



**GMES
AND AFRICA**



MONTHLY OCEANOGRAPHY BULLETIN

South West Indian Ocean
February 2021



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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 February 2021, relatively higher temperature was observed in the Mozambique Channel and between latitudes 10 °S to 15 °S while temperature remained relatively lower off Somalia.
- The average Sea Surface Temperature (SST) in the Mascarene region varied between 27 to 29 °C while in the Mozambique Channel it exceeds 30 °C.
- The monthly average for February 2021 differed slightly from the climatological mean in certain regions namely off the eastern coast of Seychelles where the temperature was relatively lower, and in the Mozambique Channel and between latitudes 10 °S to 15 °S where the temperature was relatively higher.
- The time series analysis for the region around Mauritius confirms the negative anomaly in the Mascarene region while the positive anomaly observed for the region south of Madagascar since mid-December 2020 is being maintained.

Chlorophyll-*a* Concentration

- For the month of February 2021, a high Chlorophyll-*a* (Chl-*a*) level was observed in the region off Somalia while Chl-*a* concentration was relatively lower in the Mascarene region.
- Chl-*a* concentration was comparatively lower in the western side of Madagascar, that is, in the Mozambique Channel, as compared to the eastern side.
- Chl-*a* concentration was relatively higher than the climatological mean throughout the South West Indian Ocean region
- The monthly time series for the region around Mauritius Island showed that the positive Chl-*a* anomaly observed since the beginning of 2020 is being maintained.



3.0 Sea Surface Temperature

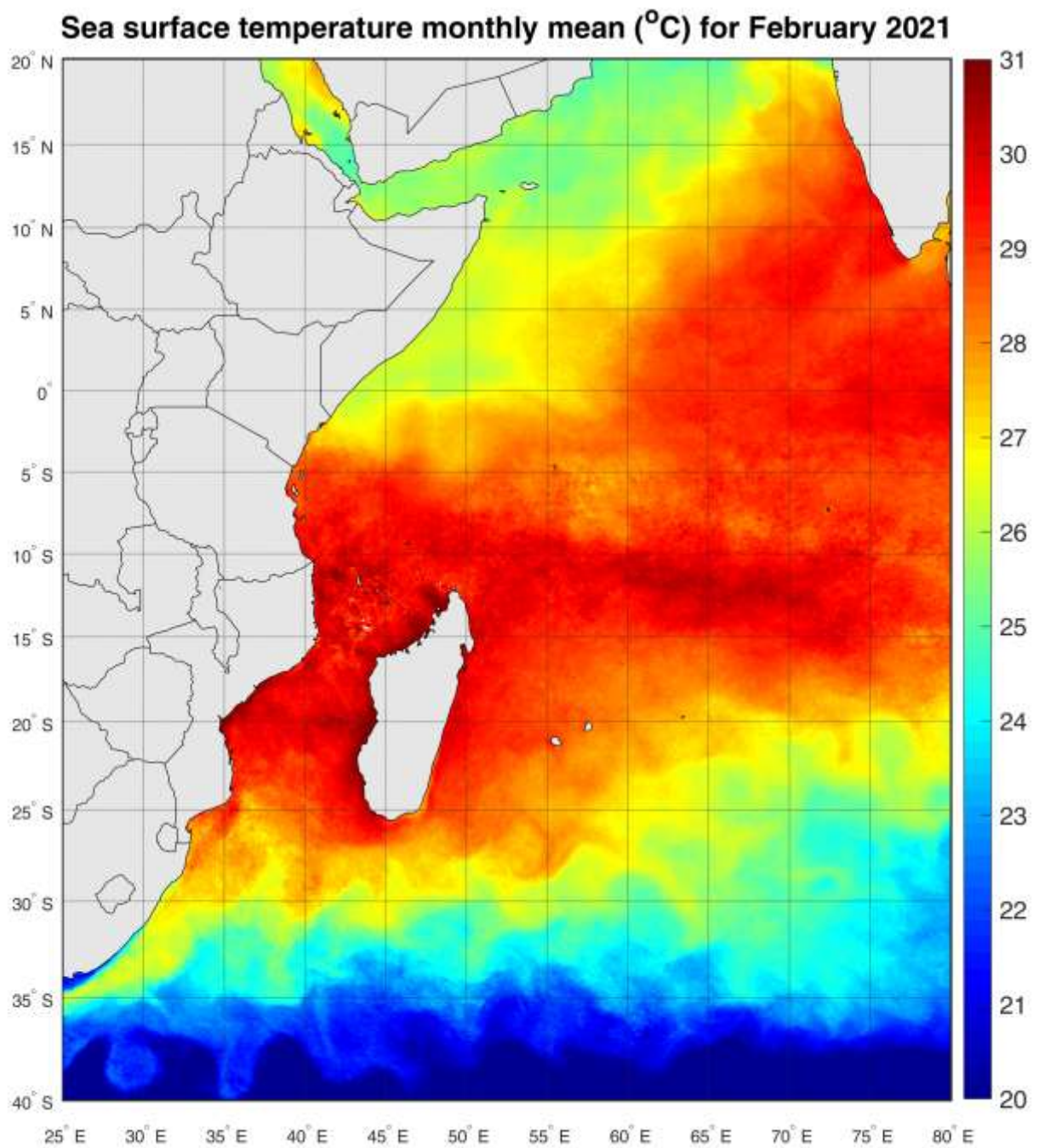


Figure 1: Mean sea surface temperature for the month of February 2021 ($^{\circ}\text{C}$)

