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Abstract

SEA LEVEL FORECASTING BY KALMAN FILTER

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Some human activities in coastal area or ocean engineering works are strongly affected by sea level variations. Hence sea level forecasting is necessary for proper planning and operation. Sea level variations are mainly affected by tidal motions which can be represented by harmonic models. Therefore, an efficient algorithm for finding the tidal parameters in the harmonic models is a key for effective sea level forecasting. In this study, a recursive algorithm called Kalman filter adopted for solving harmonic sea-level models is presented. The harmonic sea-level models are put into the state space form such that Kalman filter can be applied to find their parameters.

In order to test the abilities of the Kalman filter technique in tide modeling and prediction, short length of Macau tide data is used to solve harmonic sea-level models with this recursive algorithm. The solved models are then used for prediction and comparisons. From the case study of Macau, it is shown that Kalman filter is able to solve harmonic sea-level models from short observation record. In each model, different numbers of tidal constituents are used and the length of tide record for obtaining accurate forecast is determined. Current case study indicates that harmonic models with four to five dominant tidal constituents may give the best prediction performance in Macau giving that their harmonic parameters are estimated by Kalman filter with as little as four to twenty days record. These encouraging results indicate that Kalman filter is a strong contender for solving harmonic tidal forecaster in Macau

as well as other places in the world if only limited monitoring data are available. The recursive nature of Kalman filter also provides computation efficiency in real time monitoring and forecasting if such system is required.