Supplementary Materials

Variability of extreme events in coastal and inland areas of South Koreaduring 1961–2020

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Mann–Kendall (MK) Test

The MK test was used for the long-term data trend analysis (Guan *et al.*, 2015). The MK test x_i value (Equation 1) is assumed for the time series to follow the explanation of the model input (Mann, 1945; Kendall, 1962).

$$x_i = f(t_i) + \varepsilon_i (1)$$

where $f(t_i)$is a function of time, i.e., decreasing or increasing, and ε_i is assumed to have zero-mean from the same distribution. Therefore, the distribution's variance is assumed to be constant in time (Salmi, 2002).

The MK test values show the positive and negative trends, which specify the data's upward or downward trend. The normal approximation test is used if the time series number is at least 10 or more (Salmi, 2002).

The variance of the MK test is computed using the equation

$$VAR(S) = \frac{1}{18}\left[n(n-1)(2n+5) - \sum_{p=1}^{q} t_p\,(t_p - 1)(2t_p + 5)\right](2)$$

Here, q is the number of tied groups and $t_p$is the number of data values in the pth group. The MK test values and variance (Hasan *et al.*, 2014) are used to compute the *Z*-test statistic using Eq. (3).

$$Z = \begin{cases} \frac{S-1}{\sqrt{VAR(S)}}\ if\ S > 0 \\ 0\ if\ S = 0 \\ \frac{S+1}{\sqrt{VAR(S)}}\ if\ S > 0 \end{cases} \quad (3)$$

The statistically significant trend was calculated using the Z-test value. A positive (negative) Z valueindicates an upward (downward) trend (Safeeq*et al.*, 2013).

In the coastal and inland areas, trend studies were conducted for the period 1961–2020. The non-parametric test was used to examine the statistical significance of all temperature and precipitation extreme indicator trends (Mann, 1945; Kendall, 1962;Salmi, 2002).The amount, severity, and magnitude of statistically significant positive and negative effects on extreme rainfall and temperature indices are expressed at the 0.05 confidence level. Tables 5 and 6 show the positive and negative trends in all the extreme indices in the selected stations. The

indicator trends were classified as negative (N), positive (P), significant negative (NS), significant positive (PS), and no trend (NO).

Temperature and Precipitation Data Used

Publicly available datasets were analyzed in this study. This data can be found here: https://data.kma.go.kr/resources/html/en/aowdp.html