

# Consiglio Nazionale delle LONG-TERM CHANGES IN THE NORTHWESTERN ATLANTIC AND **MEDITERRANEAN SST FROM 1982 TO 2015**



# A. Pisano<sup>a</sup>, B. Buongiorno Nardelli<sup>a,b</sup>, S. Marullo<sup>c</sup>, V. Artale<sup>c</sup>, C. Tronconi<sup>a</sup>, and R. Santoleri<sup>a</sup>

<sup>a</sup>Institute of Atmospheric Sciences and Climate (ISAC) of the Italian National Research Council (CNR), Roma, Italy (andrea.pisano@artov.isac.cnr.it) <sup>b</sup>Institute for the Coastal Marine Environemnt (IAMC) of the Italian National Research Council (CNR), Napoli, Italy

The Copernicus programme is <sup>c</sup>Technical Unit Development of Application of Radiations, Diagnostics and Metrology Laboratory, Italian National Agency for New Technologies, Energy funded by the European Union and Sustainable Economic Development (ENEA), Frascati, Italy



# **ABSTRACT**

Estimating long-term SST changes is crucial to evaluate global warming impact at regional scales. Here, we analyze the Mediterranean (MED) and the Northwestern Atlantic Box (NWA) SST changes over the last 34 years (1982 - 2015) by combining reprocessed (REP) and near-real-time (NRT) data. Actually, the Italian National Research Council (CNR) has recently produced daily (nighttime), 4 km resolution REP MED level 4 datasets (REP L4), also covering the adjacent Atlantic region, based on the latest Pathfinder v5.2 AVHRR dataset (1982-2012). These data represent the longest satellite MED SST L4 time series and are freely distributed through the European Copernicus Marine Environment Monitoring Service (CMEMS). However, as Pathfinder has not yet released an update of its product, the REP data end in 2012. To fill in the gap between 2013 and 2015, we investigated the possibility to extend the time series by using the Mediterranean near real time (NRT), multi-sensor L4 SST data at Ultra-High spatial Resolution (UHR) produced by CNR, which are distributed through CMEMS and now mirrored at GHRSST. Since this product is available since 2008, the consistency with the REP has been assessed. Combining the REP L4 data (1982-2012) and a bias-corrected version of the NRT L4 data (2013-2015), we built the SST time series and provided updated estimates of the MED and NWA SST trends. The analysis shows that The Atlantic Box and The Mediterranean Sea have similar trend behavior until 2008. Afterward the Mediterranean Sea SST continued to increase while the Atlantic persisted in its warming pause.



# SST TIME SERIES ANALYSIS

### SST SPATIAL TREND ANALYSIS

X-11 additive decomposition has been applied to the monthly mean time series in order to extract the trend component. Mann Kendall test and the Sens's method have been applied to estimate the magnitude (°C/year) and significance of trends.



SST 1982-1993 Trend (Period 1)



**Fig.** 6

#### Fig. 7 SST 1994-2007 Trend (Period 2)



SST overall trend (1982-2015): 0.03 °C/Year (99% conf. level), showing the different behavior of the western side from the eastern side of the Mediterranean Sea, in which the former seems to follow the Atlantic box and the latter displays a more intense warming (*Fig. 5*). During the three periods the Atlantic trends slightly increased with a tendency toward negative values in the third period. Within the Mediterranean Sea more variability is observed especially in the Adriatic and in the Levantine basin (Figs 6, 7, 8).



## **Multidecadal Context**

The Satellite Era in the context of the longer HadISST and ERSST Time Series of the Mediterranean Sea (annual averages)



#### STATISTICAL FORECAST (SSA + Maximum Entropy Method)

The last 8 years (Period 3) of data are removed from the original time series, and SSA is applied to the remaining data-Leading T-EOFs 1-3 are used to reconstruct the time (RC) series excluding noise but retaining oscillations and trends. MEM is applied to RC using a window with of 1/10 of length of the series. The deviation of the statistical forecast from the observations gives a measure of the predictability of the dynamics of the system that generated the series. In this context it appears evident the difference between the Atlantic and the Mediterranean cases.



#### **Conclusions**

- During recent years the Mediterranean Sea tends to decouple from the NWA
- $\checkmark$  The statistical forecast shows limitation to the predictability of the Mediterranean system respect to the Atlantic side, this is more evident in the Aegean-Levantine basins figures 10e,f

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