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EXTRATROPICAL STORM SURGE FORECAST GUIDANCE FOR SOUTHPORT, NORTH CAROLINA

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1. INTRODUCTION

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.

Automated extratropical storm surge forecast guidance (Richardson & Gilman, 1983) and beach erosion forecast guidance (NWS, 1978) are provided for locations along the east coast of the United States. However, there is no automated surge guidance for North Carolina's coast south of Cape Hatteras. The development of a coastal community and businesses along the North Carolina beachfront has increased the potential for serious damage resulting from extratropical storm surges. Plans were made to use the tide records from a Southport, N.C. gage to develop storm surge forecast guidance for the southern coast of North Carolina. Due to a lack of significant surge cases, it was decided to do a comparison between surge events at Southport, N.C. and Charleston, S.C. (since Charleston has surge forecast guidance), and then determine if Charleston's surge forecast guidance is appropriate for Southport, N.C.

2. SOUTHPORT WATER LEVEL DATA

The Southport tide gage is located on North Carolina outer coast near 33.9°N and 78.0°W (see Fig. 1). The tide records from this gage were investigated for the months of October through April, from December 1974 through March 1983 (17 months). During this 17 month period, there were six storm surge events where the peak surge was 1.5 feet or greater. The largest storm surge height, which occurred on March 17, 1983, was 1.8 feet.

A sample of six surge events is too small to derive a storm surge equation. Therefore, the recommended Southport storm forecast guidance is based on the relationship between the observed storm surges at Southport, N.C. and Charleston, S.C. The Charleston tide gage, located 150 miles southwest of Southport (see Fig. 1), is the location nearest the North Carolina coastline for which automated storm surge forecast are made.

3. OBSERVED SURGES AT SOUTHPORT AND CHARLESTON

Observed storm surge data at Charleston were available for these six recorded surge events. Figure 2 illustrates the similarity between the observed storm surge at Southport and that at Charleston. Due to this similarity, automated surge forecast guidance for Charleston should also be good guidance for Southport.

AUTOMATED SURGE FORECAST GUIDANCE FOR FEBRUARY 14, 1983

In February 1983, a low pressure system moved from off the southwest Florida coast, over Florida, and up the east coast in a northeasterly direction (see Fig. 3). At 0700 EST on February 14, 1983, the low was located over Charleston's coastline. The peak surge (1.7 feet) at Southport occurred 2 hours later at 0900 EST February 14. Fig. 4 shows the observed storm surge at Southport and the automated storm surge forecast for Charleston for February 13-15. This automated forecast guidance (Richardson & Gilman, 1983), which is valid at 6-h intervals through 48 hours, is based on the sea-level pressure forecasts of the LFM model. The forecasts of the peak surge are good for all forecasts. However, there is a time difference of approximately 6 hours from Charleston's peak surge forecast to Southport's peak surge. This is due to the distance between the two stations (150 miles), and will vary depending on the speed of the storm.

5. RECOMMENDATIONS

Based upon comparisons between observed storm surges at Southport and the observed and forecasted Charleston storm surges, I recommend that the automated storm surge forecasts for Charleston be used as guidance for Southport, taking the 6-h time difference into consideration. (Users of this guidance should keep in mind that this recommendation is based on the comparison of only six surge events.) Further improvement in this forecast is likely if the Charleston surge equations are applied to the LFM field at Southport's grid location.

6. ACKNOWLEDGMENTS

I wish to thank Sonny Richardson for all of his help with this project. Also, I'm grateful to the National Ocean Survey for providing hourly measured water level data.

REFERENCES

Richardson, W. S., 1979: Extratropical storm surge forecast guidance for Ocean City, Maryland. TDL Office Note 79-5, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 6 pp.

_____, and C. S. Gilman, 1983: Improved 6-, 12-, 18-, and 24-h extratropical storm surge forecast guidance for Boston, Massachusetts; New York, New York; Norfolk, Virginia; and Charleston, South Carolina. TDL Office Note 83-8, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 25 pp.

