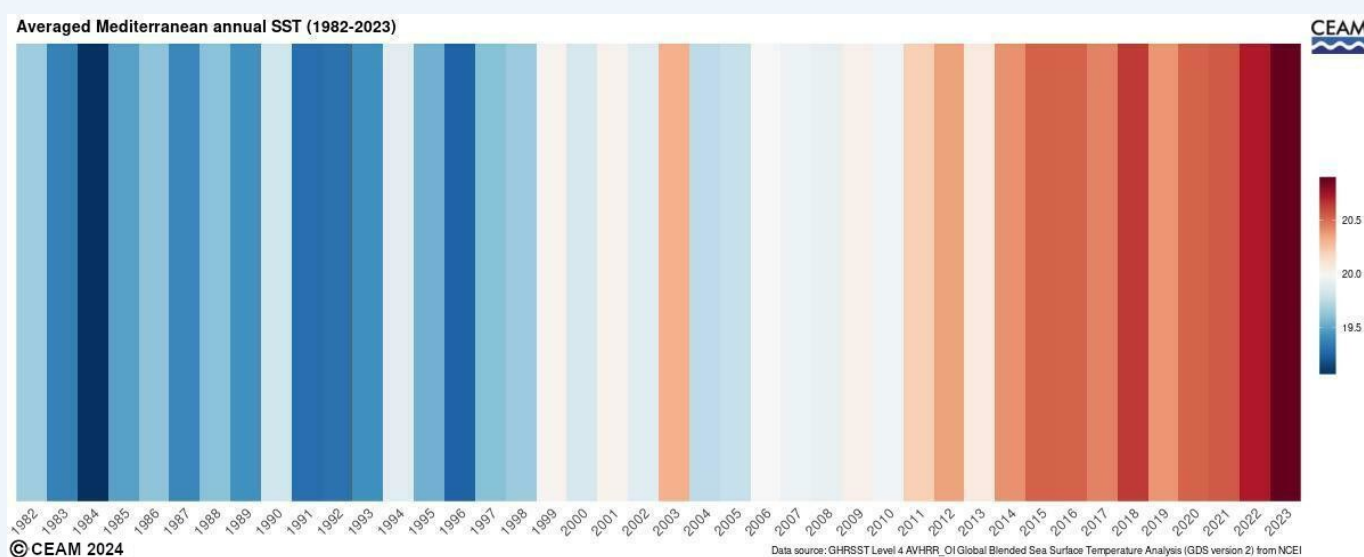


Mediterranean SST report

Autumn 2023

The Mediterranean area has been defined as a *hot-spot* for climate change. From a climatic point of view, the Mediterranean Sea and its interactions with the atmosphere play a fundamental role in its environmental conditions. It is, therefore, crucial to study the behaviour of the Mediterranean Sea in the past and to monitor its current situation to understand possible future scenarios in the region.

Mediterranean SST report is an initiative of the Mediterranean Center for Environmental Studies ([CEAM](http://www.ceam.es)) Meteorology and Climatology area to periodically review and update sea surface temperature (SST) climatology and trend in the Mediterranean basin. This newsletter will be issued on a seasonal basis and is intended to disseminate the state of the art about Mediterranean SST but also as information for stakeholders and media interested in climate change. It is also our intention to offer this newsletter as a meeting point for the scientific community involved in the study of Mediterranean SST. SST daily updated information can be found in our web SST-CEAMed at <http://www.ceam.es/SST>.



All graphics and analysis are based on daily SST data from GHRSSST Level 4 AVHRR_OI Global Blended Sea Surface Temperature Analysis (GDS version 2) from NOAA National Centers for Environmental Information available at PODAAC site (https://podaac.jpl.nasa.gov/dataset/AVHRR_OI-NCEI-L4-GLOB-v2.1).

Mediterranean SST report will be issued in a seasonal basis (4 times a year). If you are interested in receiving upcoming issues please contact Francisco Pastor at paco@ceam.es. Please, feel free to distribute to anyone who might be interested.