Sea surface temperature climatology ($^{\circ}\text{C}$) for February from 2003 to 2019

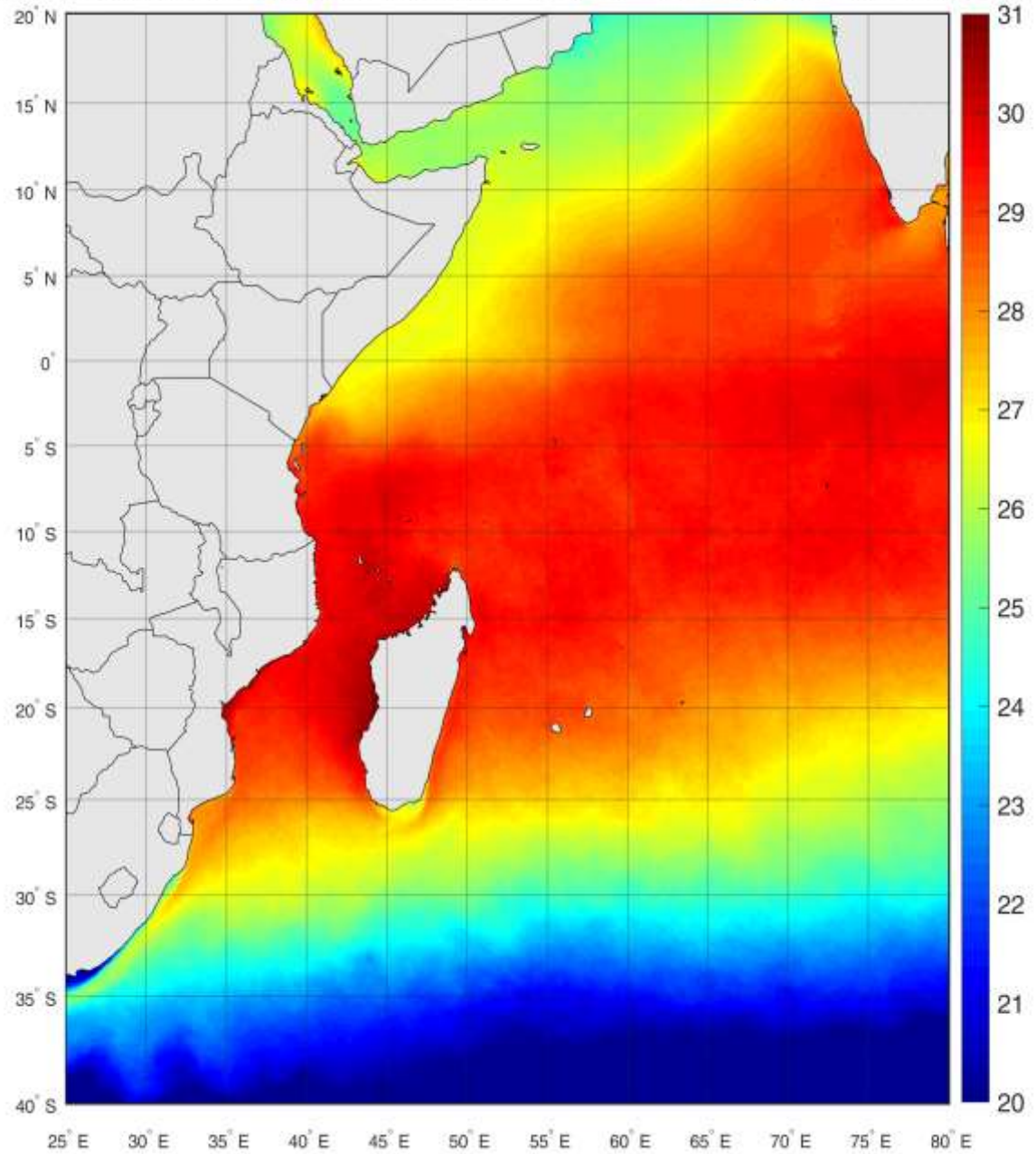


Figure 2: Sea Surface Temperature Climatology ($^{\circ}\text{C}$) for the month of February (2003 -2019)

