U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
SYSTEMS DEVELOPMENT OFFICE
TECHNIQUES DEVELOPMENT LABORATORY

TDL OFFICE NOTE 79-5

# EXTRATROPICAL STORM SURGE FORECAST GUIDANCE FOR OCEAN CITY, MD.

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January 1979

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## 1. INTRODUCTION

The development of a coastal community and businesses along the Ocean City, Md. beachfront has increased the potential for serious damage resulting from extratropical storm surges. Storm surge (measured water level minus astronomical tide) is caused by wind stress on the water surface. This surge, which is modified by the nearshore bathymetry and the shoreline, is superimposed on the astronomical tide. When significant storm surges occur at the same time as high astronomical tides, coastal property may be seriously damaged. On October 14, 1977 a 3.6-ft surge combined with high astronomical tides and large waves to seriously undermine Ocean City beachfront structures. During 1977-1978, extratropical storm surges and high astronomical tides also damaged Ocean City beach property on October 29 and December 20, 1977 and April 27, 1978.

## 2. BACKGROUND

Automated extratropical storm surge forecast guidance (National Weather Service, 1978a) and beach erosion forecast guidance (National Weather Service, 1978b) are provided for locations along the east coast. However, there is no automated surge guidance for Maryland's coast. After the installation of a tide gage at Ocean City in October 1975, plans were made to use the tide records from this gage to develop storm surge forecast guidance for Ocean City.

## 3. OCEAN CITY WATER LEVEL DATA

The Ocean City tide gage is located on Ocean City's outer coast near the Ocean City inlet at 38.3°N and 75.1°W (see Fig. 1). The tide records from this gage were investigated for the months of October through April, from October 1975 through December 1977 (17 months). Data for 1978 has not been processed. During the 17-month period, there were 10 storm surge events where the peak surge was 1.5 ft or greater. The largest storm surge height was 3.6 ft which occurred on October 14, 1977.

A sample of 10 surge events is too small to derive a storm surge equation. Therefore, the Ocean City storm surge forecast guidance, which is recommended in this Office Note, is based on the relationship between the observed storm surges at Ocean City and Breakwater Harbor, Del. The Breakwater Harbor tide gage, located 30 n mi north of Ocean City (see Fig. 1), is the location nearest the Maryland coastline for which automated storm surge forecasts are made.

## 4. OBSERVED SURGES AT OCEAN CITY AND BREAKWATER HARBOR

Observed storm surge data at Breakwater Harbor were available for six of the 10 Ocean City surge events. For these six events, graphs of observed

storm surge heights for Ocean City and Breakwater Harbor are shown in Fig. 2. The observed surges at these two locations are very similar. Since the observed storm surge at Ocean City is so similar to the Breakwater Harbor surge, automated surge forecast guidance for Breakwater Harbor should also be good surge forecast guidance for Ocean City.

## 5. AUTOMATED SURGE FORECAST GUIDANCE FOR OCTOBER 12-15, 1977

A low pressure system, which was located off the Georgia-South Carolina coast at 1900 EST October 12, 1977, intensified and moved up the east coast in a northeasterly direction (see Fig. 3). At 0700 EST on October 14, 1977, the low was located off the North Carolina-Virginia coast. The peak surge (3.6 ft) at Ocean City occurred 6 hours later at 1300 EST October 14. Fig. 4 shows the observed storm surge at Ocean City and the automated storm surge forecasts for Breakwater Harbor for October 12-15. This automated forecast guidance (National Weather Service, 1978a), which is valid through 48 hours at 6-h intervals, is based on the sea-level pressure forecasts of the LFM-II model. The forecasts of the time of the peak surge are very good for all forecasts. However, the peak surge is underforecast by about 1.0 ft. Even though the peak surge is underforecast, the Breakwater Harbor surge forecasts provide useful storm surge forecast guidance for Ocean City.

## 6. RECOMMENDATION

Based upon comparisons between observed storm surges at Ocean City and the observed and forecasted Breakwater Harbor storm surges, I recommend that the automated storm surge forecasts for Breakwater Harbor be also used as guidance for Ocean City. Users of this guidance should keep in mind that this recommendation is based on the comparison of only six surge events.