Mediterranean SST report - Autumn 2023

SUMMARY

Mean Mediterranean temperature has consistently remained above the average values for the autumn months. September SST started with positive anomalies, still below the extraordinary 2022 values, but rose rapidly in October to reach the highest values (2.1°C) in the historical series for this month. November mean SST anomalies remained at the top of the series with a positive anomaly of 1.8°C. These values averaged a seasonal anomaly of 1.7 °C. The long-term trend of seasonally unseasonalised Mediterranean SST persisted with a cumulative warming (1982-2023) of 1.6°C on average.

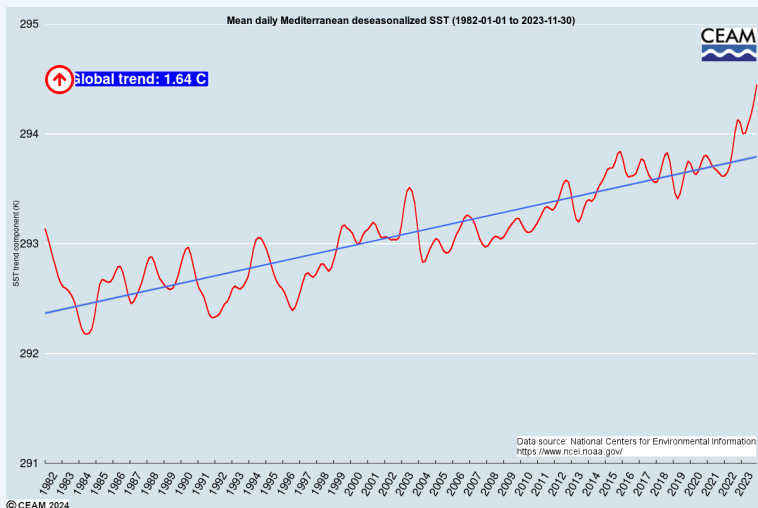


Figure 1. Time evolution for deseasonalized mean Mediterranean SST

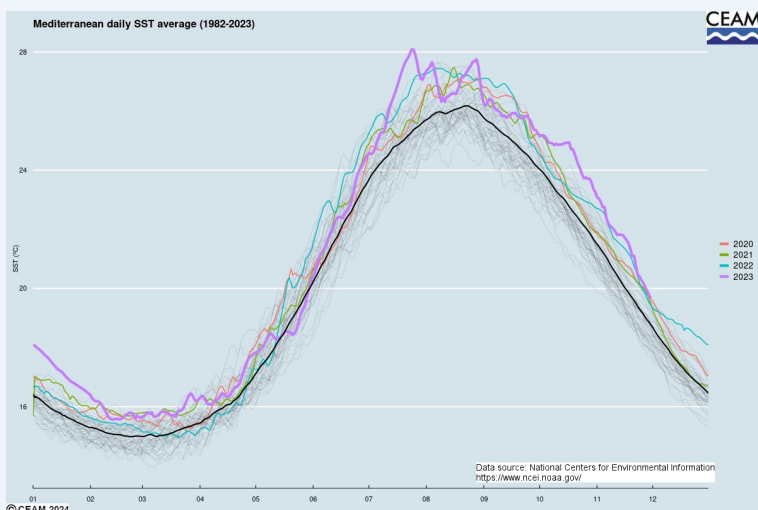


Figure 2. Yearly time series for mean Mediterranean SST

The mean SST in the Mediterranean has remained above climatological average for the whole autumn season. September SST anomalies were positive but clearly lower than the record 2022. Anomalies began to rise at the end of September, reaching record highs in October. Very high daily anomaly values were maintained in November, generally at historical highs but closer to those of 2022. The long-term cumulative increase in SST is 1.6°C for the period of analysis (1982-2023) for the seasonally adjusted SST.

Figure 2 shows the annual series of daily mean SST (black line for the mean 1982-2023). The raw SST anomaly values were 1.3°C in September, 2.1°C in October and 1.8°C in November. For the unseasonalised SST the values were around 1.5°C during the whole autumn season.

