Coastal Engineering Technical Note

COMPUTER PROGRAMS - STORM SURGE

PURPOSE: The purpose of these computer programs is to calculate the water level and vertically averaged current velocity in a coastal area subject to flooding from hurricanes.

PROGRAM DESCRIPTION: Three computer programs are available at CERC to treat storm surge problems. They are referred to as TWO-D-SURGE, SURGE III and SYSTEM 21. The TWO-D-SURGE and SYSTEM 21 (see CETN-I-4) programs can be applied to the continental shelf and large coastal regions (hundreds of miles of coast) as well as smaller individual bay inlet systems as shown in the Figure.

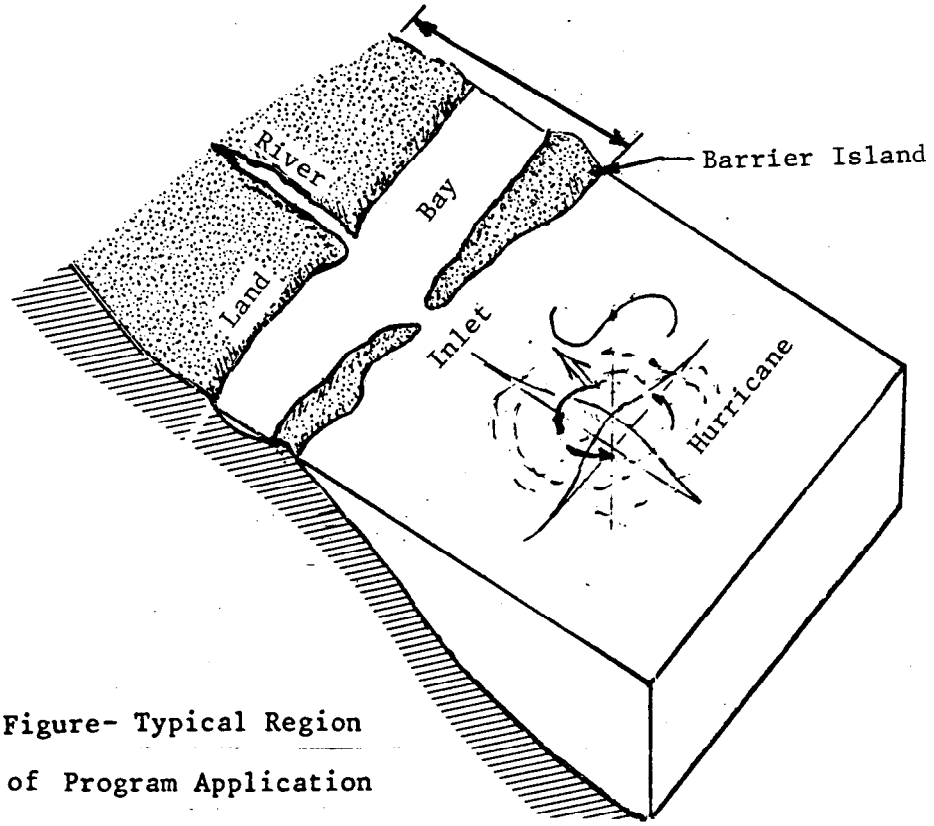

Figure- Typical Region of Program Application

The SURGE III program is applicable to smaller regions of nearshore area (about 100 miles in length) as well as bay inlet systems. Each of the programs allows water to flood and recede from the land. The TWO-D-SURGE and SURGE III programs contain routines to simulate hurricane winds. Hurricane parameters such as track, central pressure and radius to maximum wind are input variables so that various types of tropical storms can be simulated. The programs can also be applied to extratropical storms such as a northeaster if the wind and pressure fields are available. These storm surge programs are in general use in the Corps and have superseded the procedures used to estimate storm surges as discussed in the Shore Protection Manual, 1977.

PROGRAM APPLICATION: The programs can be applied to storm surge problems or tidal circulation problems or a combination of both. They can be used to hindcast historical events or used to predict conditions for hypothetical events. They can be used to determine design water levels and currents for storms and/or tides or used in cases where proposed man-made structures may induce changes in water levels and currents and need to be determined for design evaluation.

INPUT: The basic data needed to run the models are:

1. Bathymetry and topography at each grid cell over the region of interest (see CETN I-a "Tides and Tidal Datums").

2. Data on features present in the region which would affect the distribution of flood waters, such as rivers or channels (location, depth, width, and bottom friction in each reach), and barriers (location, height, frictional coefficient).

3. Tidal height as a function of time on the boundary of the region. Parameters describing a tropical storm such as location, radius to maximum wind and pressure drop all as a function of time, which are used to calculate the wind velocities at each grid cell.

4. Miscellaneous constants such as cell size, time step, number of channels, barriers, grid cells, etc.

OUTPUT: The output of the models consist of:

1. The time history of water level and current speed and direction for each wetted grid cell in the region and each channel reach if channels are included.

2. The highest and lowest water levels in each cell during the simulation.

3. The time history of wind speed and direction at each grid cell.

4. The value of input parameters associated with each cell in the region.

PROGRAM AVAILABILITY: The programs are available at the U.S. Army Engineer Waterways Experiment Station's Coastal Engineering Research Center, P.O. Box 631, Vicksburg, Mississippi 39180-0631 (601) 634-2027

. The contact is the Coastal Oceanography Branch, WESCR-O. Because of their complexity, it is recommended that the programs be applied by one of the Corps experts on storm surge problems.

REFERENCES:

U.S. ARMY CORPS OF ENGINEERS, COASTAL ENGINEERING RESEARCH CENTER, Shore Protection Manual, 4th ed., U.S. Government Printing Office, Washington, D.C., 1984.

U. S. ARMY CORPS OF ENGINEERS, COASTAL ENGINEERING RESEARCH CENTER, "Computer Program: S21-Coastal Water Level Variations and Flows," CETN-I-4, Vicksburg, MS, 1981.