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APPLICATION OF MODIFIED LAKE ERIE STORM SURGE PROGRAM TO 1972-1973 SURGE CASES

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by

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INTRODUCTION

When the TDL Lake Erie Storm Surge method was developed (Richardson and Pore, 1969), we were faced with the problem of having pressure fields available only at six-hour intervals. We could have developed one forecast equation that would have used pressure fields with lags of 00 hr., 06 hr., 12 hr., etc., and would have produced forecasts valid for 00 GMT, 06 GMT, 12 GMT, and 18 GMT. This was not done because peak surges can occur between these synoptic times.

We had hourly water level data for Buffalo, and bi-hourly data for Toledo. Therefore, we attempted to make hourly forecasts for Buffalo and bi-hourly forecasts for Toledo. This was done by deriving a set of six regression equations for Buffalo and a set of three for Toledo. Each equation applied to a synoptic time plus n hours, where n is 0, 1, 2, 3, 4, and 5 for Buffalo, and 0, 2, and 4 for Toledo. Because each equation is derived separately and does not explain 100% of the variance of water level, systematic oscillations exist in the water level calculations. We have known this for a long time and have debated as to whether removal of the oscillations from the forecasts would be desirable. After discussion with the Scientific Services Division of the Eastern Region and personnel at NWSFO, Cleveland, we modified the surge program to eliminate oscillations in the forecasts.

MODIFICATION

On May 2, 1973, the surge program was modified to compute the surge in the following manner. The hourly (bi-hourly) water level for Buffalo (Toledo) is calculated first by using the complete set of regression equations. The program selects the greatest departure from normal level and then uses the forecasts only at six-hour intervals from the time of greatest departure. This procedure maintains the peak values, gives a forecast every six hours, and eliminates the oscillations in between. The program computes the linear interpolated values between the six-hour forecasts.

APPLICATION

We tested the modified method on eight storm surge cases which occurred during 1972-1973. Figure 1 through Figure 4 contain the graphs of the observed surge and the surge estimated by the modified method using observed

sea-level pressure as predictors (hindcasts) for the eight cases. The dates shown on the storm surge graphs are placed at the 1200 EST (1700 GMT) position for each day.

CONCLUSION

We feel that by removing the oscillations from the forecasts, the modified method gives more meaningful guidance to the forecaster. The method gives a better indication of the trend of the surge and maintains the time and maximum value of the peak surge.

REFERENCES

Richardson, William S., and N. Arthur Pore, "A Lake Erie Storm Surge Forecasting Technique," ESSA Technical Memorandum WBTM TDL 24, August 1969, 23 pp.

