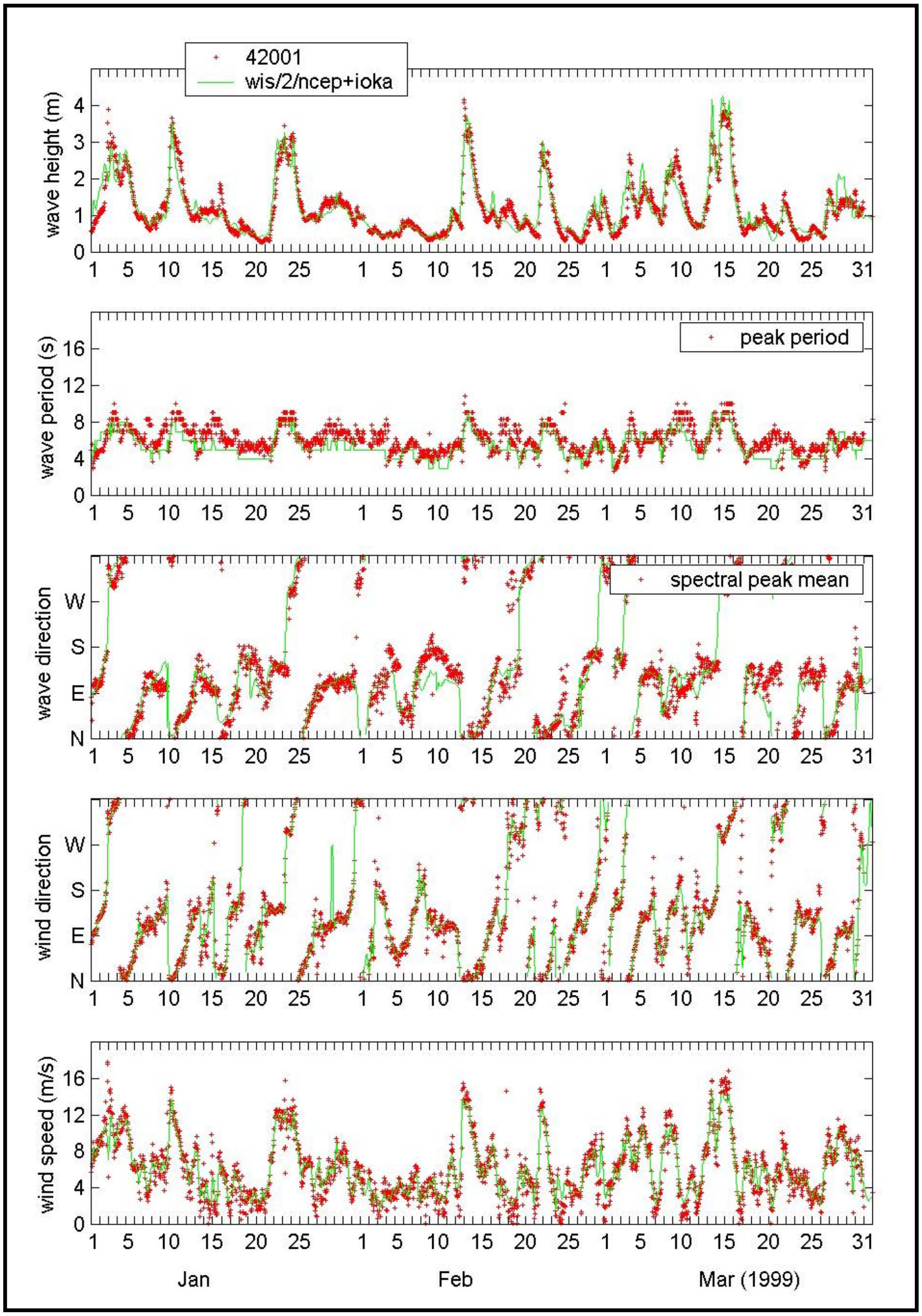

Figure 43. Comparision of the time series of WIS L2 output (solid lines) and NDCB Buoy 42001 data (+) in the period of January to March 1999

site. It also gave an opportunity to compare the hindcast information with the actual local wave gage records.

Wave model and grids. The CHL spectral wind-wave growth and propagation model STWAVE (STeady-state spectral WAVE) was chosen for wave transformation modeling in this study (Smith, Resio, and Zundel 1999 and