Trend summary (1982-2023)	
Global trend	1.64°C
Global daily trend	1.0·10 ⁻⁴ °C/day
Monthly anomalies	September 1.4°C
	October 1.5°C
	November 1.6°C

Global trends and monthly anomalies for deseasonalized SST

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Global SST anomalies

As observed in recent years, the warming of the Mediterranean has consistently maintained during the autumn months of 2023. October showed the highest anomaly in the historical series, since January 1982, with 2.1°C while November recorded the third highest anomaly with 1.8°C. The trend towards higher positive SST anomalies since 1982 slightly reinforced, with values almost always positive since 2000.

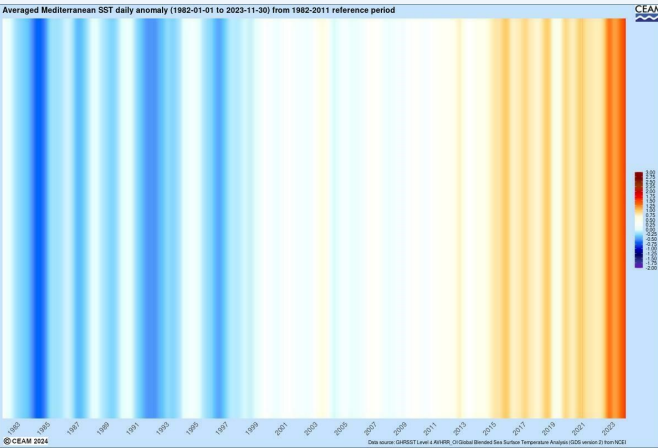


Figure 3. Mean SST daily anomaly

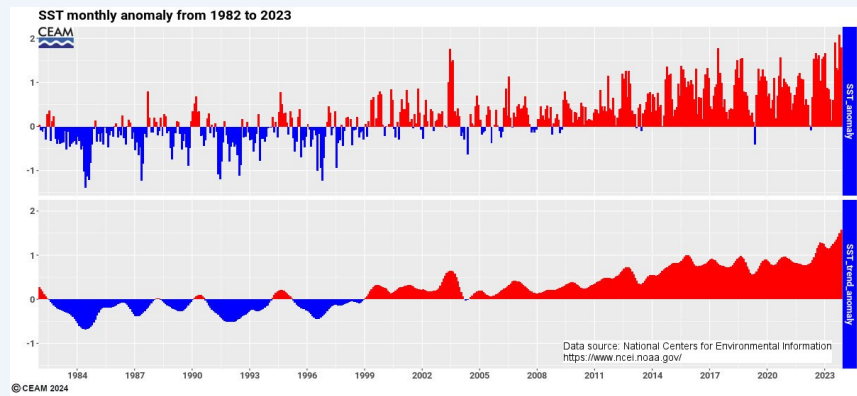


Figure 4. Mean SST monthly anomaly since 1982

SST monthly analysis September 2023

September SST show a spatial distribution similar to summer months and a mean value 25.9°C. The highest values recorded were found in the Eastern Mediterranean, between Turkey, Cyprus and Egypt while the lower ones were observed in the Aegean Sea and the Gulf of Lion. The highest positive anomalies were located in the Eastern Mediterranean but also in the relatively colder area of the Gulf of Lion. Significant positive anomalies were also recorded in coastal southern Spain and the Adriatic Sea. The monthly mean SST anomaly in September was the fourth in the historical series (1982-2023) for this month, but in the case of seasonally adjusted SST it was the highest in history.

