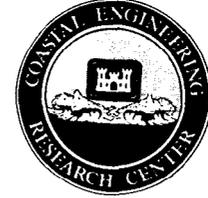




# Coastal Engineering Technical Note



## SURFACE CURRENT MEASUREMENTS USING A MICROWAVE SCATTEROMETER

PURPOSE : To present a method, utilizing microwave radar technology, for the remote measurement of mean surface currents from a fixed platform.

BACKGROUND: It has been demonstrated that ocean surface currents can be measured over areas of a few square meters using a microwave scatterometer system. This system consists of two small antennas, one each for transmitting and receiving, and the associated electronics, housed in a compact, portable package that can be readily transported to any site. It is easily installed and virtually maintenance free. Output is in the form of an analog voltage which is proportional to the line-of-sight, mean surface current. A strip chart recorder can be used to provide a hard-copy printout.

This technique was employed from the Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) pier during the Atlantic Remote Sensing Land Ocean Experiment (ARSLOE) to monitor longshore currents. The time-averaged, longshore current component measured by the scatterometer showed good agreement with currents measured by dye tracers (Keller et al., 1982).

METHOD: The two antennas are mounted on a fixed platform, such as a pier, jetty, breakwater or other structure, as shown in Figure 1. The height of the system above the water surface can vary from a few meters to a few tens of meters, depending on microwave frequency. Depression angles can range from 30-60 deg, with 45 deg being the most convenient. The scheme depicted on the right side of the figure can be accomplished by rotating antennas or by deploying two systems.

When the system is activated, energy at a fixed frequency is transmitted by one antenna, backscattered from the rough ocean surface, and received by the other antenna. The returned signal contains information on processes of

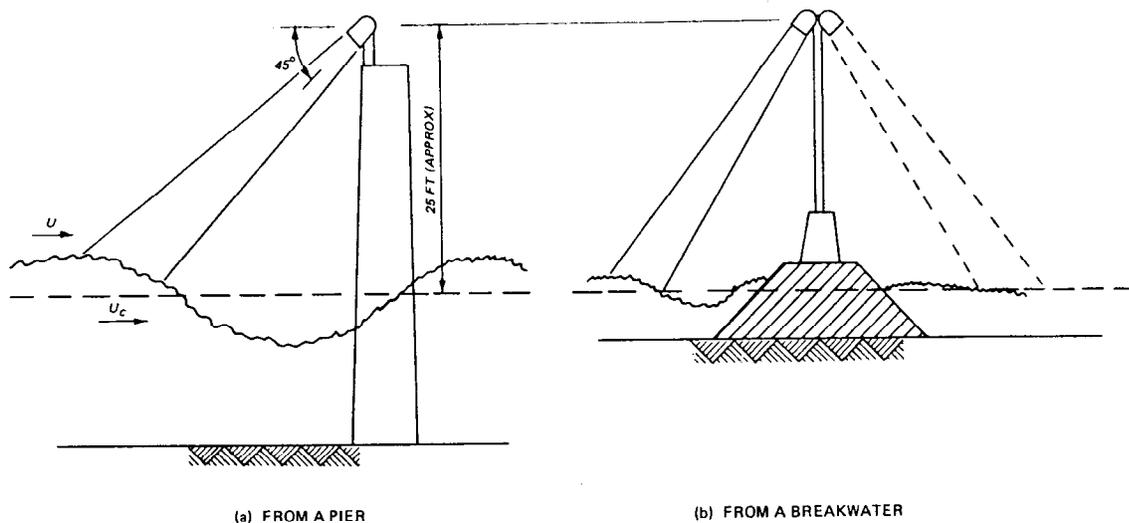


Figure 1. Schematic of Microwave Scatterometer used to Measure Surface Currents ( $U_c$ ) and Wave Orbital Velocities ( $U$ )

two different scales. Waves with lengths of a few centimeters are responsible for the backscattering. These short, small waves are modulated and advected by the larger, dominant wave system and by the mean surface drift. This advection causes a Doppler shift in the frequency spectrum of the returned signal that is proportional to the line-of-sight velocity. Averaging over a period of many dominant waves eliminates the large-wave orbital velocity contribution and results in a signal that is directly proportional to the mean surface current along the horizontal antenna-look direction. It is important to note that the current measured is only that horizontal component in the direction the antenna is looking. Thus, the system can be used to measure longshore surface currents with the antennas mounted on a pier and looking parallel to shore.

Furthermore, the system's ability to measure the large-wave orbital velocity components provides an indirect measure of wave height. For a given wave frequency, the wave height is proportional to the orbital velocity, so

that if the radar is mounted such that it is looking in the direction of the dominant wave, wave height information is available.

AVAILABILITY: The microwave scatterometer system was developed by the Naval Research Laboratory (NRL) and has been used primarily by NRL in a research mode. The US Army Engineer Waterways Experiment Station, CERC, is currently pursuing the design and purchase, from NRL, of a compact microwave system to monitor both nearshore surface currents and wave orbital velocities. After a short demonstration period, the system is expected to be available for district needs by 1986.

ADDITIONAL INFORMATION: For further information, contact Mr. David Driver, Coastal Oceanography Branch (WESCR-0), at (601)634-3040 (FTS 542-3040) directly.

REFERENCE:

*KELLER, W. C., PLANT, W. J., and JOHNSON, J. W., "Microwave Measurement of Sea Surface Velocities from Pier and Aircraft," Ocean '82 Conference Record, IEEE, Publ. No. 0197-7385/82, 1982, pp. 909-913.*