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TECHNIQUES DEVELOPMENT LABORATORY

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EVALUATION OF COMPUTER-PRODUCED LAKE ERIE STORM SURGE FORECASTS FROM SEPTEMBER 1, 1973 THROUGH APRIL 30, 1974

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By

William S. Richardson

INTRODUCTION

This Office Note describes my evaluation of the computer-produced Lake Erie storm surge forecasts which were transmitted from NMC to WSFO, Cleveland from September 1, 1973 through April 30, 1974.

I have verified storm surge cases where the observed set-up (magnitude of difference in storm surge between Buffalo and Toledo) was 6 feet or greater. I have also verified those cases where the set-up was forecast to be 6 feet or greater during the 01- to 12-hour forecast period.

STORM SURGES CASES

Figure 1 through Figure 13 contain the graphs of the observed, estimated, and forecast storm surges for 13 cases which satisfied the six-foot criteria. The "estimated" surges (hindcasts) were computed with the observed sea-level pressures as predictors, while the sea-level pressure forecasts from the PE model were used to compute the storm surge forecasts. The top set of graphs in each figure shows the observed and estimated surges. The remaining graphs are observed and forecast surges.

The initial time of the PE sea-level pressure data, used in each forecast, is indicated above the forecast curve. The surge forecasts for Buffalo are hourly forecasts valid 1 to 48 hours after the time of the initial data. The surge forecasts for Toledo are made bi-hourly and are valid 2 to 48 hours after the time of initial data. The dates shown on the storm surge graphs are placed at the 1200 EST (1700 GMT) position for each day.

CONCLUSIONS

In most cases the estimated storm surge is in good agreement with the observed surge. However, in cases where the observed surge was negative at Buffalo, (February 2, 1974, February 6, 1974, and April 8, 1974) the forecast equation for Buffalo estimated a much more negative surge than was observed. This problem is probably due to the developmental data. Most of the developmental data consisted of positive surges at Buffalo and negative surges at Toledo.

Storm surges which occur in February and early March are difficult to verify because a large part of the lake may be covered with ice. This was the situation before the February 22, 1974 case. Figure 14 shows

that 70%-90% of the lake was covered with ice. However, the winds associated with the February 22 case were strong enough to break up some of the ice and cause a set-up greater than 6 feet. The set-up may have been as great as the estimated set-up (Figure 9) if the lake had not been partially covered with ice.

While the storm surge forecasts are in reasonable agreement with the observed surges, the surges are underforecast. This is particularly true of the 30- to 48-hour forecasts which also forecast the surges to occur 12 to 18 hours later than they were observed. While the PE sea-level pressure forecasts are generally good, the PE tends to underforecast the speed and intensity of low pressure systems particularly in the 30- to 48-hour forecast period. Even with these forecast errors, the storm surge forecasts still provide meaningful guidance to the forecaster.