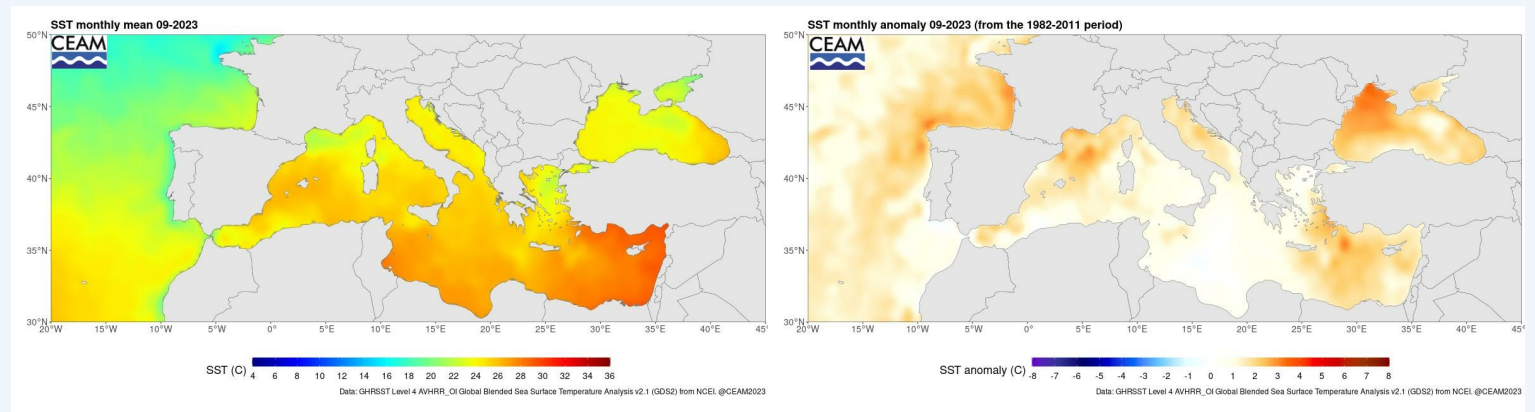


Figure 5. Mean monthly SST (left) and mean monthly SST anomaly (right) on September 2023

September SST	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
SST anomaly	0.6	1.1	1.1	0.9	0.4	1.6	1.1	1.6	1.2	1.6	1.3
SST trend comp. anom.	0.5	0.7	1.0	0.8	0.8	1.0	0.8	0.9	0.8	1.2	1.4

Minimum values in blue/maximum values in red

Mediterranean SST report - Autumn 2023

SST monthly analysis October 2023

October was characterized by high SST values across the whole Mediterranean basin with a spatial distribution resembling that of summer. As in September, the highest SST values were recorded in the Eastern Mediterranean and the lower values were found in the Aegean and Gulf of Lion. Regarding SST anomalies, most of the basin showed positive and significant anomalies with the strongest values were recorded in the northern half of the Western Mediterranean. The monthly mean SST anomaly in October was the highest on record since 1982, by a wide margin from the second record, as it also was the seasonally adjusted SST anomaly.

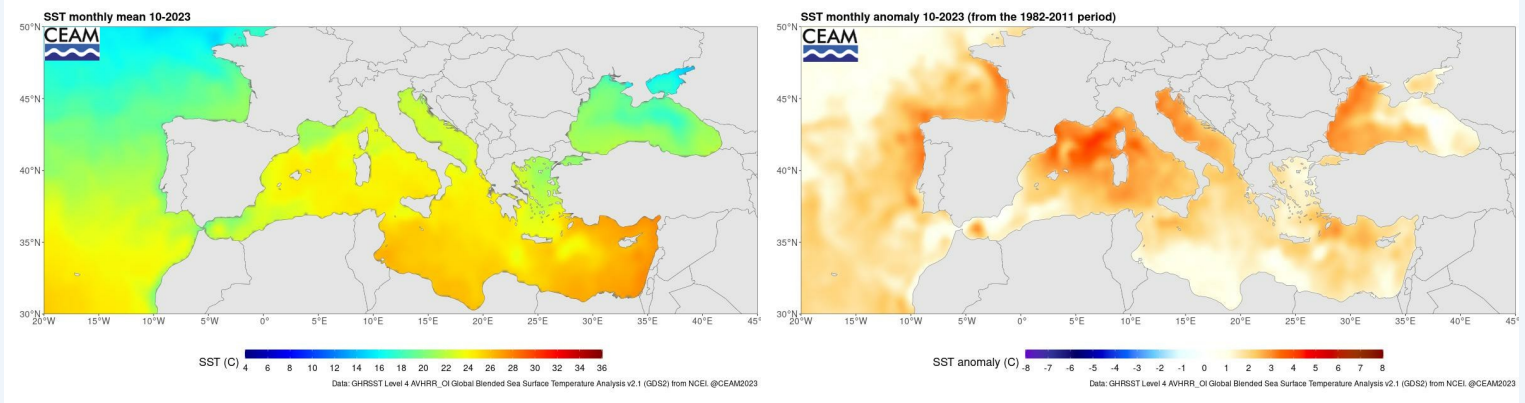


Figure 6. Mean monthly SST (left) and mean monthly SST anomaly (right) on October 2023