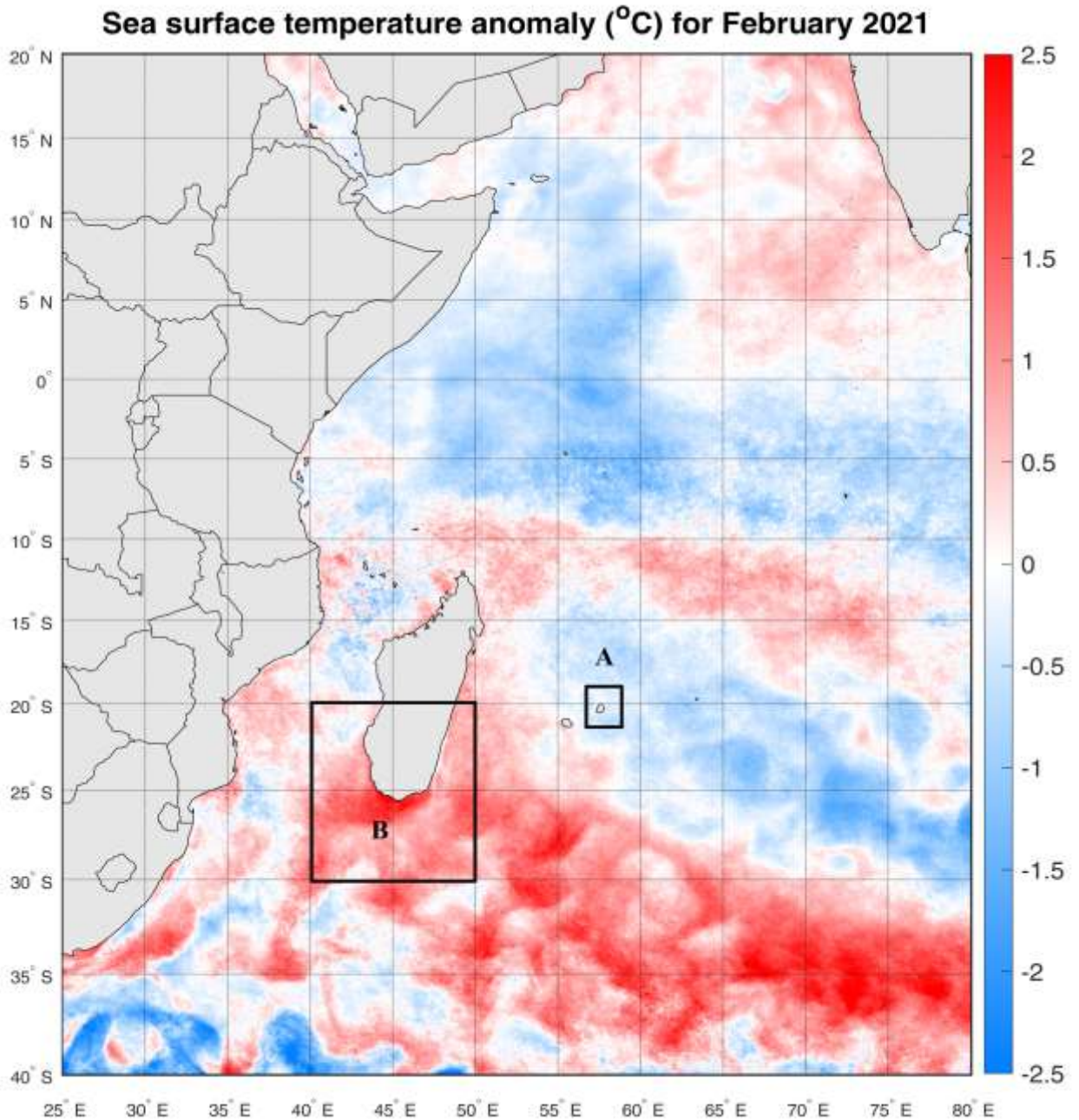


Figure 3: Anomaly of Sea Surface Temperature for February 2021 (°C)

Time series generated from the monthly average for February 2021 and the climatological mean for February 2021 in the region highlighted in Figure 3, namely Region A around Mauritius Island and Region B, South of Madagascar.