National Weather Service, 1978: 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.

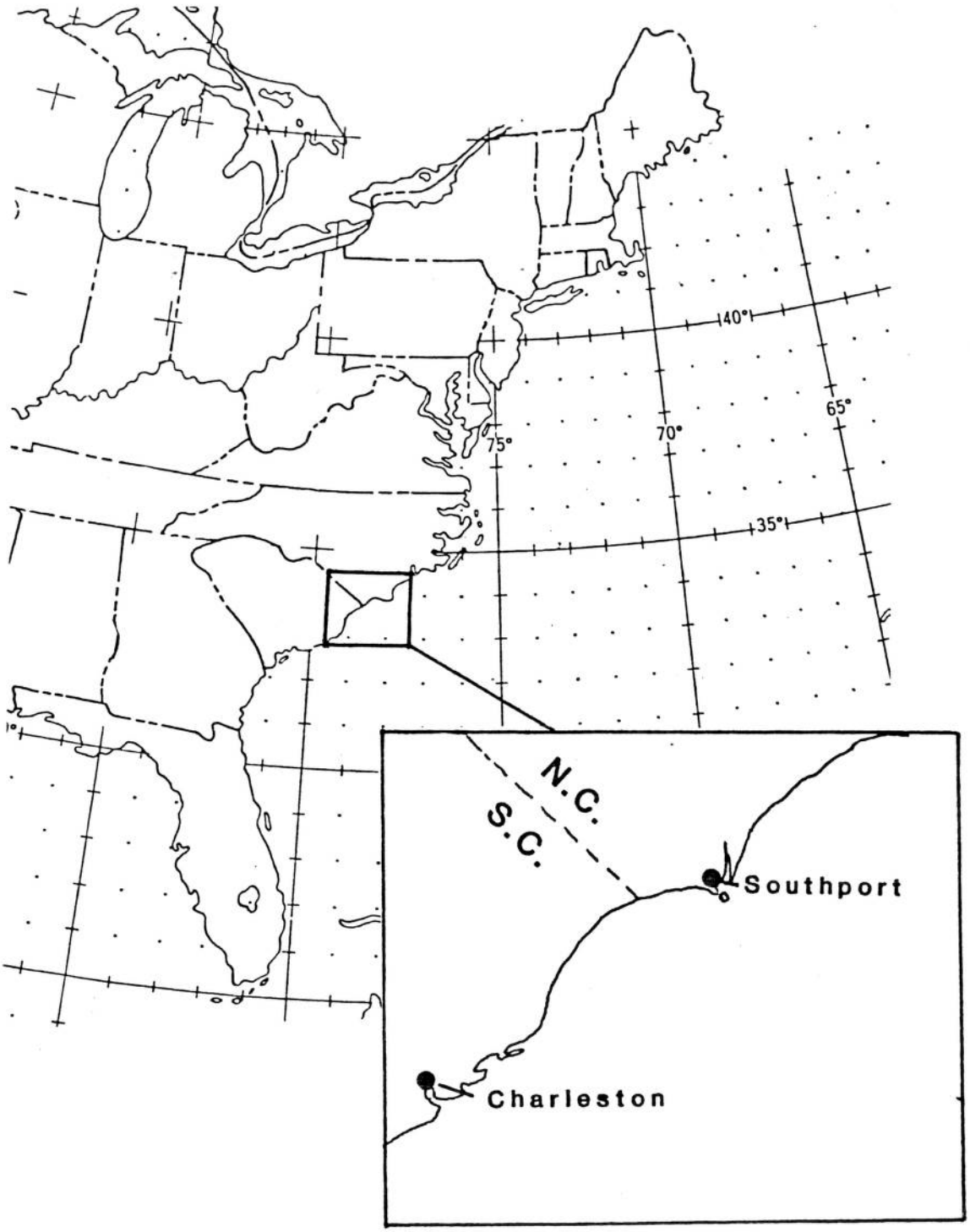


Figure 1. Locations of Southport, N.C. and Charleston, S.C.