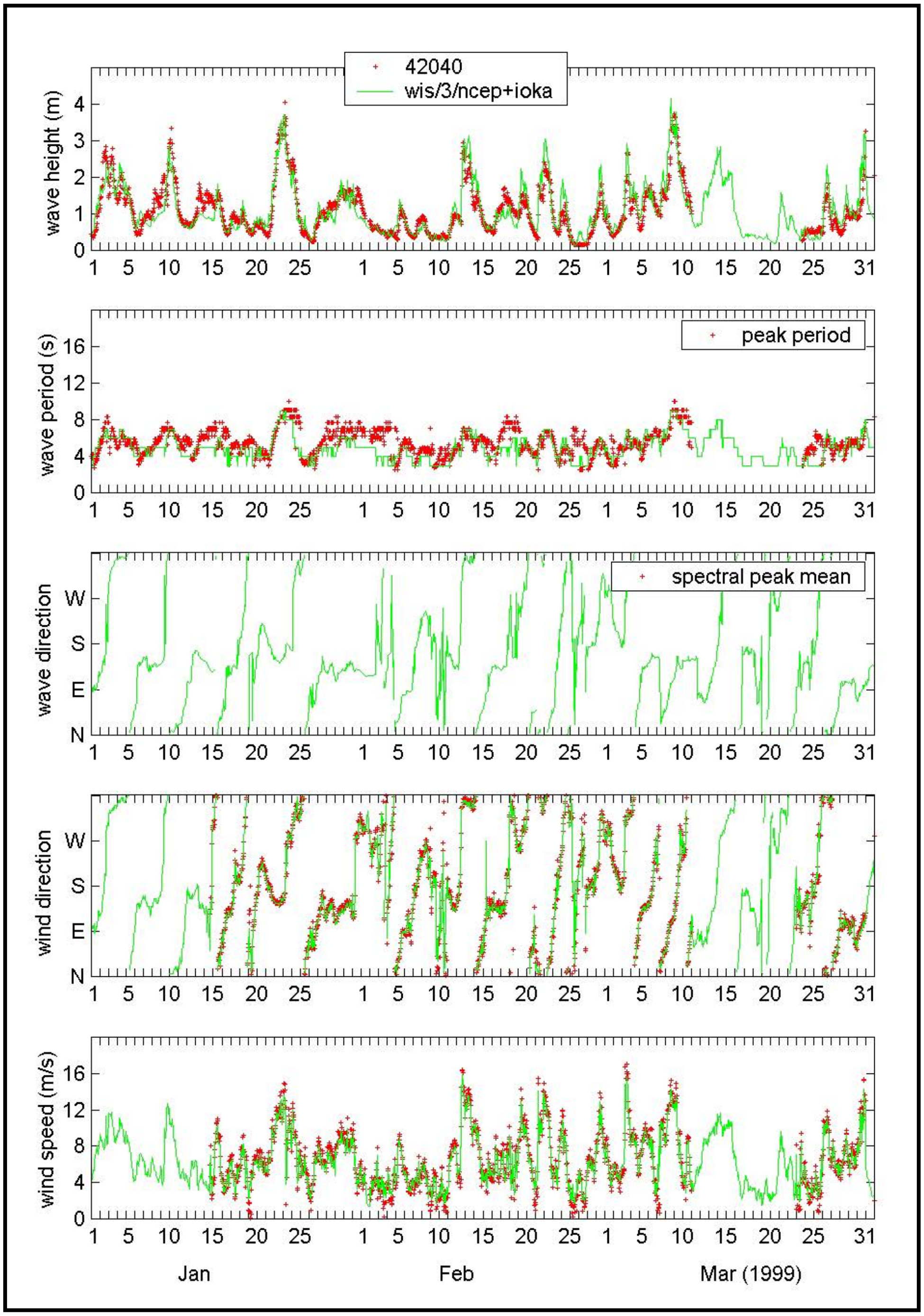

Figure 44. Comparison of time series of WIS L3 output (solid line) and NDCB Buoy 42040 data (+) for the period of January to March 1999

Appendix B). The spectral representation was expected to be advantageous for transforming waves around the complex bathymetry of Mobile Bay entrance.

An STWAVE grid was developed to include coastal bathymetry extending from a depth of about 21.3 m (70 ft) on the south boundary to Sand Island at the north boundary (Figure 53). The grid encompasses the disposal area of interest,

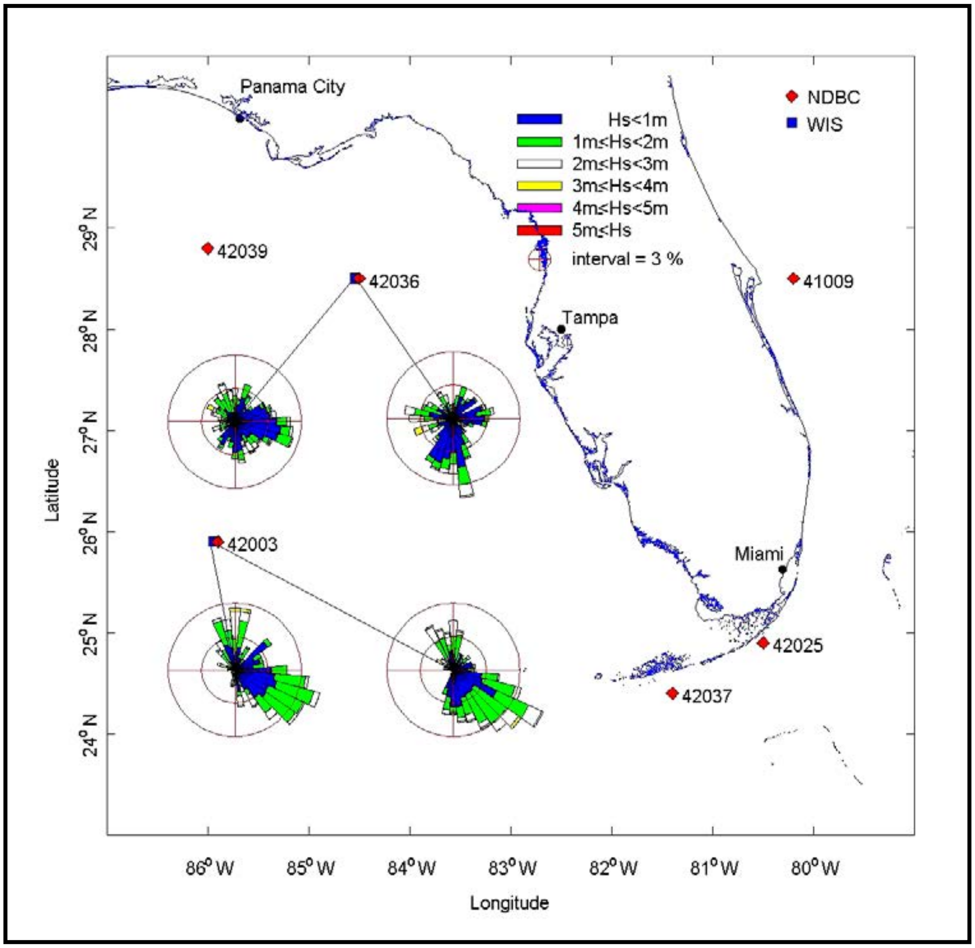

Figure 45. Comparison of model and measured wave roses at NDBC Buoy 42003 and 42036 locations for the period January to March 1999

another disposal area to the west, and the outer part of the dredged entrance channel to Mobile Bay. Wave transformation between offshore and the vicinity of the disposal area can be modeled with this grid. The STWAVE grid has a spatial resolution of 61 m (200 ft).