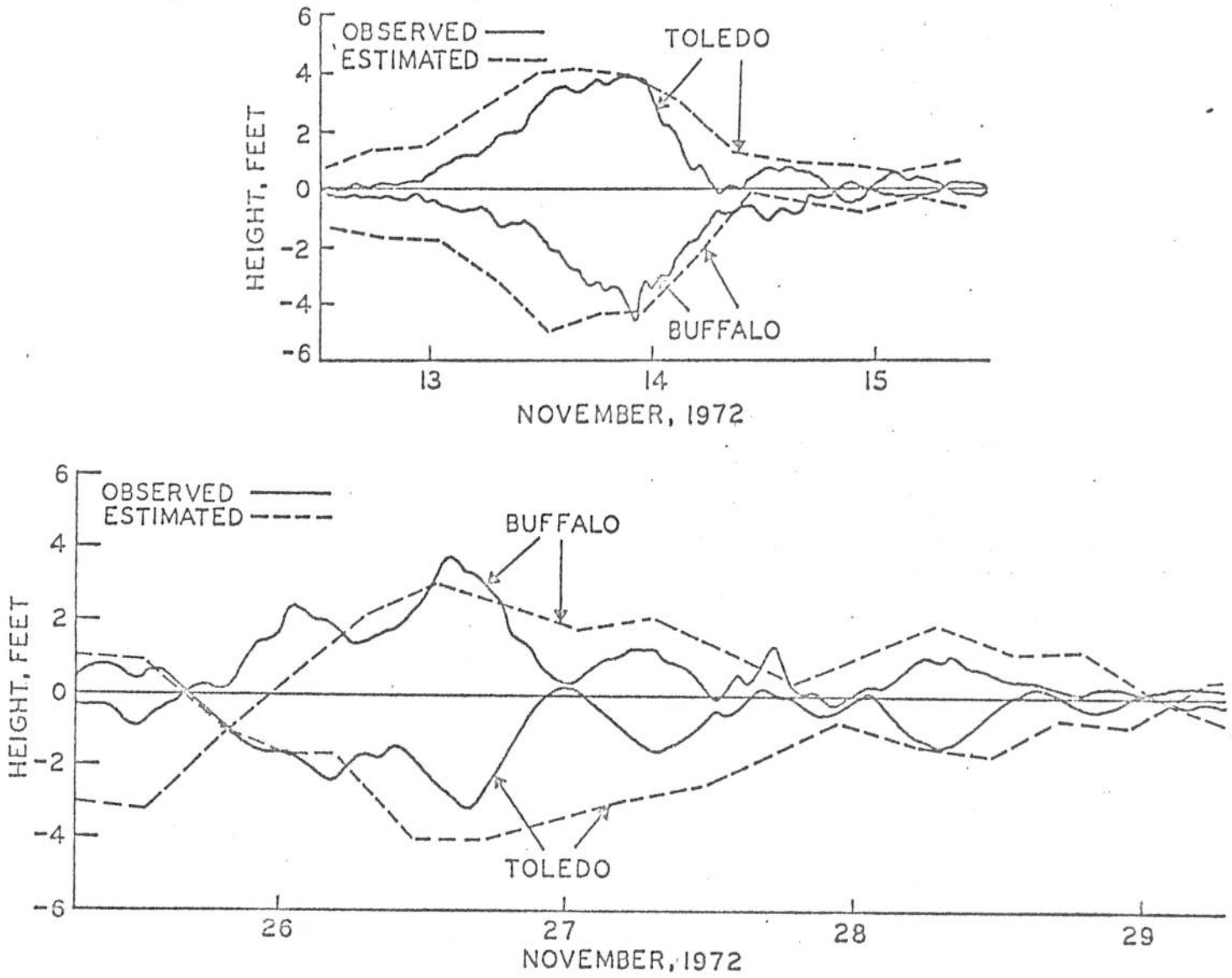

Figure 1. The observed surge and the surge estimated by the modified method using observed sea-level pressure for November 14, 1972 and November 27, 1972 storm surge cases.

