

THE EFFECTS OF HINDCASTED WAVES ON COASTAL STORM WATER LEVELS DURING THE BLIZZARD OF 2003

by

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Wave Hindcasting and Forecasting
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EFFECT OF WAVES ON WATER LEVELS OUTLINE

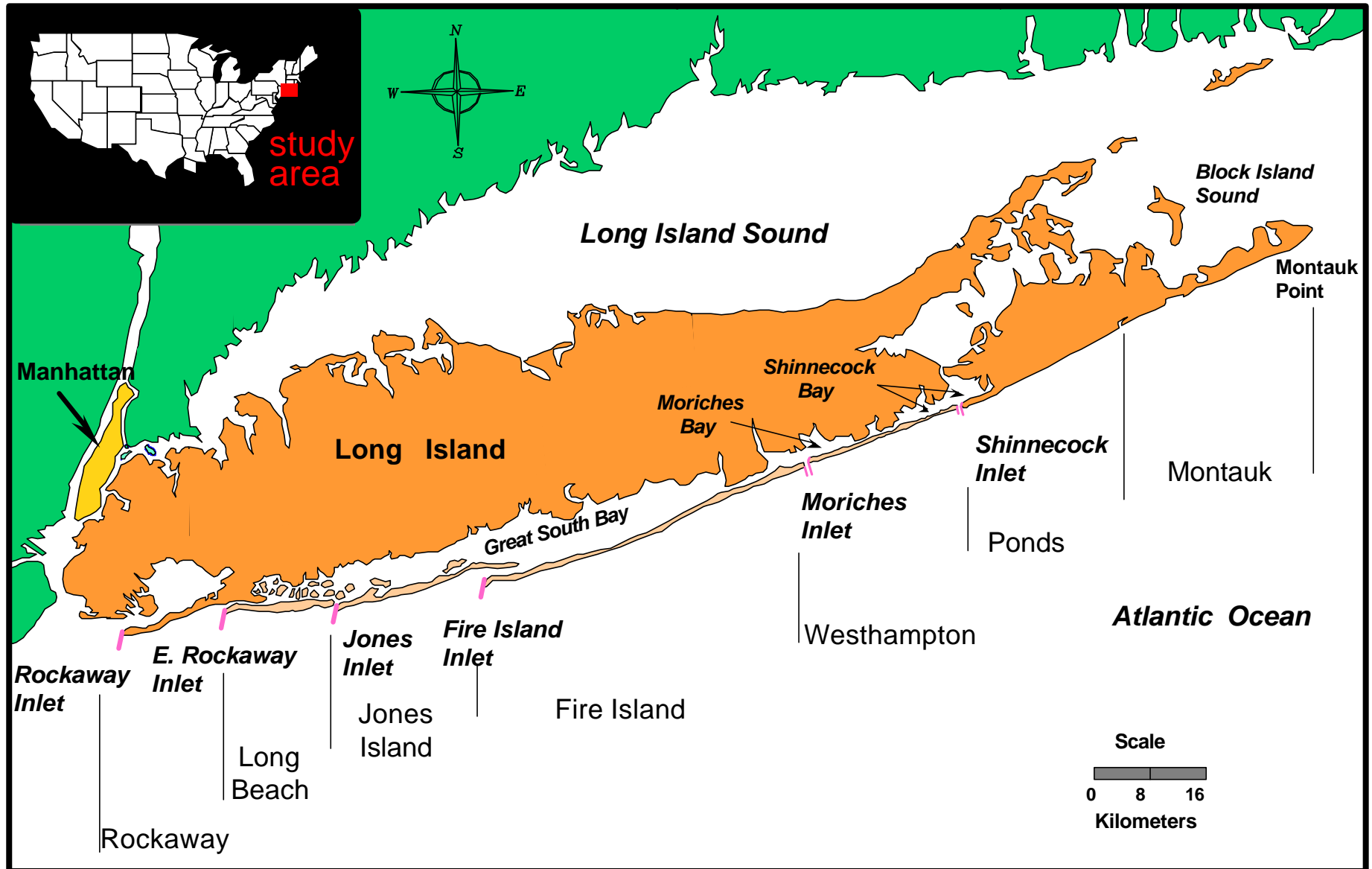


- **Background and Project Purpose**
- **Modeling Methodology**
- **Blizzard of 2003 Simulation**
- **Bay Water Level Contributions**
- **Conclusions**



EFFECT OF WAVES ON WATER LEVELS

BACKGROUND AND PROJECT PURPOSE





EFFECT OF WAVES ON WATER LEVELS BACKGROUND AND PROJECT PURPOSE

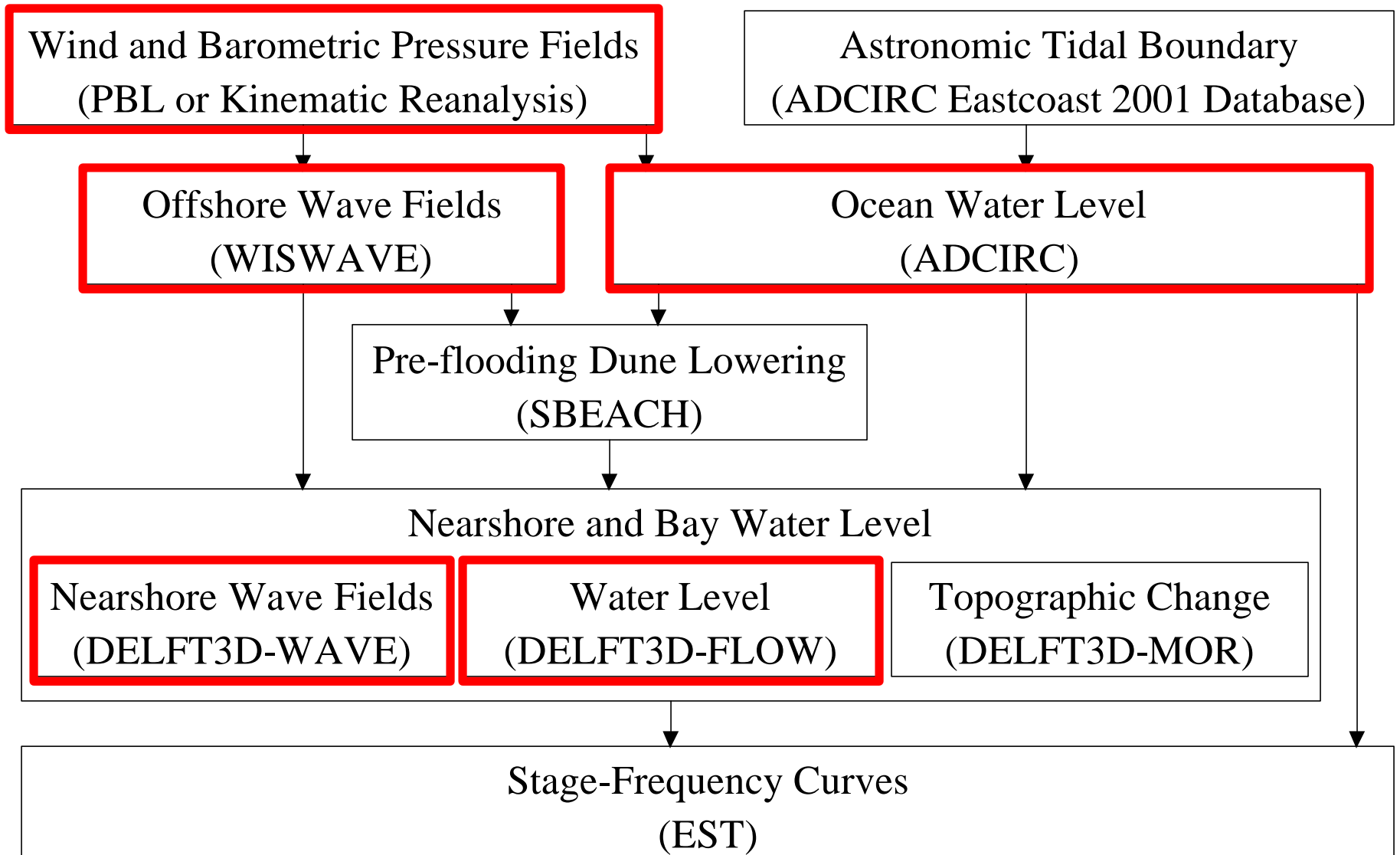
Water Levels for Economic Analyses and Coastal Design:

- Astronomical Tide
- Storm Wind Fields
- Barometric Pressure
- Wave Setup
- Barrier Island Overwash
- Barrier Island Breaching





