The Mediterranean is a boundary region that feels the dynamics of both the tropical and the mid-latitudes circulation. The seasonal cycle is characterized by a winter regime, dominated by mid-latitude wave-mean flow interactions, and a summer regime, influenced by the tropical dynamics. Common modes of variability of ocean and atmospheric parameters up to decadal timescales have been studied by analysing time series of sea level, observed at tide gauge stations, ocean heat content, atmospheric pressure and large-scale atmospheric circulation indicators. The mean seasonal signal is subtracted from each time series. Moreover, the long-term linear trend is subtracted from each sea level time series, in order to remove the effect of the local vertical ground motion, which is peculiar to each station. The analysis is mainly performed using the Empirical Orthogonal Function and correlation techniques. The connection of sea level and atmospheric pressure variations, which can also be accounted for by the Arctic Oscillation and North Atlantic Oscillation indices, occurs through the inverted barometer effect and it is observed in most of the basin at interannual and decadal timescales, particularly in winter. The relationship between sea level and ocean heat content variability can be recognized on the decadal timescale. In this regard, noticeable differences characterize the western and eastern Mediterranean. In the western basin decadal sea level fluctuations and the Sahel precipitation index exhibit similar behaviours.