Offshore waves can approach the study area from a wide range of directions. To accommodate these incident directions, three versions of the STWAVE grid were prepared. They differ only in the designation of the seaward boundary. One has the seaward boundary facing east, one south, and one west. With these three grids, incident waves coming from about 40 deg azimuth to 320 deg azimuth can be modeled with reasonable accuracy.

Bathymetry data were taken from the NOAA National Ocean Service (NOS) digital bathymetric database Geophysical Data System for Hydrographic Survey Data. A bathymetry file was built to include the most recent survey coverage of all areas in the STWAVE grid domain. This file was supplemented in the disposal area by surveys taken during in October 1998. The digital bathymetry was input to the surface modeling system (Brigham Young University 1995) to build

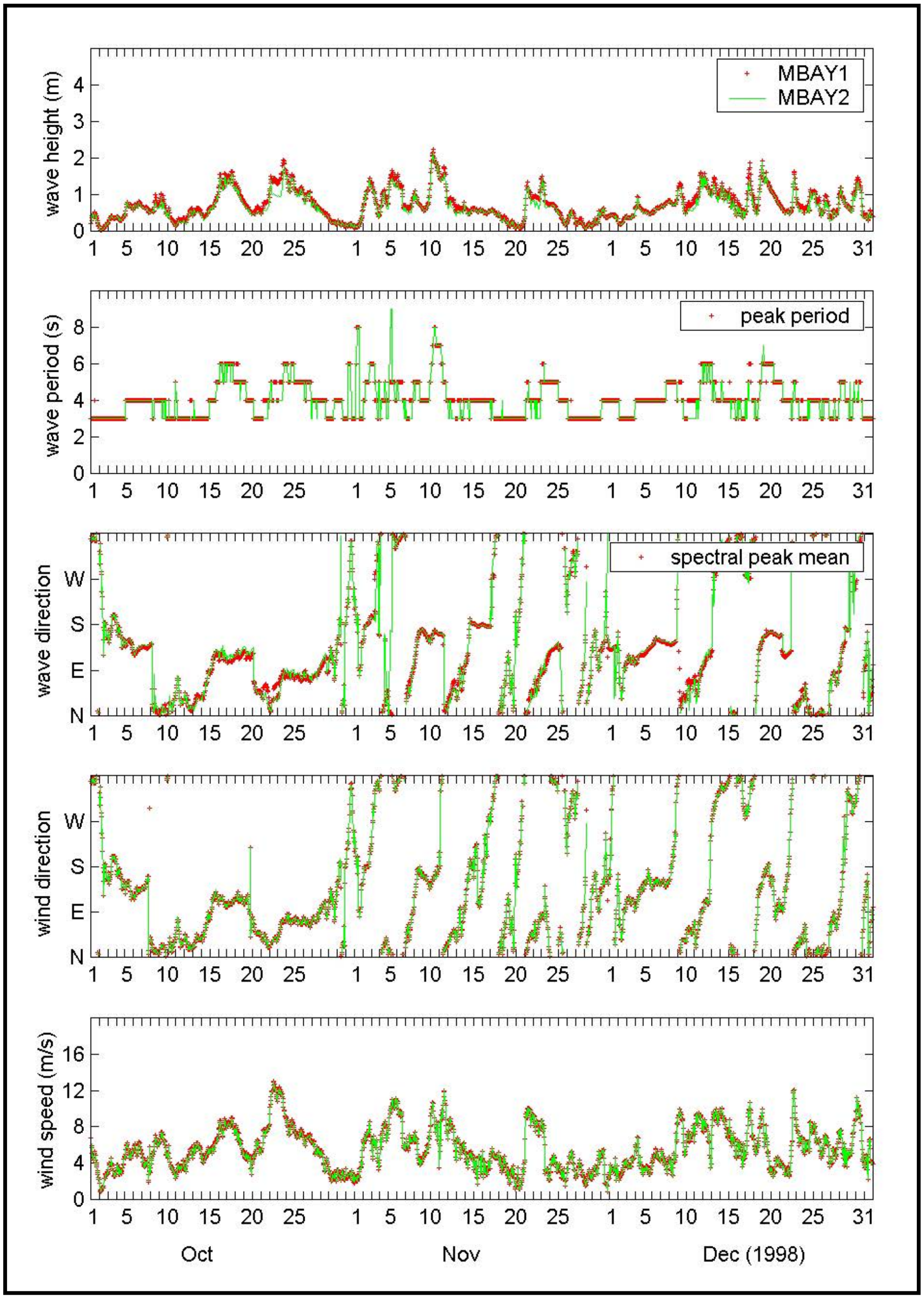

Figure 46. Time series of WIS L3 output at MBAY1 (+) and MBAY2 (solid line) for the period of October to December 1998

the uniform rectangular grids needed for STWAVE. Grids were built in a State Plane coordinate system. Specifications for the south-facing grid are given in Table 10.

Incident wave conditions. Incident WIS wave conditions at 19- and 12-m (62.34- and 30.37-ft) depth, and available analyses from the wave gage located

