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Coastal Engineering Technical Note

COMPUTER PROGRAM: RCPWAVE

PROGRAM PURPOSE: RCPWAVE is a numerical model for estimating the characteristics of waves as they propagate over arbitrary bathymetry.

BACKGROUND INFORMATION: The model simulates the propagation of linear, monochromatic waves by solving finite difference approximations of the model's governing equations at each grid cell of a mesh encompassing the area of interest. The equations represent the following aspects of linear wave theory: refraction, shoaling, diffraction due to very irregular bathymetry, and wave breaking. The model of Dally, Dean and Dalrymple (1984) is used to compute wave heights in the surf zone.

PROGRAM APPLICATION: The RCPWAVE model is typically applied in the following manner. An area of interest is defined and a Cartesian coordinate system is defined with the x-direction pointing in an offshore direction and the y-direction in an alongshore direction. A system of rectangular grid cells which encompasses the area is established by choosing constant grid cell dimensions in both coordinate directions which adequately resolve the bottom variations. Bottom bathymetry at the center of each grid cell must be digitized (usually from bathymetric charts) and entered into a disk file on computer. A second disk file is constructed; it contains the remaining input data which specify deep water wave parameters, grid cell dimensions, the number of grid cells, and parameters controlling the volume of printed output. Output is in the form of two-dimensional arrays of water depth, wave height, wave angle, wave length, and a breaker index which defines those cells where wave breaking is occurring.

PROGRAM ADVANTAGES AND DISADVANTAGES: The program is very inexpensive to apply. Presently, the simulation of one wave condition costs approximately four to five dollars on its host computer, the Control Data Corporation's (CDC) Cybernet system. The program requires very little input. The difficulty lies in selecting a grid system and digitizing the water depth data. Diffractive effects in the governing equations preclude the formation of caustics (wave ray crossing) and the necessity of having to interpret results at caustic locations. This is a problem with conventional wave ray propagation methods.

The program only treats monochromatic wave propagation using linear theory. A spectral representation of the wave climate is assumed to be

reasonably well simulated using a significant wave approach (use of the significant height, peak spectral period, and mean direction). The program cannot treat the effects of structures and therefore is limited to open coast applications or applications of a large scale where structural effects are not important.

ADDITIONAL INFORMATION: Program documentation and a user's manual are contained in WES Technical Report CERC-86-4 (Ebersole, Cialone, and Prater (1986)). Technical questions concerning application of the model can be directed to Bruce Ebersole, at (601) 634-3209, Bruce.A.Ebersole@erdc.usace.army.mil.

REFERENCES:

Dally, W. R ., Dean, R. G., and Dalrymple, R. A. 1984. "Modeling Wave Transformation in the Surf Zone," Miscellaneous Paper CERC-84-8, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Ebersole, B. A., Cialone, M. A., and Prater, M. D. 1986. "Regional Coastal Numerical Modeling System 1: RCPWAVE -- A Linear Wave Propagation Engineering Use," Technical Report CERC-86-4, U.S. Army Engineer Watersways Experiment Station, Vicksburg, MS.