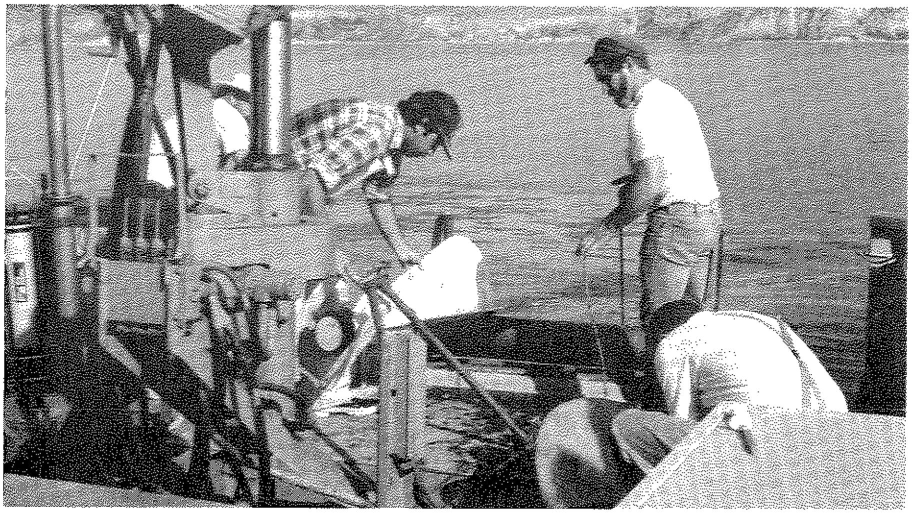

CURRENT MEASUREMENT NEAR OUTFALLS

During 1985-86, staff oceanographer Terry Hendricks and other SCCWRP researchers continued to measure the properties of currents on the nearshore shelf and in submarine canyons. Observations were made in Santa Monica Canyon and in the vicinity of the White Point, Encina and Point Loma outfalls. These measurements have been used to provide information on the initial dilutions achieved by ocean outfalls, to estimate the transport, dispersion and sedimentation of effluent constituents, and to provide supporting data for other studies.

CURRENT METER VALIDATION

Using a tow channel, the researchers made calibration studies of a tiltmeter-type current meter of SCCWRP design. Threshold speed, accuracy and dynamic range of the instrument were found to be well adapted to the local subsurface ocean environment. However, the use of the meters in a dynamically changing environment has been questioned because they record instantaneous velocities rather than average velocities at 15 minute intervals.

To address this question, Hendricks compared the performance of SCCWRP's current meter with that of a current meter of different design during simultaneous deployment in January-February 1985. This season is characterized by enhanced swell generated by North Pacific winter storms, and so the deployment provided a test of dynamic conditions more severe than is usually encountered in SCCWRP studies. Currents were recorded in the White Point outfall area 250 meters upcoast from a mooring that was part of a study carried out by Dr. Alan Bratkovich of the University of Southern California. His mooring contained an EG&G Sea Link Systems Model 630 "vector measuring current meter" at 14 meters depth in 54 meters of water; the SCCWRP meter was at a depth of 12 meters in 52 meters of water. This is shallower than the depths of the wastefields usually monitored by SCCWRP; however, the deployment provided an opportunity to test the meter under the increased influence of surface gravity wave-induced currents.

A portion of the longshore components of the current meter records collected at the two moorings are shown in Figures 1a and 1b. The two records are remarkably similar, except around January 17-18, when the largest swell of the winter swept through the area. During this period, the record collected by the SCCWRP meter was characterized by erratic fluctuations, as might be expected by sampling at 15 minute intervals in the presence of swell with 10-20 second period.

Figure 1c shows the same components after averaging the SCCWRP data over three-hour periods. It indicates that the gross properties of the flow are still resolved by the SCCWRP meter — even though there is some error in the speeds. The corresponding plots for the cross-shore components are shown in Figures 1d, 1e and 1f. These results indicate that the SCCWRP meters should provide an accurate record of currents at the depths typically involved in outfall studies and that periods of suspect data can be recognized by the presence of erratic fluctuations.