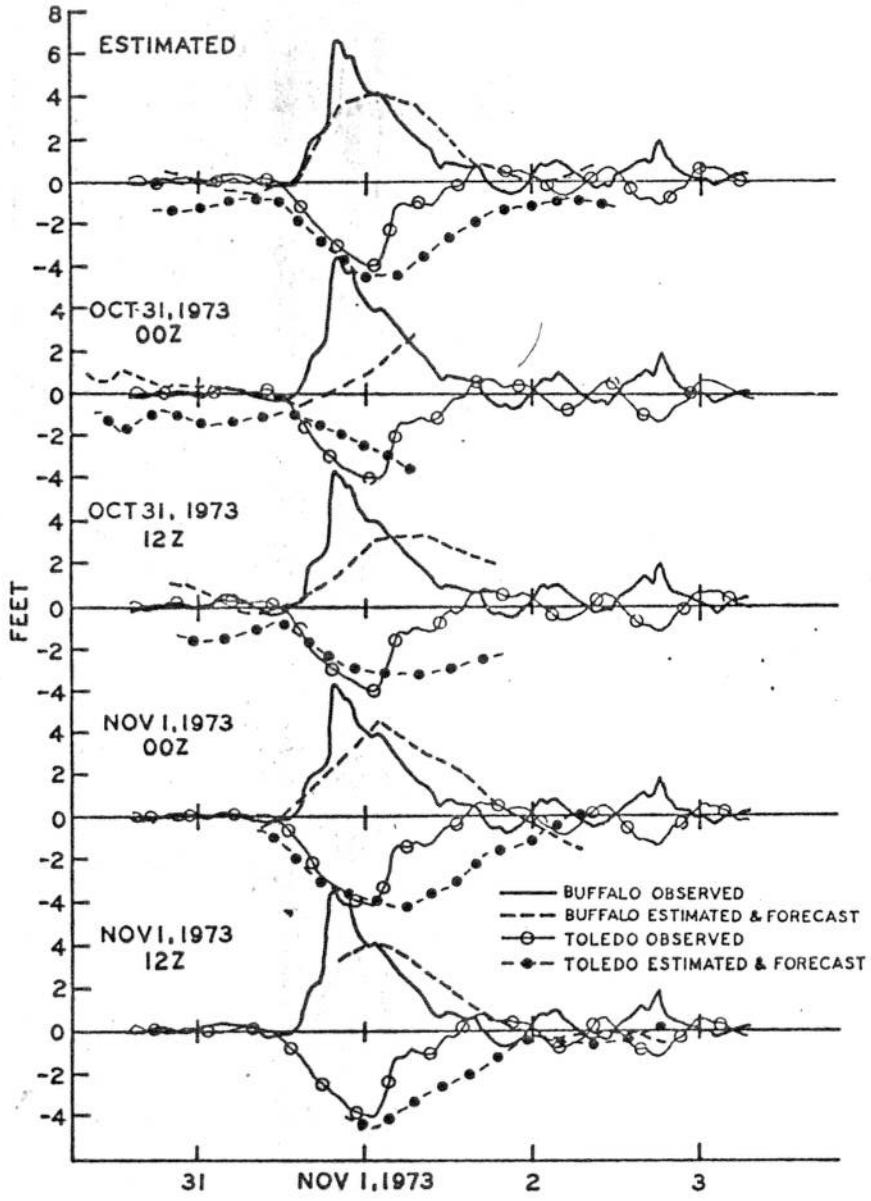

Figure 1. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for November 1, 1973.

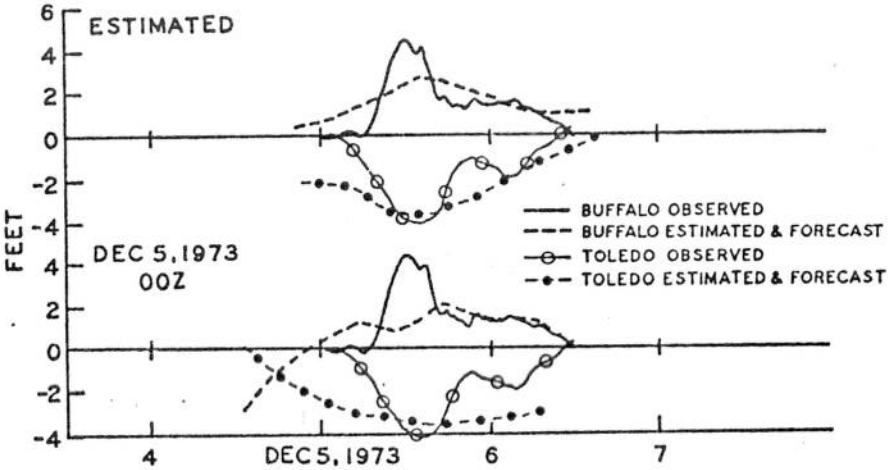

Figure 2. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for December 6, 1973.

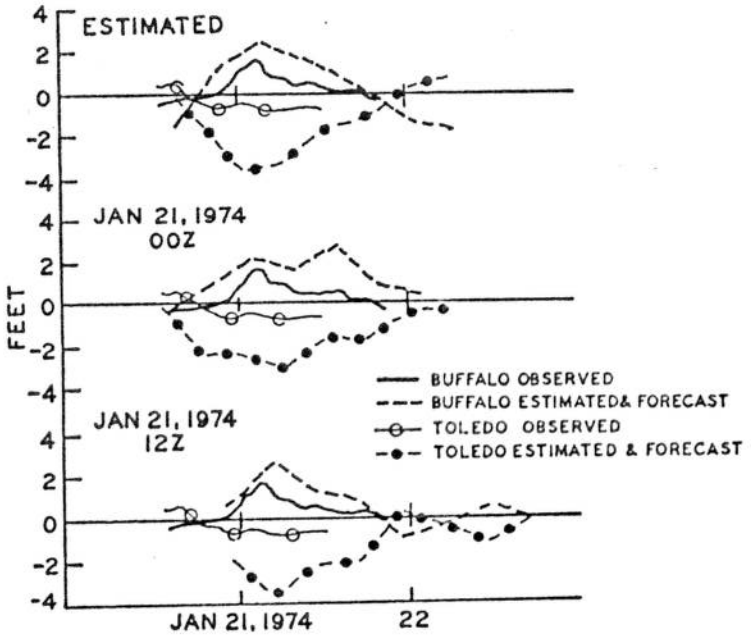

Figure 3. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for January 21, 1974.

