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NONLINEAR MESOSCALE PROCESSES IN THE EASTERN LEVANTINE BASIN

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Interesting mesoscale processes such as the formation of internal Rossby radius of deformation eddies and jet enhancing phenomena modified by local driving mechanisms were observed and investigated for the first time in the Eastern Levantine Basin. We used a CTD data set composed of 17 cruises, each of them centered at 33.5N, 33.5E covering a 300 X 300 km^2 region. This data was collected during 6 years (1979-1984) by the Israeli R/V Shikmona. Here we examine only a subset of the entire data base. For this investigation we adapted and tuned the methodology of data assimilation for mesoscale eddy fields in open ocean regions to the environment of the Eastern Mediterranean Sea. We studied the vertical structure of the single cruises through an EOF analysis and the dynamical modal decomposition of the climatological $N^2(z)$ profile for the region. We produced geostrophic streamfunctions and we dynamically interpolated the data fields with the Harvard open ocean boundary model. Local wind forcing, topographic effects and free non-linear evolution of the mesoscale eddy fields are intercompared. The data shows very different horizontal and vertical structures between mid-summer and winter-spring time conditions but with patterns persisting over two to three months in each season.

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WIND CURL VS VARIABLE EDDY VISCOSITY : A PRELIMINARY NUMERICAL STUDY

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In our recent modelling studies the influence of different magnitudes of the vertically constant eddy viscosity coefficient (Kuzmić et al., 1985), as well as heterogeneity in the wind field (Orlić et al., 1986), on the wind-induced motions in the Northern Adriatic has been considered. The magnitude of the eddy viscosity coefficient proved to be of considerable influence on the magnitude and particularly direction of the current vectors at different depths. The wind-field heterogeneity studies have suggested that the wind curl is the most energetic source of variability in the fields commonly considered in the analysis (the elevation of sea surface and different velocity fields). Comparisons of model predictions to available and appropriately processed field data (multi-level current meter measurements at several locations) have shown considerable similarity between the measured and model-generated vectors in terms of magnitude, direction and relative position of different-depth vectors, but all three aspects have left room for improvements.

Vertically variable eddy viscosity coefficient has been seen as a way to improve predictions of wind-induced vertical shearing. Therefore, a new hydrodynamical numerical model has been developed (Kuzmić, 1986) which allows for such a variability. The governing set of equations is derived assuming homogeneous and incompresible water, hydrostatic motion, f-plane, and neglecting the advective terms and lateral shear. The three--dimensionality is retained using the integral transformations pioneered by Heaps (1972). However, the appropriate eigenvalue problem is solved numerically and appart from the main modelling procedure.

In this paper preliminary results of a modelling study of combined effects of wind curl and vertically variable eddy viscosity are presented. The model has been applied to the Northern Adriatic assuming realistic coastal geometry but flat bottom of average 40 m depth in order to exclude the topographic effect. Assuming constant and linearly decreasing vertical eddy viscosity, homogeneous southwestward wind and "linearized saddle" wind curl, four cases have been obtained and analysed. For each case four output fields (elevation of sea level, vertically averaged current, surface current and bottom current) and vertical distribution of currents at selected points have been analysed after 48 simulated hours.

Eddy viscosity has been allowed to drop to the tenth of its constant value of 0.01 Nm^{-2}, while the wind curl has been generated by linearly decreasing, the southwestward wind from 10 m/s at both ends to zero value in the middle. Preliminary analysis shows that such a variability leaves a visible mark on all four analysed fields. The change in the sea level due to variable eddy viscosity is apparently more pronounced in the presence of the wind curl. The influence of linearly decreasing eddy viscosity is also clearly visible in vertical distributions of currents with distinct pattern of change for the areas of high and low curl influence. These schematized formulations of wind and eddy viscosity variability, combined with numerical parameter values representative for the Northern Adriatic, are ment to produce only reference predictions. The work on other, more realistic viscosity distributions and wind curl functions is in progress.

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