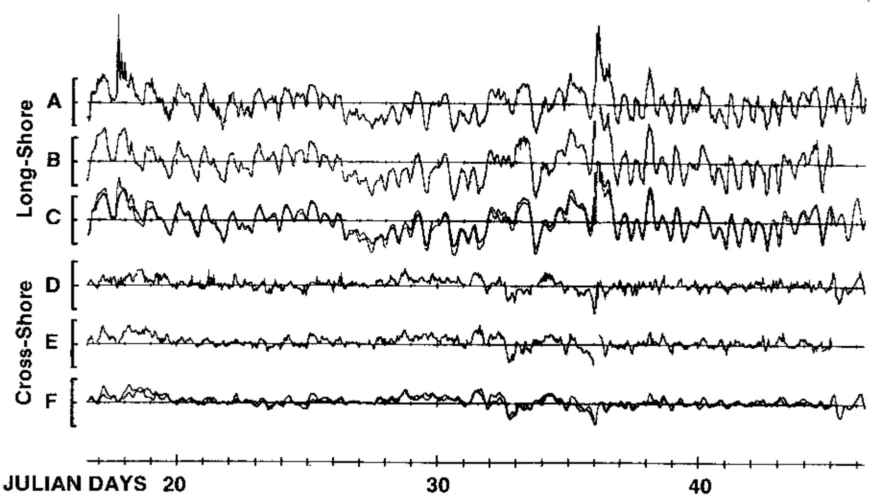

Figure 1. Inclinometer Intercomparison with a Vector-Measuring Current Meter Vertical "tick" marks indicate + 15 cm/sec (Positive values correspond to upcoast or onshore) Horizontal "ticks" indicate the start of a new "Julian" Day (1985). A = Inclinometer; B = VMCM; C = Low-pass filtered components - both meters; D = Inclinometer; E = VMCM; F = Low-pass filtered components - both meters.

LONGSHORE AND CROSS-SHORE CORRELATIONS IN THE CURRENTS

Both the longshore and cross-shore velocities are highly correlated over a longshore distance of at least 1/4 kilometer (Figure 1). Previous studies by SCCWRP and others have shown that slowly-varying fluctuations in the longshore component of the flow are generally correlated over distances of 10-30 kilometers, so this correlation between the longshore components of the velocities at White Point was not surprising.

Similar correlations were also seen at Point Loma and Encina. For example, the slowly varying fluctuations in the longshore component of the flow at three stations with a total separation of 5 kilometers near the Encina outfall were highly correlated (Figure 2a). The meters were located at 16 meters depth in 46 meters of water; samples were collected during August-September 1986. The correlation is immediately evident to the eye, and the computed value of the square of the correlation coefficient between the two end meters is 0.88 ($r = 0.94$). Since longshore transport is dominated by both the net current and these slowly varying fluctuations, longshore transport can be estimated with reasonable accuracy.

Cross-shore motions were somewhat different. They are highly correlated at longshore separations of 1/4 kilometer (Figures 1d, 1e, and 1f) but have low correlation at separations of from three to five kilometers; the square of the correlation coefficient is 0.16 ($r = 0.40$) (Figure 2b). This suggests that it would be difficult to directly estimate cross-shore exchange over longshore distances longer than the 1/4 to three kilometer range.

Similar results — high correlations of longshore motions, low correlation for cross-shore motions — are observed for moorings positioned along a cross-shore transect. Figures 3a and 3b show the slowly varying longshore and cross-shore components of the flow in the Encina area at a cross-shore separation of 0.8 kilometers. The square of the longshore correlation coefficient is 0.90 (inshore lag of 1.5 hours); for the cross-shore component, the value is 0.09.

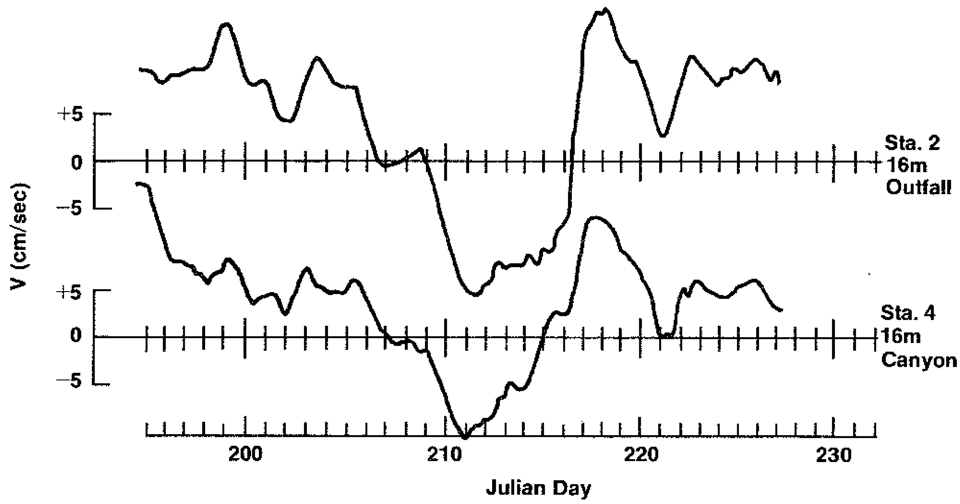

Figure 2a. Midwater Long-shore Currents, Encina, 7/13 - 8/15/86 (24.75 hr. low-pass filter) (+ = Upcoast − = Downcoast)