EFFECT OF WAVES ON WATER LEVELS MODELING METHODOLOGY





EFFECT OF WAVES ON WATER LEVELS

MODELING METHODOLOGY: WIND HINDCASTS

- **PBL (Thompson and Cardone, 1996)**

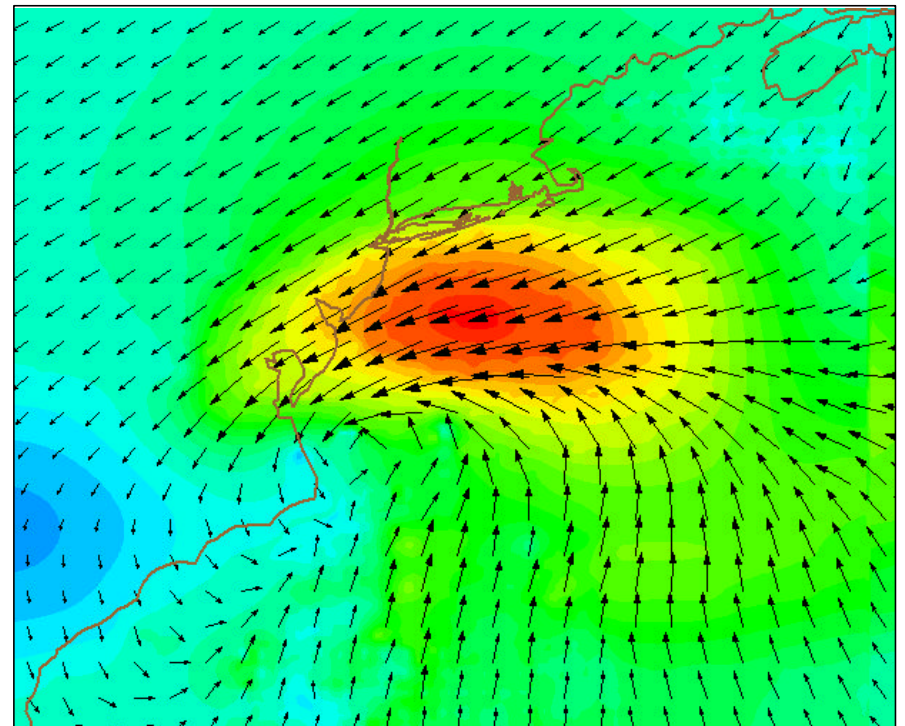
- Tropical storms
- Wind speed and direction
- Barometric pressure
- 30-minute, $0.0625^\circ \times 0.0625^\circ$

- **IKOA (Cardone et al., 1995):**

- Extratropical storms
- Wind speed and direction
- 3-hour, $0.625^\circ \times 0.833^\circ$

- **NCEP:**

- Extratropical storms
- Barometric pressure

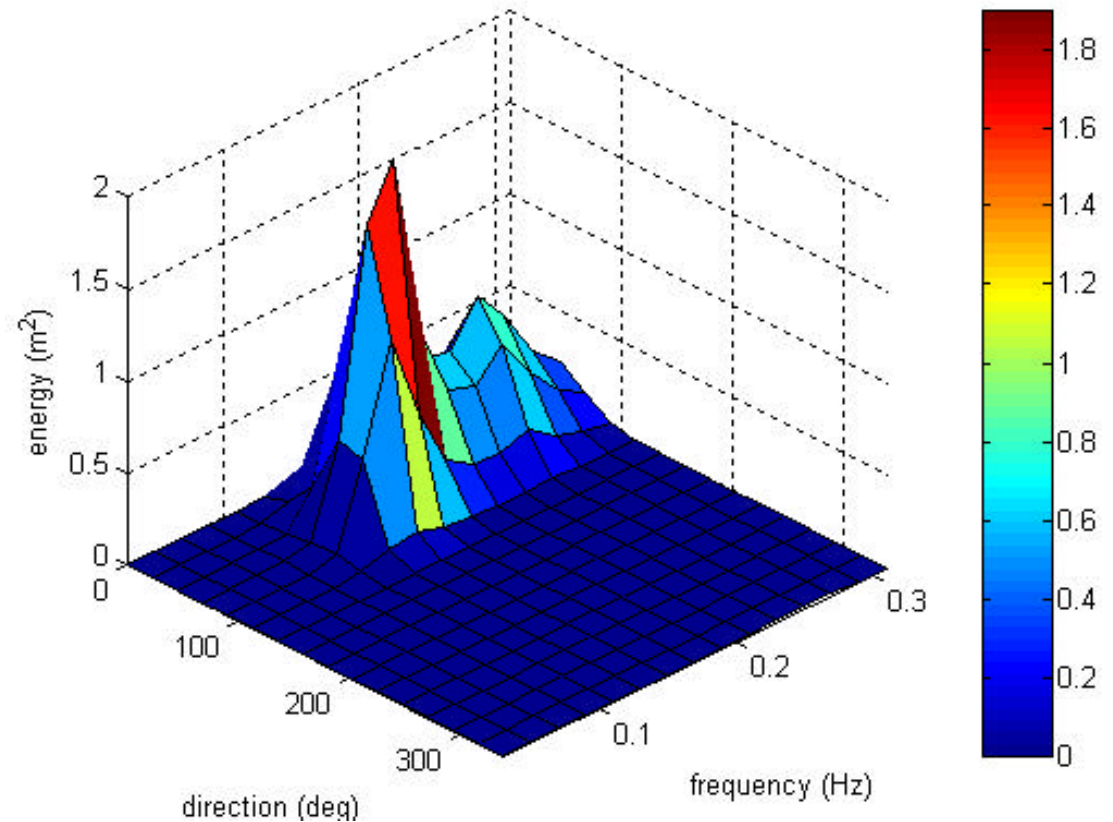




EFFECT OF WAVES ON WATER LEVELS

MODELING METHODOLOGY: WAVE HINDCASTS

- **WISWAVE (Resio and Perrie, 1989; Hubertz, 1992)**
 - Tropical and extratropical storms
 - Hourly directional spectra at 30-m depth
 - Nested grid
 - 0.083° resolution

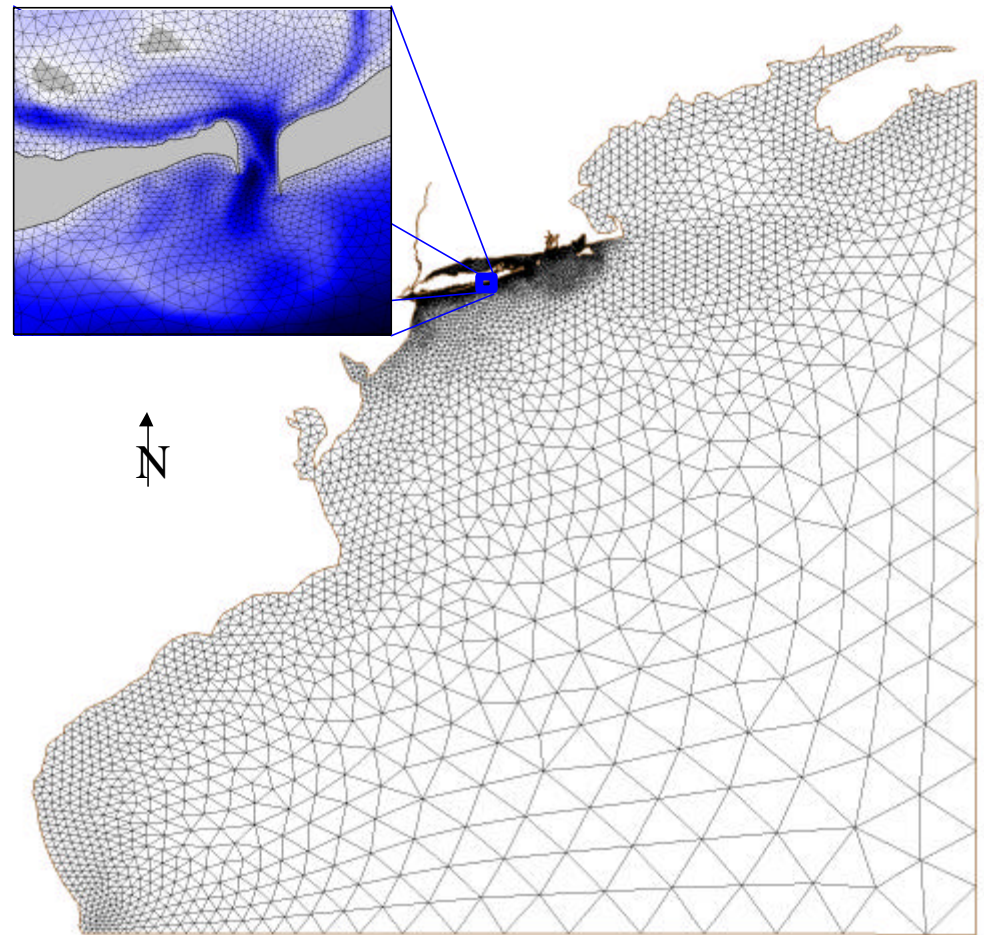




EFFECT OF WAVES ON WATER LEVELS

MODELING METHODOLOGY: OCEAN WATER LEVEL

- **ADCIRC (Luettich et al., 1992):**
 - Tidal potential for 7 constituents
 - Wind stress
 - Barometric pressure
- **Grid Development:**
 - Finite element
 - Variable resolution
- **Model Bathymetry:**
 - SHOALS surveys
 - Condition surveys
 - GEODAS (NOAA)
 - NOAA charts