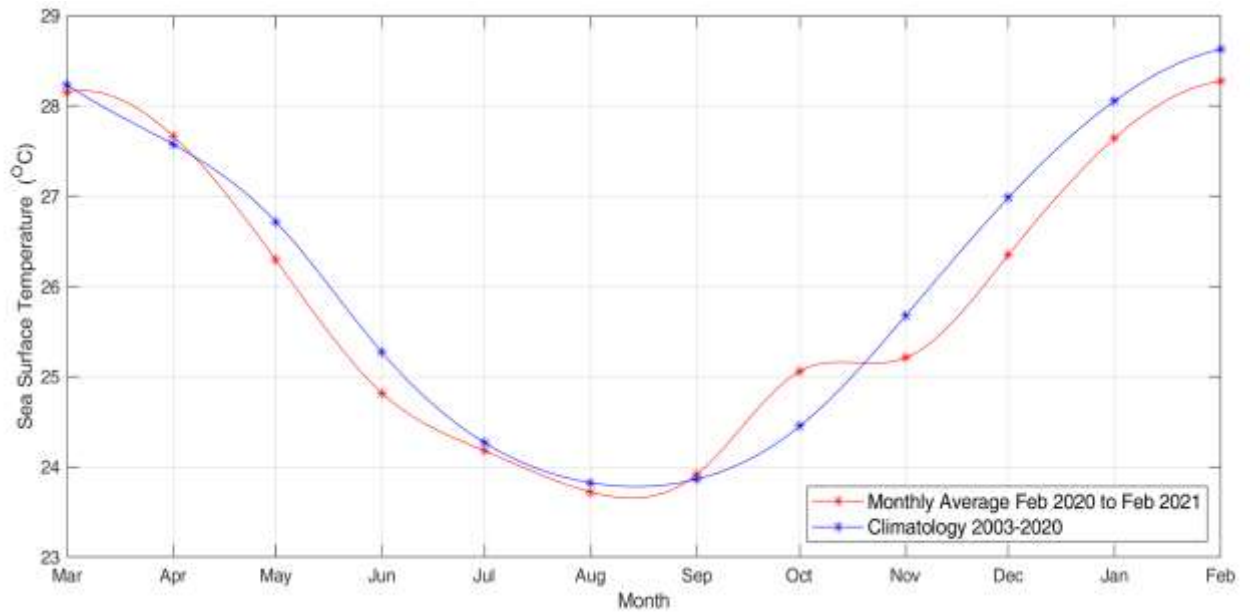


Figure 4: Temporal variation of sea surface temperature (°C) around Mauritius Island (Region A)

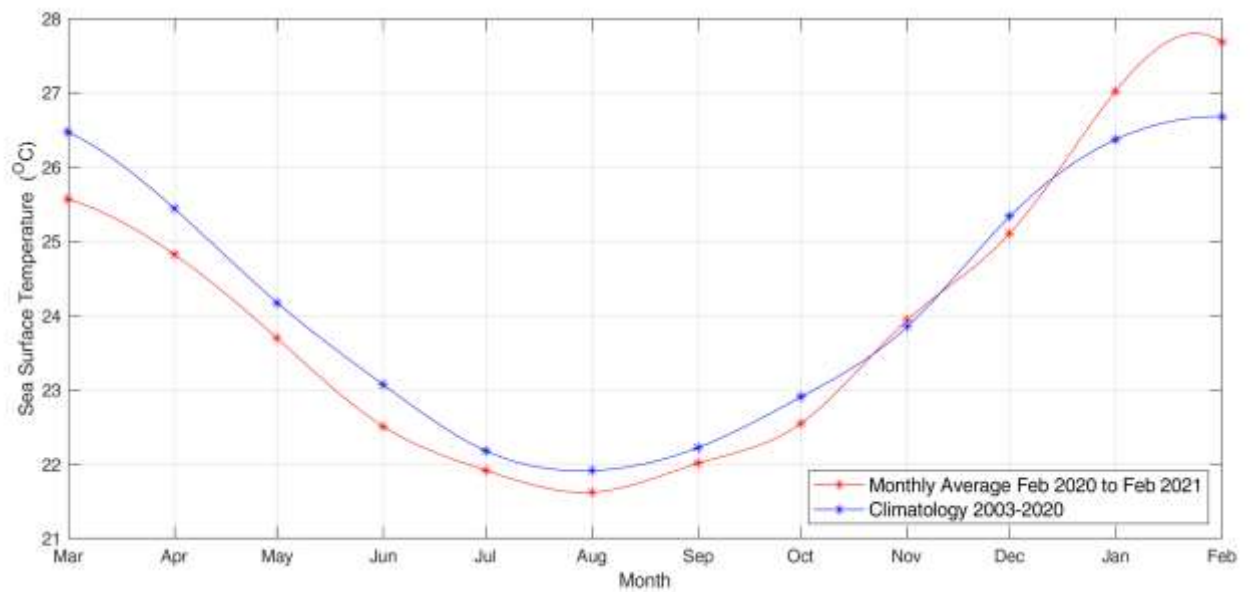


Figure 5: Temporal variation of sea surface temperature (°C) in the region south of Madagascar (Region B)

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 February 2021. 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 February 2021, relatively higher temperature was observed in the Mozambique Channel and between latitudes 10 °S to 15 °S, while temperature remained relatively lower off Somalia. The average SST in the Mascarene region varied between 27 to 29 °C, while in the Mozambique Channel it exceeds 30 °C. Figure 2 represents the climatology for the month of February based on average SST calculated from 2003 to 2019. The monthly SST average for February 2021 differed slightly from the climatological mean in certain regions namely off the eastern coast of Seychelles where the temperature was relatively lower, and in the Mozambique Channel and between latitudes 10 °S to 15 °S where the temperature was relatively higher.

Figure 3 shows temperature anomaly for the period covered in this bulletin. The blue colour on the map represents temperatures that were cooler than the average, the white colour shows near-average temperatures, while the red colour shows temperatures that were warmer than average. The image shows that the temperature was relatively higher in the region south of Madagascar while the negative anomaly persisted in the Mascarene region. The time series analysis for the region around Mauritius (Figure 4, depicted by 'Region A' in Figure 3) confirms the negative anomaly in the Mascarene region.