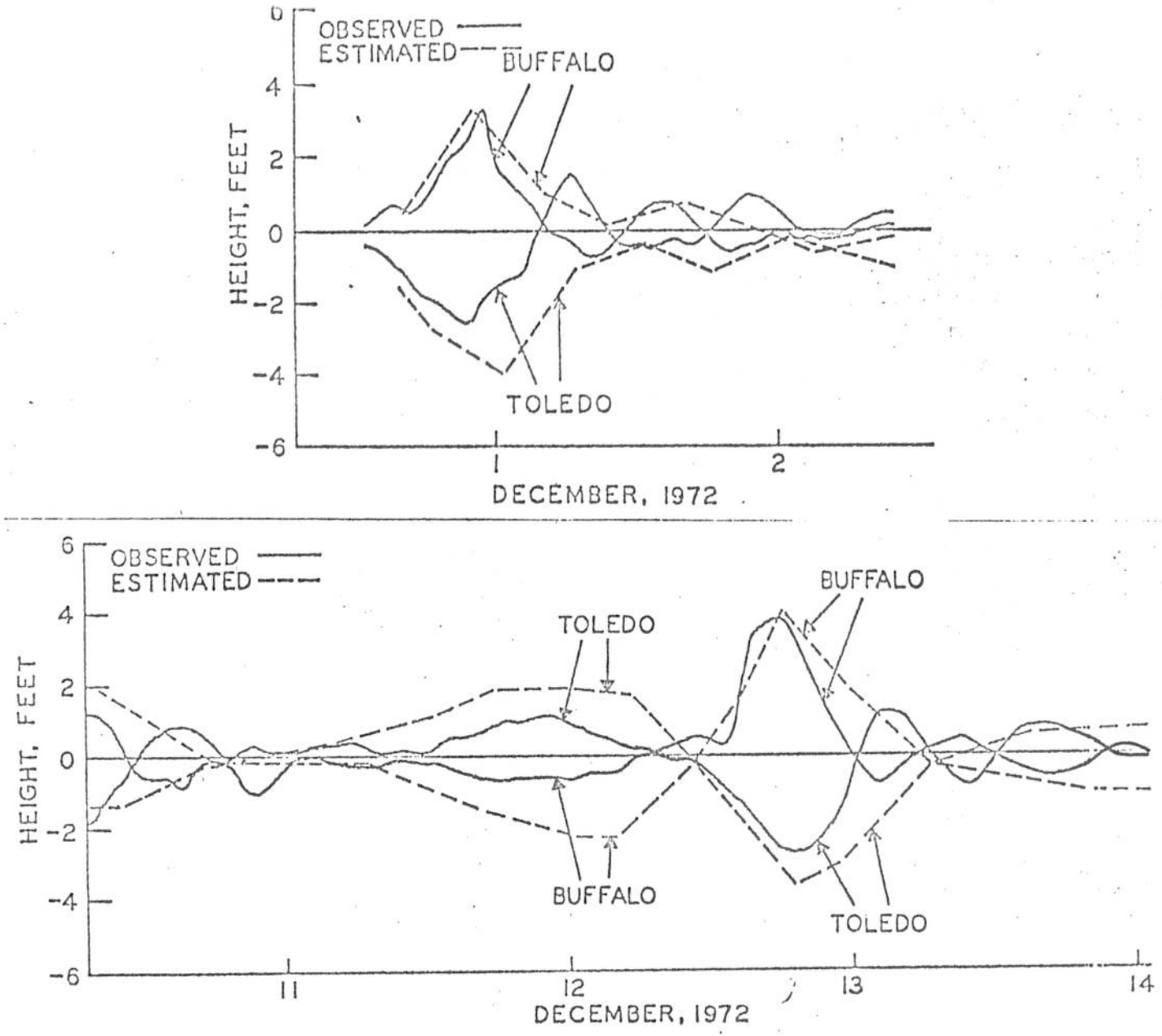

Figure 2. The observed surge and the surge estimated by the modified method using observed sea-level pressure for December 1, 1972 and December 13, 1972 storm surge cases.

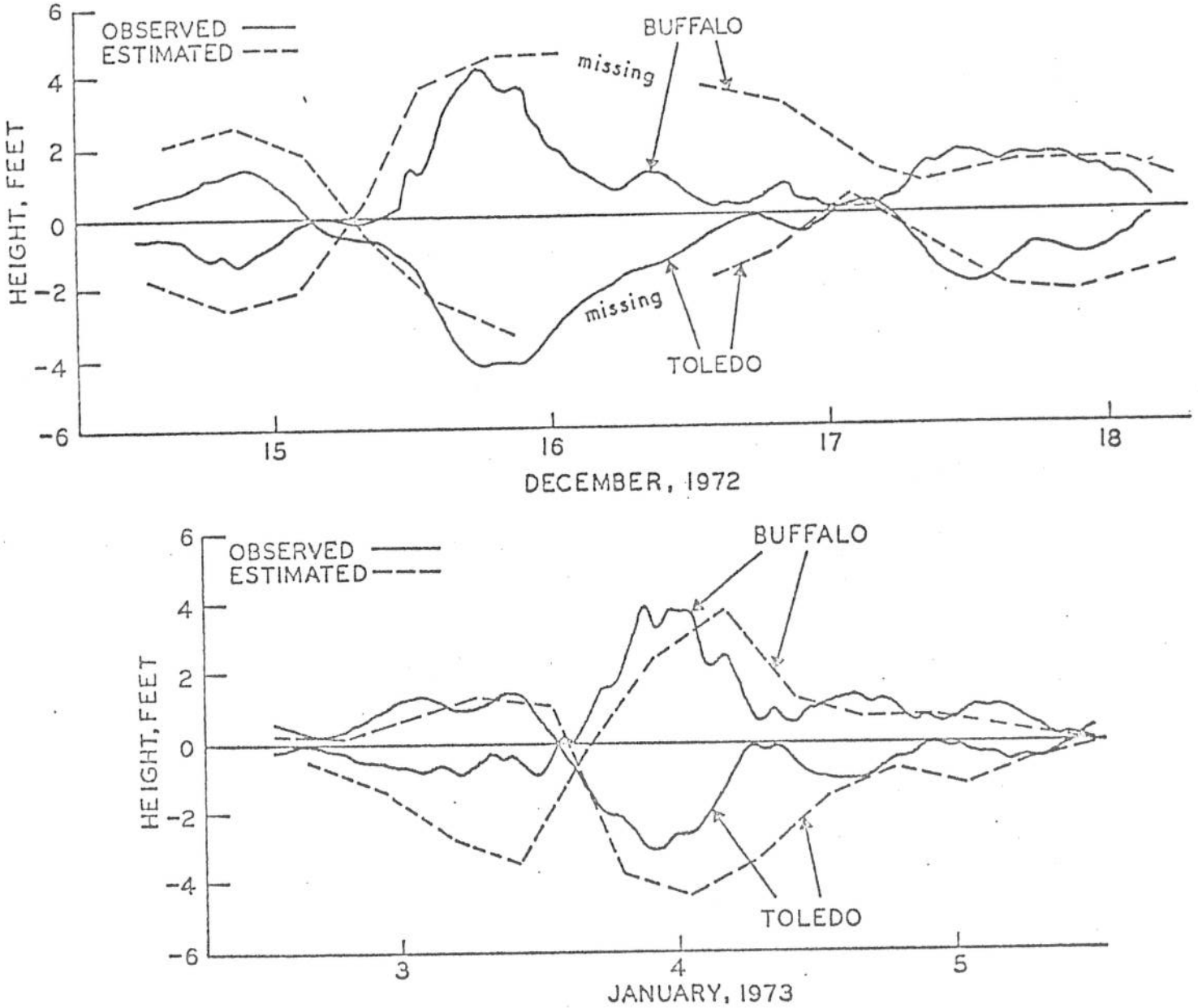

Figure 3. The observed surge and the surge estimated by the modified method using observed sea-level pressure for December 16, 1972 and January 4, 1973 storm surge cases.