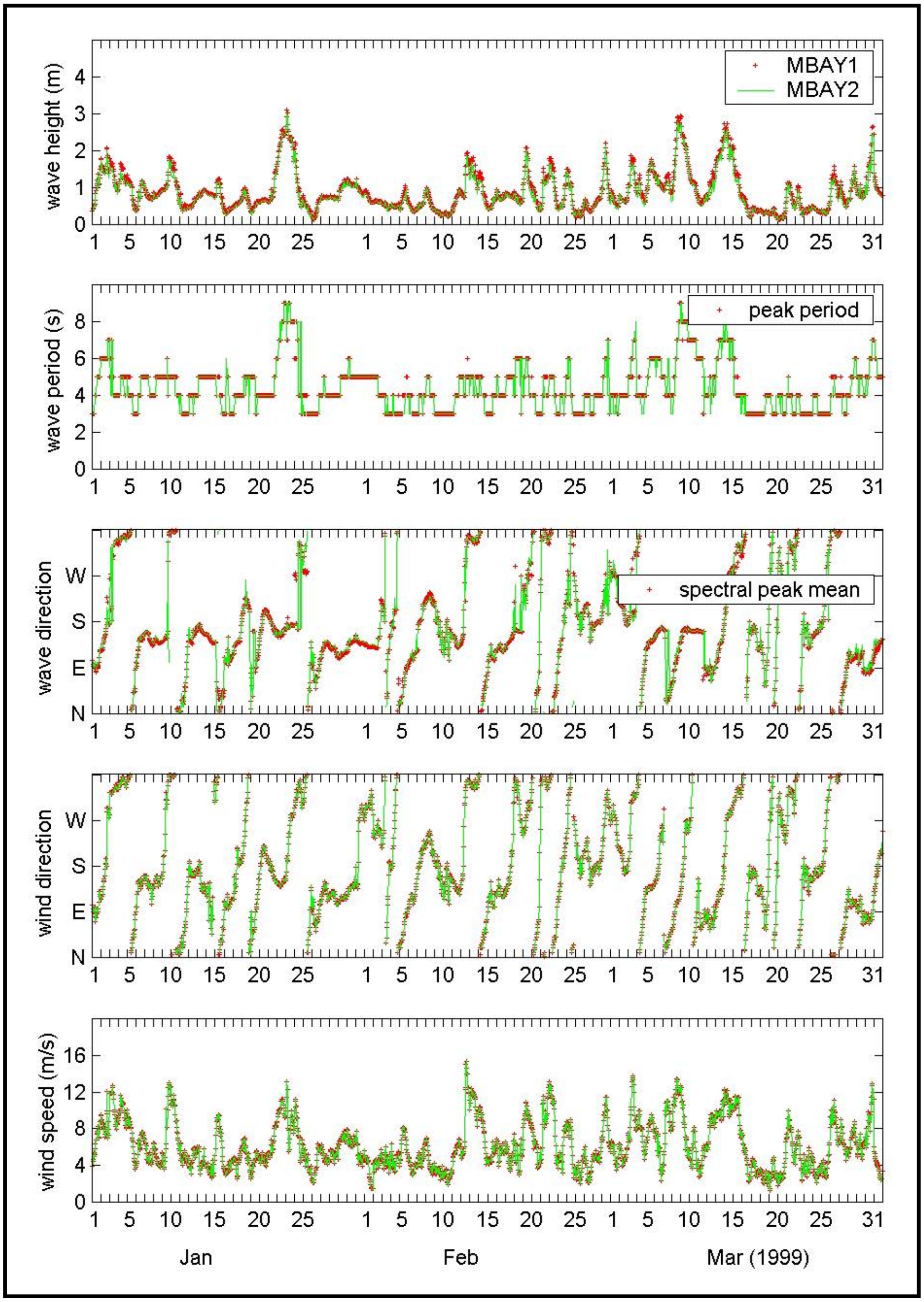

Figure 47. Time series of WIS L3 output at MBAY1 (+) and MBAY2 (solid line) for the period of January to March 1999

1.6 km (1 mile) west of the disposal area were reviewed to determine the range of significant wave height (*Hs*), peak spectral period (*Tp*), and dominant wave direction (θ*d*) characteristic to the area. Ranges determined for wave modeling were 0-2 m (0-6.56 ft) for *Hs*, 4-14 sec for *Tp*, and 40-320 deg azimuth for θ*d*. Ranges were modeled in intervals of 0.5 m (1.64 ft), 2 sec, and 10 deg. An