Figure 5 shows the temporal variation of SST in the region south of Madagascar, between latitude 20 °S to 30 °S and longitude 40 °E to 50 °E (Region B in Figure 3). The graph shows a positive anomaly is being observed for this region since mid-December 2020.

4.0 Chlorophyll-a Concentration

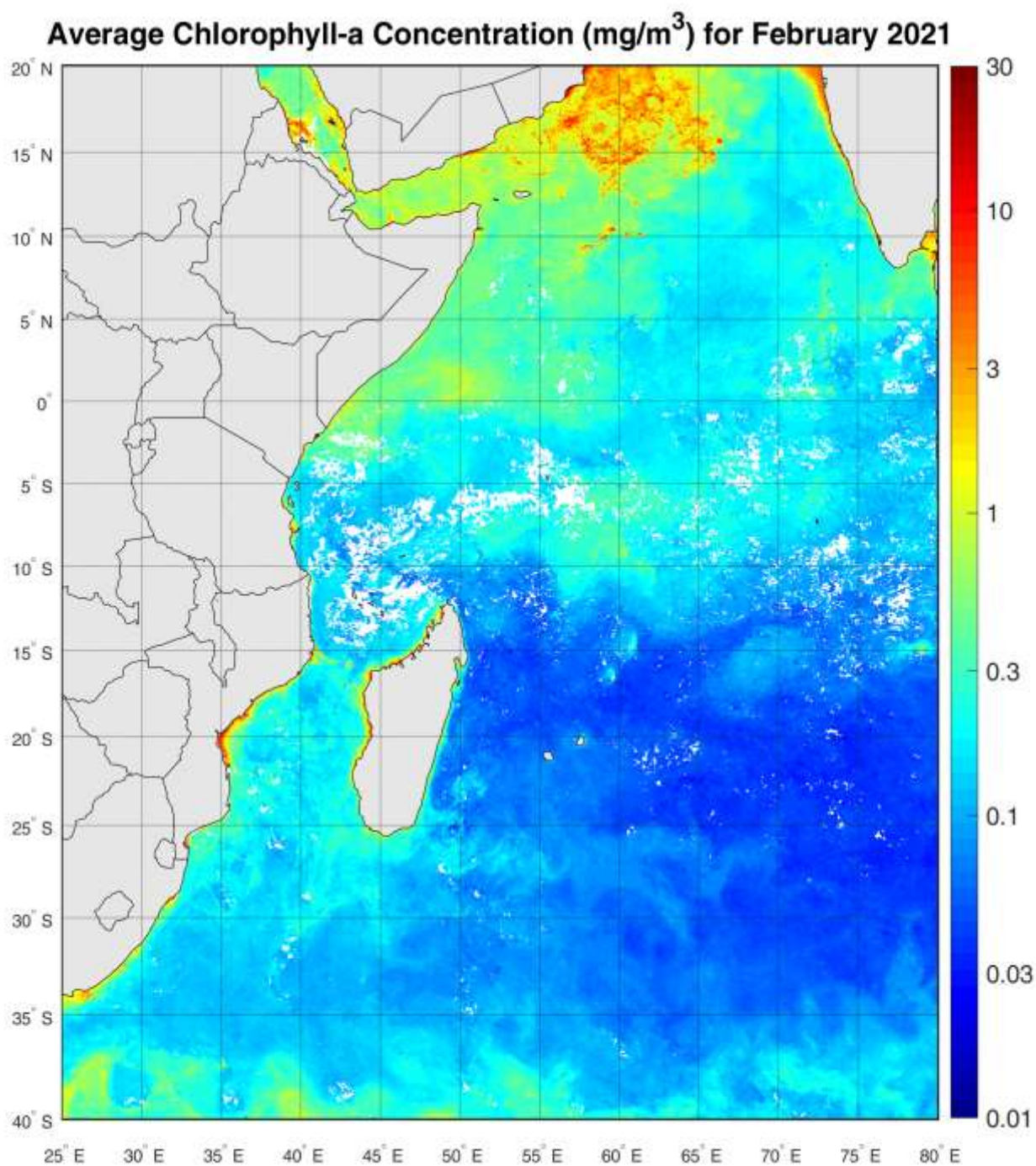


Figure 6: Mean chlorophyll-*a* concentration for the month of February 2021 (mg/m^3)

Climatology of Chlorophyll-*a* Concentration (mg/m³) for February from 2003 to 2019