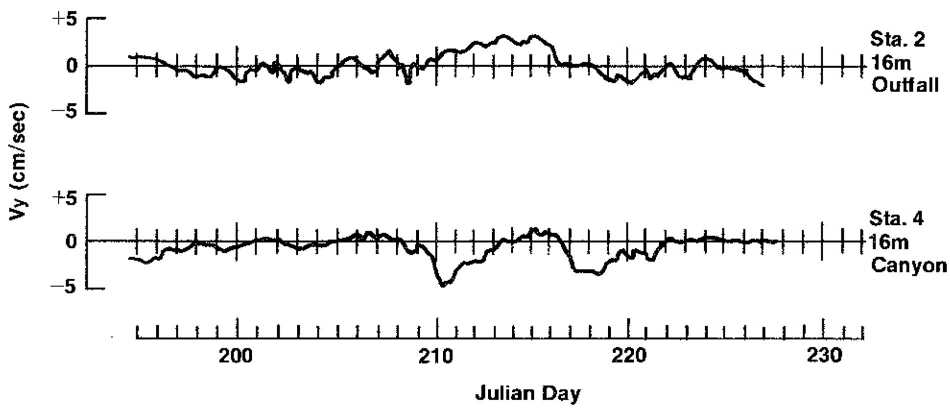

Figure 2b. Cross-shore Component of the Currents, Encina, 7/13 - 8/15/86 (+ = Onshore − = Offshore)

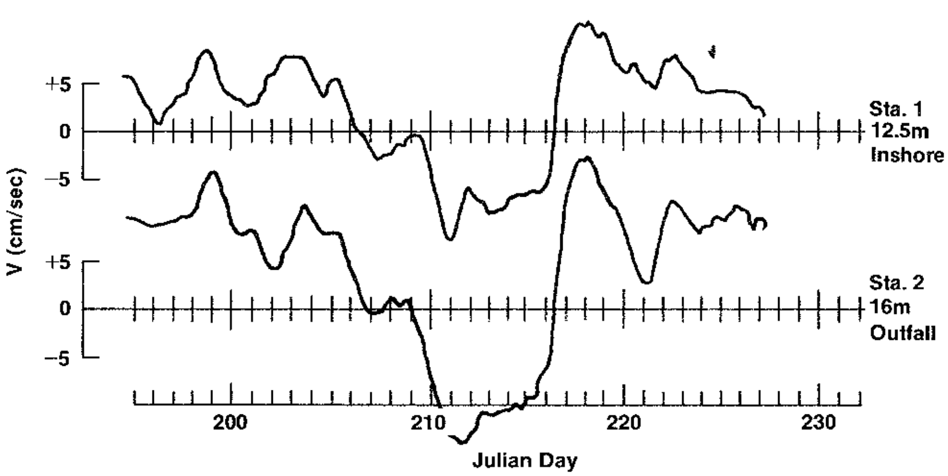

Figure 3a. Midwater Longshore Currents, Encina, 7/13 - 8/15/86 (24.75 hr. low-pass filter) (+ = Upcoast − = Downcoast)

The same situation holds for vertically separated current meters on the same mooring. For meters at a depth of 20 meters and 40 meters (below the pycnocline in 60 meters of water) off Point Loma, the slowly varying component of the longshore flow was highly correlated (the square of the correlation coefficient is 0.79) while the corresponding components of cross-shore flow showed little correlation (maximum square of correlation coefficient is 0.13) at a lag of 12 hours.

These results indicate that it is difficult to adequately predict the cross-shore transport of wastewater materials except over very short distances. Since such transport can be important for wastewater discharge practices, additional studies of this transport and exchange will be an important element of SCCWRP's continuing studies of ocean currents.

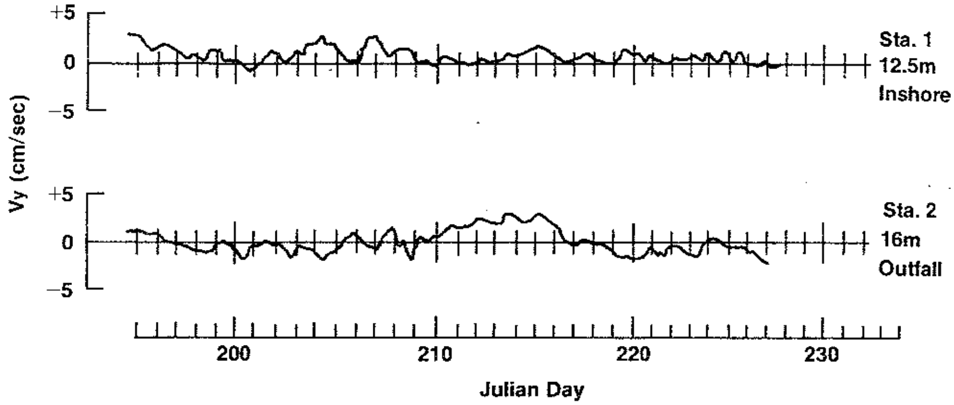

Figure 3b. Cross-shore Component of the Currents, Encina, 7/13 - 8/15/86 (+ = Onshore − = Offshore)