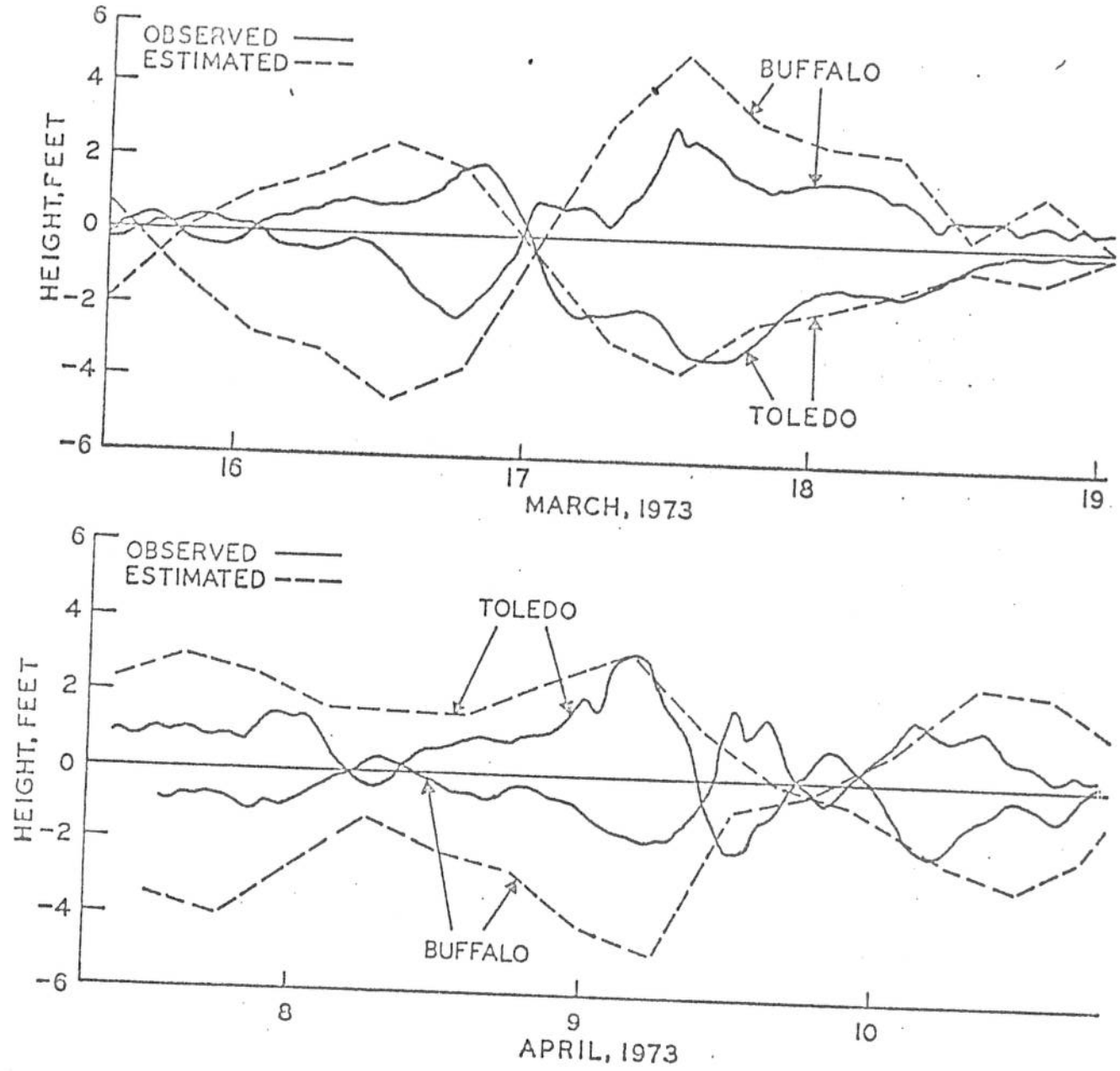

Figure 4. The observed surge and the surge estimated by the modified method using observed sea-level pressure for March 18, 1973 and April 9, 1973 storm surge cases.