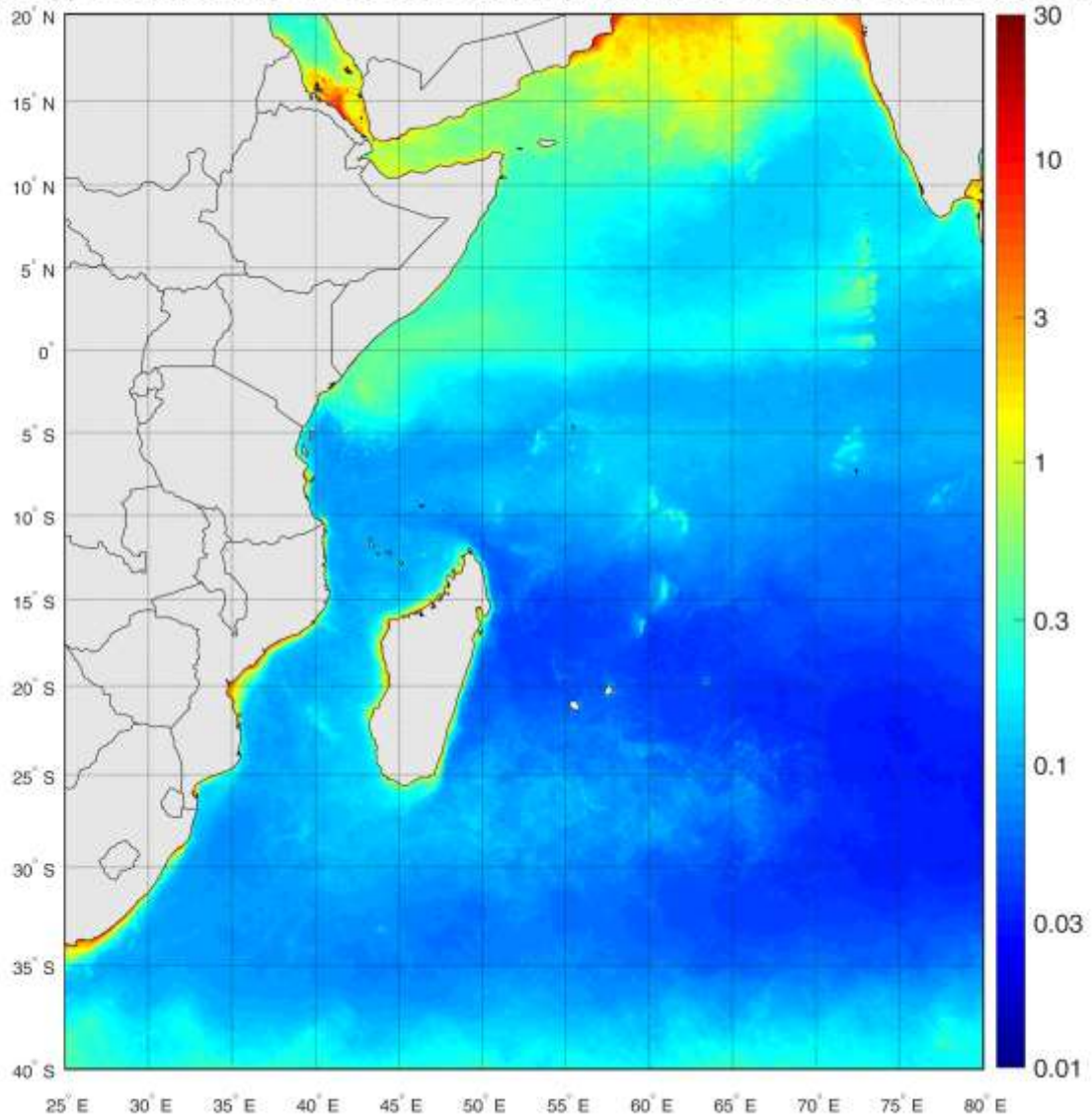


Figure 7: Chlorophyll-*a* Climatology (mg/m³) for the month of February (2003 -2019)