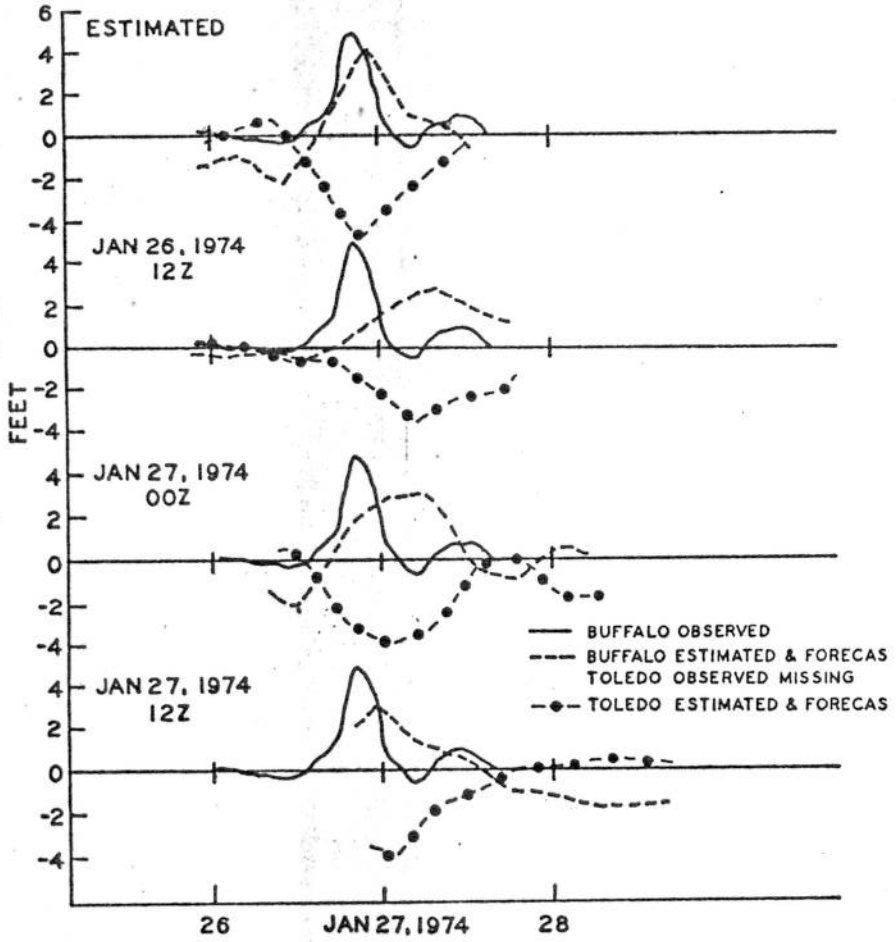

Figure 4. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for January 27, 1974.