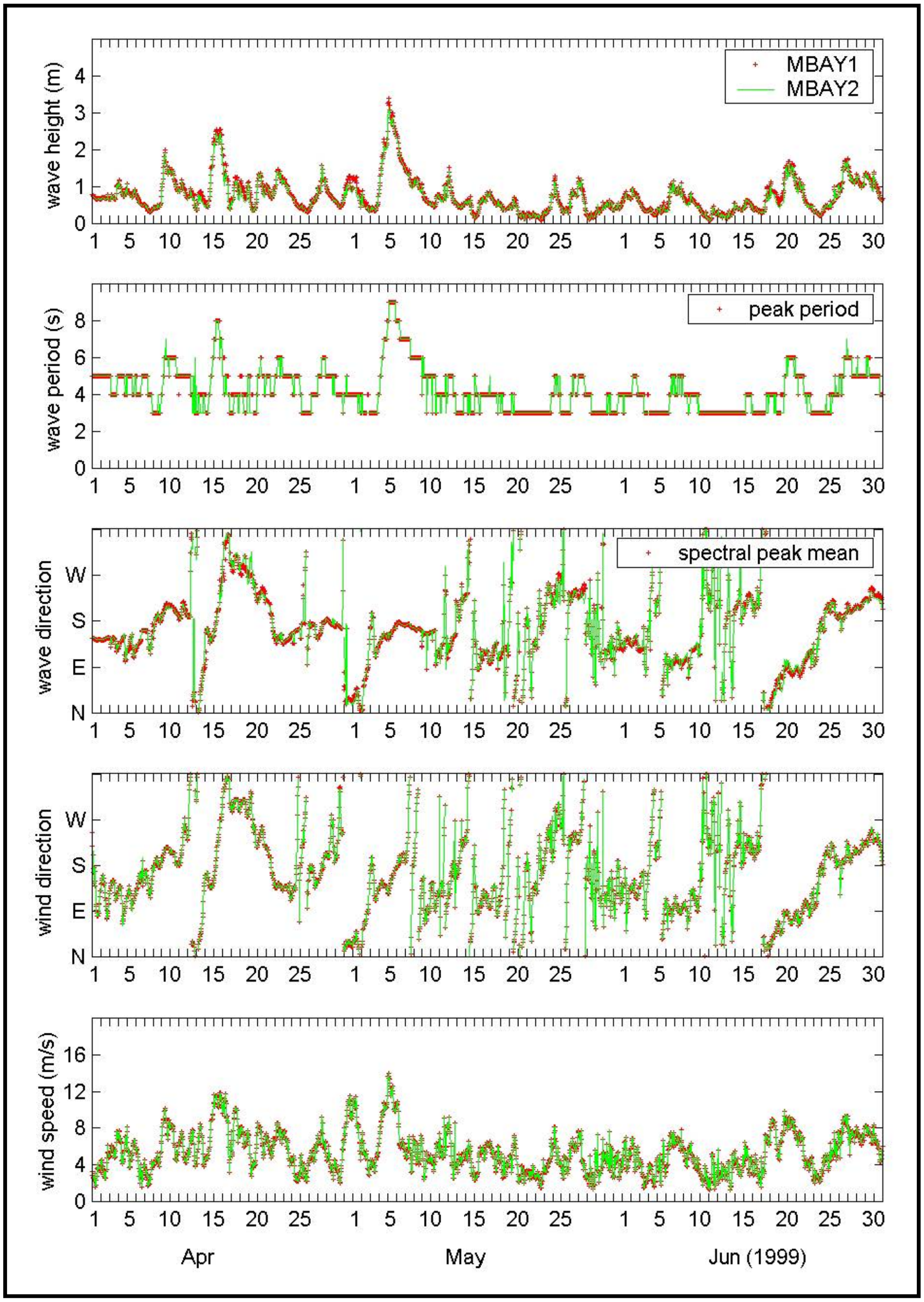

Figure 48. Time series of WIS L3 output at MBAY1 (+) and MBAY2 (solid line) for the period of April to June 1999

STWAVE run was done for each case, a total of (4 heights) × (6 periods) × (29 directions) = 696 cases.

Wave directions from 40-130 deg azimuth were modeled on the east-facing grid. Wave directions from 140-220 deg were run on the south-facing grid. Wave directions from 230-320 deg were run on the west-facing grid. This approach

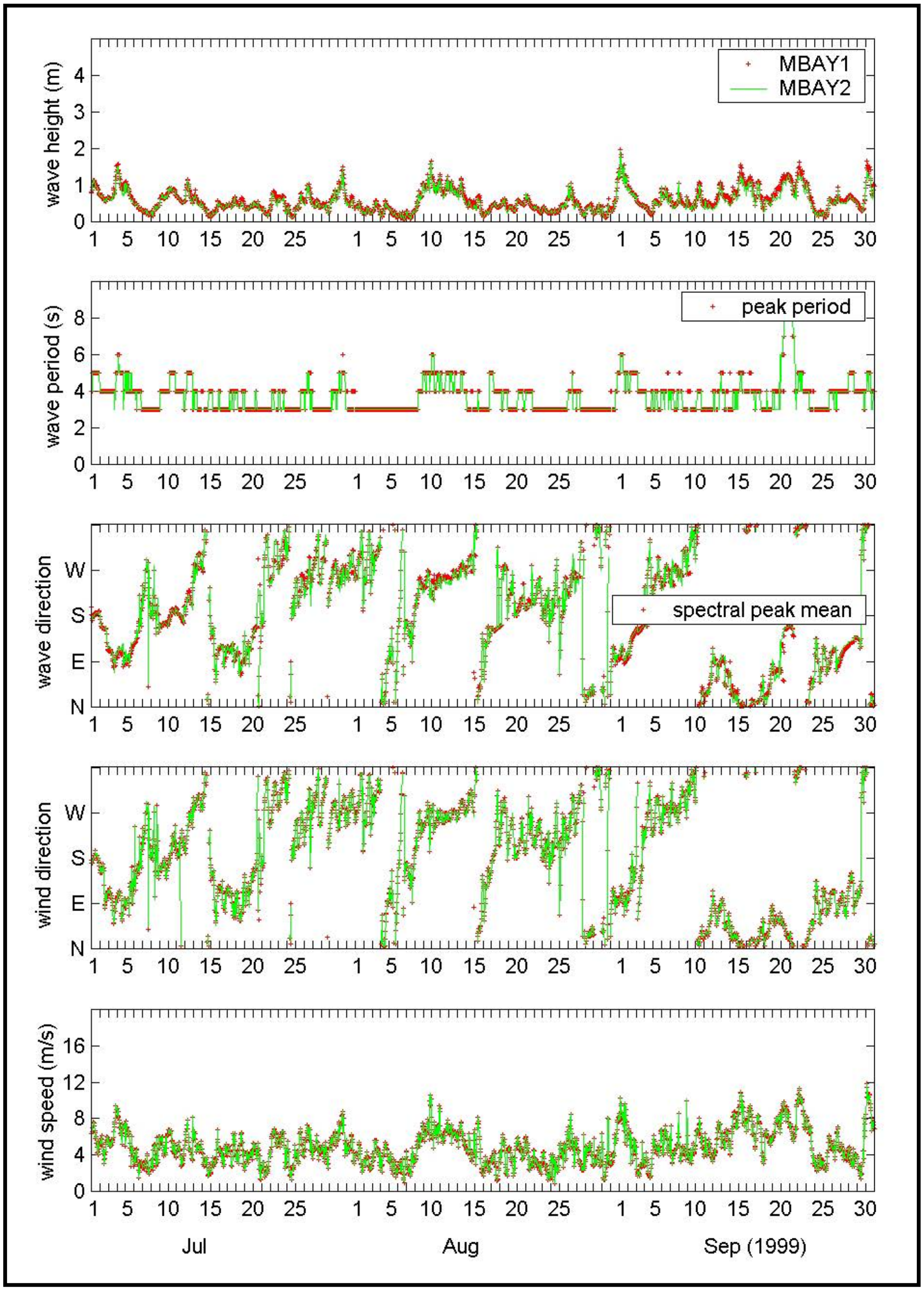

Figure 49. Time series of WIS L3 output at MBAY1 (+) and MBAY2 (solid line) for the period of July to September 1999

assured that waves in areas of interest inside the model domain were always within about 45 deg of perpendicular to the seaward boundary, an important model constraint.

For each STWAVE input height/period/direction combination, a stand alone version of the ACES 2.0 software code was used to generate a directional wave spectrum in water depth appropriate to the corresponding grid seaward boundary.

