

Study on the Urban Heat Islands and the Meteorological Elements over the Pearl River Delta, China



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1. Motivation

- To understand the temporal evolution and spatial distribution of UHI over PRD, China.
- To identify the relationships of UHI and the meteorological elements

2. Data and methods

- Weather stations: 20, including Guangzhou, Shenzhen, Zhuhai, etc.
- Data period: 1999-2008

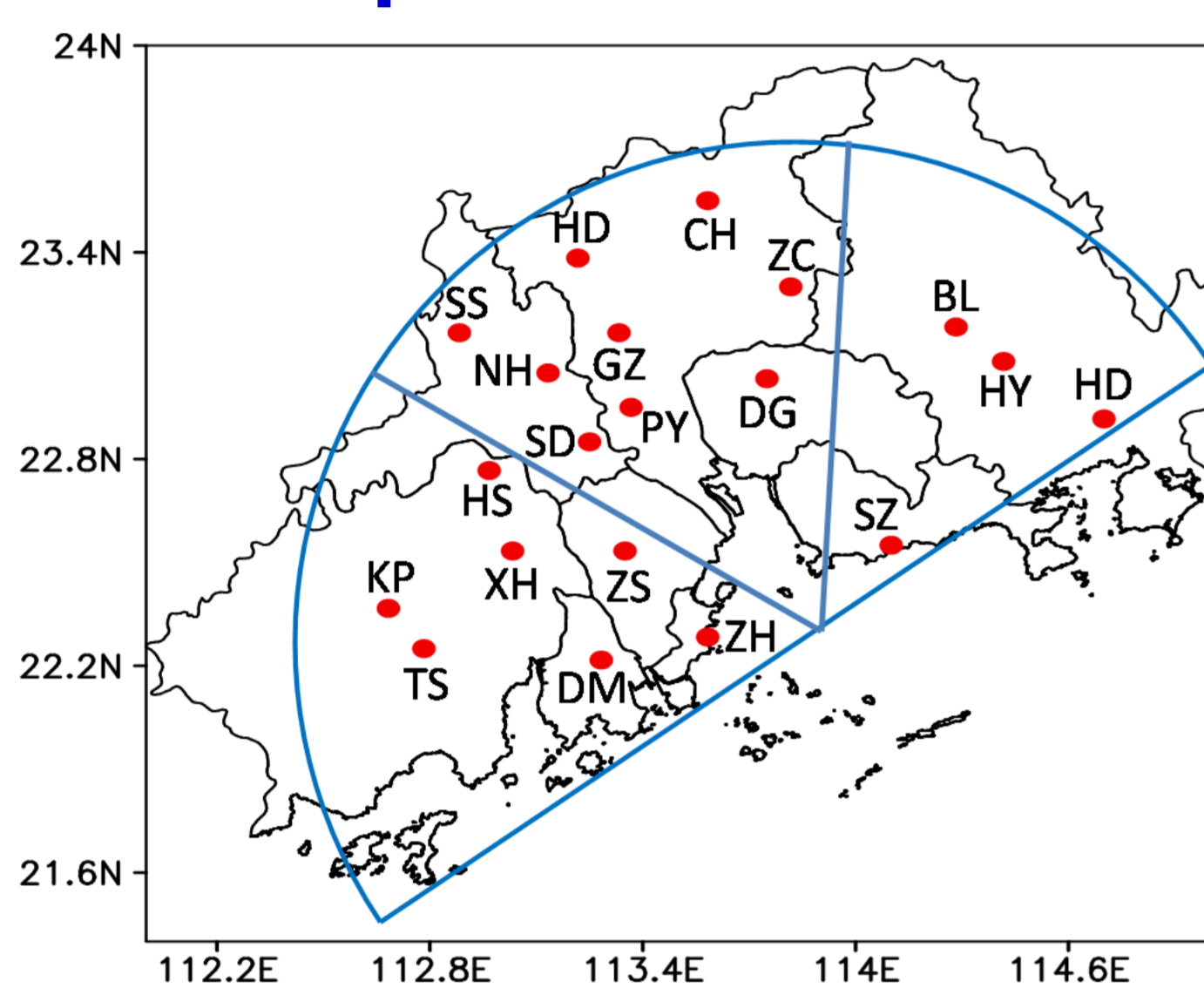