October SST	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
SST anomaly	0.8	1.4	0.9	1.2	0.6	0.8	1.3	0.9	1.1	1.0	2.1
SST trend comp. anom.	0.5	0.7	1.0	0.8	0.7	0.9	0.9	1.0	0.8	1.3	1.5

Minimum values in blue/maximum values in red

SST monthly analysis November 2023

During November Mediterranean SST experienced a progressive decrease but still remained at high values for the month. Relatively cold areas extended through the coasts of Spain and France while central and Eastern Mediterranean showed the highest values. In this case, the strongest SST anomalies were recorded in the Aegean sea and Eastern Mediterranean with a narrow band of negative anomalies along the Spanish coastline. For the monthly mean SST anomaly, values for both raw and seasonally adjusted SST are the highest ones since 1982, followed by November 2022.

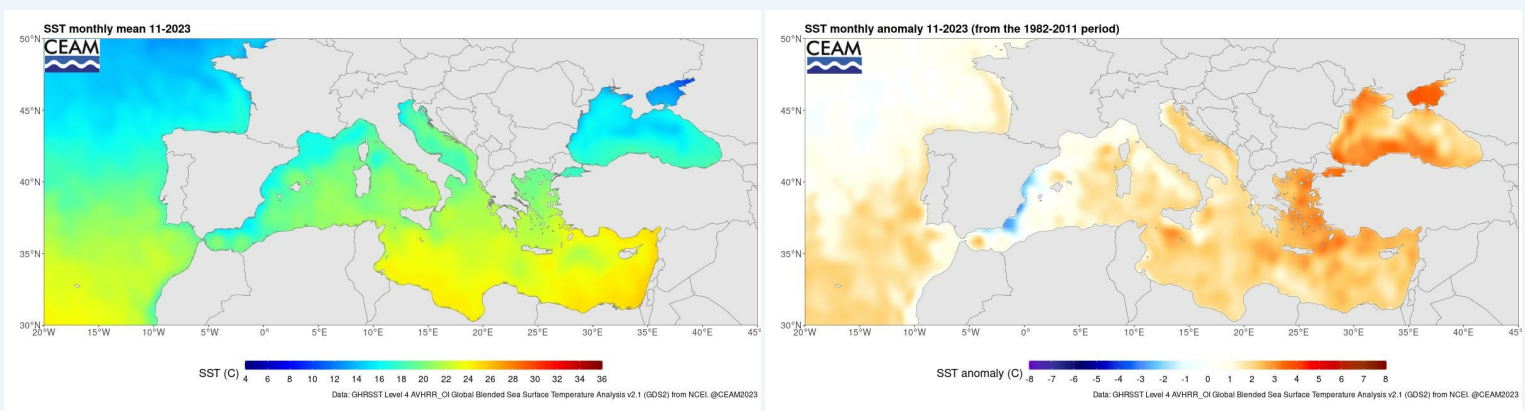


Figure 7. Mean monthly SST (left) and mean monthly SST anomaly (right) on November 2023

November SST	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
SST anomaly	0.8	1.2	1.0	1.3	0.3	0.8	1.1	1.1	1.1	1.5	1.8
SST trend comp. anom.	0.5	0.8	1.0	0.8	0.7	0.8	0.9	1.0	0.8	1.3	1.6

