DIGITIZING FLOOD PROCESSES FOR SARAWAK RIVER OPERATIONS

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Abstract
Kuching city of the Sarawak State, Malaysia is located on a flat alluvial plain 30 km away from the sea. The low-lying city is vulnerable to high tides, where the city had experienced recorded spring tides as high as 3.5 m MSL. In 1998, a barrage is established near estuary to protect the city. The structure is the property of the State Government under the care of Sarawak Rivers Board, but the operation is managed by a private contractor. The operation team extensively regulates the hydrological data of the river system with its telemetry system. However, the operator is lacking a flood forecasting system to predict high flow from upstream. This paper reports a computer modelling effort to guide the barrage operations in flood warning. We present a way of warning based on computerized flood mappings. The behaviours of the river in terms of levels, rates of flow, and other parameters are simulated. The riverside communities are to be alerted at lower river water levels between 0.8 and 1.0 m MSL as compared to the currently used 1.37 m MSL for flood warning with reference to Batu Kawa.

BACKGROUND

A tidal barrage was established since 1998 across Sarawak River, the major river flowing through the capital city of Kuching in the State of Sarawak, Malaysia (see Figure 1). A barrage is an artificial obstruction at the mouth of a tidal watercourse. Kuching Bay is subjected to spring tides as high as 3 - 3.5 m MSL (A. Memon and M. Murtedza, 1999). Annual rainfall within the catchment is typically around 4000 mm. Therefore, the city is at risk to fluvial and tidal flooding events. The Sarawak River flow was modified from a naturally tidal regime to regulated gates system constructed just downstream of Kuching city under the Sarawak River Regulation Scheme (KTA Consulting Engineers, 1994). Kuching Barrage was the only outlet of the catchment while another two river courses to the sea were blocked. It was designed to reduce the incidence of floods in the Kuching city area, principally by curtailing the effects of tides upstream of the barrage (J.J. Sharpand and Y.H. Lim, 2000).

Operations of the Kuching Barrage to control river water levels involve frequent opening and closing of five (5) mechanical radial gates plus a ship lock. During periods of low river flow, all the gates must be closed to completely stop the flow and maintain high water levels. During floods, the gates may all be opened depending on tide levels. For intermediate conditions, constant regulation is required to prevent the entry of salt water and to keep the water level upstream at the required level. For daily operations, Kuching Barrage is carrying out flushing operation during low tide and alternate weekdays flooding-in operation during high tide (P.L. Law et al., 2007). Flooding-in operation is to specially provide the required water levels for shipyard maintenance activities located at the immediate upstream of the barrage.

Previously, only seven (7) telemetry stations were installed. The extreme floods in January 2003 and February 2004, however, have prompted a more pro-active flood warning system along the Sarawak River since December 2005. Twenty-four (24) telemetry stations utilizing Australian expertise and technology are now providing early warning for Kuching