A 9-year monitoring of environmental changes over the continental shelf in the Catalan Sea from multiparametric measurements

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Introduction

Long-term global warming trends reported in the last decades by NOAA-NASA may be accelerating in recent years [1]. Extreme global average temperatures reported since 2014 are consistent with the largest annual atmospheric CO2 what may be a signal of slowdown of carbon sequestration, in oceans and continents. The Mediterranean Sea warming trend is in line with global warming [2].

Coastal marine ecosystems in the Mediterranean are particularly exposed to the effect of warming, as they hold relatively high biodiversity at shallow water layers. Longer and warmer summer periods are related to massive mortalities of benthic (deep-sea) organisms [3], because the specific temperature ranges of some species may be overtaken.

Rationale

Though long-term coastal monitoring systems allow better approaching the effect of water heating on marine biota, those monitoring systems are very scarce. The Operational Observatory of the Catalan Sea (OOCS) was one of those expectations [4], operating from March 2009 to March 2018. The OOCS collected in-situ data from fixed coastal observation stations over the continental shelf in the Catalan Sea, fuelling time series data of physical and biogeochemical characteristics of the marine environment from hourly to fortnightly time scales. Data were collected from instrumentation in a meteorological and oceanographic buoy [Fig. 1] and from instrumentation on-board a research boat.

Figure 1: Oceanographic buoy moored at the observation station in the Blanes canyon head.

Products

On-board measurements for the period between 2014 to 2017 indicated that yearly temperature of the water column over the continental shelf was 0.4°C higher than temperature in the period between 2010 to 2013 [Fig. 2].

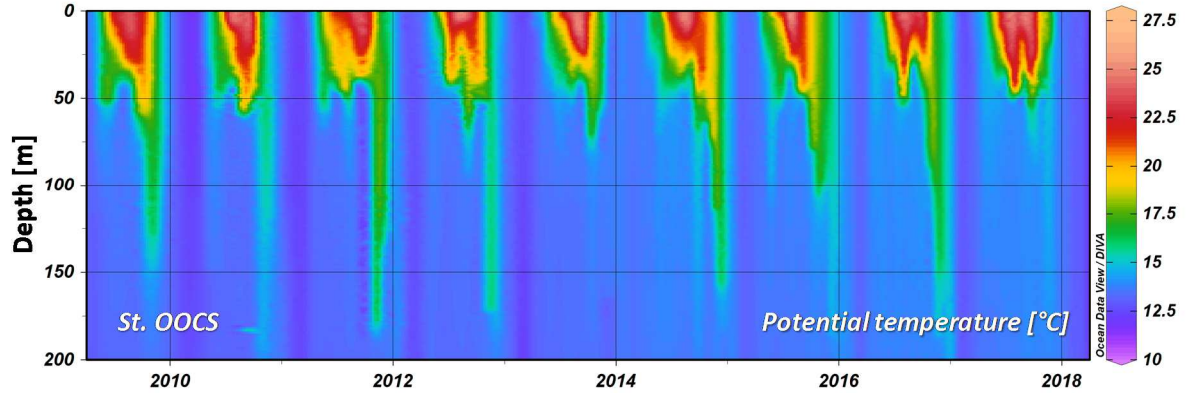

Figure 2: Time series of water column temperature over the continental shelf in the Blanes canyon head.

Simultaneously collected in-situ measurements from the buoy instrumentation (e.g. atmospheric pressure, relative humidity, wind speed and air and sea temperatures) along with reanalysis products from NOAA (sea surface albedo and cloud cover), allowed monitoring daily net air-sea heat fluxes [3].

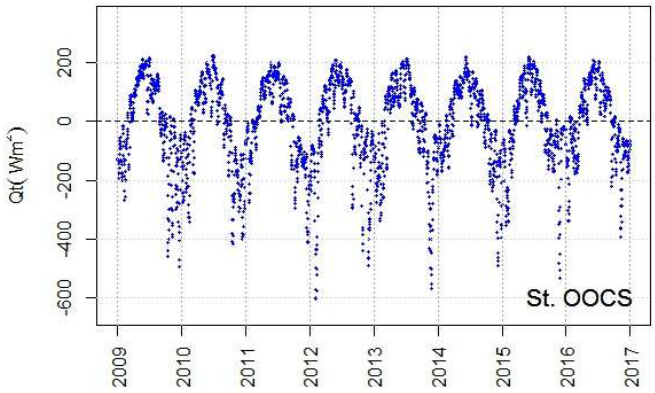

Figure 3: Estimated net sea-surface heat fluxes at the observation station in the Blanes canyon head. Negative values indicate heat losses from seawater, whereas positive values indicate heat gains by seawater.

Since 2013, turning points from negative to positive heat flux started earlier, whereas the turning points from positive to negative starter later. This made the summer periods since 2013 were about 13 days longer than summers before 2013. Persistence of longer and warmer summers are expected to amplified the negative effects on the dynamics of the pelagic ecosystem [3,5].

References

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