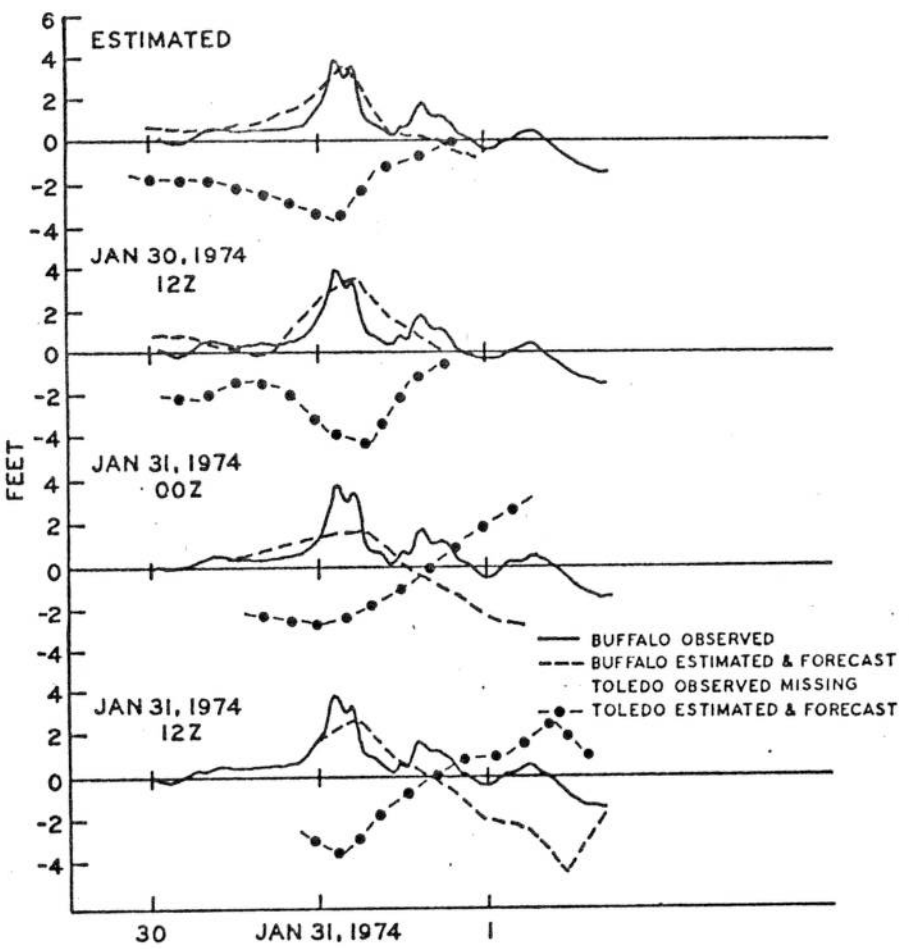

Figure 5. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for January 31, 1974.

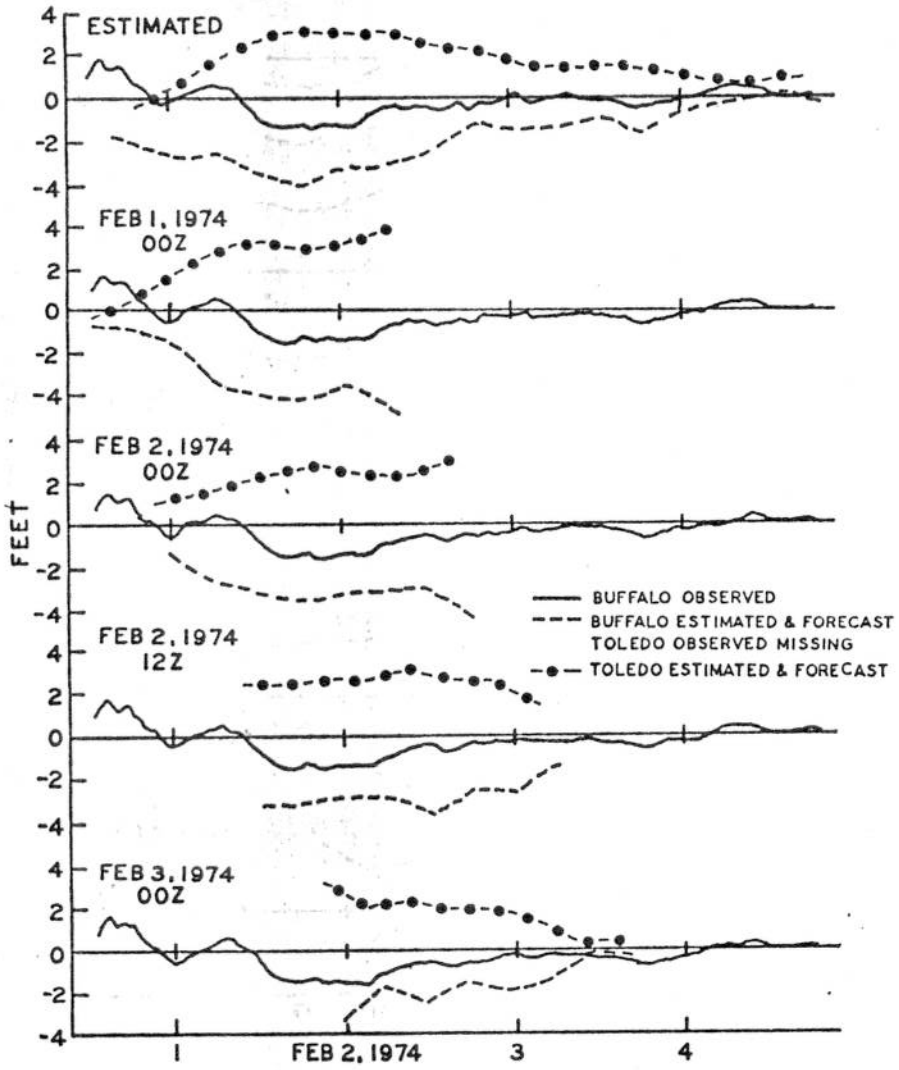

Figure 6. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for February 2, 1974.

