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Shin, Ji-Yae; Jeon, Myeonho; Kim, Tae-Wong

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NON-STATIONARITY OF STREAMFLOW IN SOUTH KOREA: FOCUS ON THE EFFECT ON FLOOD FREQUENCY

Ji-Yae Shin¹, Myeonho Jeon², and Tae-Wong Kim³

In South Korea, hydro-climatic disasters including localized heavy storms, typhoons, and flooding are a main concern every rainy season. During the last decades, the average annual rainfall increases 9.1% compared to the long-term average during the last 30 years. Especially, the localized convective heavy storms result in rapid flood in urban areas across South Korea, leading to serious damages in both life and property. Due to the lack of discharge data, nonstationary rainfall frequency analysis, as shown in Figure 1, is sometimes employed to derive design floods under the nonstationary condition.

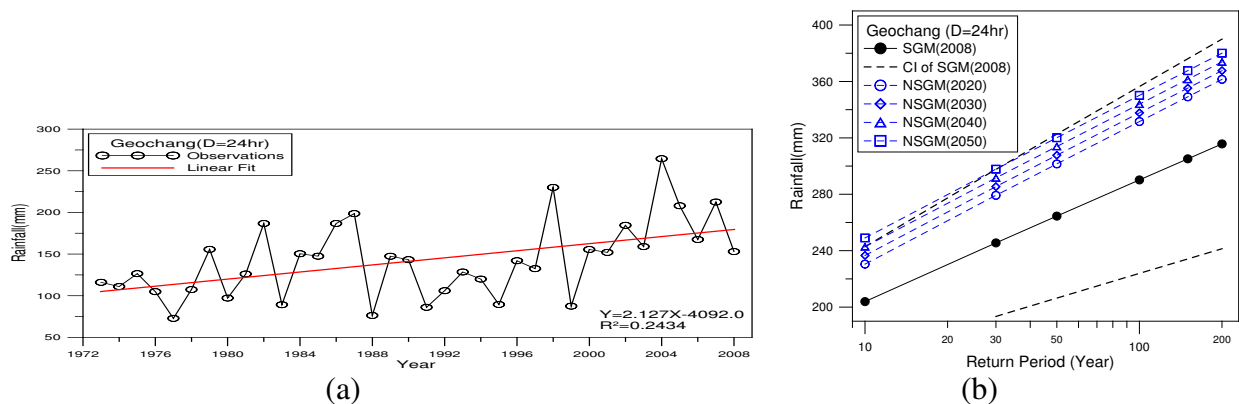


Figure 1 Annual maximum rainfalls (a) and nonstationary rainfall frequency curves at Geochang station in South Korea (Seo et al., 2012).

Nowadays gradually over 30 years discharge data are accumulated at several gauging stations in South Korea which motivates us to develop a statistical scheme to appropriate design floods under the changing world.

This study focuses on identifying the non-stationarity in the streamflow measured in large river basin in South Korea due to climate change and variability. The streamflow data were collected from four large dams, as listed in Table 1, in South Korea. Changes of statistics such as mean and variance of observed streamflows and significant linear and/or nonlinear trend embedded in observations are identified through various statistical testing methods.

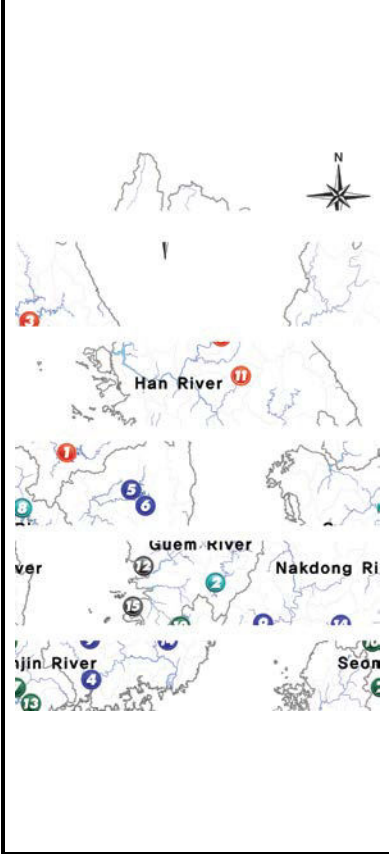
Table 1 Basic information of multi-purpose large dams in South Korea (Lee et al., 2011).

¹ Graduate Research Assistant, Department of Civil and Environmental Engineering, Hanyang University, Seoul, 133-791, Korea (email: jiyaeshin@naver.com)

² Graduate Research Assistant, Department of Civil and Environmental Engineering, Hanyang University, Seoul, 133-791, Korea (email: dektol79@gmail.com)

³ Corresponding Author, Associate Professor, Department of Civil and Environmental Engineering, Hanyang University, Ansan, 426-791, Korea (email: twkim72@hanyang.ac.kr)



	Name of Dam	River	Const' Period	Watershed Area(km ²)	Scale of Watershed
	① Chungju ② Daecheong ③ Soyanggang ④ Namgang ⑤ Andong	Han River Guem River Han River Nakdong River Nakdong River	'78~'86 '75~'81 '67~'73 '87~'03 '71~'77	6,648.0 4,134.0 2,703.0 2,285.0 1,584.0	Large Scale (1,500km ² ~)
⑥ Imha ⑦ Juam ⑧ Yongdam ⑨ Hapcheon ⑩ Seomjingang	Nakdong River Seomjin River Guem River Nakdong River Seomjin River	'84~'93 '84~'92 '90~'06 '82~'89 '61~'66	1,361.0 1,010.0 930.0 925.0 763.0	Medium Scale (500~1,500km ²)	
⑪ Hoengseong ⑫ Boryeong ⑬ Juam Regulation ⑭ Milyang ⑮ Buan	Han River Others Seomjin River Nakdong River Others	'90~'02 '90~'00 '84~'96 '90~'02 '90~'96	209.0 163.6 134.6 95.4 59.0	Small Scale (~ 500km ²)	

In addition, the effect of the non-stationarity of observed streamflows in the frequency of flood is investigated in this study. This study expects that extreme floods have similar tendency of non-stationary to precipitation data which is already reported in many studies, as shown in Figure 1 and 2.

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