Papers

doi:10.5697/oc.56-3.411
OCEANOLOGIA, 56 (3), 2014.
pp. 411–443.

Recent sea surface temperature trends and future scenarios for the Mediterranean Sea

KEYWORDS
Mediterranean Sea
Sea surface temperature
Climate change
Heat exchange
Total cloud cover

Mohamed Shaltout[1,2]*
Anders Omstedt[2]

[1] Faculty of Science,
Department of Oceanography,
University of Alexandria,
Alexandria, Egypt;

e-mail: mohamed.shaltout@gvc.gu.se

*corresponding author

[2] Department of Earth Sciences,
University of Gothenburg,
P.O. Box 460, Göteborg 40530, Sweden

Received 13 May 2013, revised 25 November 2013, accepted 23 January 2014.

Abstract

We analyse recent Mediterranean Sea surface temperatures (SSTs) and their response to global change using 1/4-degree gridded advanced very-high-resolution radiometer (AVHRR) daily SST data, 1982–2012. These data indicate significant annual warming (from 0.24°C decade^{-1} west of the Strait of Gibraltar to 0.51°C decade^{-1} over the Black Sea) and significant spatial variation in annual average SST (from 15°C over the Black Sea to 21°C over the Levantine sub-basin). Ensemble mean scenarios indicate that the study area SST may experience significant warming, peaking at 2.6°C century^{-1} in the Representative Concentration Pathways 85 (RCP85) scenario.

The complete text of the paper is available at http://www.iopan.gda.pl/oceanologia/

1. Introduction

The Mediterranean Sea and its surrounding sub-basins extend from −9° to 42°E and from 30° to 47°N (Figure 1) and can be divided into several sub-basins, for example, the Active Atlantic Mediterranean sub-basin (hereafter 'AAM sub-basin') west of the Strait of Gibraltar and the Black Sea, connected to the Aegean Sea by the Dardanelles Strait. The study area is economically important, being exploited for fisheries, oil and gas extraction, and offshore renewable energy; it is also used for shipping, which links its many harbours. In the coastal zone, tourism, road transportation and recreation are major uses. According to IPCC (2007) and Lionello et al. (2010), the study area is a climate change hotspot, especially vulnerable to the increased sea surface temperature (SST) caused by greenhouse gas emissions.

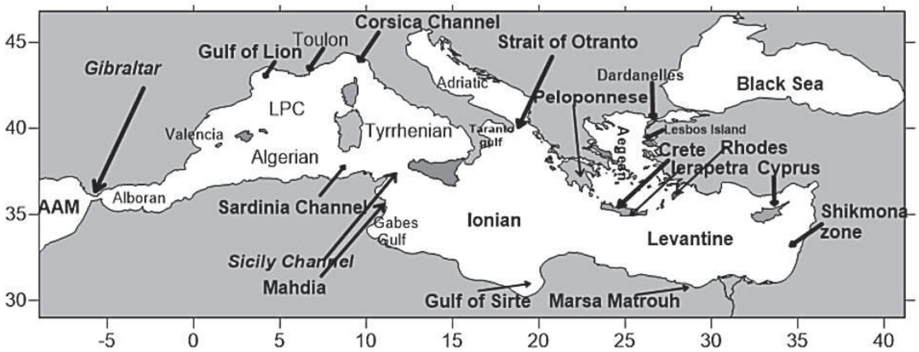

Figure 1. Geography of the Mediterranean Sea (LPC = the Liguro-Provencal and Catalan sub-basins, AAM = Active Atlantic Mediterranean sub-basin to the west of the Strait of Gibraltar)

Parada & Canton (1998) found that 1993 satellite thermal images of the Alboran Sea indicated that the western Alboran anticyclonic gyre was an important feature; they also found seasonal SST variation over the Alboran Sea. Marullo et al. (1999) stated that the eastern Mediterranean SST is defined by two extreme distribution patterns, i.e. winter (zonal) and summer (meridional) patterns, with a transition period between them. They also identified permanent SST features in the eastern Mediterranean Sea (e.g. the Cretan Cyclone and Pelops Anticyclone). Their analysis was based on advanced very-high-resolution radiometer (AVHRR) weekly data with a spatial resolution of 18 km. Leitz (1999) demonstrated that the Ionian Sea is characterised by strong seasonal variability with a mesoscale structure. Skliris et al. (2011) stated that the Aegean SST clearly increased