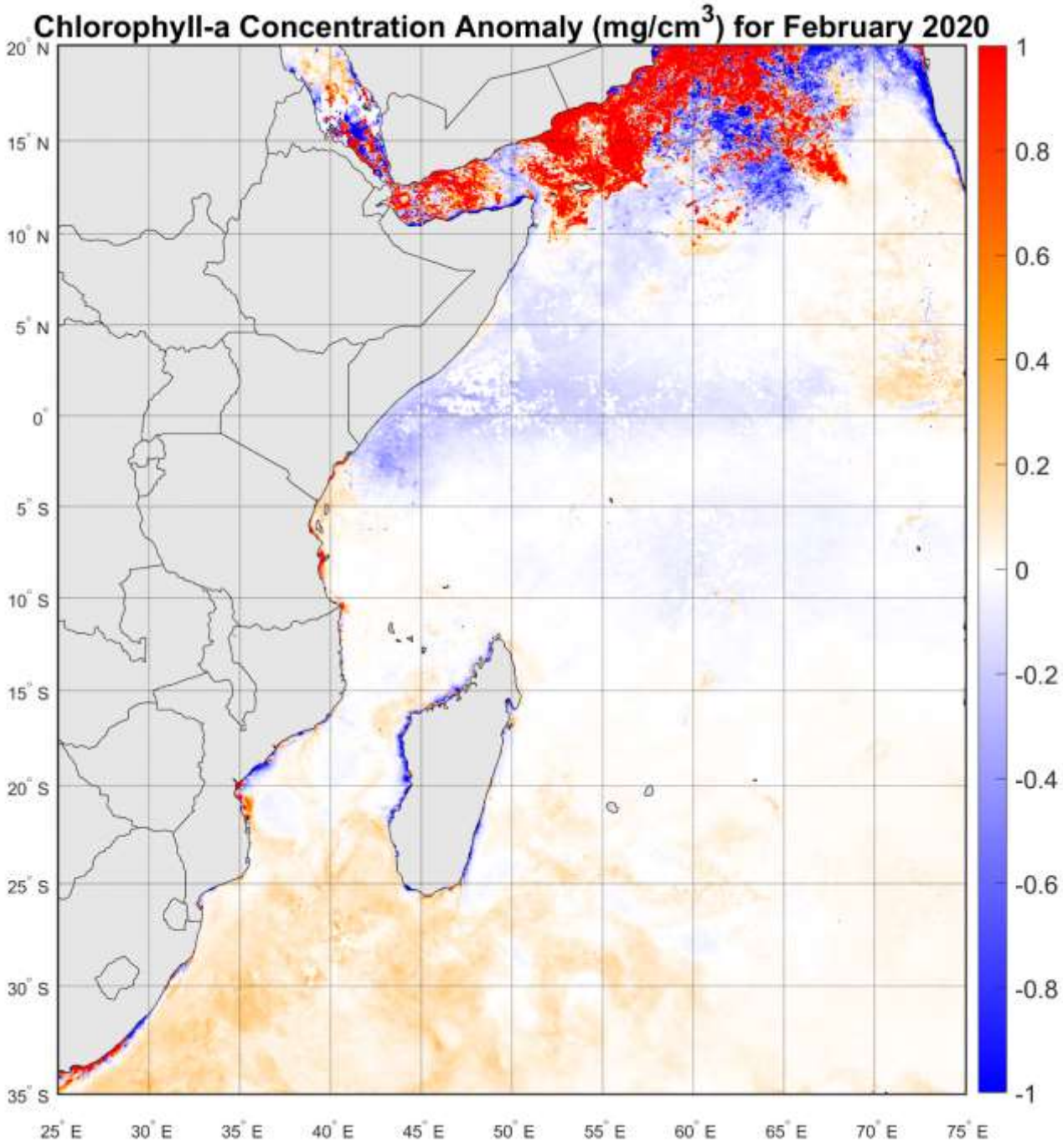

Figure 7: Anomaly of chlorophyll-*a* for February 2020 (mg/m^3)

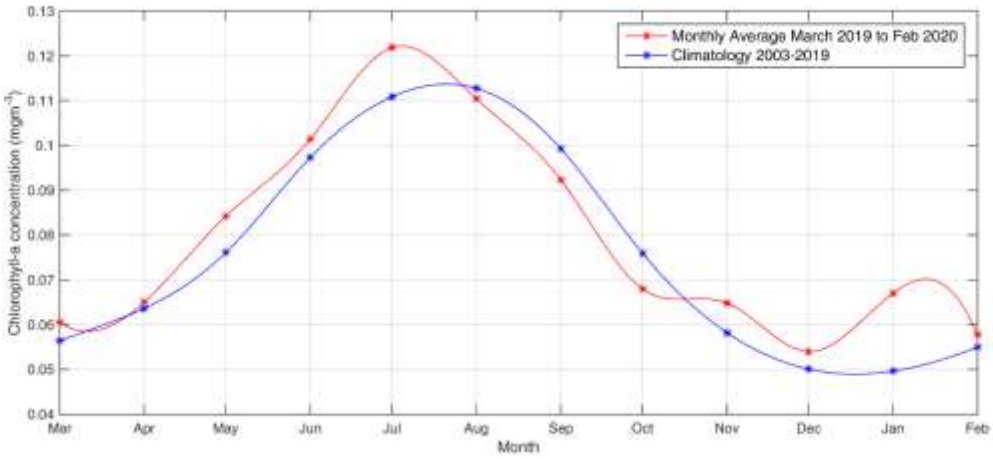

Figure 8: Temporal variation of chlorophyll-*a* (mg/m^3) for the region around Mauritius

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 February 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.

Relatively higher Chl-*a* concentration were observed in the region below Madagascar and south of the Mascarene region. 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.

Compared to the monthly mean climatology for February, Chl-*a* concentrations was lower than normal in the northern part of Madagascar. Negative Chl-a anomaly was also observed around the equator.

The analysis of the time series around the region of Mauritius (Figure 8) shows slightly higher chlorophyll-a concentration than the mean for February 2020.

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.