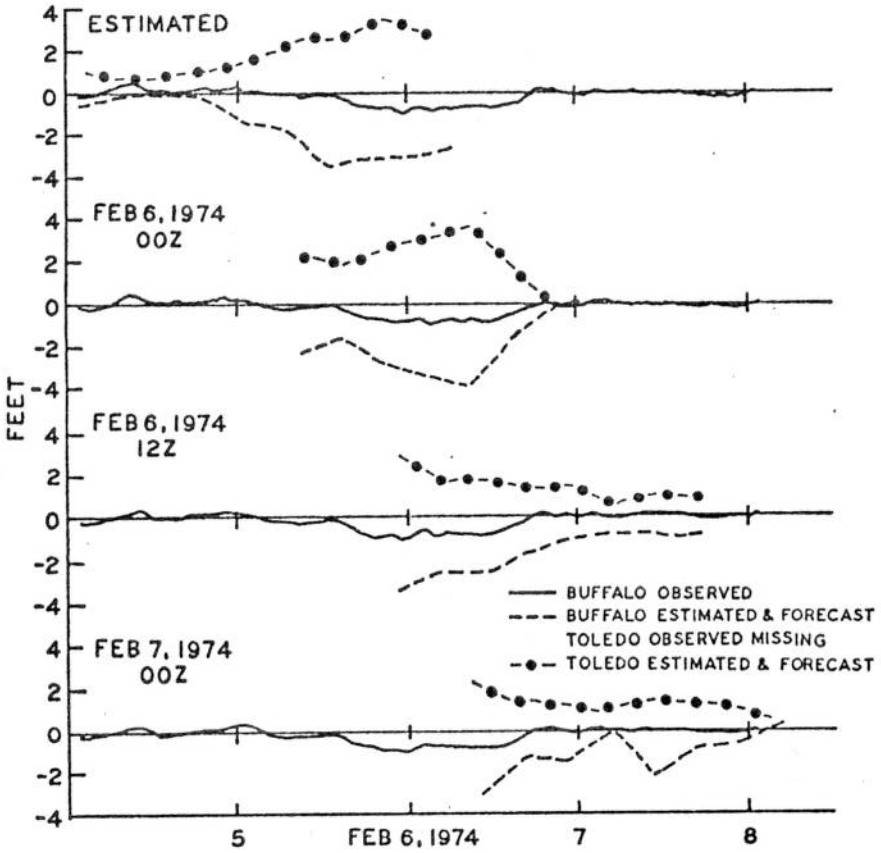

Figure 7. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for February 6, 1974.

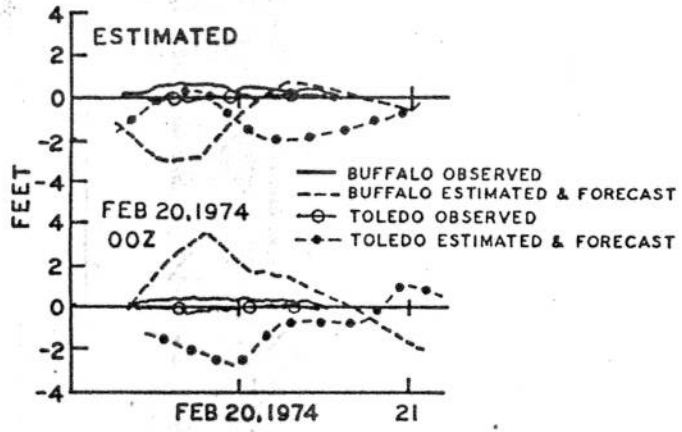

Figure 8. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for February 20, 1974.