In a few years, when more Ocean City tide data become available, plans to derive an Ocean City storm surge equation will be reevaluated.

## 7. ACKNOWLEDGMENTS

I am especially greatful to the National Ocean Survey for hourly measured water level data and tide station constituents for Ocean City, Md.

## REFERENCES

National Weather Service, 1978a: Extratropical storm surge forecasts for the U.S. east coast. NWS Technical Procedures Bulletin No. 226, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 5 pp.

_____, 1978b: Qualitative beach erosion forecast for the oceanic coastlines of the east coast states. NWS Technical Procedures Bulletin No. 245, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 7 pp.

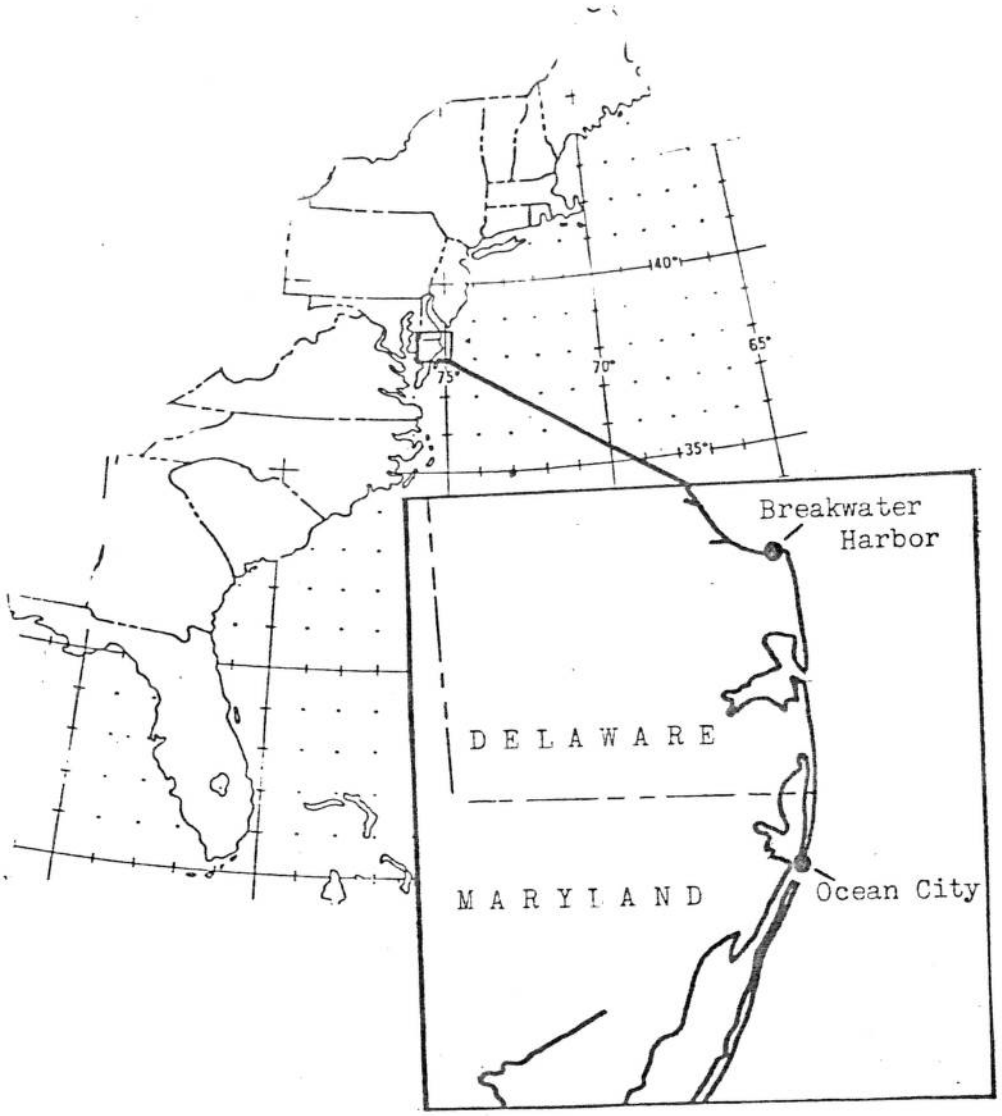


Figure 1. Locations of Ocean City, Md. and Breakwater Harbor, Del. tide gages.

