POSTER 26

Area Detection for Flood Inundation in Akyang Watershed Caused by a Once-in-100 year Heavy Rainfall Event

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I. Introduction

The flood damage occurs suddenly in a relatively short time. Therefore, alarm and preventative measures are very important. Currently, Ministry of Land, Infrastructure, and Transport of South Korea runs a flood forecast system. A Flood Control Office of each large river provides a flood forecast at least 3 hours before a flood occurs (Han river Flood Control Office, http://www.hrfco.go.kr). However, it is a large river-oriented information and the information may not be applicable to small to medium rivers. Particularly, the scale of farmland damage can vary by the type of a crop and the growing stage of it as well as the immersion time and inundation depth. Therefore, we require an efficient system suitable to farmland.

The conventional flood forecast calculates the runoff according to the amount of rainfall and declares the flood warning or the flood alarm depending on the water level fluctuation with considering the amount of dam water storage. Rainfall runoff models are used to calculate runoff due to rainfall and HEC-1, HEC-HMS, and SWAT are good examples. The runoff calculated from rainfall runoff models is used to simulate the stream flow and flooding by using the HEC-RAS, a type of hydraulic models. The HEC-RAS was developed by US Army Corps of Engineers and it is used to review the designs of irrigation facilities and simulate stream flow. The HEC-RAS has an advantage that it can simulate various flows. However, it is based on the Cross-Section Survey Data for stream channel, so it is hard to build geometric data for a simulation. Moreover, it only prints out the simulation results and it is not possible to determine a flood by itself, which are disadvantages of the model. Therefore, various extensions are used in conjunction with the HEC-RAS in recent years. (Im *et al.*, 2005; Hwang *et al.*, 2004)

This study conducted hydraulic modeling by connecting HEC-GeoRAS and HEC-RAS at the drainage area of Akyang stream in Hadong-gun, Gyeongnam and evaluated the possibility to predict the flooding area.

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II. Materials and Methods

2.1. Study area

Akyang stream is the first tributary of Seomjin river, a large river watershed, and it has 4 tributaries. It takes a lot of time to study a large river watershed, which has high temporal fluctuation in flux and water level and goes directly to the ocean, because all spatial changes in flow such as non-uniform flow must be considered in the flooding simulations. Contrarily, the Akyang stream does not have many tributaries and goes directly to the Seomjin river, a large river watershed. Therefore, it was determined that the stream flow could be assumed as a steady flow. Moreover, approximately 30% of the Akyang stream basin is farmland and more than 70% of farmland is the rice field. It was an advantage to utilize the previous study (NICS, 2015) on the flooding damage of rice.

2.2 Application of hydraulic analysis program

Experiment to set the flooding potential area was conducted by using HEC-GeoRAS and HEC-RAS (Fig. 1). Rainfall data, water level at the estuary, and Manning's Law roughness coefficient, which representing the roughness of the stream channel, were estimated from the RIMGIS analysis. The flow of Akyang stream was assumed as steady flow and the flood inundation area and flood stage were calculated by distributing inlet portion flow rate during flooding at the Akyang stream. Simulation results were induced by inputting stream bed-slope (1/n), flood quantiles (m^3/s), water level at the estuary, and Manning's roughness coefficient to HEC-RAS (Fig. 2). The flooding potential area was mapped by applying the results to ArcView and HEC-GeoRAS.

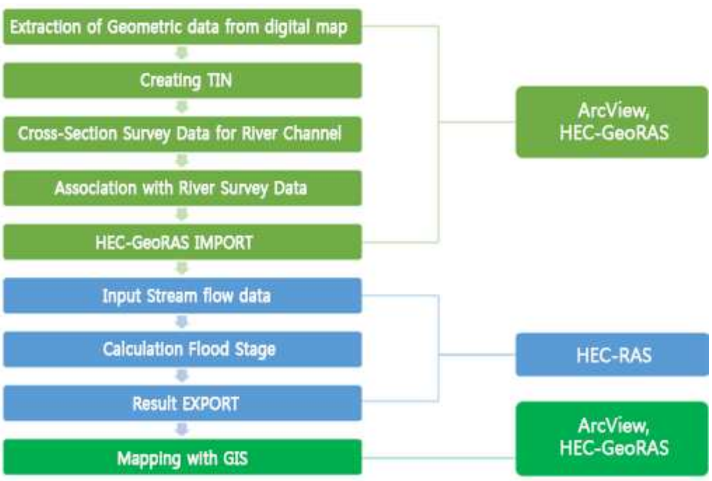

Fig. 1. Simulation process of flooding potential area.