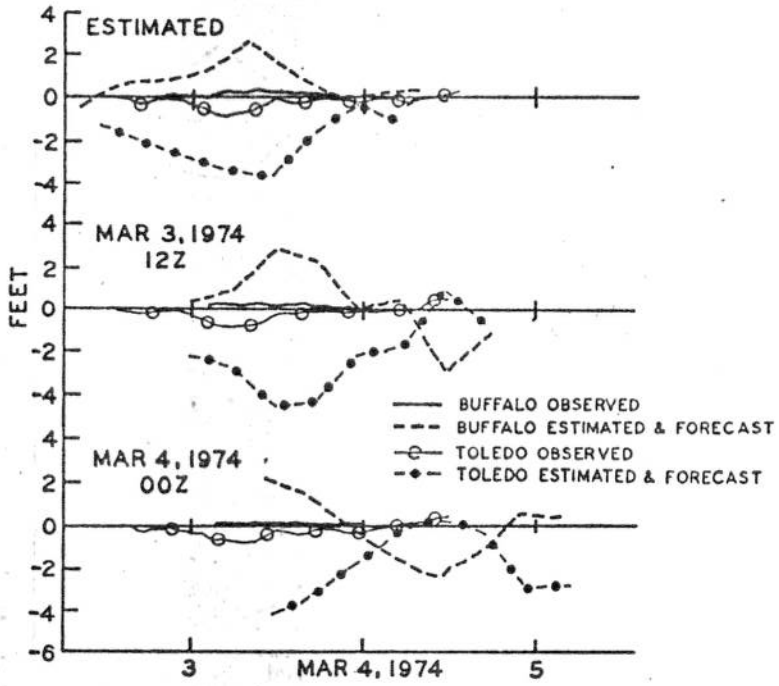

Figure 10. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for March 3, 1974.

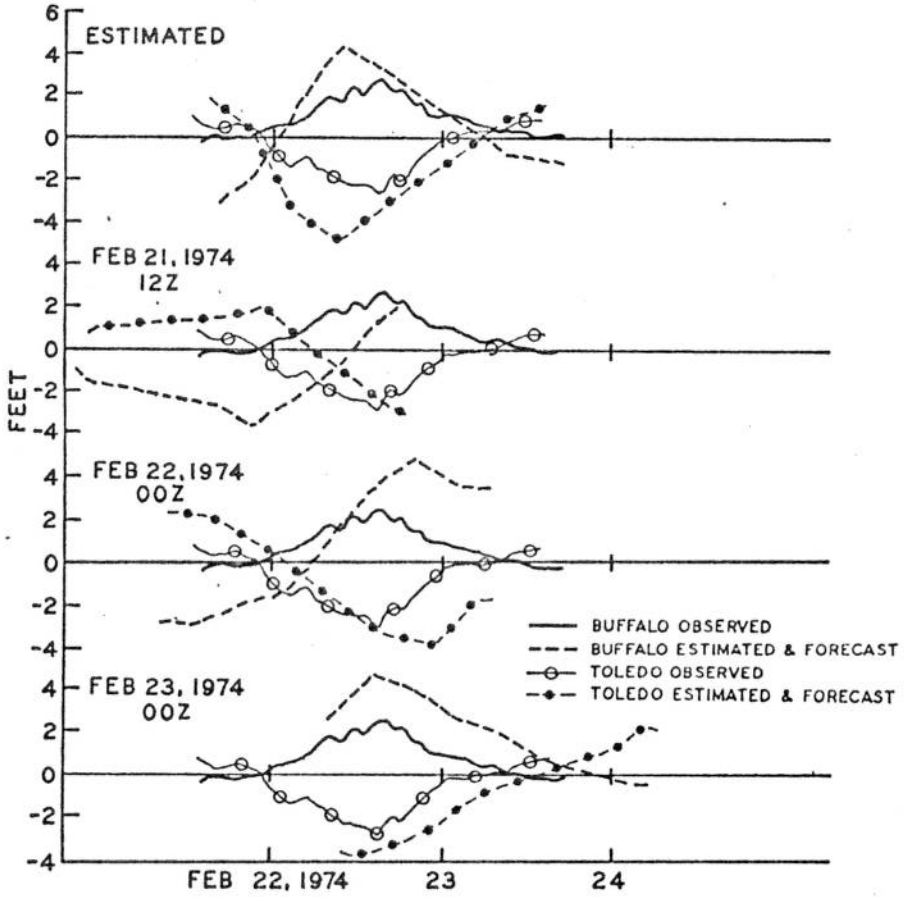

Figure 9. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for February 23, 1974. The forecast for February 22 at 1200 GMT is missing.

