Analyzing Extreme Diurnal Temperature Range in Spring on the South Korea using a Sliding Window Approach

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Introduction

The effect of an extreme diurnal temperature range (DTR) on public health in biometeorology can lead to significant diseases, such as cardiovascular and respiratory illnesses, potentially resulting in a higher incidence of diseases and increased mortality.

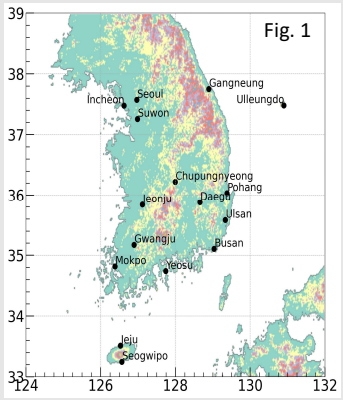
The non-steady pattern of extreme DTR events is not commonly studied, but the acceleration of climate change has amplified the non-stationarity of extreme values.

Data

Analysis period
- 1964 to 2022 (59-year)

Variables (day)
- DTR
- Tmax
- Tmin

Observation station
- 16 ASOS stations



The data collected from Korea Meteorological Administration (KMA)

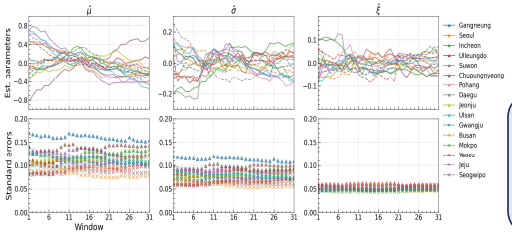
Methodology

To capture the time-varying the extreme DTR, we employed the following:

1) Sliding window approach
- Window size : 30 years
- Window step : 1 year
- The extreme values separated by the sliding window approach have total 31 windows denoted by (W_1, W_2, … , W_{31}).

2) r-largest order statistic (r-LOS)
- r = 5 (days)
- Select optimal *r* value using entropy difference method

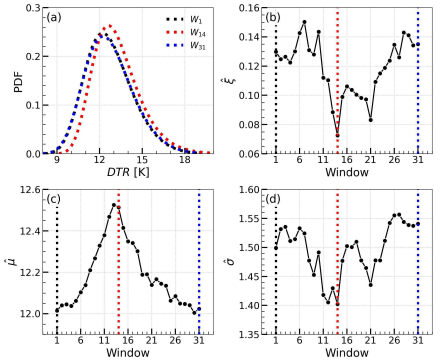
3) Generalized extreme value (GEV) distribution
- Using Maximum Likelihood Estimation
- The MLE is applied in each window, and the estimates of GEV using MLE are calculated.

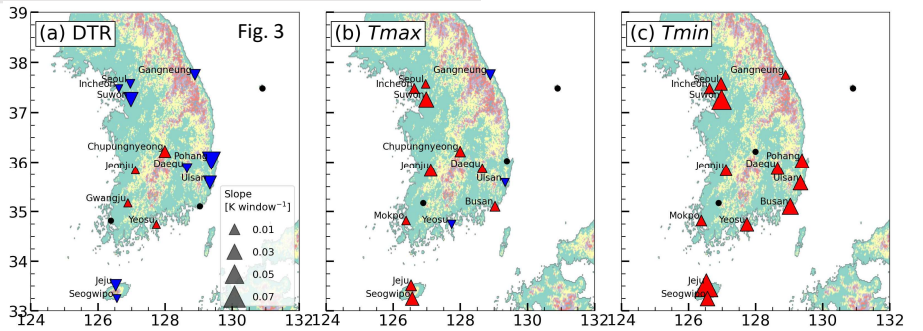


Remaining question

For Fig. 2, applying linear function to non-stationary GEV analysis can vary depending on the selected study period.

For Fig. 3, the decreasing trend in extreme DTR is associated with a steeper increase in Tmin.
The limitation of MK test result in this study is the absence of consideration for break-point.
The changes in extreme DTR are non-steady, while the changes in Tmax and Tmin are relatively steady.





Conclusions

- Extreme DTR does not represent the steady increasing or decreasing pattern over the windows.
- Extreme DTR has a statistically significant increase in four stations, with three of them particularly having high DTR values (about 22 K) that could pose physical risks.

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