Minimum values in blue/maximum values in red

Mediterranean SST report - Autumn 2023

Mean Mediterranean SST temporal trend heatmaps

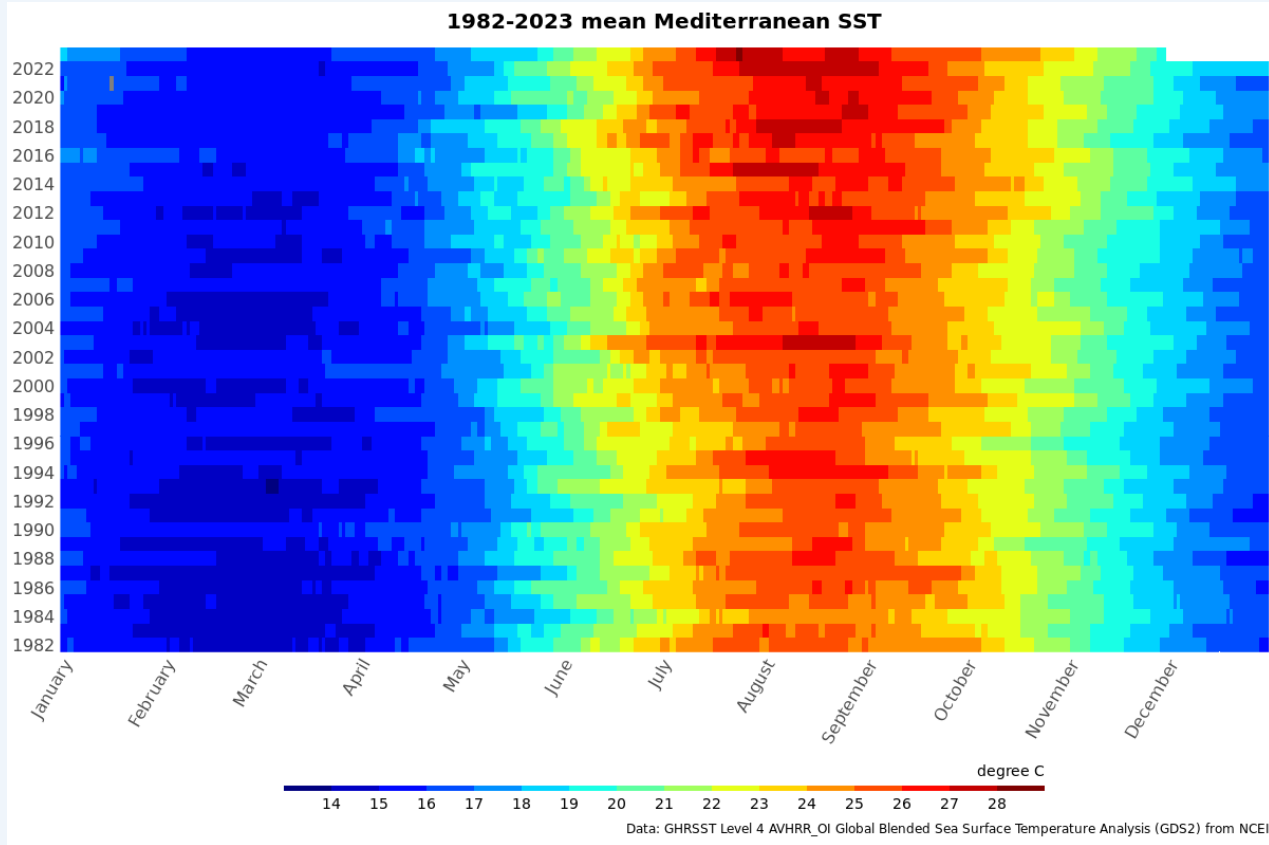


Figure 8. Yearly heatmap for daily mean SST in the Mediterranean (1982-2023)

Figure 8 shows the mean Mediterranean SST evolution in the 1982-2023 period and figure 9 shows its anomaly, with reference period 1982-2011. It can be seen how warm values have been progressively broadening their annual time range, especially warmer SST in summer season.