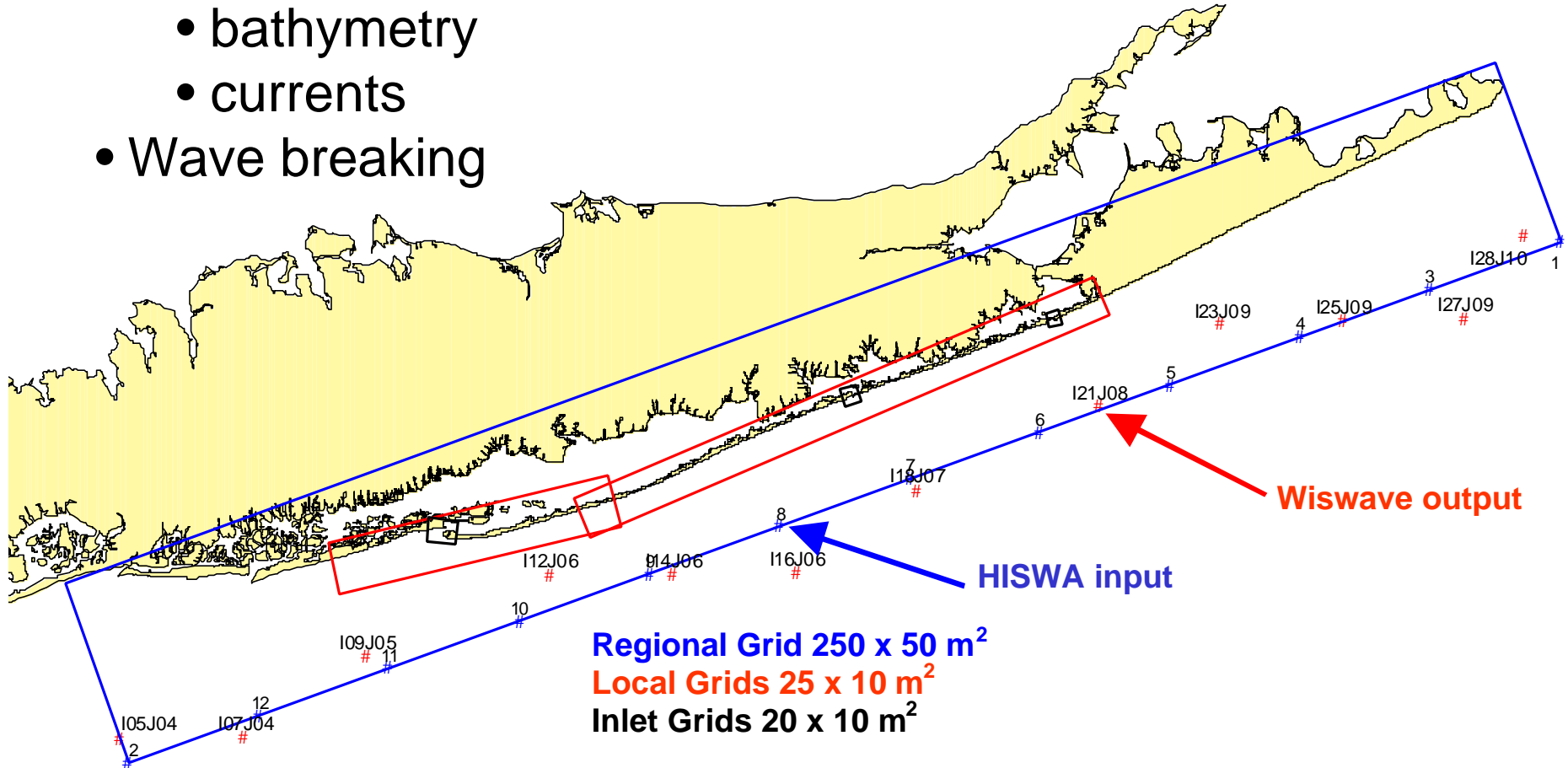


EFFECT OF WAVES ON WATER LEVELS

MODELING METHODOLOGY: NEARSHORE WAVES

• HISWA (Holthuijsen et al., 1989):

- Wave propagation
- Wave refraction and shoaling:
 - bathymetry
 - currents
- Wave breaking

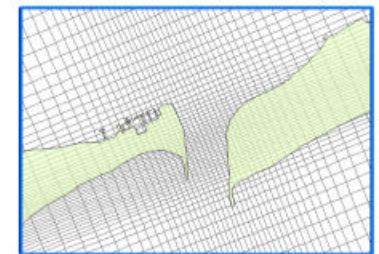
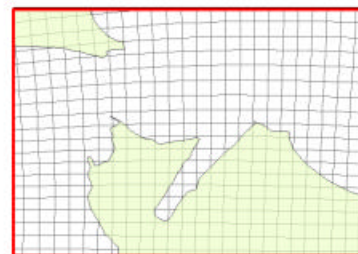
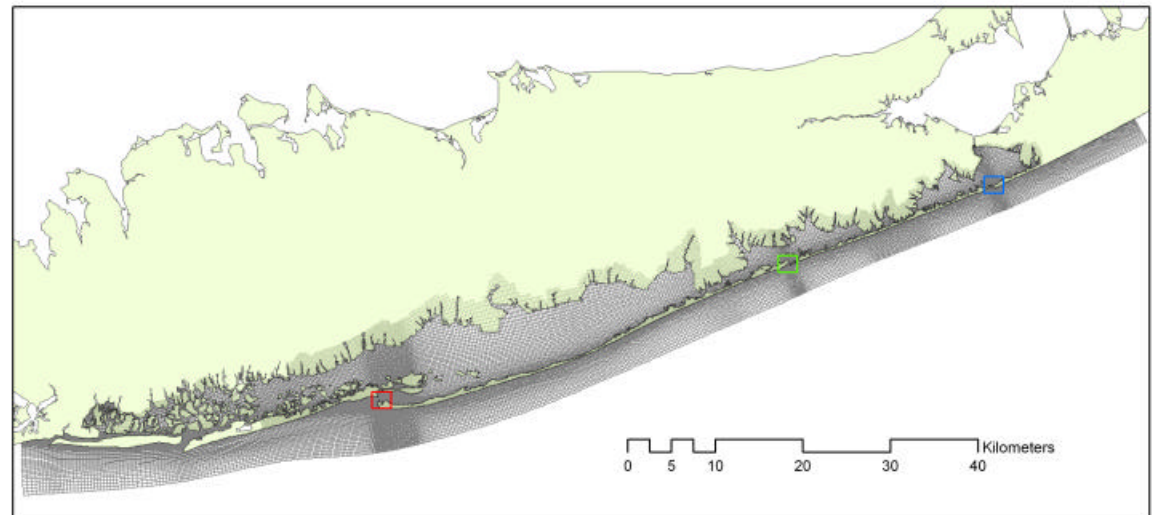




EFFECT OF WAVES ON WATER LEVELS

MODELING METHODOLOGY: BAY WATER LEVEL

- **DELFT3D-FLOW (WL| Delft Hydraulics, 2001):**
 - Tidal potential for 7 constituents
 - Wind stress
 - Barometric pressure
 - Radiation stress
- **Grid Development:**
 - Finite difference
 - Curvilinear