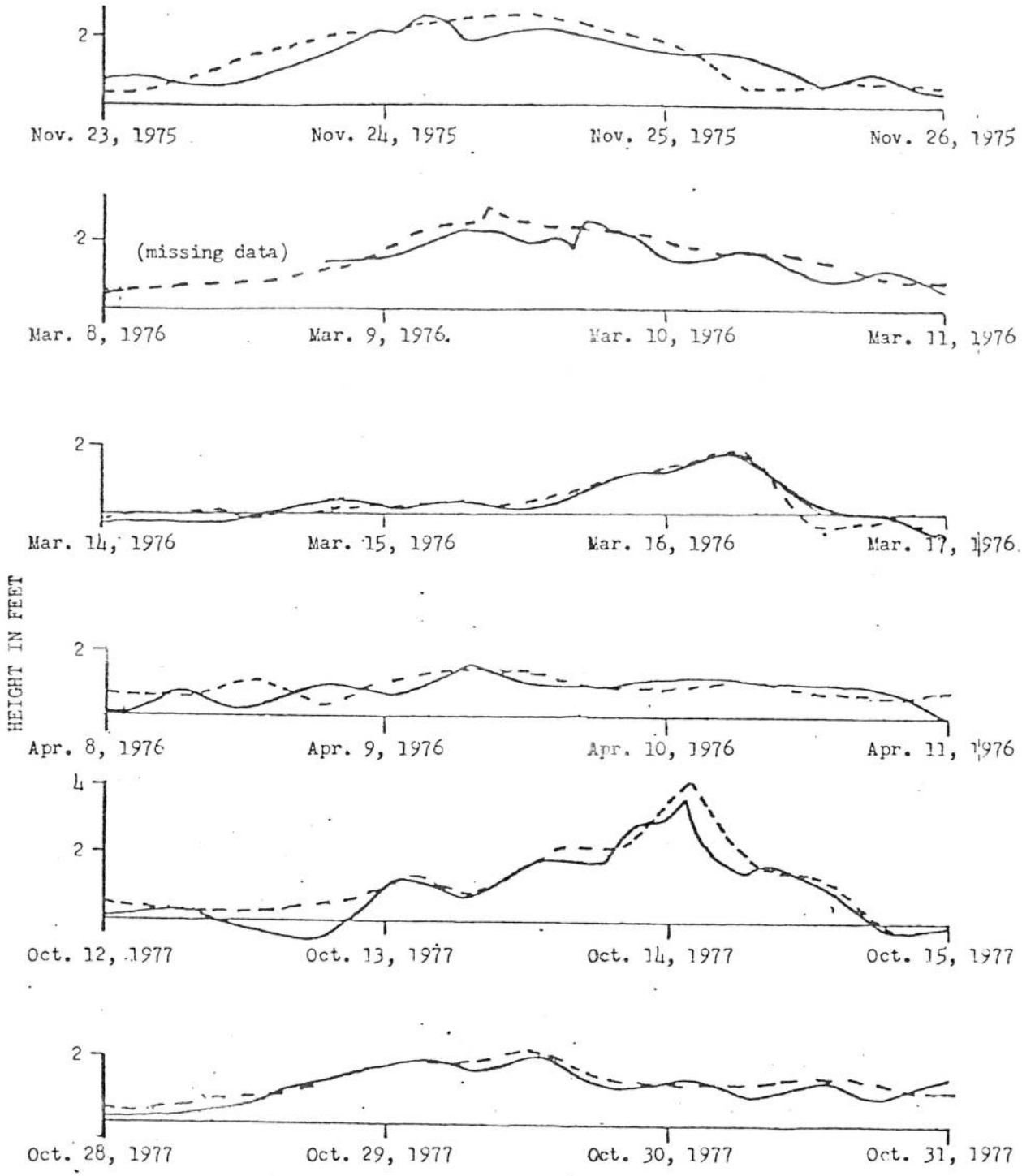


Figure 2. Observed storm surges at Ocean City, Md. (solid lines) and Breakwater Harbor, Del. (dashed lines). The date of each day is placed at 1200 EST.