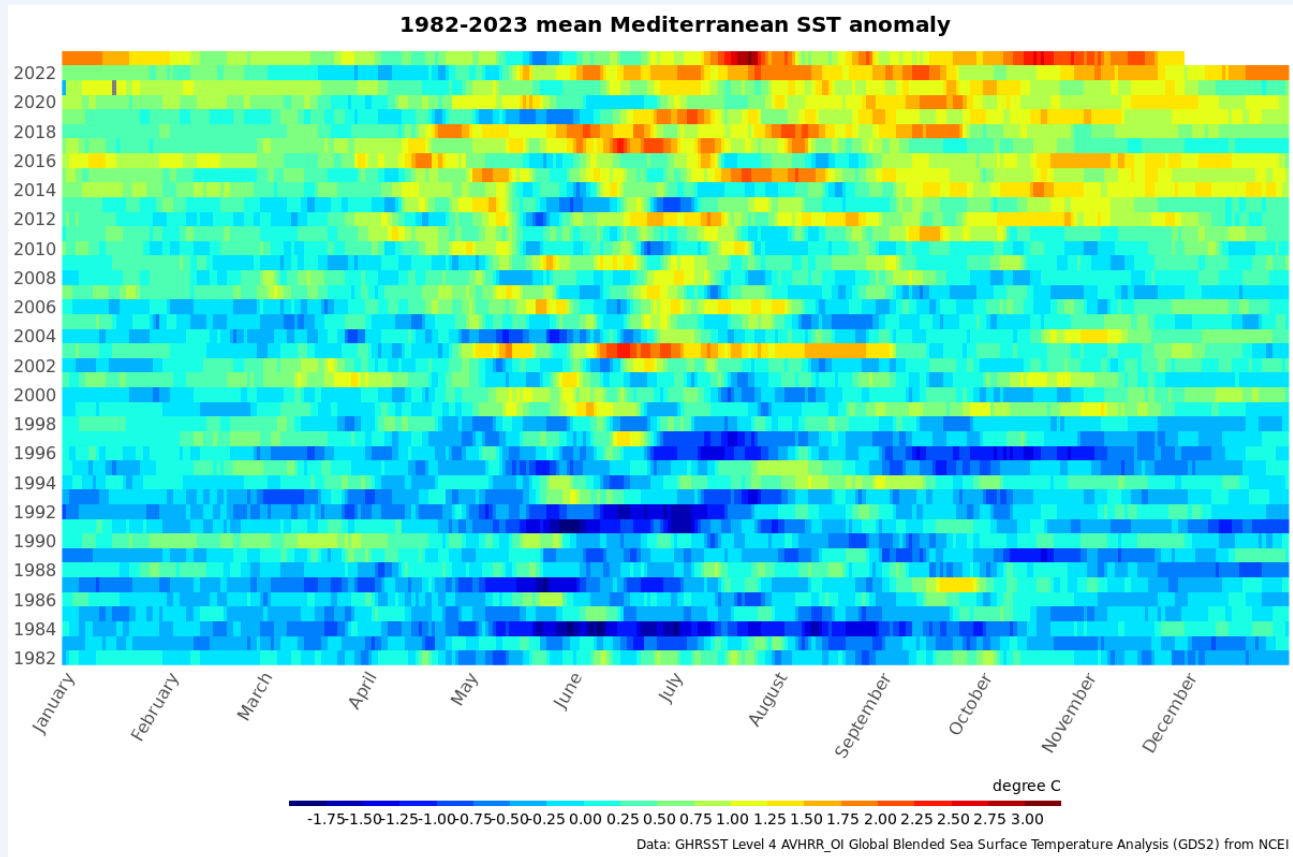


Figure 9. Yearly heatmap for daily mean SST anomaly in the Mediterranean (1982-2023)



Mediterranean SST report is an initiative of the Mediterranean Center for Environmental Studies (CEAM) Meteorology and Climatology area, funded by the Generalitat Valenciana.

More information about Mediterranean sea surface temperature (daily updates) at our SST CEAMed web portal www.ceam.es/SST

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Data source: National Centers for Environmental Information. 2021. Daily L4 Optimally Interpolated SST (OISST) In situ and AVHRR Analysis. Ver. 2.1. PO.DAAC, CA, USA. Dataset accessed 2021-06-05 <https://doi.org/10.5067/GHAAO-4BC21>.

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