TIDAL PREDICTION IMPROVEMENTS IN ESTUARIES AND COASTAL SEAS

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To improve accuracy of tidal prediction in estuaries and coastal seas, two alternatives are investigated in this study. One is harmonic analysis and prediction with tidal components automatic optimized method and the other is the prediction base on average harmonic constants of years.

The tidal analysis and prediction with the tidal components automatic optimized method is separated into two steps. The first step is to select an original tidal components series for tidal analysis. This original series should consist of much more tidal components than the series for normal fixed components group method does. So the original series can cover almost all the important constituents at a certain location. By using the original tidal components series, the tidal analysis is carried out and the tidal constants of every component within the series are obtained. The second step is optimizing and obtaining dominant tidal components series for tidal prediction. Based on the results of the first step, the amplitude of every component within the original series is compared to a certain criterion value. Then the components with their amplitudes exceeding the certain value are select to compose a dominant tidal components series. The other components are neglected. Finally, the tidal predictions are carried out based on this optimized dominant components series.

The tidal components automatic optimized method for tidal analysis and prediction has been used for several cases with good results comparing to the measurements. A case study about tidal predictions based on normal fixed tidal components group method and tidal components automatic optimized method was presented at Xiamen station for the same duration of 1994.6.1, 00:00:00 ~ 1995.5.31, 23:00:00. Table 1 shows the comparison results between predictions of two methods and tidal measurements. The deviation of 0.1m between predicted water level and the measurement is regarded as the criterion value for an accurate prediction. It can be seen from table 1 that the prediction accuracy base on the tidal components automatic optimized method is at least 20% higher than that based on the normal fixed tidal components group method. It also can be obtained that the range of the perdition error of the optimization method is much smaller than that of the normal method.

Some interesting phenomena were observed that the variation between predictions at same locations for the same period based on harmonic constants from analysis on different year's measurements could be notable. Comparison results showed the prediction based on average harmonic constants of years was more reasonable than that based on constants of one year. Prediction error analysis was carried out to investigate the accuracy of predictions based on different harmonic constants. It obtained that the standard deviation of prediction based on average harmonic constants is the smallest except the case of analysis and prediction for the same year, which has no sense for predictions. In the other word, the accuracy of predictions based on average harmonic constants is the highest.

Table 1. Comparison of perdition accuracy at Xiamen station (After Zhao, 1999) (1994.6.1,00:00:00~1995.5.31,23:00:00)

Deviation between measurements and predictions (+)	Occurrence		Deviation between measurements and predictions (-)	Occurrence	
	Normal method	Optimization method		Normal method	Optimization method
≥0.1 m	2650	1411	≤-0.1 m	2143	1425
≥0.2 m	1188	344	≤-0.2 m	771	306
≥0.3 m	490	80	≤-0.3 m	240	52
≥0.4 m	164	35	≤-0.4 m	64	8
≥0.5 m	63	16	≤-0.5 m	17	0
≥0.8 m	13	0	≤-0.7m	3	0
≥1.0 m	3	0			
Maximum	1.17m	0.68m	Maximum	-0.83m	-0.44m
Accuracy (±0.1m)	45.3%	67.6%			

REFERENCES

Zhao, Y.H., Wang, X.L., Zhang, J.L.(1999), "Applied system for tidal analysis and prediction", *Journal of Hohai University (Natural science)* Vol.27. No.4.