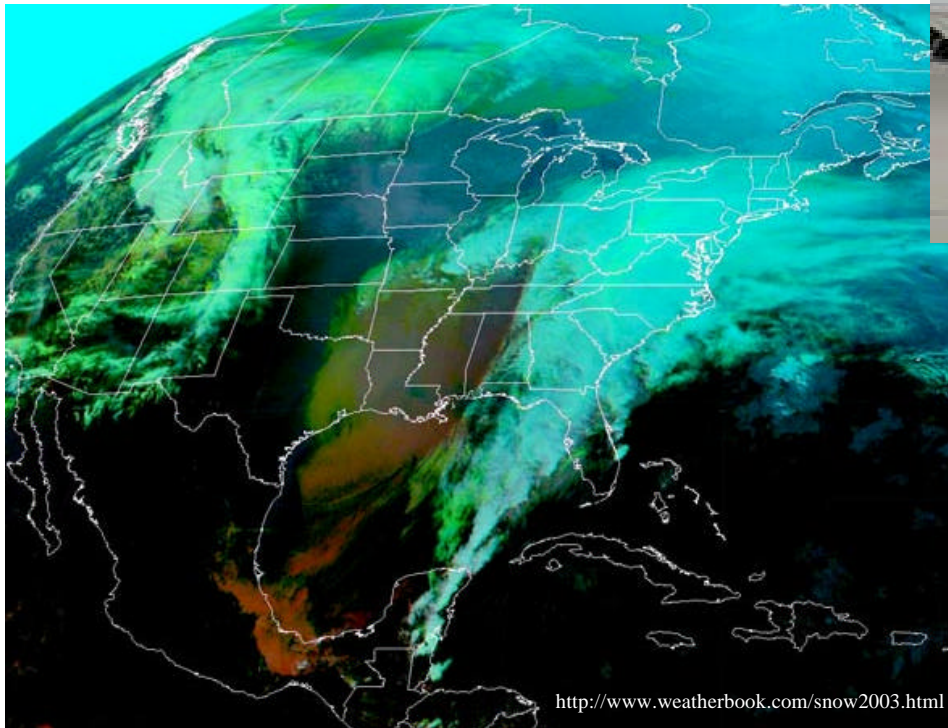
0 250 500 1,000 1,500 2,000 Meters



EFFECT OF WAVES ON WATER LEVELS

BLIZZARD OF 2003

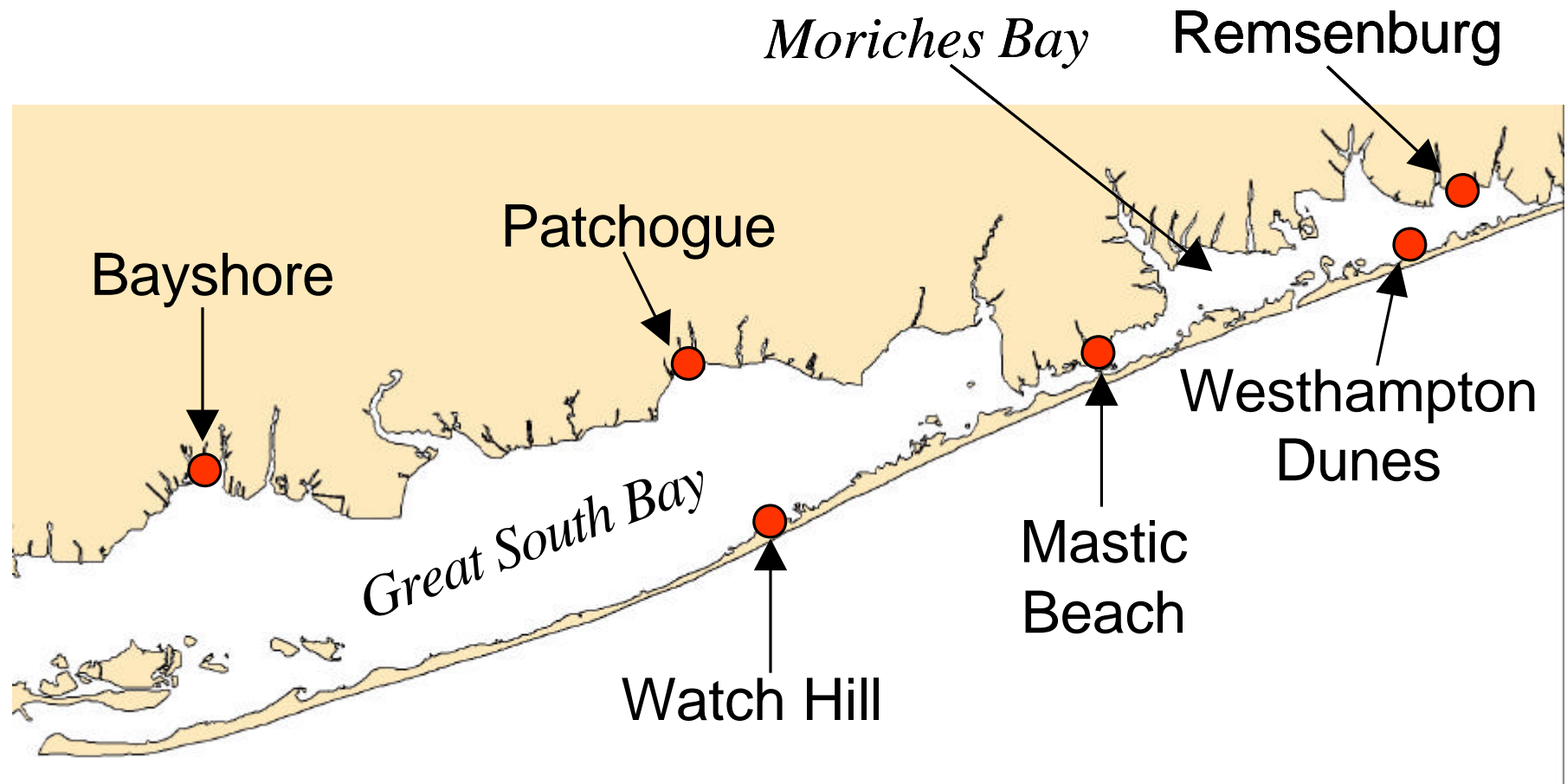
- **February 2003 (President's Day)**
 - Peak winds: 20 m/s
 - Ocean storm surge: 0.5 m
 - Peak offshore wave height: 6 m
 - Duration: 1.5 days