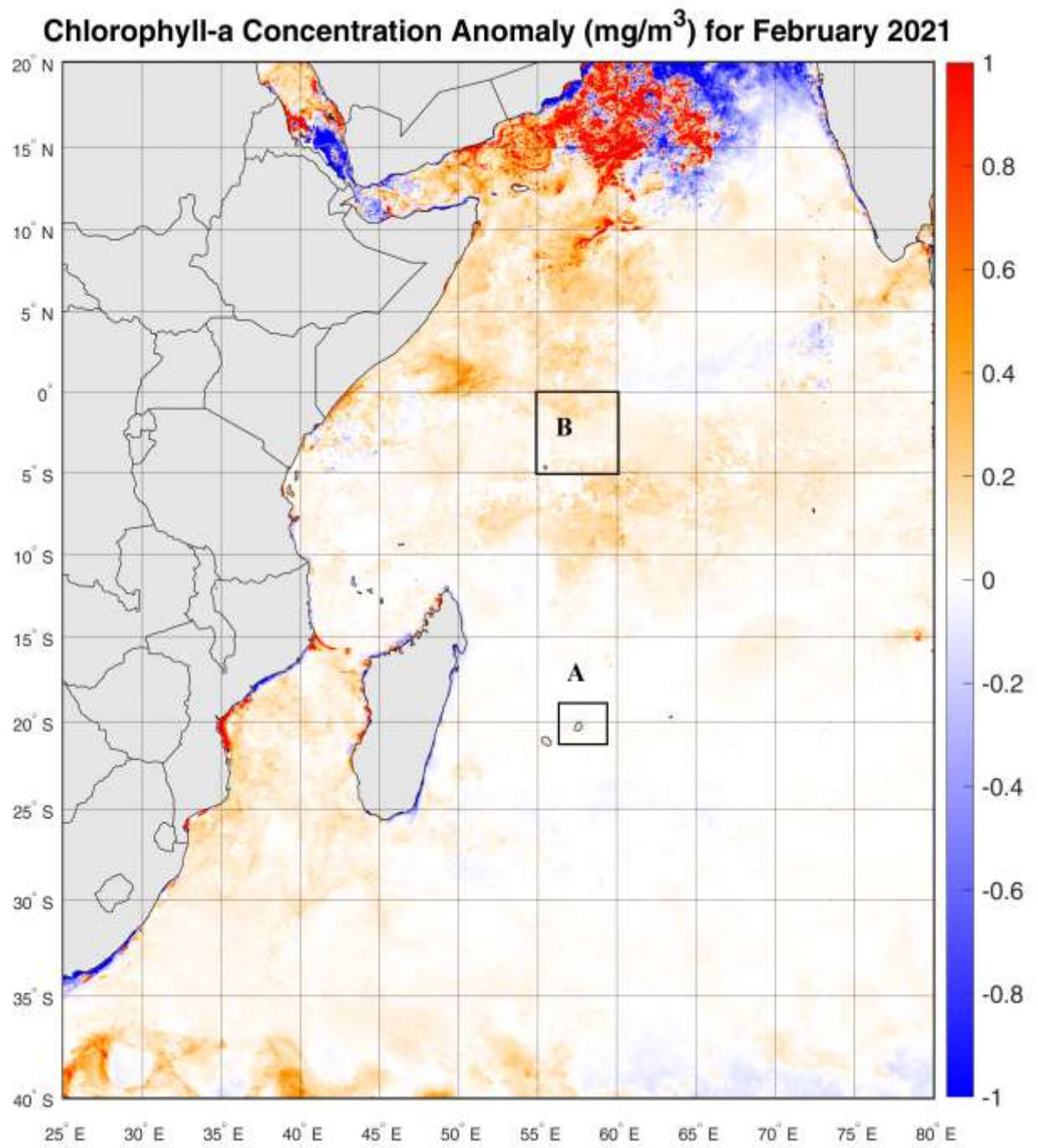


Figure 8: Anomaly of chlorophyll-*a* for February 2021 (mg/m³)

Chlorophyll-a time series generated from the monthly average for February 2021 and the climatological normal for February in the region encircle in Figure 8, namely region A around Mauritius and region B around Seychelles Island.

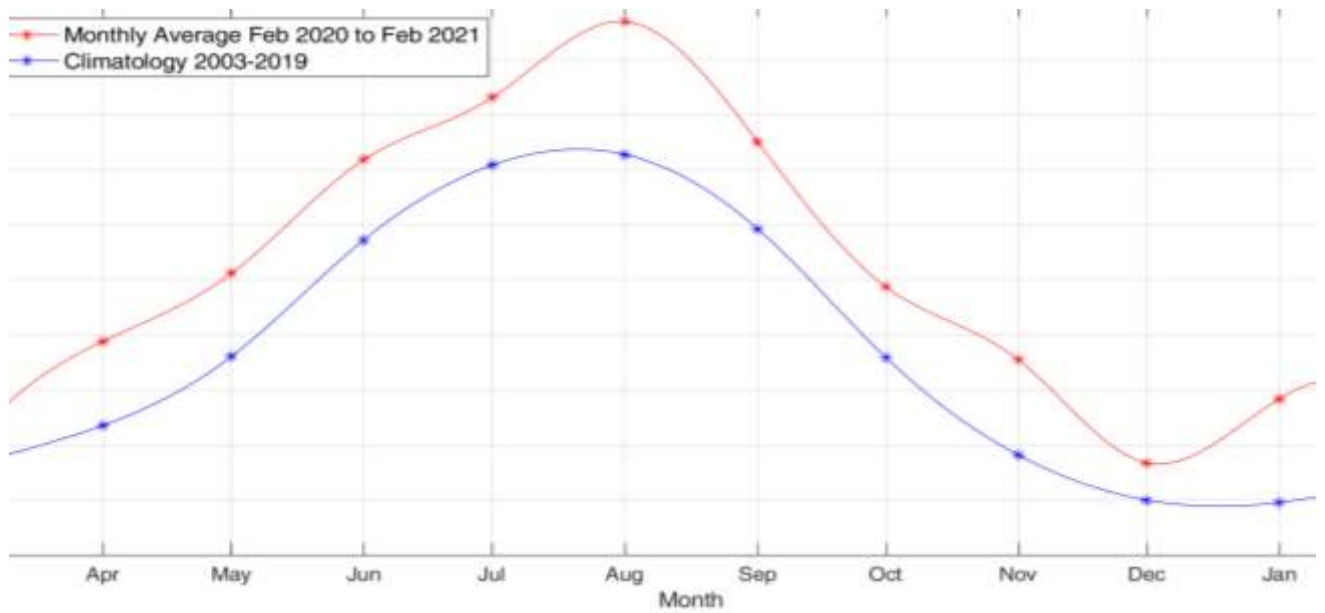


Figure 9: Temporal variation of chlorophyll-a (mg/m^3) around Mauritius Island (Region A)

