



# Coastal Engineering Technical Note



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## MICROCOMPUTER APPLICATIONS FOR COASTAL ENGINEERING (MACE)

**PURPOSE:** This note discusses a series of microcomputer programs available at the Coastal Engineering Research Center that can be used in the practice of coastal engineering.

**MACE CONTENTS:** Microcomputer Applications for Coastal Engineering (MACE) is a collection of self contained microcomputer programs that perform tasks common to many coastal engineering projects of the Corps of Engineers.

MACE programs may be placed in one of the following categories

1. Tide elevation and current estimates
  - A. TIDEHT - Tidal elevation estimates
  - B. TIDEC - Tidal current estimates
2. Statistical analyses for derivation of design criteria
  - A. WAVDIST1 - Extremal significant wave height distribution (least squares fit)
  - B. WAVDIST2 - Extremal significant wave height distribution (method of moments)
  - C. FWAVOCUR - Frequency of wave occurrence
3. Volumetric estimates
  - A. DUNE - Estimation of storm induced dune erosion
4. Cost-effective optimization
  - A. BWCOMP - Comparison of breakwater volumes and costs
  - B. BWLOSS1 - Estimation of economic losses as a function of wave height
  - C. BWLOSS2 - Estimation of economic losses from transmitted waves
  - D. BWDAMAGE - Estimation of long-term damage to rubblemound breakwaters
5. Wave forecasting
  - A. HURWAVES - Hurricane wave parameters

Other microcomputer programs previously included in MACE but now incorporated into the Automated Coastal Engineering System (ACES) (CETN-VI-20, March 1988) include HUDSON, WIND, SHALWAVE, SINWAVES, JONSWAP, WAVFLOOD, WAVTRANS, WAVRUNUP, TOEPRO, and QOVERTOP.

DESCRIPTION OF MACE APPLICATIONS: A brief description of each program follows.

TIDEHT - This program estimates the elevation of the water surface at any time or the time at increments of elevation based on the predictions of the National Oceanic and Atmospheric Administration (NOAA) "Tide Tables."

TIDEC - This program estimates the tidal current speed at any time based on the predictions of the National Oceanic and Atmospheric Administration (NOAA) "Tidal Current Tables."

BWCOMP - This program calculates breakwater volumes and costs, demonstrating the effect of varying breakwater slopes on wave transmission, the choice of armor size and shape, and overall volume.

HURWAVES - This program estimates the maximum gradient windspeed, the maximum sustained windspeed, the maximum significant wave height, and the maximum significant wave period for slow-moving hurricanes.

BWLOSS1 - This program is intended to aid planners of coastal structures which provide protection from wave attack by deriving an empirical mathematical expression relating economic losses from wave effects to the responsible significant wave height. These losses include the property damage or inefficiencies in a port operation which the structure is intended to reduce or prevent. The program optionally provides an estimate of expected annual economic losses due to wave attack, given the parameters of the long-term (extremal) cumulative probability distribution of significant wave heights. The detailed technical basis for application of BWLOSS1 in a breakwater optimization process is presented by Smith (1986).

BWLOSS2 - This program fits a long-term cumulative probability distribution to transmitted wave height data and estimates expected annual economic losses due to wave attack after a protective breakwater has been built. The program is intended to aid in the definition of incremental economic benefits attributable to a breakwater design, not to estimate potential damages to the breakwater itself. The detailed technical basis for application of BWLOSS2 in a systematic optimization procedure for design of rubble-mound breakwater cross section is discussed by Smith (1986).

WAVDIST1 - This program estimates the parameters of three commonly applied probability distributions (Extremal Type I, Weibull, and Log-Extremal) used in the prediction of extreme wave conditions. The program assumes that all the wave height properties of a storm sea can be represented by the significant or spectrally based (zero moment) wave height. Extremes are typically defined as those events in which the peak conditions of the storm exceed a subjectively set threshold. It is suggested that this threshold be set to yield an annual average number of extreme events of one or more. A discussion on the confidence of predicted extreme values is given in CETN-I-5 (1985). WAVDIST1 computes the parameters for each distribution by a least squares fit.

WAVDIST2 - This program is an alternate version of WAVDIST1 that estimates the parameters by the method of moments.

BWDAMAGE - This program estimates the expected damage and life cycle costs of related maintenance and repairs of a rubblemound breakwater. A comprehensive discussion of this method is found in Smith (1986).

DUNE - This program predicts storm induced dune erosion given an initial profile shape, storm surge level, sediment size, and a wave height. The results of this program can be used to estimate the impact of a particular storm on a dune profile and as an aid in the design of beach and dune construction projects.

FWAVOCUR - This program determines how frequently a certain wave might occur. FWAVOCUR calculates a non-encounter probability for a given wave height over time.

AVAILABILITY: The MACE library is contained on three double-sided double-density diskettes or one high-density diskette and may be obtained from Ms. Gloria J. Naylor at (601) 634-2581 of the Engineering Computer Programs Library Section, Technical Information Center, US Army Engineer Waterways Experiment Station, PO Box 631, Vicksburg, Mississippi 39180-0631.

ADDITIONAL INFORMATION: Individual Coastal Engineering Technical Notes describing MACE programs are being removed from the Technical Notebook. Documentation for the remaining MACE program is still available. Documentation requests and questions concerning the application of MACE programs can be directed to Mr. Doyle L. Jones at (601) 634-2069 of the Coastal Engineering Research Center's Coastal Design Branch.

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