EFFECT OF WAVES ON WATER LEVELS

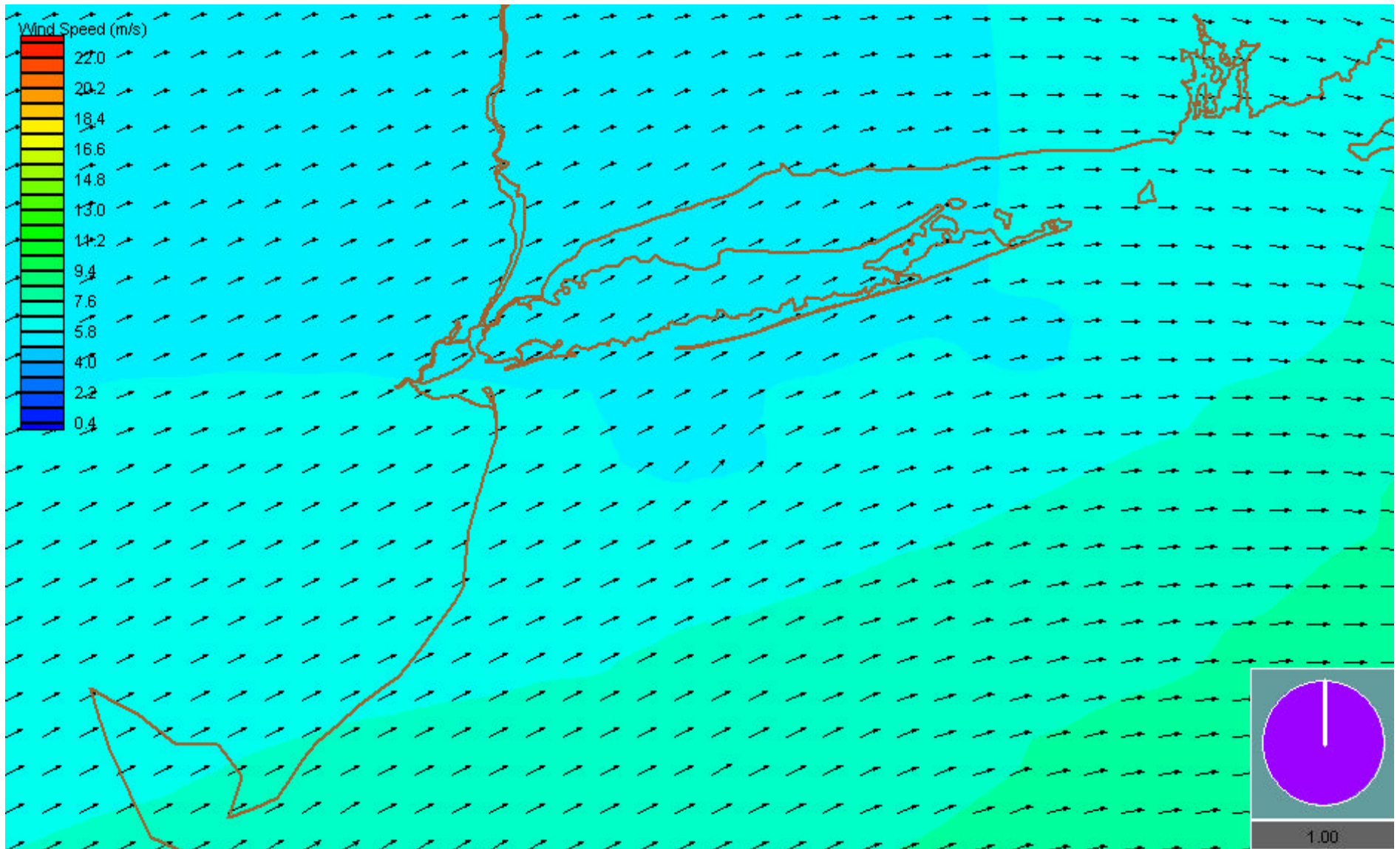
BLIZZARD OF 2003: FIELD MEASUREMENTS





EFFECT OF WAVES ON WATER LEVELS

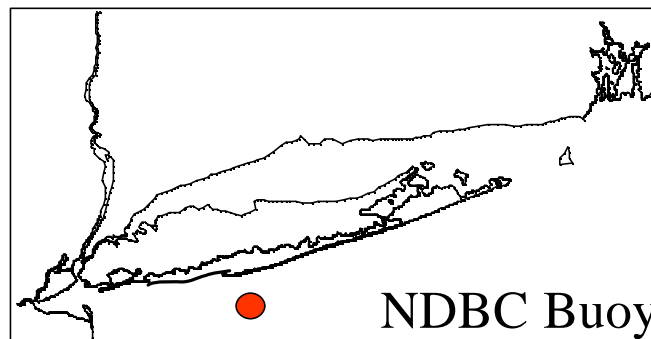
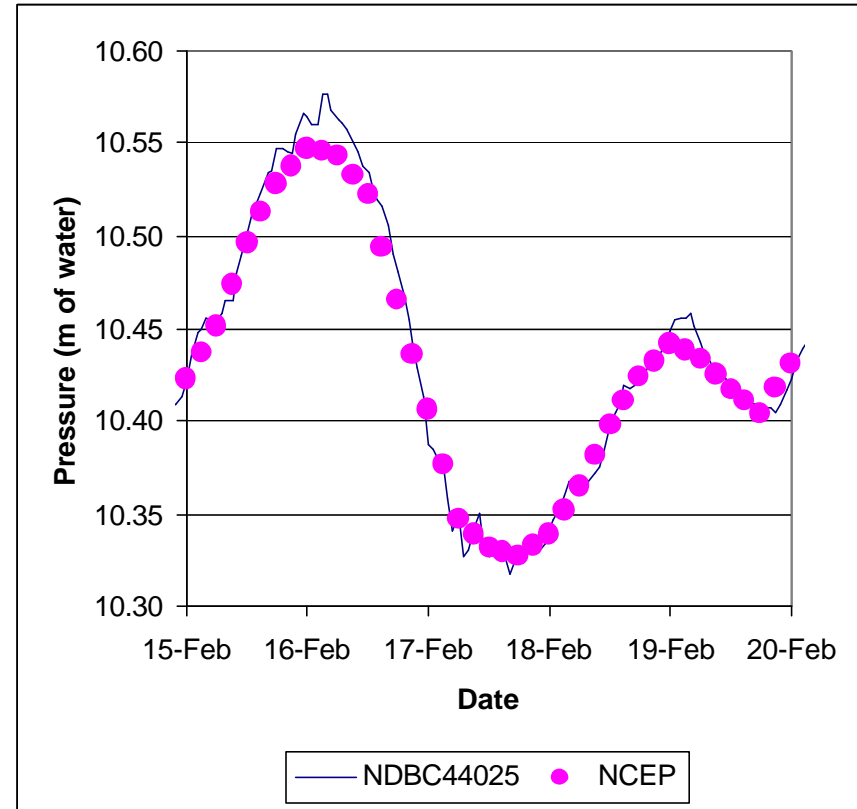
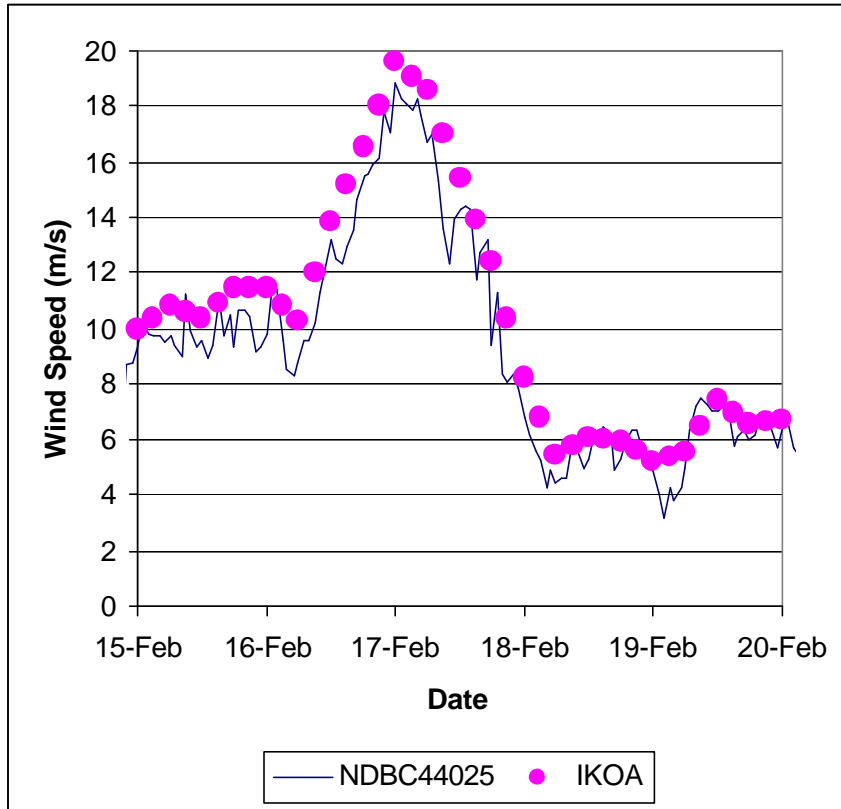
BLIZZARD OF 2003: METEOROLOGY





EFFECT OF WAVES ON WATER LEVELS

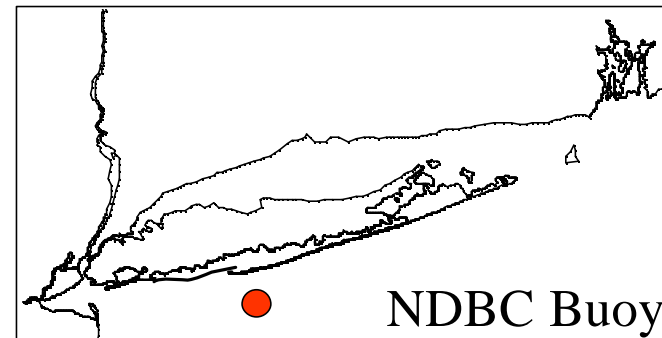
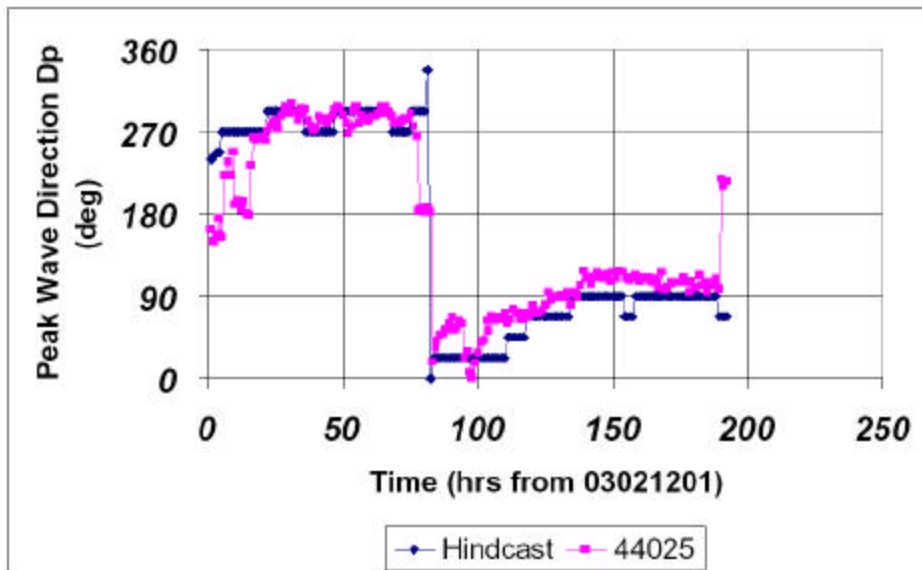
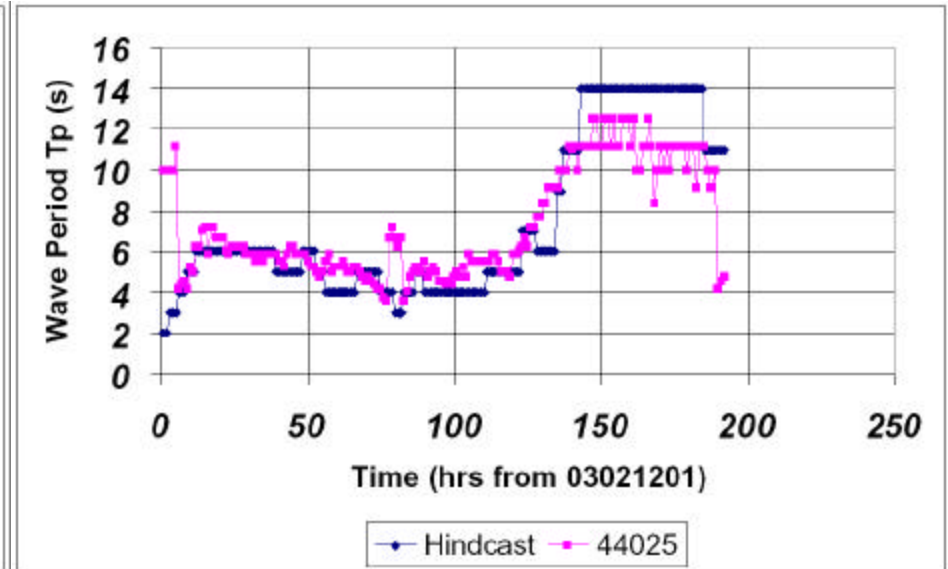
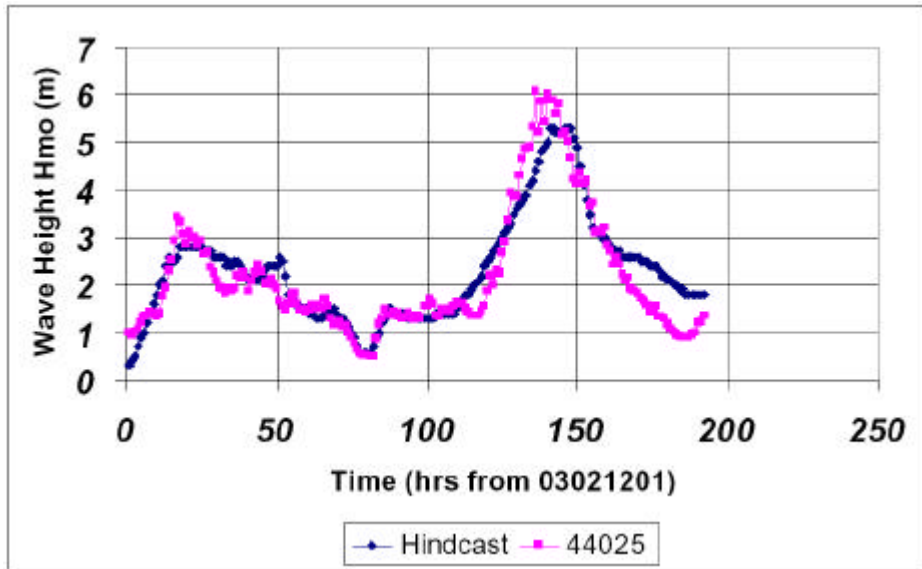
BLIZZARD OF 2003: METEOROLOGY