Fig. 1 Weather stations over Pearl River Delta area, China

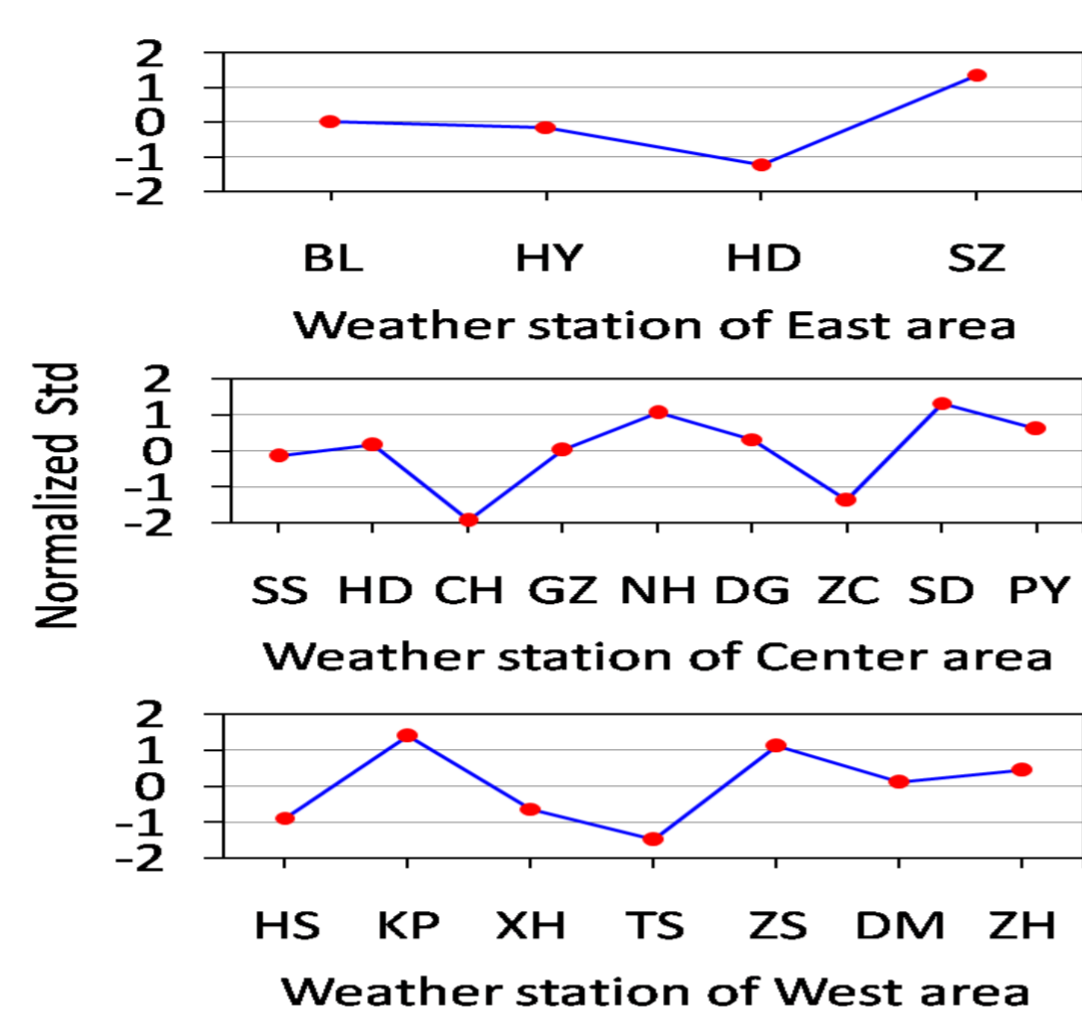


Fig. 2 selecting suburb sites by normalized STD of temperature

- UHIF: UHI intensity is defined as the difference of temperature in urban sites and suburb sites. UHIF is defined as the frequency of UHI when UHI intensity is greater than 0.5 °C.

4. Spatial distribution of UHI

- There are two high value centers of UHI.
- EOF: the first two modes, 71.2% and 8.9%.

