CHARACTERISTICS OF LONGTERM TRENDS OF RAINFALL AND STREAM FLOW IN SOUTH KOREA

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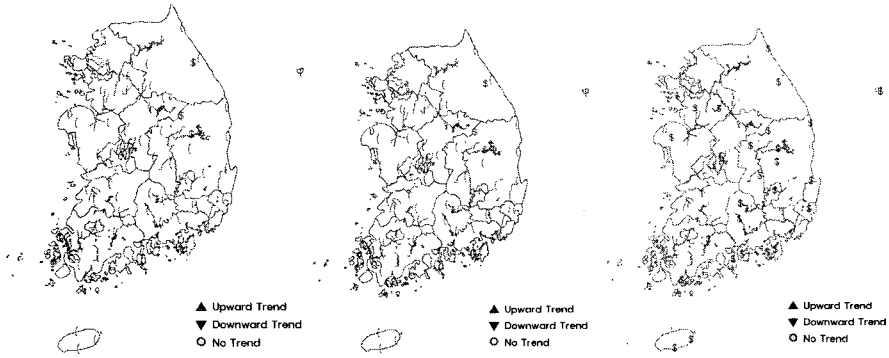
To do the optimal planning and management of water resources, proper statistical analysis of the spatial and temporal variability of climatic and hydrologic data and the relationship between climate change and the variability of water resources is necessary. The trend of global land precipitation over the 20th century showed a statistically significant increase, which showed an increase of 0.5 to 1 % per decade over much of mid- and high latitudes of the Northern Hemisphere (IPCC, 2001). Also the frequency of heavy rainfall events has increased throughout this century. This trend of increasing rainfall rates were reported in many parts of world such as China, Japan, Australia, and South Africa. However the trend analysis of the world-wide maximum annual river flow data demonstrated that 70% of data had no specific trend and 16% of data decreased and 14% of data increased (Kundzewicz, 2004). It may mean that despite the world-wide longterm trend of rainfall increment, stream flow response is not directly proportional to trend of rainfall because of complex relationship with change of vegetation, temperature etc. Characterization of climatic change of rainfall is very important since the longterm trend of rainfall will directly impact many aspects associated with available water resources. Therefore, it is essential to investigate the trend of rainfall characteristics and stream flow for effective water resources planning and management in the future.

Nonparametric statistics is valid under less restrictive assumptions that that of classical methods and nonparametric methods are distribution free methods (Gibbons, 1990). The magnitude of a trend of nonparametric Mann-Kendall (MK) test is not sensitive to the properties of sample data, which is the advantage of MK test (Mann, 1945; Kendall, 1975). Therefore MK test has been widely used to detect trends in hydrologic variables (Hirsch and Slack, 1984; Jung et al., 2002; Yue and Wang, 2004; Piccarreta et al., 2004; Brunetti et al., 2001; Serrano et al., 1999; Burn and Hag Elnur, 2002; Kahya and Kalayci, 2004; Kundzewicz, 2004) In this study, a nonparametric statistical test, MK test, was used to investigate the statistical significance of trend. Annual and monthly longterm changes of watershed stream flows, total rainfall, number of rain days, and number of rain days their rainfall intensity above certain quantities were analyzed in this study.

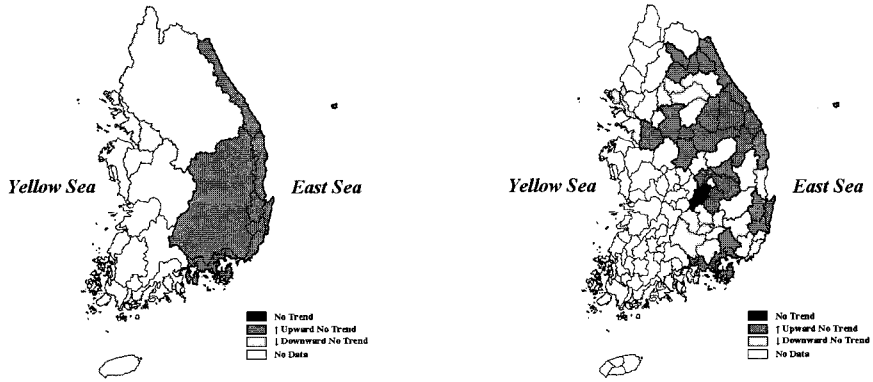
The longterm climatic change of summer rainfall pattern in South Korea was summarized as the total number of rain day decreases, nevertheless, the total amount of rainfall increases, and the total number of days, whose daily rainfall amount is greater than 80 mm, increases. Despite increment of rainfall amount, the longterm trend of mostly stream flow records did not show statistically significant trend, it means that there were few sites which have upward or downward trends satisfying significance level of 90%.

Results provided valuable information for the long-term water resources as well as other industries planning and management.



(a) (b) (c)

Fig. 1. Summary of type of trend (a) rainfall annual sum, (b) total number of annual rainy day, (c) total number of days whose daily rainfall amount is greater than 80 mm



(a) (b)

Fig. 2. Summary of type of trend (a) annual stream flow of large basins, (b) annual stream flow of middle basins

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