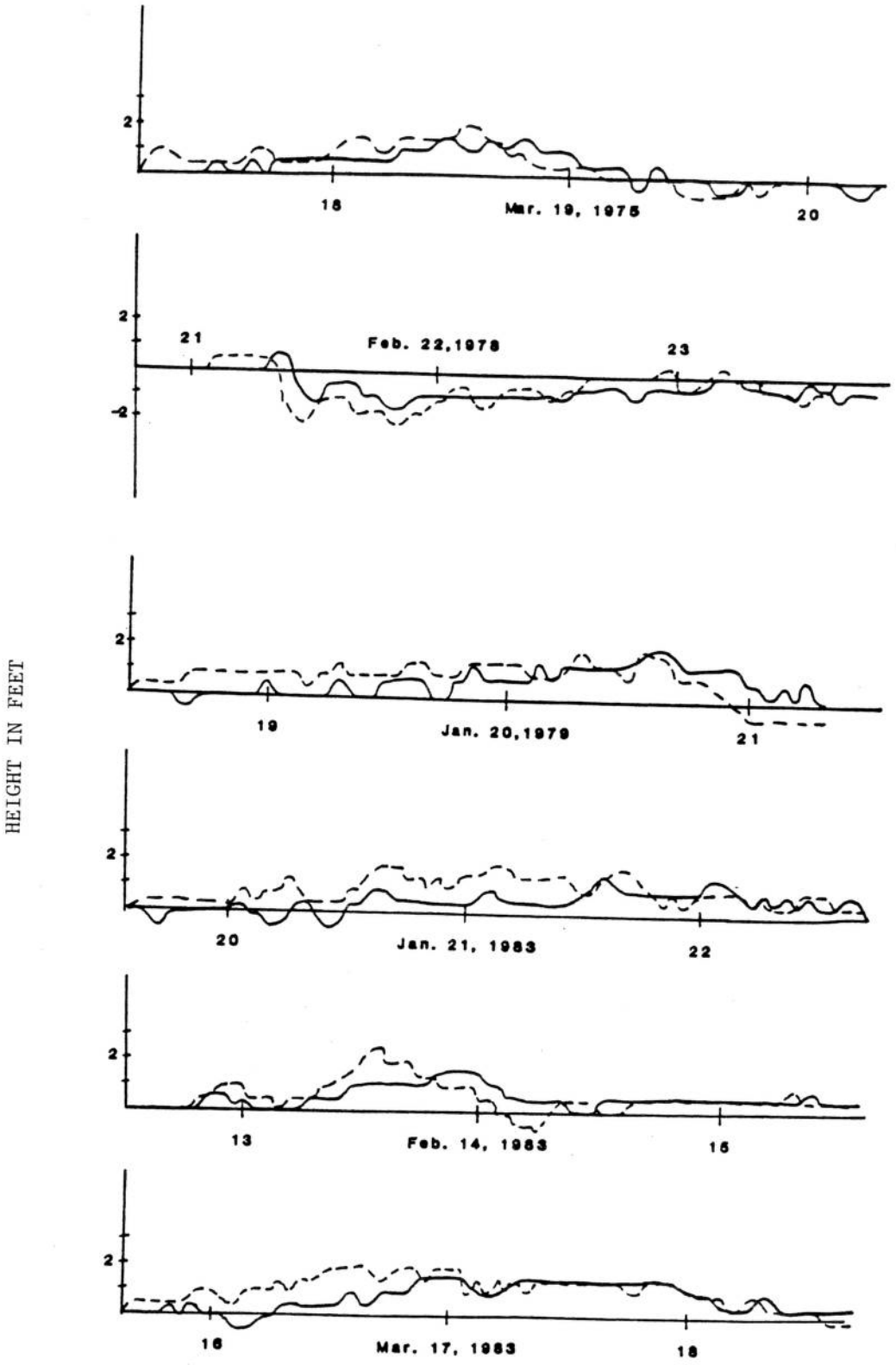
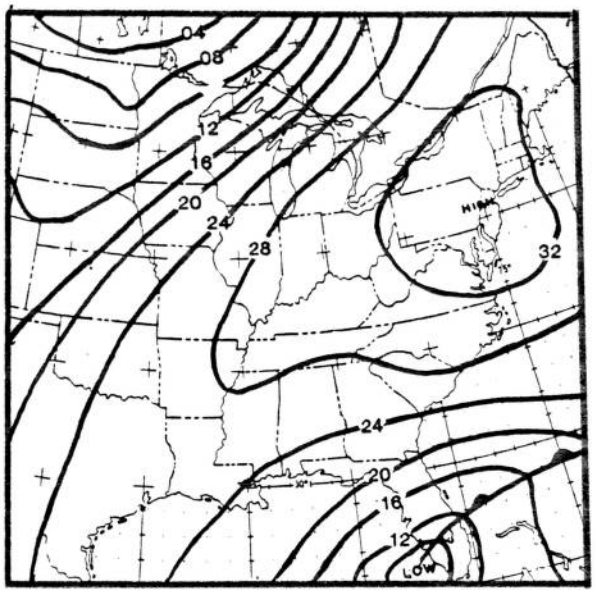
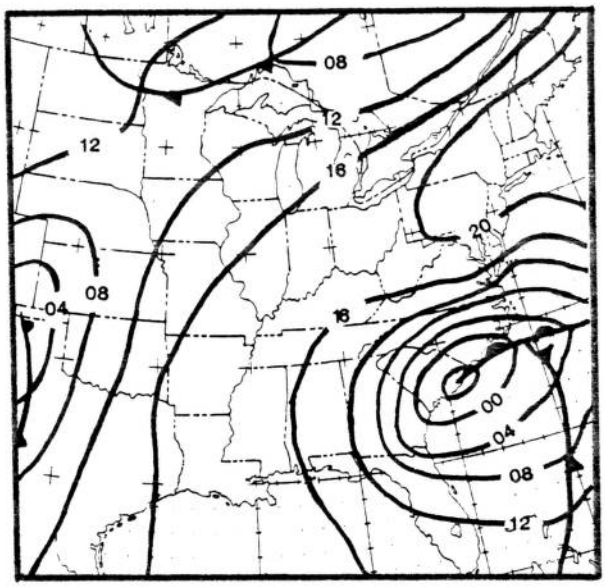