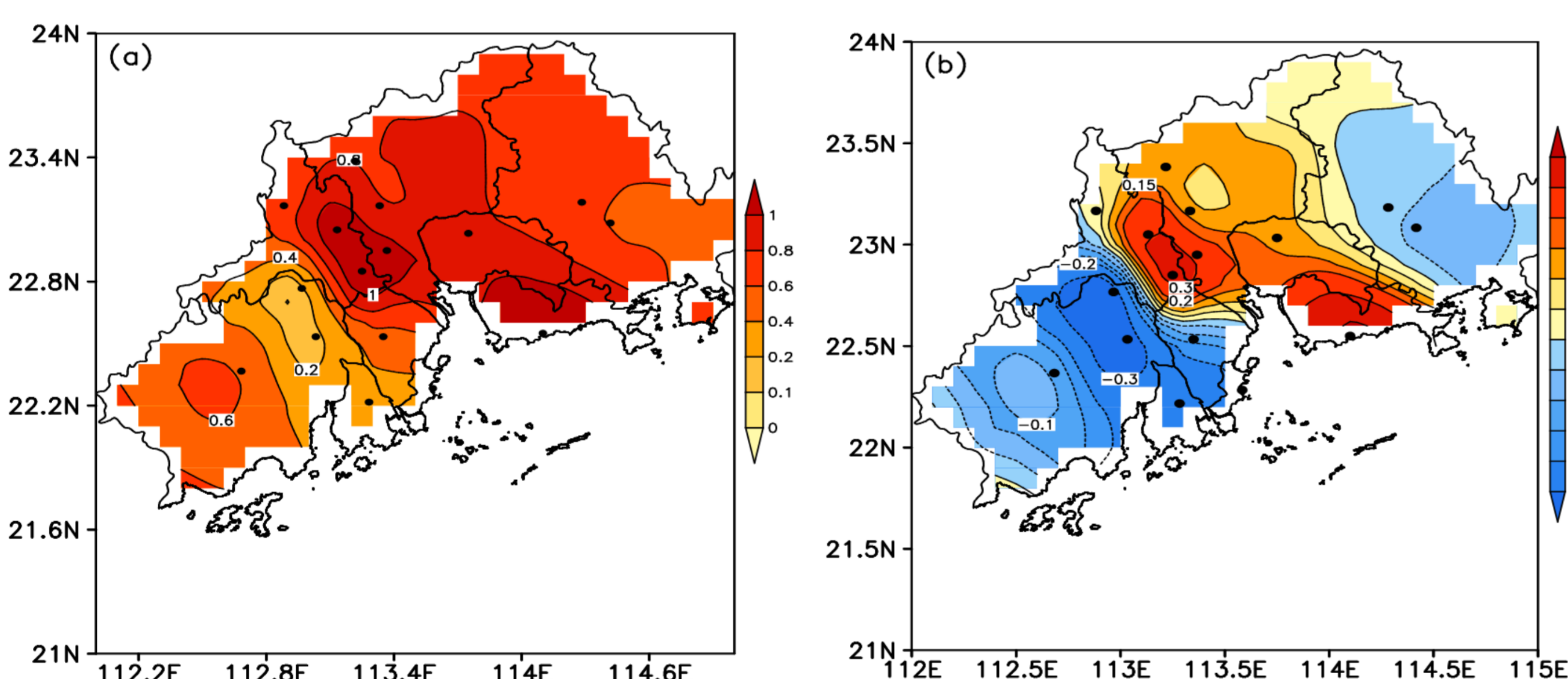


Fig. 6 Spatial distribution of UHI intensity over PRD (a) and the first mode of EOF (b)

6. Conclusion

- The average UHI intensity is 0.71 °C and the linear trend is 0.29 °C/10a.
- The spatial distribution of UHI presents a tri-pole pattern, in which the UHI intensities in the central zone of PRD are higher than those in the east and the west zone.
- The average UHI shows clearly seasonal and diurnal changes, is weakest in spring (0.39 °C), strongest in autumn (1.06 °C), higher in nighttime (0.91 °C) than in daytime (0.53 °C).
- The UHI intensity decreases with increasing low cloud cover, relative humidity, wind speed and precipitation.
- The results may contribute to city planning and risk zoning of meteorology and environment in PRD

3. Temporal evolution of UHI

- The annual average UHI is rising, linear increasing trend is 0.29 °C / 10 a, 10 years average UHI intensity was 0.71 °C.
- UHI intensity in April is the lowest and the peak occurs in October or November. On average, the strongest heat island is 1.06 °C in October, the weakest is 0.39 °C in April.
- the UHI shows diurnal variation. During the day, the PRD average UHI is 0.53 °C and 0.91 °C during the night. UHI intensity difference between day and night is the largest in central region, a difference of 0.61 °C and the western region difference is lowest, 0.14 °C.