EFFECT OF WAVES ON WATER LEVELS

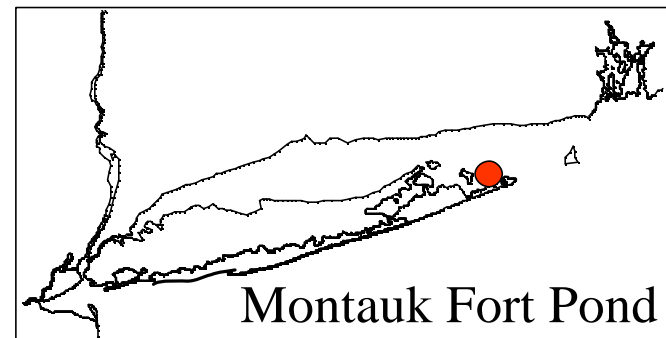
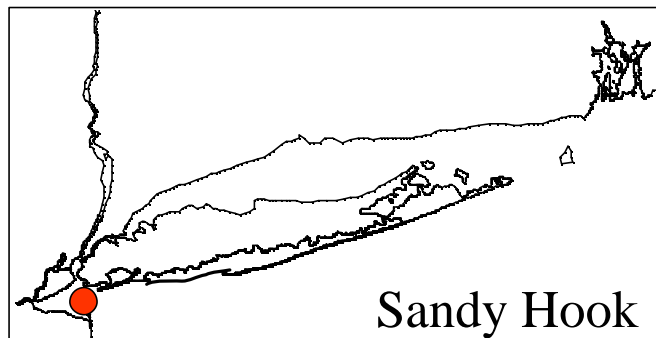
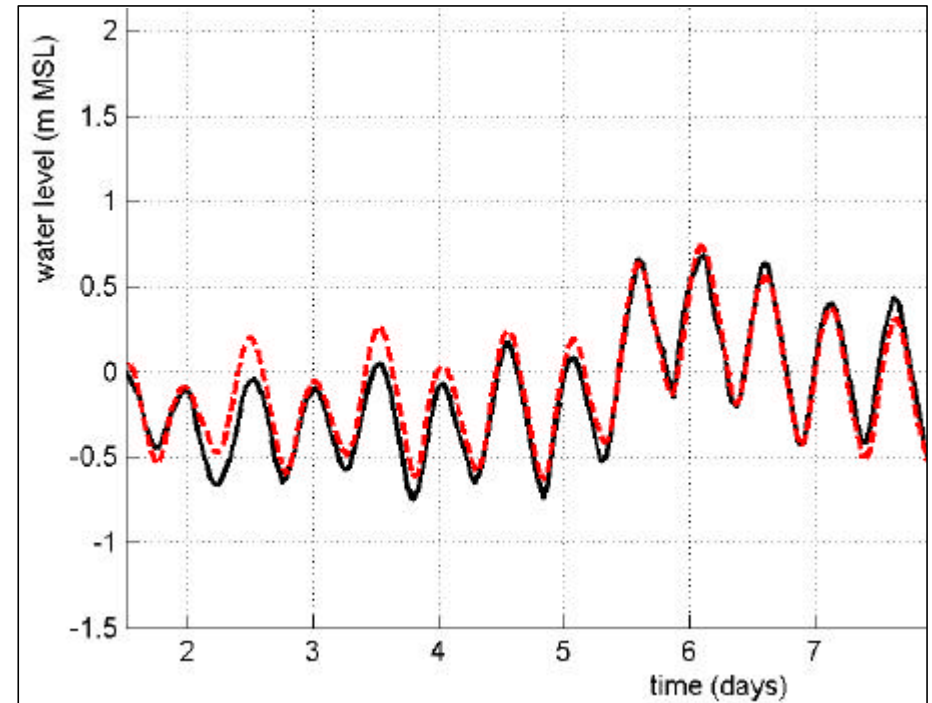
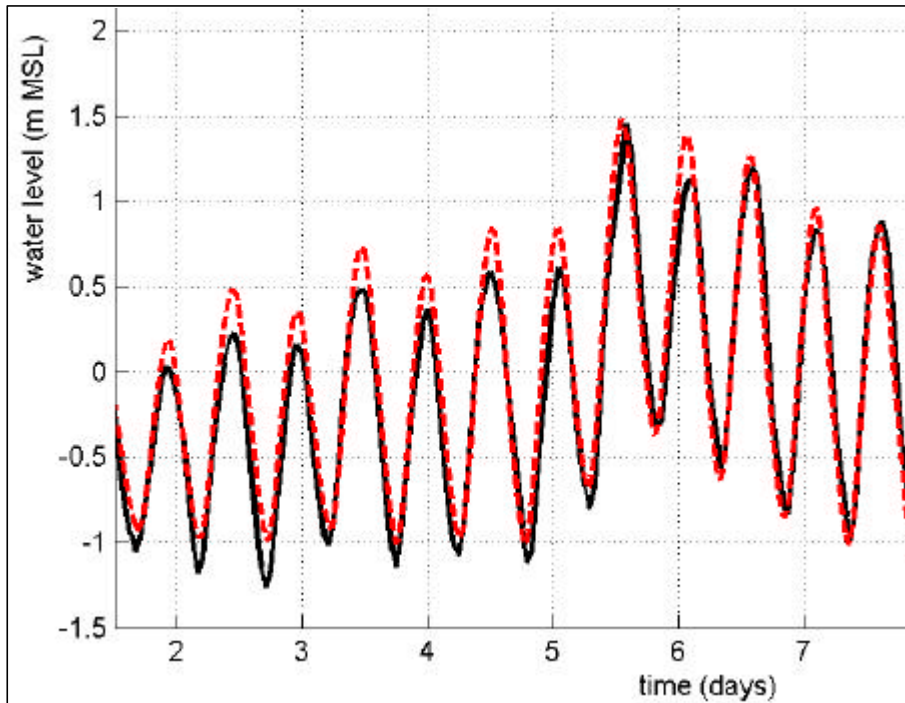
BLIZZARD OF 2003: OFFSHORE WAVES





EFFECT OF WAVES ON WATER LEVELS

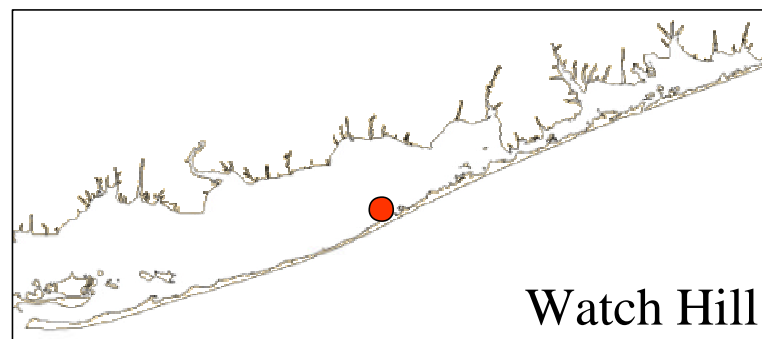
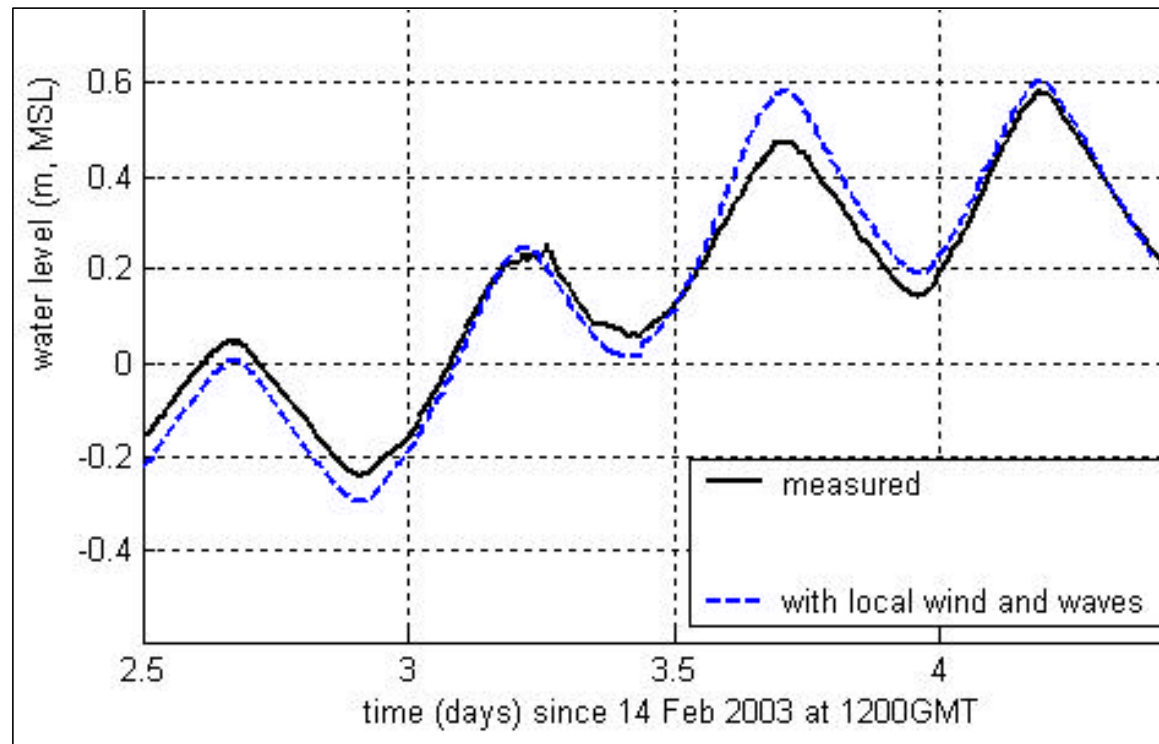
BLIZZARD OF 2003: OCEAN WATER LEVEL





