

SEA SURFACE TEMPERATURE TREND OF THE LAST 125 YEARS IN THE MEDITERRANEAN SEA: FROM DAILY TO DECADEAL VARIATIONS

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Abstract

AVHRR data have been used to investigate the recent SST variability at basin and sub-basin scale in the Mediterranean Sea starting from 1985. The low frequency analysis has been carried out using historical in situ data available, at lower spatial and temporal resolution, from the ICOADS database. Focusing on the two more recent decades both datasets show an increasing of the mean SST from the 19.4 °C of the second half of 80' (to the 19.8-20.0 °C of the beginning of the new century. The analysis of the longer time series indicates that before 1940 the SST was between 0.5 °C and 1.0 °C lower than the 1961-1990 reference mean, from 1945 to 1990 the SST oscillates between +0.3 °C and -0.1 °C respect to the 1961-1990 reference mean while after 1990 a continuous increase is observed.

Keywords : Remote Sensing, Air-sea Interactions, Global Change, Temperature, Time Series.

AVHRR SST data estimates permit to analyse SST trends from the beginning of the 80's to today. Within this time window it is possible to investigate either the high frequency variability or the interannual variability but the analysis of lower frequency variations is not feasible due to the relatively short time period. The study of decadal or longer periods variability requires a longer time series not yet available from satellite data only. This low frequency analysis can be carried out using historical in situ data available, at lower spatial and temporal resolution, from the ICOADS database. 1 degree resolution monthly time series are available starting from 1960 while using 2 degree spatial resolution ICOADS it is possible to extend the time series up to 1880.

Our strategy was to use the higher quality and space-time resolution satellite POISSST (Pathfinder Optimally Interpolated Sea Surface Temperature) to investigate recent high frequency variability at basin and sub-basin scale and to use 2 degree resolution monthly ICOADS to study the lower frequency variability and to contextualize in a larger time window the more recent satellite estimate.

The Pathfinder Mediterranean Forecasting System Toward Environmental Prediction (MFSTEP) OISST are currently produced in on a daily basis in the framework of the MFSTEP project. This time series consists of a daily series of optimally interpolated SST maps over the regular grid of the operational MFSTEP OGCM model of the Mediterranean basin from 1985 to today. A complete validation of this POISSST product with in situ measurements has been performed in order to exclude any possibility of spurious trends due to instrumental calibration errors/shifts or algorithms malfunctioning related to local geophysical factors. The validation showed that satellite POISSST is able to reproduce in situ measurements with a mean bias of less than 0.1 °C and RMSE of about 0.5 °C and that errors do not drift with time or with the percent interpolation error (Marullo et al. 2006)

Focusing on the more recent decades (from 1982 to 2005) it results that all the two datasets (Satellite and ICOADS) show an increasing of the mean SST from the 19.4 °C of the second half of 80' (the mean Mediterranean SST in the period 1961-1990) to the 19.8-20.0 °C of the beginning of the new century. The analysis of the full ICOADS time series permits to divide the analysed period in three distinct intervals: before 1940 when the filtered SST was between 0.5 °C and 1.0°C lower than the 1961-1990 reference mean SST, from 1945 to 1990 when the filtered SST oscillates between +0.3 °C and -0.1 °C respect to the 1961-1990 reference mean SST and after 1990 when a continuous increase of the SST is observed. The zonally averaged SST shows a tendency of isotherms to move northward. This northward shift of isotherms was particularly evident from about 1910 to 1950. During this time period the 19 °C isotherm (for example) moved from 35 N to 39 N. After 1950 this isotherm continued to oscillate around 35 N. Zonally averaged temperatures below 17 °C are observed only before 1935. A second period of northward shift of the isotherms is observed after 1995.

Reference

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