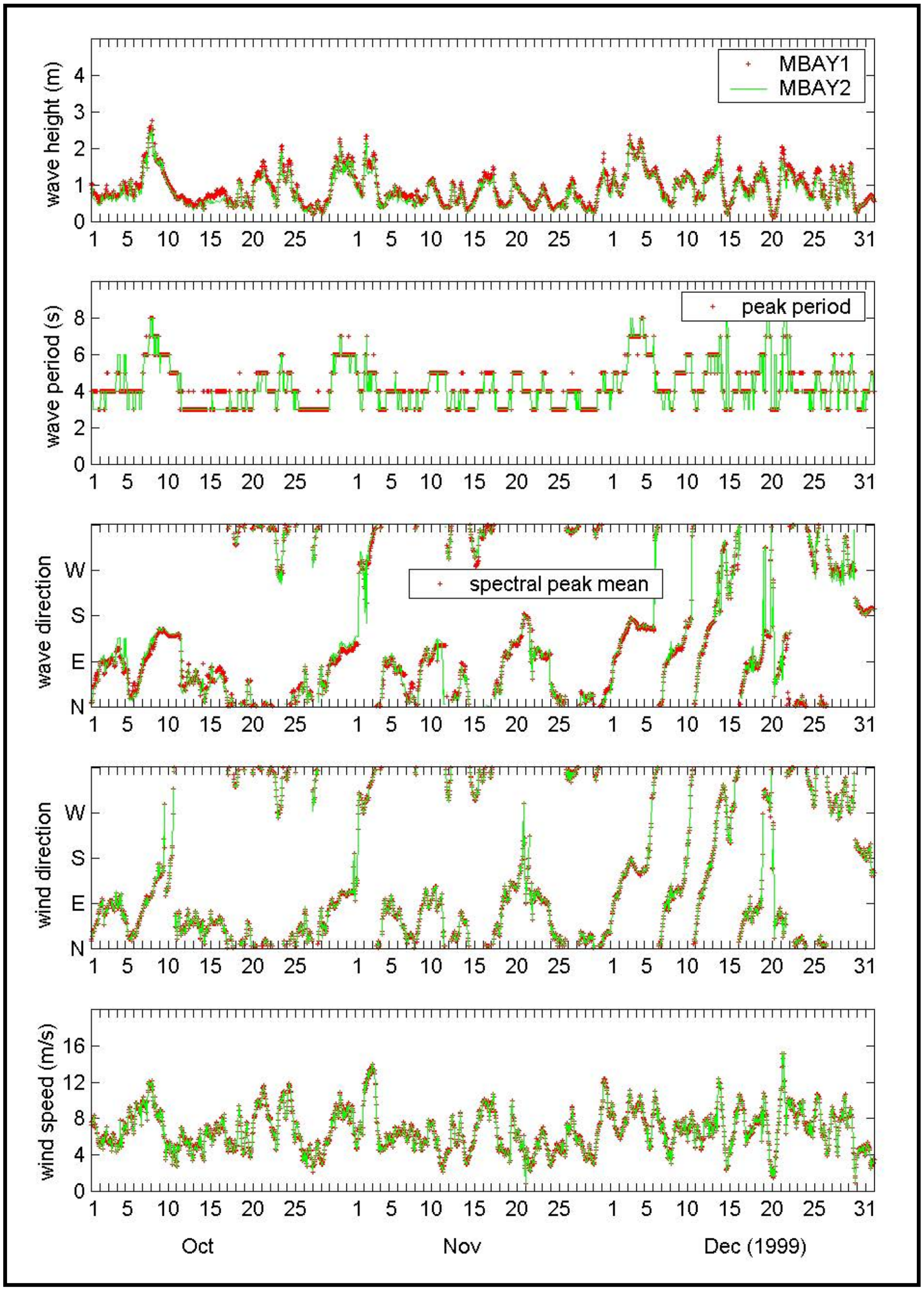

Figure 50. Time series of WIS L3 output at MBAY1 (+) and MBAY2 (solid line) for the period of October to December 1999

Seaward boundary depths were 2.3 m (70 ft) for the south-facing grid and 15.2 m (50 ft) for the east- and west-facing grids. Spectral frequencies ranged from 0.078 Hz to 0.312 Hz at 0.009 Hz intervals. A single water level was used in all simulations, representing mean sea level (2 m (0.6 ft) above the mlw datum).