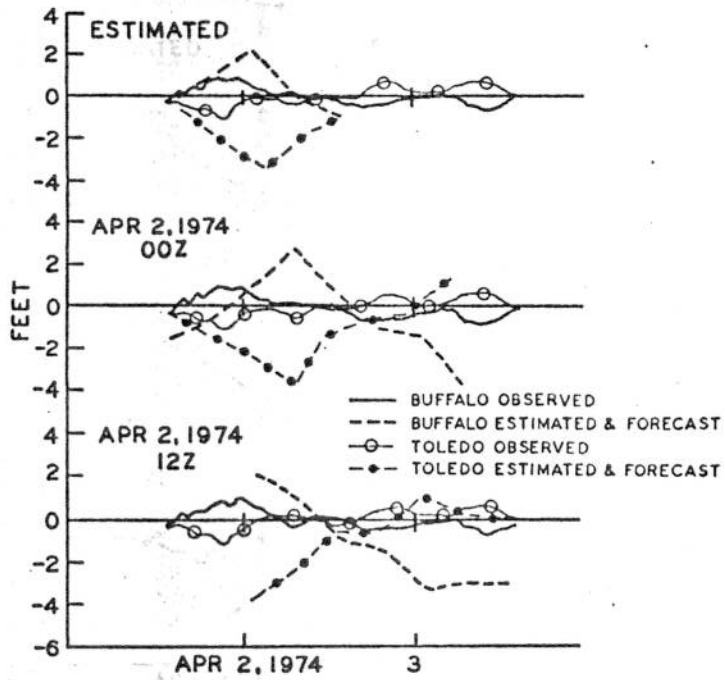

Figure 11. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for April 2, 1974.

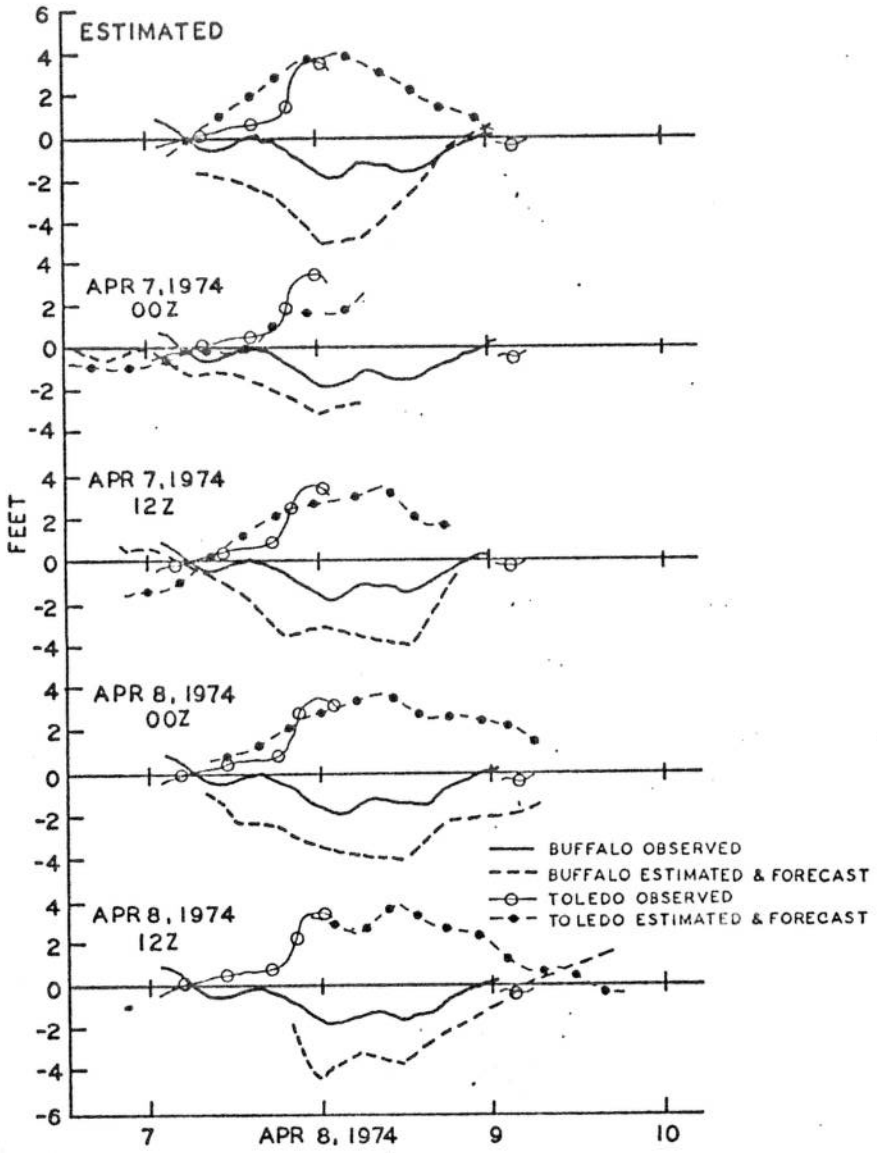

Figure 12. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for April 8, 1974.