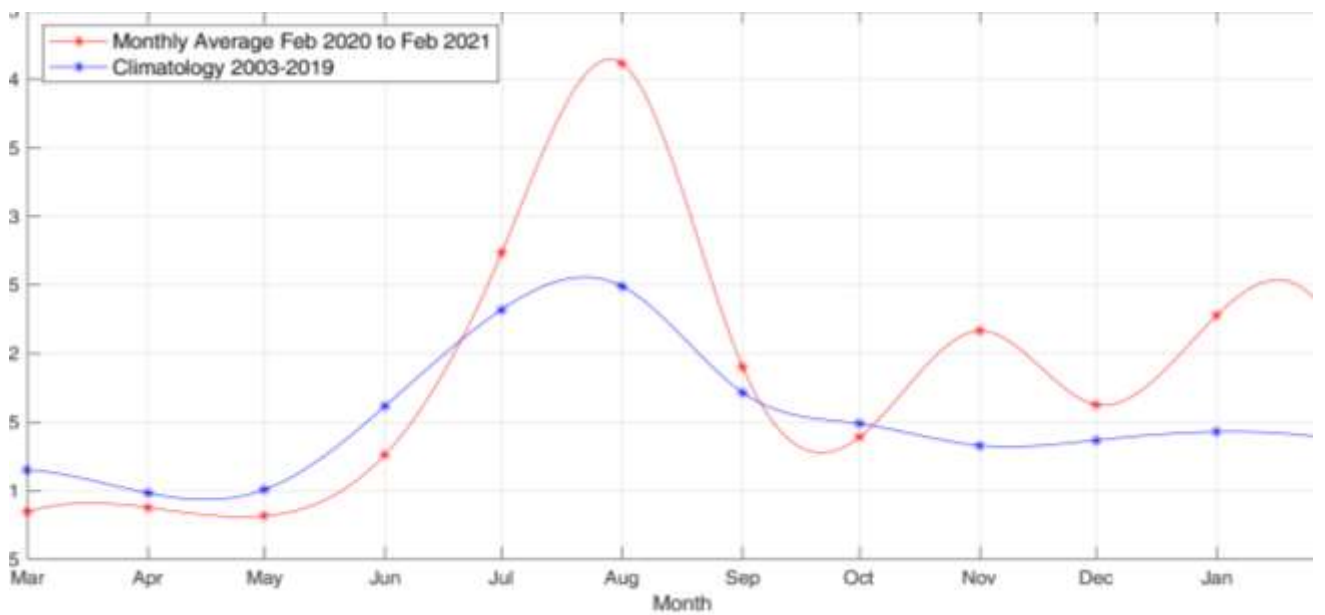


Figure 10: Temporal variation of chlorophyll-a (mg/m^3) for the region around Seychelles Islands (Region B)

4.1 Description of chlorophyll-a

Figure 6 shows chlorophyll-*a* concentration in milligrams of Chl-*a* per cubic metre of seawater for the month of February 2021. The regions where the Chl-*a* concentration was very low, indicating a low abundance of phytoplankton, are in blue and those where Chl-*a* concentration was high are shown in red. Land is light grey, and places where there is no data (e.g. cloud cover) is represented in white.

A high Chl-*a* concentration usually indicates high primary productivity, an essential condition for fish aggregation and fish catch, while positive Chl-*a* anomaly shows a higher concentration of Chl-*a* than the average observed for the same period.

A high Chl-*a* level was observed in the region off Somalia while the Chl-*a* concentration was relatively lower in the Mascarene region. The Chl-*a* concentration was comparatively lower in the western side of Madagascar, that is, in the Mozambique Channel, as compared to the eastern side. Similar to the previous months, Chl-*a* concentration was relatively higher than the climatological mean throughout the South West Indian Ocean region as shown in the anomaly map for February 2021 (Figure 8).

Figure 9 shows the monthly time series for the region around Mauritius Island (region A on Figure 8). The graph shows that the positive Chl-*a* anomaly observed since the beginning of 2020 is being maintained.

Figure 10 shows the temporal variation of Chl-*a* for the region of the Seychelles Islands (region B on Figure 8). The graph shows that the positive Chl-*a* anomaly observed since early October 2020 is being maintained for the region.

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.

Disclaimer

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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 (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://oceandata.sci.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.