EFFECT OF WAVES ON WATER LEVELS

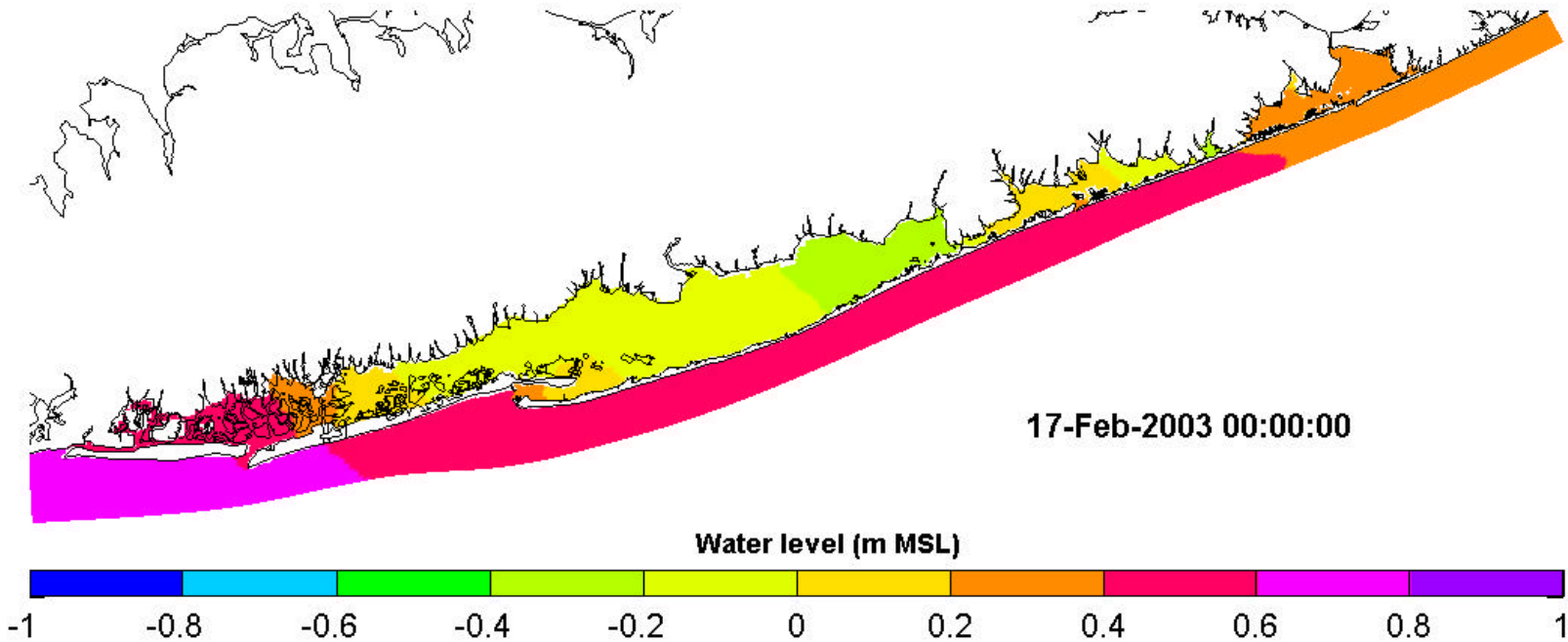
BLIZZARD OF 2003: BAY WATER LEVEL



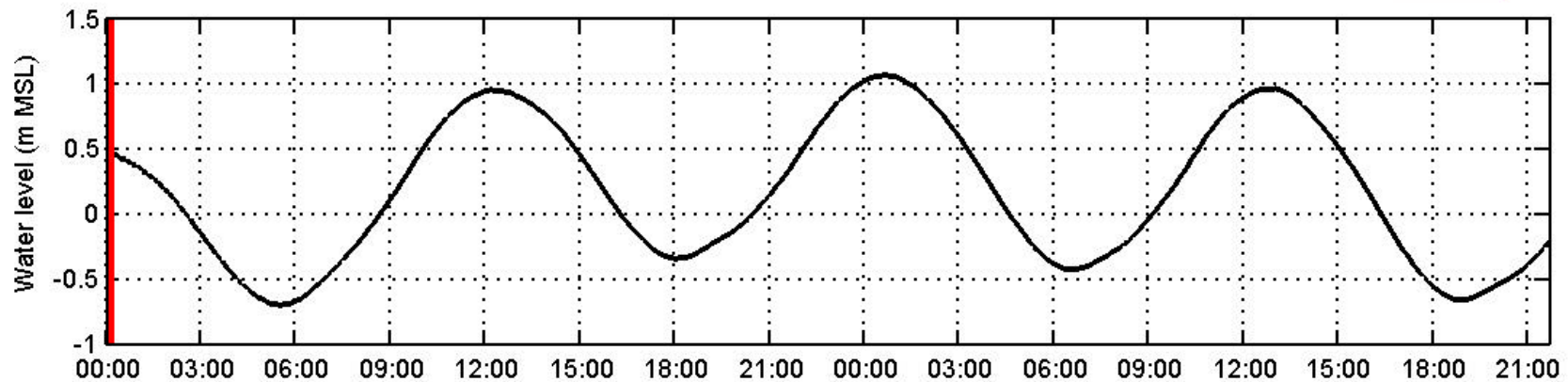


EFFECT OF WAVES ON WATER LEVELS

BLIZZARD OF 2003: BAY WATER LEVEL



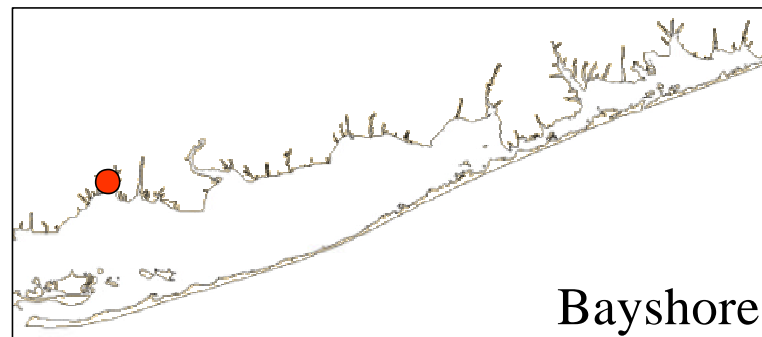
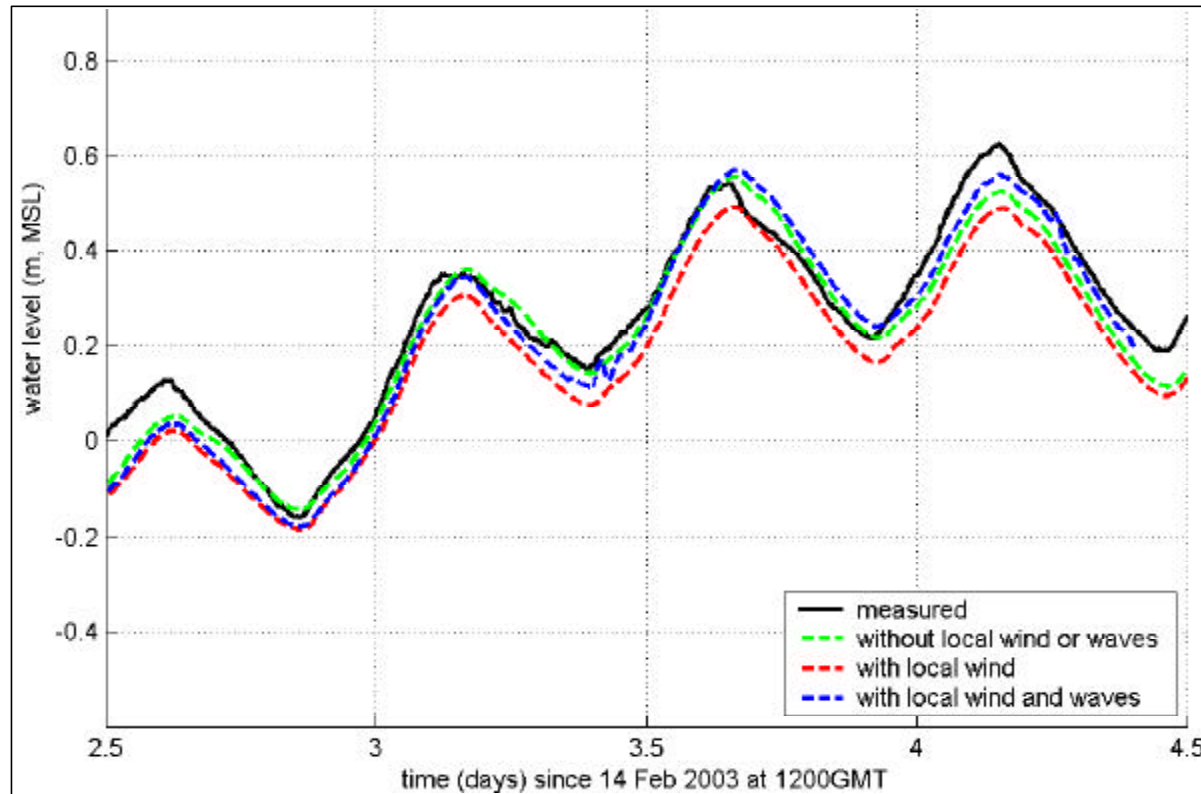
DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS, NEW YORK DISTRICT
REFORMULATION STUDY FIRE ISLAND TO MONTAUK POINT, NY





