SOME PHYSICAL OCEANOGRAPHIC ASPECTS IN THE NW COASTAL AREA OF MALTA

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The Central Mediterranean is an exchange region between the western and eastern basins of the Mediterranean and presents an interesting case in physical oceanography with phenomena that are presently of great interest in current research. The Maltese Islands provide an obstacle to the main SSE vein of Atlantic water moving across the Sicilian Channel, and unpredicted coastal oceanographic aspects that are especially relevant to island systems and covering the full spectrum of temporal and spatial scales have been revealed. The present study is mainly based on the data collected during a survey in August 1992 with support from data acquired successively. Besides the survey undertaken in the subsequent Summer, short 3-day data collection campaigns during 1994 will allow the study of the seasonal variability. An intensive water current measurement programme is also being followed since mid-1993. An ENDECO water level recorder has become operative inside Mellieha Bay since mid-1993. A meteorological station set up at a coastal point in the area of study started data registration since April 1994. Fig. 1 shows the PVD from hourly averaged water currents at Ahrax Station, measured by a taut-wire moored instrument at 6.3 m from the sea bed and in a total depth of 34.9 m. This station is positioned mid-way between the main headland at Ahrax Pt. and the White Bank (see insert) which shoals steeply to the NE, reaching depths as low as 11m. The Eulerian transport follows a SE-NW axial pattern and is dominated by diurnal current fluctuations and reversals that are modulated by longer-period signals. The PVD zoom shows in detail the frequent sharp rotations of the current vector, with both clockwise and anticlockwise changes in flow directions. This characteristic water current pattern is accompanied by an oscillation of the seasonal thermocline, and is found to persist even during the winter months when the near-coast water column has no stratification.

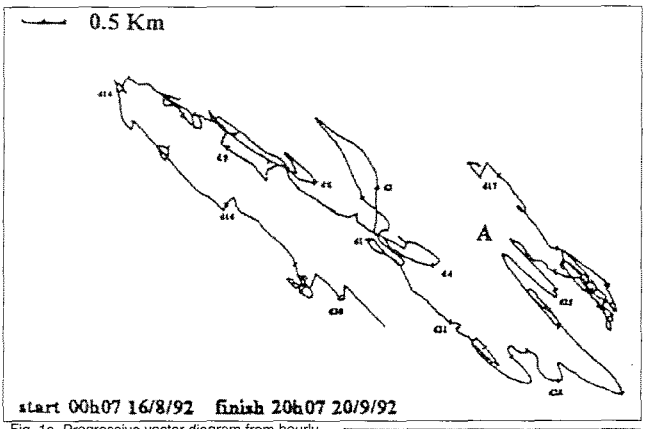
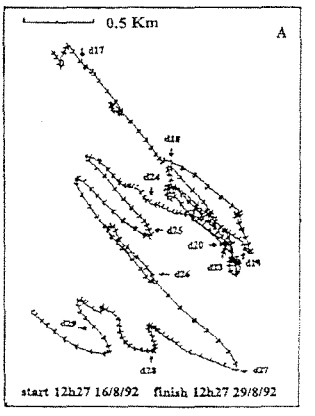


Fig. 1a. Progressive vector diagram from hourly averages current vectores at Ahrax station. Fig.1b (right). PVD zoom of section marked A on fig. 1a.



Towards the higher frequency end of the spectrum the current regime is also affected by a strong seiche which pervades the whole coastal area around the Maltese Islands, often masking completely the small semi-diurnal astronomical tide, and causing water body movements with very short time periods of the order of 20 minutes. Subsurface currents observed by an ENDECO tethered current meter inside Mellieha Bay are found to follow cycles of much the same order, with a rapid reversal of the current vector over a matter of a few minutes. Direct wind forcing is excluded because such currents are present even on very calm days; the magnitudes can often reach 10cms-1 even at points close to the head of the bay and when the seiche is not particularly active. The water column inside the bay is homogeneous throughout the year so that any turbulent origin is also excluded. Such rapid changes in the current vector have been also detected by ADCP profiles. On the spatial dimension it is known, especially from remote-sensed data, that this area of the Mediterranean is very prolific in mesoscale phenomena that give rise to a system of intertwining frontal structures that reach close the islands. Wake-like streaks have been also observed to trail towards east behind the westernmost tip of Gozo, following well-defined swerving paths downcoast, capturing surface garbage and debris along their way. On a smaller scale, data collected in the coastal area of Mellieha Bay and St. Paul's Bay is revealing a complicated circulation in the surface mixed layer, with both the White Bank and the Ahrax headland acting as sources of negative vorticity. The effect of wind forcing on this circulation as well as the relation of its seasonal variability on the presence or eventual erosion of stratification, are all issues of current study. The Maltese archipelago presents itself in an ideal position in the area, acting as a large permanent research vessel in the region; also the advantage of a small tide permits the study of physical oceanographic phenomena that are often masked or contaminated in other areas with dominant tidal streams. Physical oceanography in Malta is still at its birth and the present work in this field of study represents a foundation for future investigations.

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