Abstract View

Volume 12, Issue 11 (November 1982)

Journal of Physical Oceanography
Article: pp. 1310–1317 | Abstract | PDF (629K)

Wind-Driven Currents on the West Florida Shelf

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(Manuscript received October 7, 1981, in final form June 24, 1982)

DOI: 10.1175/1520-0485(1982)012<1310:WDCOTW>2.0.CO;2

ABSTRACT

Three weeks of current-meter, wind and sea-level data off Cedar Key, Florida are analyzed. Currents and sea level are found to be coherent with alongshore wind stress in the "synoptic" band (~ 0.05–0.25 cycle per day) and to lag it by approximately half a day. Little coherence is found with cross-shelf wind stress.

At the inshore mooring (22 m depth) currents are nearly barotropic for these winter 1978 data. A linear parameterization of bottom stress in the barotropic alongshore current leads to a bottom friction parameter r of 0.01–0.02 cm s^{-1} using coastal wind stress. No significant steady alongshore slope is found during this short interval. The dominant momentum balance in the alongshore direction is between wind and bottom stress. The offshore frictional length scale (Csanady, 1978) is estimated to be 75–100 km, which implies a seaward extent to a depth of about 30 m.

At the offshore mooring (44 m depth) there is vertical shear between the currents at 9 and 39 m. The upper cross-shelf components, which is large relative to that at the inshore mooring, is consistent with Ekman transport while the lower record shows a return flow. The u, v velocity components correlate significantly at the offshore mooring and lead to an upper layer $\bar{u}\bar{v}$ gradient on the order of 10^{-5} cm^2 s^{-2} between the arrays (75 km separation).

The sea-level fluctuations are consistent with a geostrophic balance in the cross-shelf momentum equation with a length scale of 170 km (approximately equal to the shelf width).

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