Figure 2. Observed storm surges at Southport, N.C. (solid lines) and Charleston, S.C. (dashed lines). The date of each day is placed at 1200 EST.



0700 EST Feb. 13, 1983



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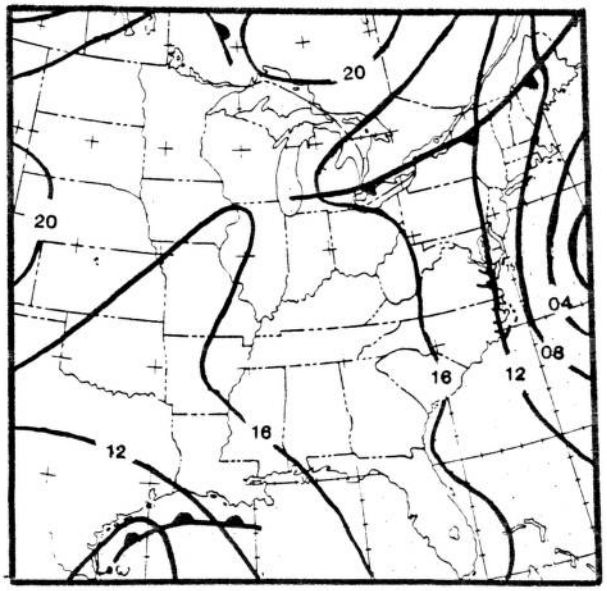

0700 EST Feb. 15, 1983

Figure 3. Sea-level pressure charts for 0700 EST February 13-15, 1983.