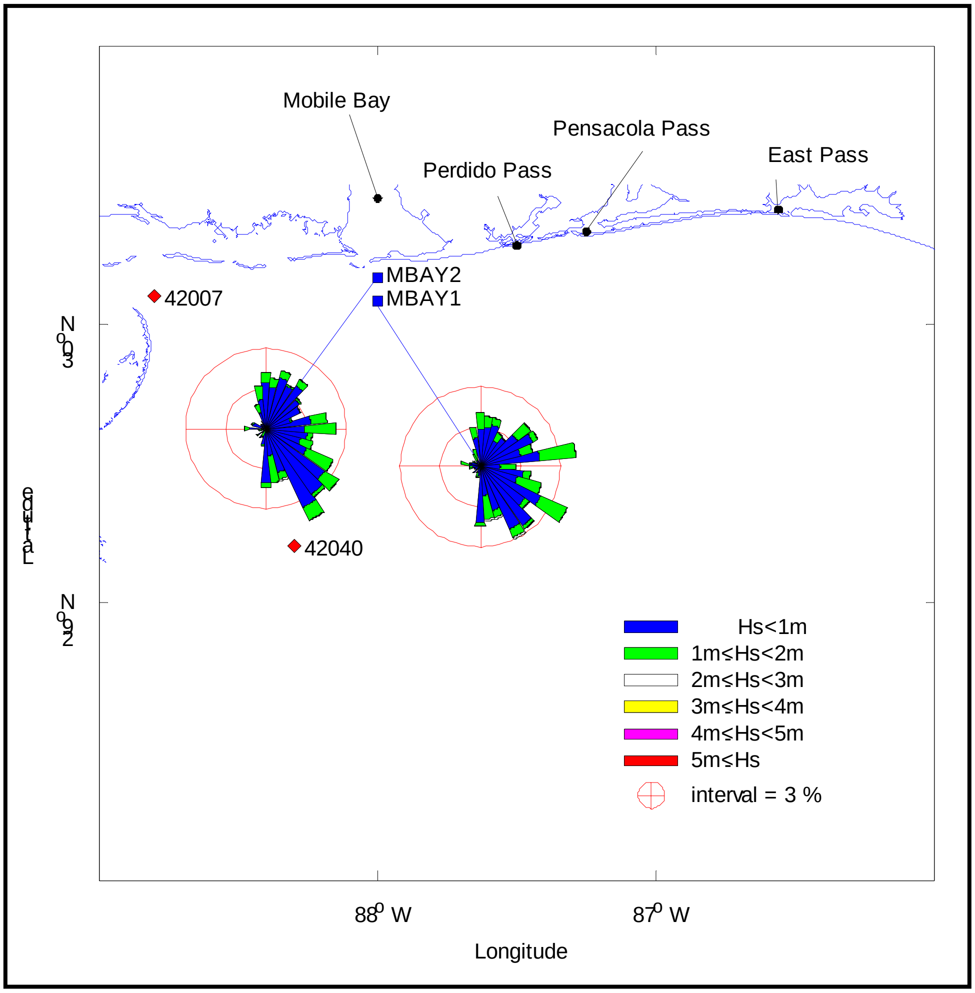

Figure 51. Wave rose diagrams at MBAY1 and MBAY2 locations for the period of October to December 1998

STWAVE output. The main output from STWAVE runs consists of arrays of significant wave height, peak period, and peak direction over the grid for each incident wave case. These relatively large files are useful for visualizing wave transformation over the grid. The height/period/direction information at selected stations in the grid is another, much more condensed output. Station output at five points relevant to the disposal mound is the primary STWAVE output in this particular study (Figure 54 and Table 11).

Time-history of waves at mound and gage locations

Transformation tables. Station results from STWAVE runs were grouped by station and written to a separate file for each station. These files provide transformation table information for converting any incident wave height, period and direction into a height, period, and direction at the station location.

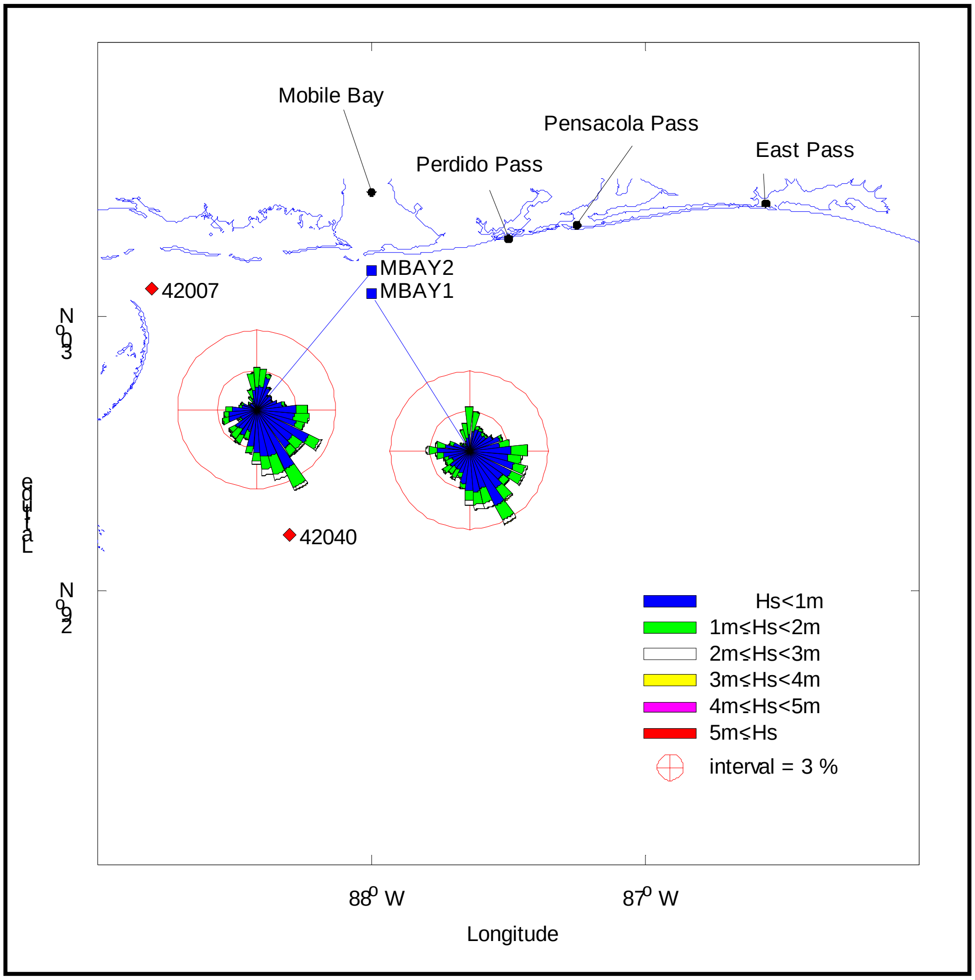

Figure 52. Wave rose diagrams at MBAY1 and MBAY2 locations for the period of January to December 1999

Station time-history calculation. A computer program was written to combine WIS incident wave information and transformation tables and create a wave time-history at each station. A significant amount of testing was involved in developing this program, to determine such issues as which WIS incident wave point to use and how to deal with incident waves from northerly directions. Procedures developed are also described in Appendix B. The possibility of using incident WIS spectra instead of generic spectra matching the WIS height/period/direction parameters was also considered by running STWAVE with WIS spectra for all cases with significant height greater than 1 m (3.28 ft) and for a large sample of cases with height between 0.5 and 1 m (1.64 and 3.28 ft). Although this approach is a more realistic representation of processes, it did not appear to warrant the considerable extra effort involved.

