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# On the presence of coastal upwelling along the northeastern Tyrrhenian coast

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The Mediterranean region shows a high climate variability due to the interactions between mid-latitude and tropical processes. This variability makes the Mediterranean a potentially vulnerable region to climatic changes.
The present research aims to investigate the hydrographical response to Northerly wind in the northeastern Tyrrhenian coast, to identify the relations between upwelling events and teleconnection patterns. In the Tyrrhenian basin northerly winds flow between North-East and North-West and could be considered upwelling favorable winds. This atmospheric circulation can causes a divergent flow near the coast that generates a subsurface water flows inshore toward the coast up to the surface layer that is upwelling. This phenomenon strongly influence the marine ecosystems, contributing to the supply of nutrients and affecting the primary producers.
In this context multi-platform observing system is an important tool to follow the evolution of these phenomena. Sea temperature and wind field acquired by the C-CEMS Observing system were used to identify upwelling phenomena between 2012 and 2016, in the coastal area of Civitavecchia, Northern Tyrrhenian sea, Italy.
Moreover a thirty years' wind-driven upwelling conditions have been studied in the area. ERA-Interim (ECMWF) wind data for the period 1982-2012 have been used to compute the distribution of upwelling favorable wind events. These have been compared to "Copernicus Marine Environment Monitoring Service" Sea Surface Temperature (SST) to compute upwelling events. Upwelling favorable wind has been defined in the sector between Northwest and Northeast (Wd >330°N & Wd < 30°N). Wind speed has been divided into three classes: between 4 m/s and 6 m/s, between 6 m/s and 8 m/s and greater than 8 m/s.
Sea Surface Temperature have been analyzed to define SST field for wind-driven coastal upwelling assessment. SST minima along the coast was used to identify upwelling from satellite imagery. The two datasets were compared and only the days that presented those characteristics were chosen.
ERA-Interim (ECMWF) sea level pressure data over the Europe for the period 1982 -2012 have been used to compute the most relevant teleconnection patterns through Empirical Orthogonal Function's analysis.
An increase of upwelling events in the Tyrrhenian coast is observed in the last thirty years; the occurrence of upwelling events has a seasonal oscillation, with a maximum frequency during winter and spring seasons. In the last decade an increase of these events in winter and a decrease in spring is observed; also a recurrence of these events in summer season has been identified, without the specific contribution of one of atmospheric regimes.
Data analyzed shows a decrement in Atlantic Ridge (AR) regime and an increment in West Blocking (WBL) regime, especially for the event characterized by wind speeds greater than 8m/s.