

Global climatic fluctuations reflected in the Mediterranean Sea

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Response of the Mediterranean Sea to slow air-pressure changes, especially those caused by planetary atmospheric waves, is being the subject of extensive studies. Here we examine low-frequency variability of the Adriatic Sea, due to long-lasting pulse of high air pressure that was recorded in the Mediterranean area in winter 1988/89.

Persistent, exceptionally low sea levels were registered in winter 1988/89 all along the east Adriatic coast (PASARIC and ORLIC, 1992), as well as in other parts of the Mediterranean Sea (e.g. ANGRISANO, 1989). These low sea levels corresponded with an anticyclonic disturbance over Europe. Monthly mean values of sea level at Bakar and air pressure at Mali Losinj, together with the 30-year monthly averages and standard deviations, are shown in Figure 1. During four months, from November 1988 until February 1989, sea level and air pressure departed significantly from their long-term averages. In January, at the peak of the event, mean air pressure was higher than the January average by more than three standard deviations, and sea level was lower than its average by more than two standard deviations. The ratio of January anomaly of sea level to that of air pressure was close to 1.6 cm/mbar; it suggests that the inverse-barometer overshoot, observed in the frequency range dominated by planetary atmospheric waves, characterizes the longer-term variability as well. The anticyclonic disturbance was of great spatial scale. Monthly charts of anomalies of sea-surface air pressure and geopotential height of the 500-mbar surface show that the high-pressure field spread in winter 1988/89 over the whole of Europe and extended to the higher levels of the troposphere.

Climatic fluctuations over Europe, similar to the one of winter 1988/89, occur from time to time, and have been analysed in a number of empirical and modelling studies. Results show that the European climate is influenced by sea surface temperature anomalies in the northwest Atlantic and equatorial Pacific. Persistent anticyclonic disturbance over Europe can be associated with the colder-than-usual surface water occurring in winter off the coast of Newfoundland (PALMER, 1986). In years when abnormally cold water appears in the equatorial Pacific (the event called La Nina), there are more anticyclonic and less cyclonic situations over Europe; these Pacific cold events peak in December, and the response of atmosphere above Europe is largest the following January and February (FRAEDRICH 1990). It seems that a dual cold event has taken place in winter 1988/89: appearance of abnormally cold surface waters has been registered in both the northwest Atlantic and equatorial Pacific (ARKIN, 1989). This implied strong anticyclonic disturbance over Europe, which in turn caused exceptionally low sea levels.

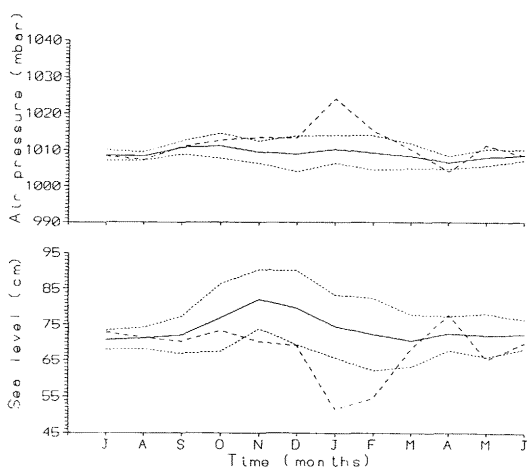


Figure 1. Monthly means of air pressure registered at Mali Losinj, and sea level recorded at Bakar. Full and dotted lines denote the 1956/85 averages and standard deviations, respectively, whereas dashed lines mark the values measured in winter 1988/89.

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