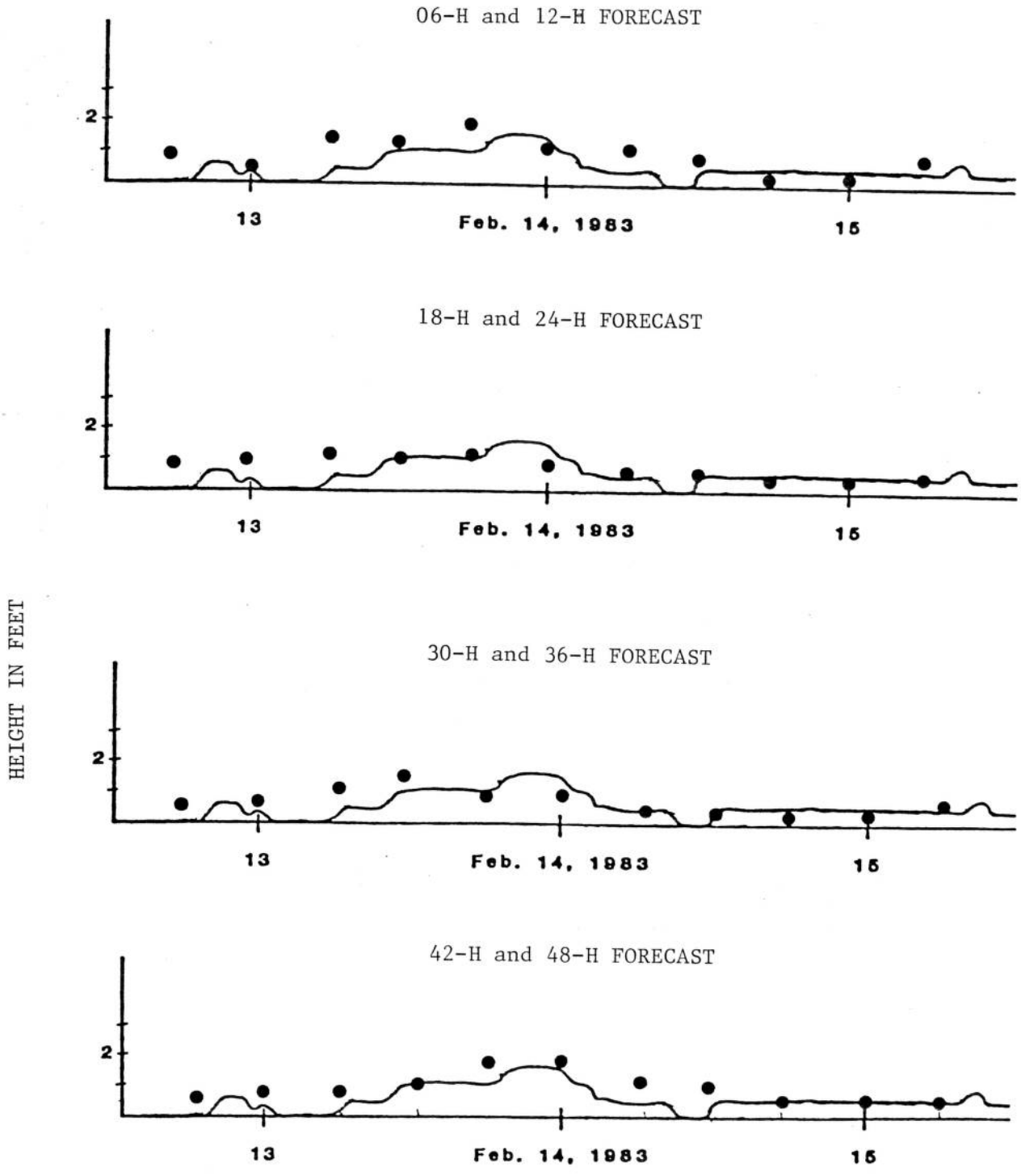

Figure 4. The observed (solid lines) and forecast (dots) storm surge for 0600 EST February 13, 1983 through 1800 EST February 15, 1983.