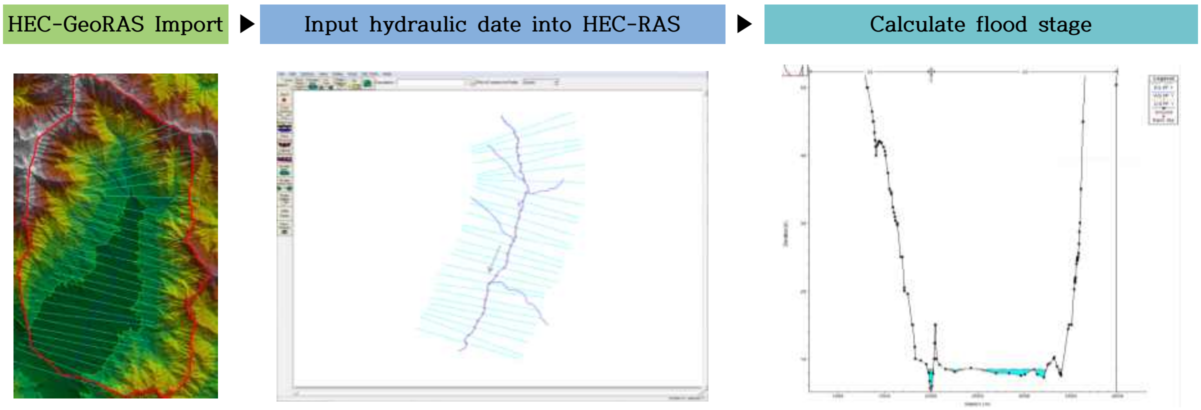

Fig. 2. Process of calculating flood stage using HEC-RAS and HEC-GeoRAS.

III. Result and Discussion

When flood quantiles were distributed in the Akyang stream basin, flooding potential area increased and the width was clearly larger in the downstream. The maximum inundation depth was approximately 1m. The larger flood area in the downstream was similar with the flooding pattern of relatively natural shape streams. Since farmland is located mostly in the downstream, the results indicated that heavy rainfall would increase the damage to farmers.

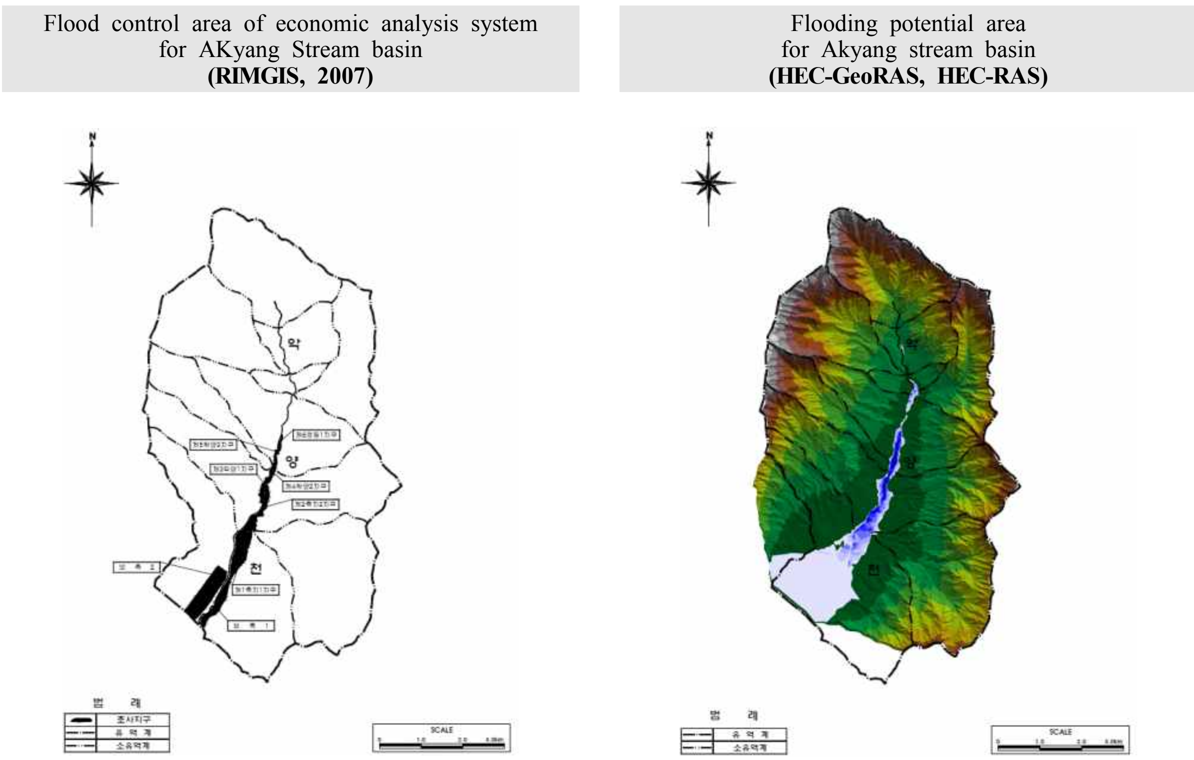

Fig. 3. Comparison of flooding potential area.

Fig. 3 compared the flooding potential area from HEC-GeoRAS and the economic analysis system for flood control area proposed from RIMGIS. The economic analysis system for flood control area is data showing the statistically estimated high flooding potential area with possible damage size and the amount of damage. It targets areas previously damaged by typhoons. The flooding potential area was mostly similar. However, this study suggested larger flooding potential area in the downstream. It was believed that it was because of the changes in drainage area due to altered geographical feature such as stream bank construction after 2007 and the change of administrative district of Akyang stream in 2013.

This study used the roughness coefficient and stream survey data estimated from old RIMGIS. Therefore, it may not fully reflect the current stream condition, if there were alterations in the stream such as river maintenance works. Generally, the higher roughness coefficient increases inundation area. Therefore, it is required to update the stream status, especially the roughness coefficient, to be most realistic. (Choi *et al.*, 2000; Kim *et al.*, 2014)

Moreover, crops are highly influenced by the time between the start of inundation to the completion of drainage as well as the size of flooding area. We will be able to predict more realistic flooding area if we consider related factors such as soil texture, drainage, and agricultural irrigation facilities.

Acknowledgements

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