EFFECT OF WAVES ON WATER LEVELS

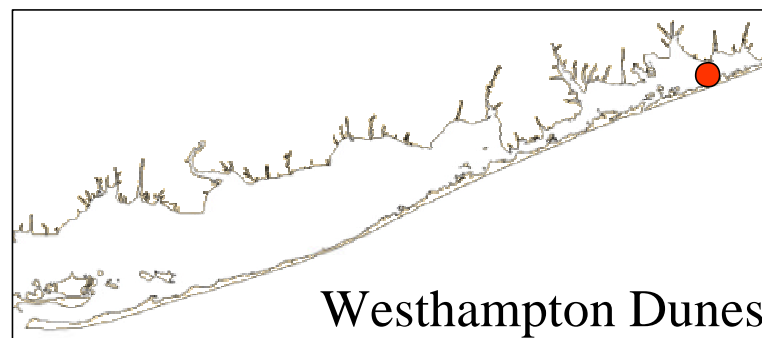
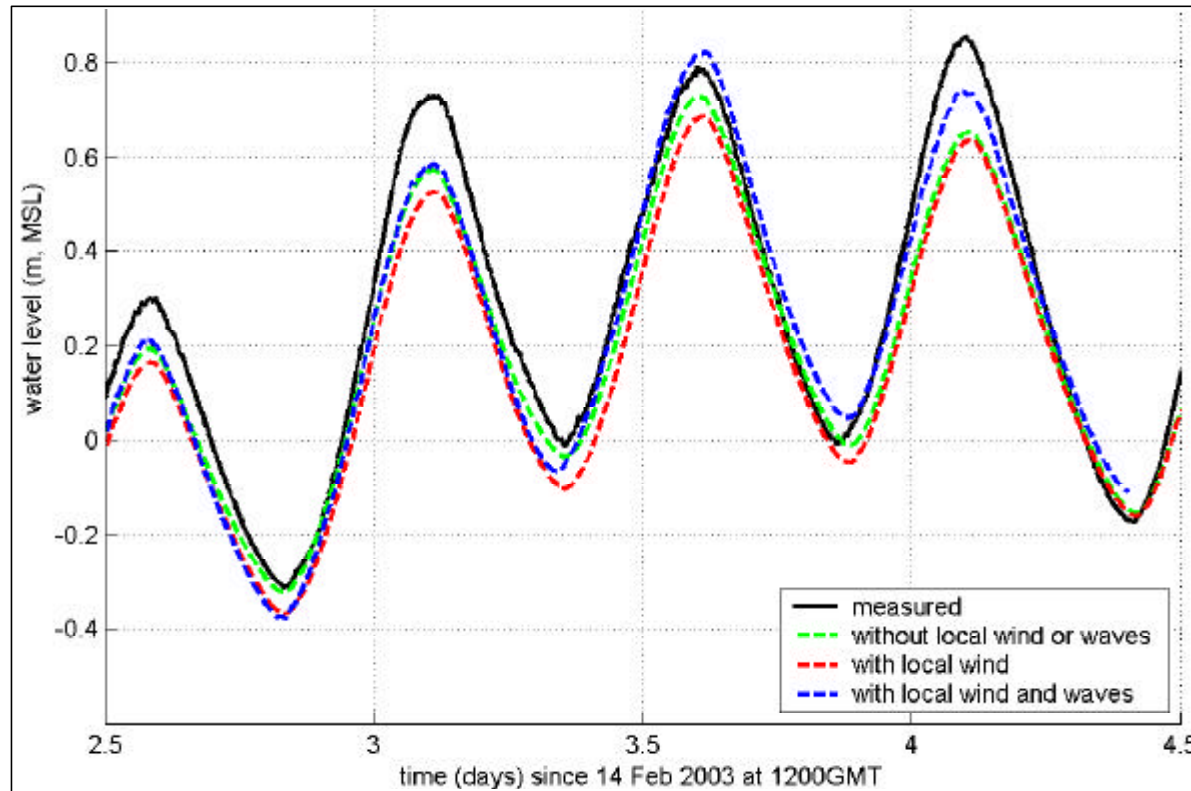
BAY WATER LEVEL CONTRIBUTIONS





EFFECT OF WAVES ON WATER LEVELS

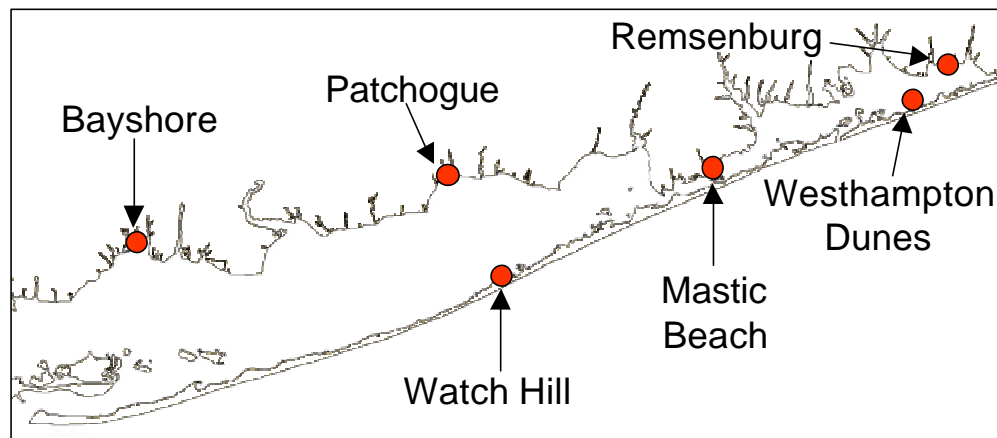
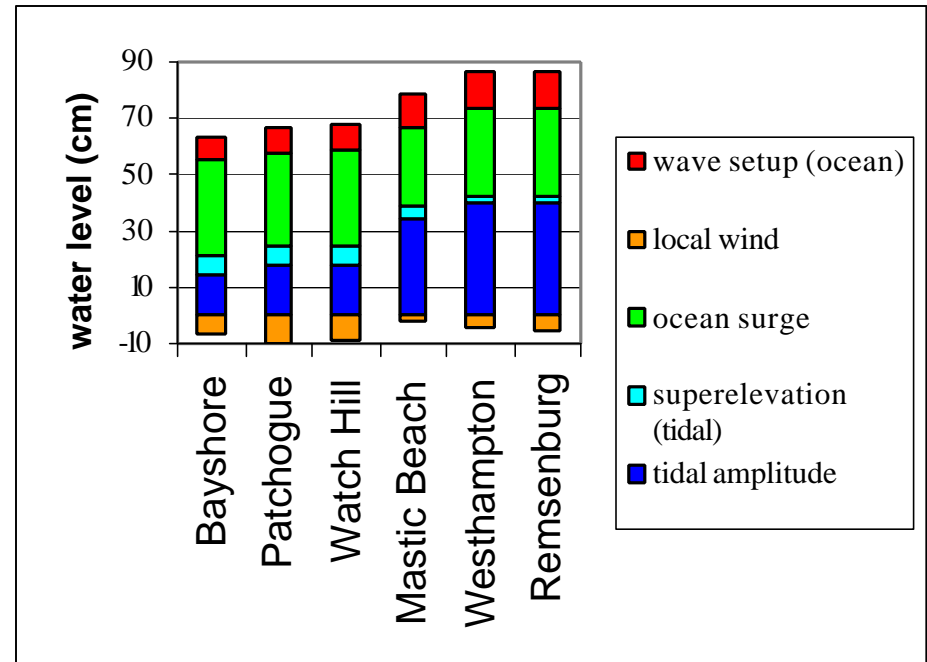
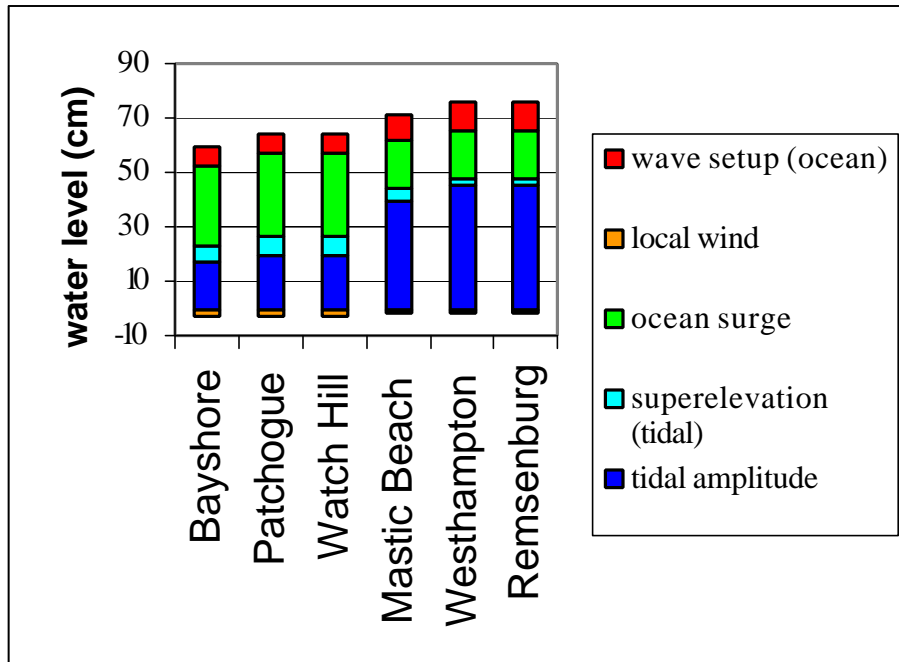
BAY WATER LEVEL CONTRIBUTIONS





EFFECT OF WAVES ON WATER LEVELS

BAY WATER LEVEL CONTRIBUTIONS





STORM SURGE MODELING CONCLUSIONS

- High-quality wind and wave hindcasting essential for accurate water level simulation
- Ocean wave setup propagation into bays contributes to bay water level
- Modeling strategy adopted for south shore of Long Island
 - Economic analyses
 - Engineering design