Wave transformation model results

Incident WIS information for the months October to December 1998 was processed to create wave time-histories at the five selected stations. Significant

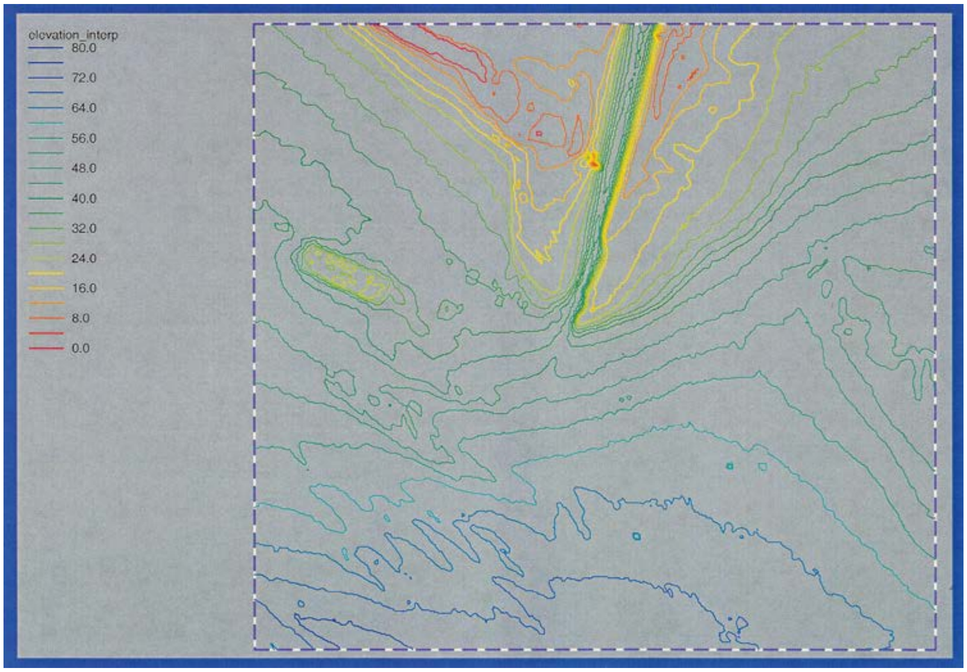

Figure 53. STWAVE grid (To convert feet to meters, multiply by 0.3048)

Table 10
Specifications for STWAVE South-Facing Grid

Parameter	Value
Cell size	200 ft[1]
Origin x	1,820,907 ft
Origin y	30,607 ft
Angle of rotation	90 deg
Length x	48,600 ft
Length y	52,800 ft
No. of I's (columns)	243
No. of J's (rows)	264

[1] To convert feet to meters, multiply by 0.3048.

wave height and direction results for the wave gage, mound center, and mound east stations are given in Appendix C. The WIS incident wave conditions are also shown.

Differences between station and incident conditions are generally small. The transformation table for the station at the disposal mound center was reviewed to give a perspective on which incident wave conditions are significantly modified during nearshore transformation. Changes of more than 10 percent in *Hs* and more than 10 deg in θd were considered significant. By these criteria, incident wave directions between 170 deg and 280 deg azimuth experienced only small

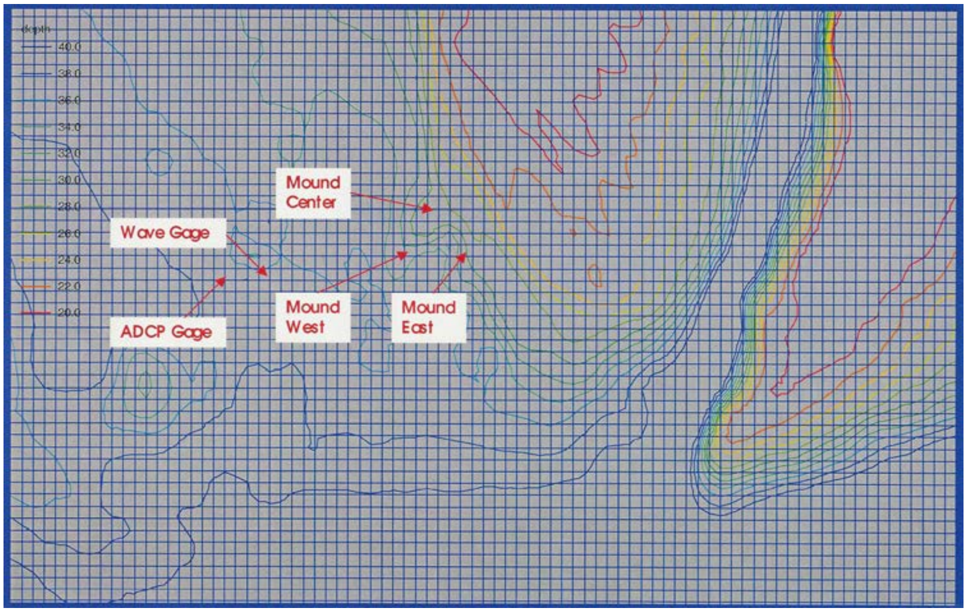

Figure 54. Location map of STWAVE output stations

Table 11
STWAVE Output Stations

Name	Description
Wave gage	Location of wave gage, 3,000[1] ft southwest of disposal mound
ADP gage	Location of Acoustic Doppler Current Profiler, 300 to 600 ft southwest of wave gage
Mound center	Center of disposal mound
Mound east	Point 600 ft east & 600 ft south of disposal mound
Mound west	Point 400 ft west & 600 ft south of disposal mound

[1] To convert feet to meters, multiply by 0.3048.

changes in transformation. Other incident wave directions were generally changed by more than 10 deg during transformation. Significant changes in *Hs* generally occurred for incident directions of 40-60 deg, 120-160 deg, and 300-320 deg azimuth. Changes were especially large for the most northerly directions. Although incident wave direction typically has the greatest impact on transformation, incident *Hs* and *Tp* also have an influence.

Since the predominant wave direction in this part of the Gulf of Mexico is from the southeast (90 to 180 deg), transformation of modeled waves was required to simulate the waves correctly over the mixed-sediment mound. Still, for the period of study, the wave climate was low and there was little modification to the mound geometry due to waves.