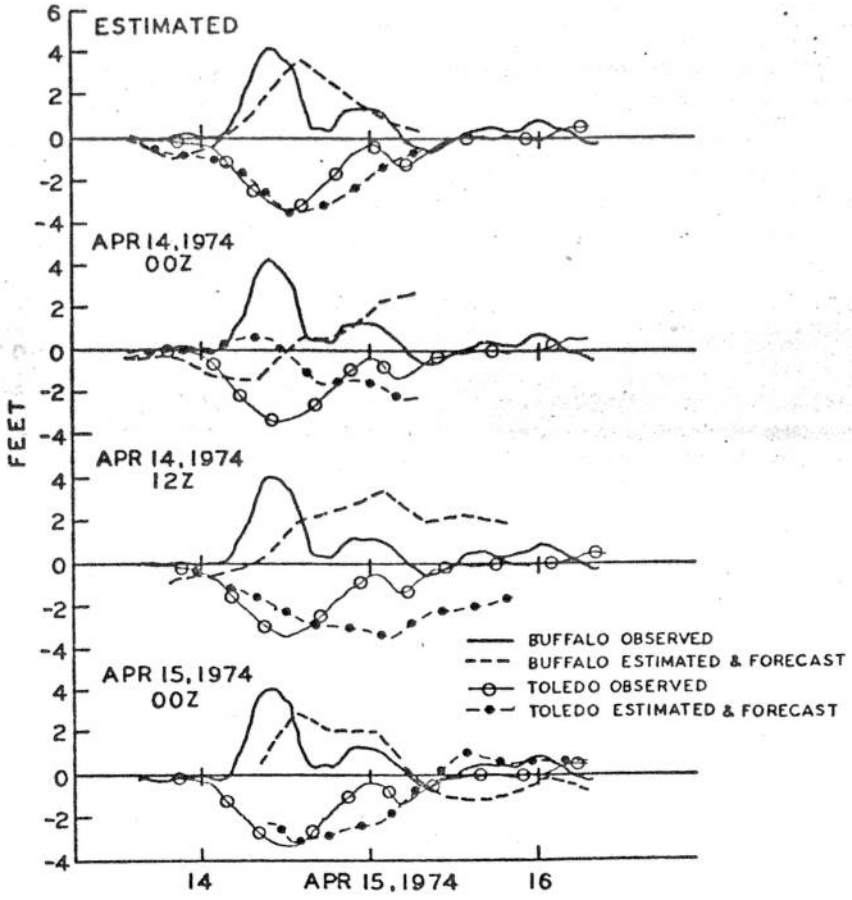

Figure 13. Observed storm surge, estimated storm surge, and forecast storm surge at Buffalo and Toledo for April 15, 1974.

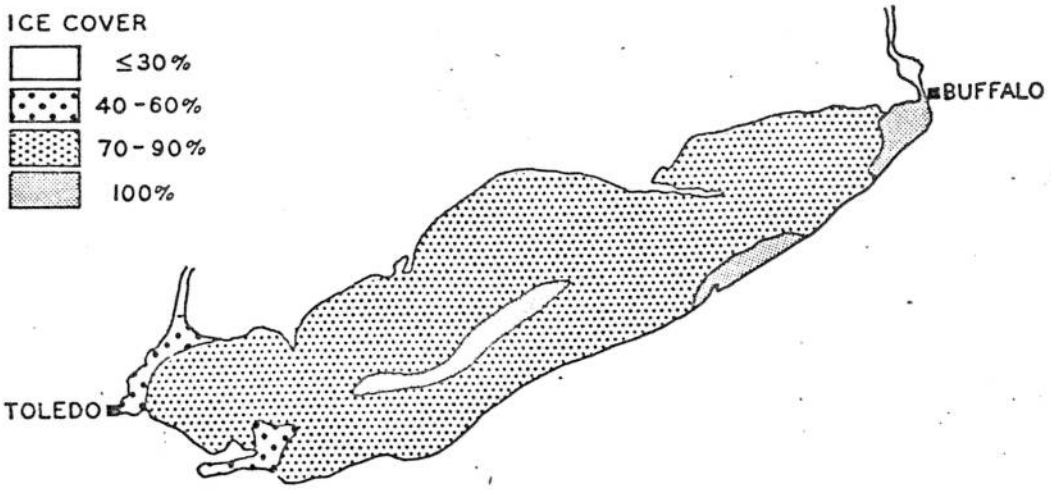

Figure 14. Percentage of ice cover on Lake Erie for the period from February 21, 1974 through February 28, 1974. (from Bernard H. Dewitt and Associates)