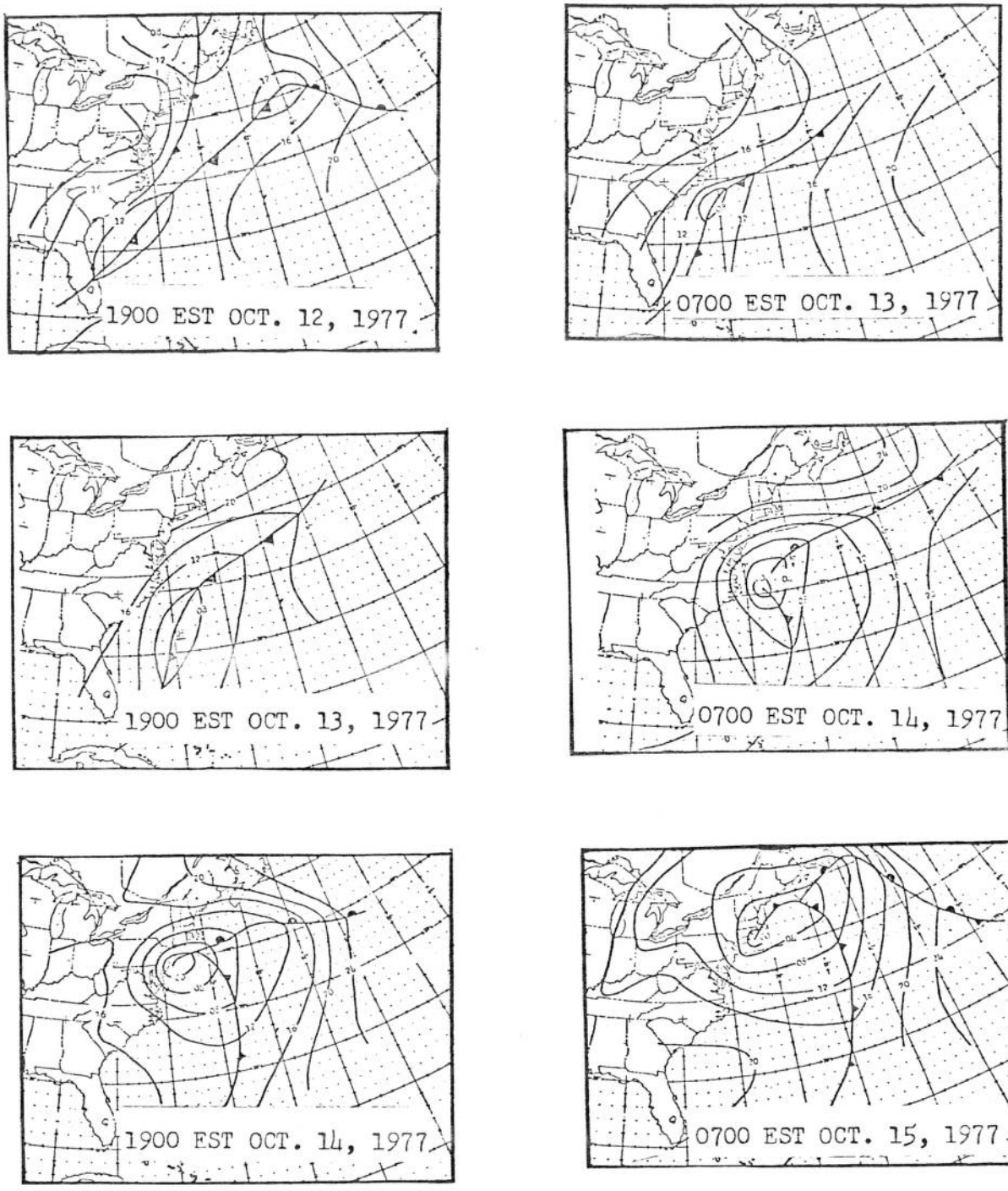


Figure 3. Sea-level pressure charts from 1900 EST October 12, 1977 to 0700 EST October 15, 1977.

