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Non-Stationarity of Streamflow in South Korea: Focus on the Effect on Flood Frequency

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

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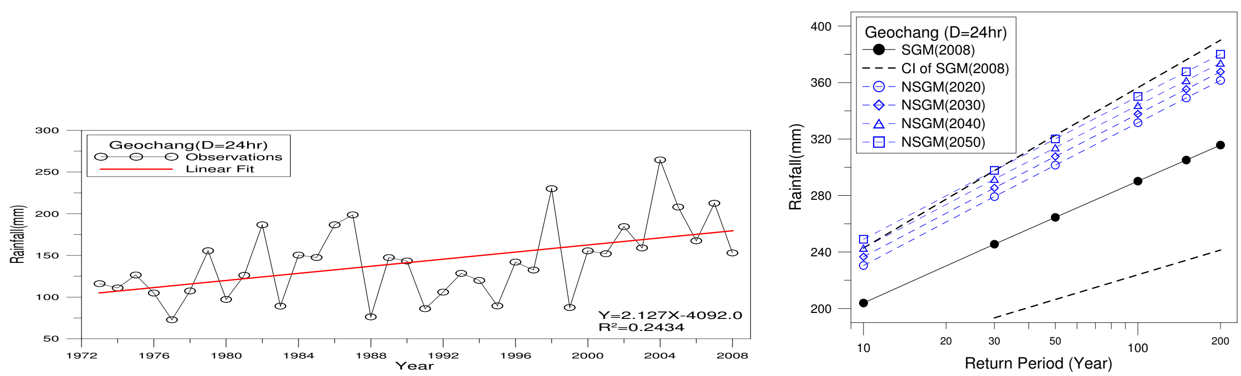
In South Korea, hydro-climatic disasters including localized heavy storms, typhoons, and flooding are a main concern every rainy season. During the last decades, the average annual rainfall increases 9.1% compared to the long-term average during the last 30 years. Especially, the localized convective 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.



(a) (b)

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 steamflow 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).

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Name of Dam	River	Const' Period	Watershed Area(㎢)	Scale of Watershed
① Chungju	Han River	'78~'86	6,648.0	Large Scale (1,500㎢ ~)
② Daecheong	Guem River	'75~'81	4,134.0	
③ Soyanggang	Han River	'67~'73	2,703.0	
④ Namgang	Nakdong River	'87~'03	2,285.0	
⑤ Andong	Nakdong River	'71~'77	1,584.0	
⑥ Imha	Nakdong River	'84~'93	1,361.0	Medium Scale (500~1,500㎢)
⑦ Juam	Seomjin River	'84~'92	1,010.0	
⑧ Yongdam	Guem River	'90~'06	930.0	
⑨ Hapcheon	Nakdong River	'82~'89	925.0	
⑩ Seomjingang	Seomjin River	'61~'66	763.0	
⑪ Hoengseong	Han River	'90~'02	209.0	Small Scale (~ 500㎢)
⑫ Boryeong	Others	'90~'00	163.6	
⑬ Juam Regulation	Seomjin River	'84~'96	134.6	
⑭ Milyang	Nakdong River	'90~'02	95.4	
⑮ Buan	Others	'90~'96	59.0	

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.

REFERENCES

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