Determination of Design Flood Levels for the Tidal Reach of the Han River

Kyungsoo Jun*, Li Li**

Abstract

The flood water level in tidal river is determined by the joint effects of flood discharge and tidal water levels at downstream boundary. Due to the variable tidal boundary conditions, the evaluated design water levels associated with a certain flood event can be significantly different. To avoid determining of design water levels just by a certain tidal boundary condition and remove the influence of variability in boundary condition from the evaluation of design water levels, a probabilistic approach is considered in this study.

This study focuses on the development of a method to evaluate the realistic design water levels in tidal river with taking into account the combined effects of river discharge and tidal level. The flood water levels are described by the joint probability of two driving forces, river discharge and tidal water levels. The developed method is applied to determine design water levels for the tidal reach of the Han River. An unsteady flow model is used to simulate the flow in the reach. To determine design water levels associated with a certain flood event, first, possible boundary conditions are obtained by sampling starting times of tidal level time series; then for each tidal boundary condition, corresponding peak water levels along the channel are computed; and finally, design water levels are determined by computing the expectations of the peak water levels.

Two types of tides which are composed by different constituents are assumed (one is composed by M_2, and the other one is composed by M_2 and S_2) at downstream boundary, and two flood events with different maximum flood discharges are considered in this study.

It is found that (a) the computed design water levels with two assumed tides have no significant difference for a certain flood event, though variability of peak water levels due to the tidal effect is considerably different; (b) tidal effect can reach to the Jamsil submerged weir and the effect is obvious in the downstream reach of the Singok submerged weir; (c) in the tidally affected reach, the variability of peak water levels due to the tidal effect is greater if the maximum flood discharge is smaller.

Keywords : Design water level, Unsteady flow model, Tidal reach, Han River

Acknowledgement

This research was supported by a grant (11-TI-C06) from Construction Technology Innovation Program funded by Ministry of Land, Transport and Maritime Affairs of Korean government.

* Professor. Graduate School of Water resources, Sungkyunkwan University. E-mail : ksjun@skku.edu

** Graduate student, Graduate School of Water resources, Sungkyunkwan University. E-mail : lili0809@skku.edu