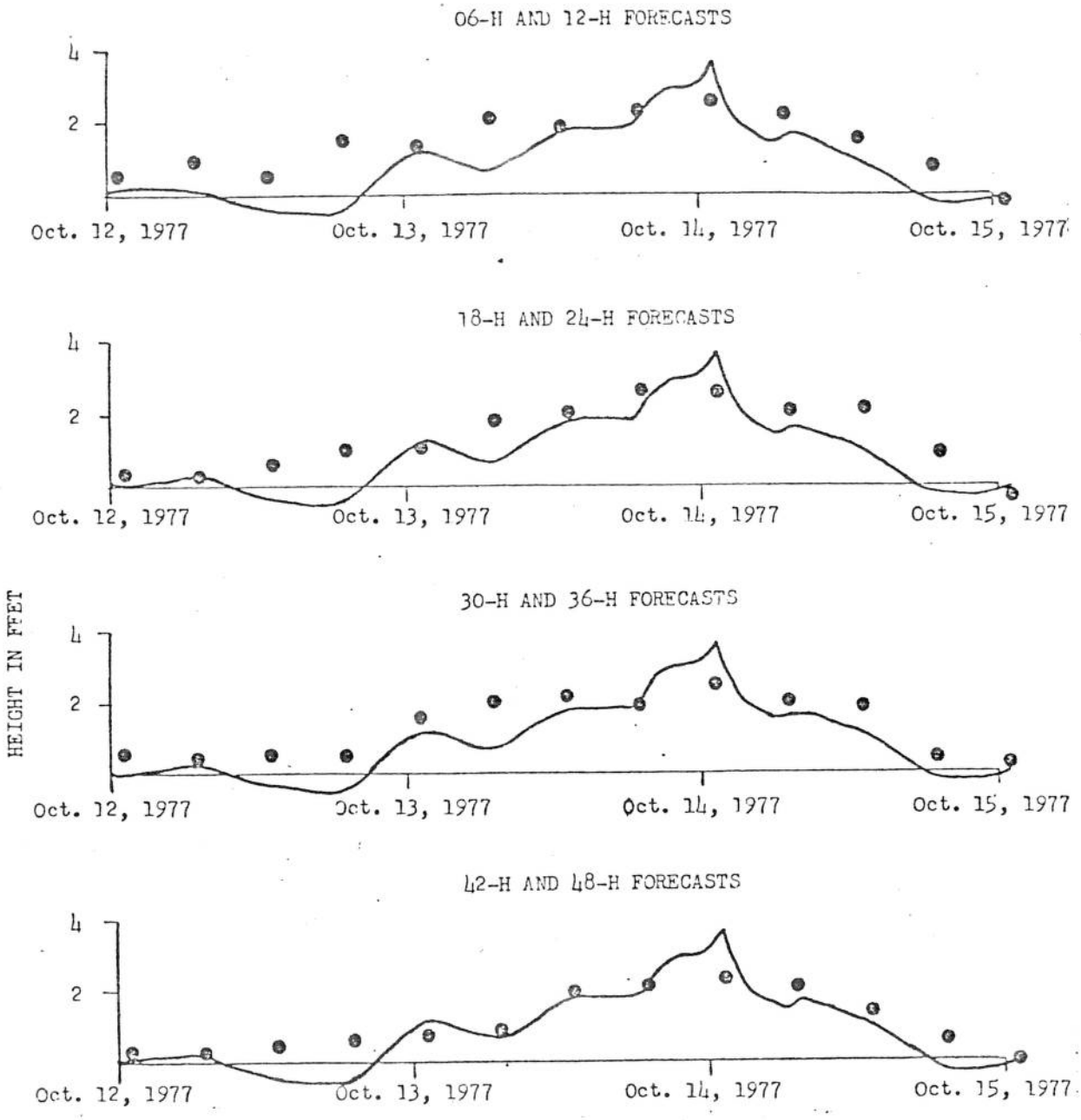


Figure 4. The observed (solid line) and forecast (dots) storm surge for 1200 EST October 12, 1977 through 1200 EST October 15, 1977.