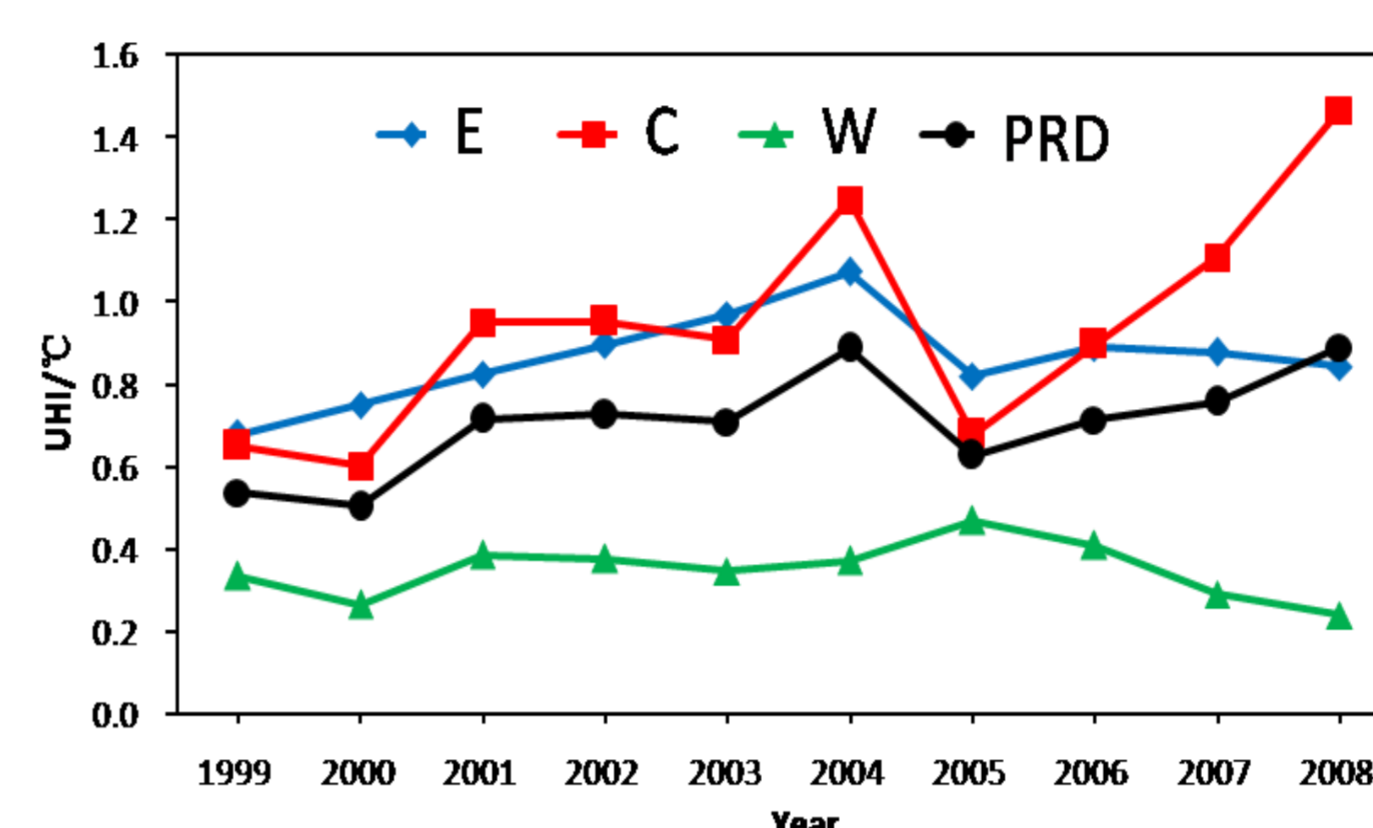


Fig.3 Annual average UHI, East area (E), Center area (C) and West area (W)

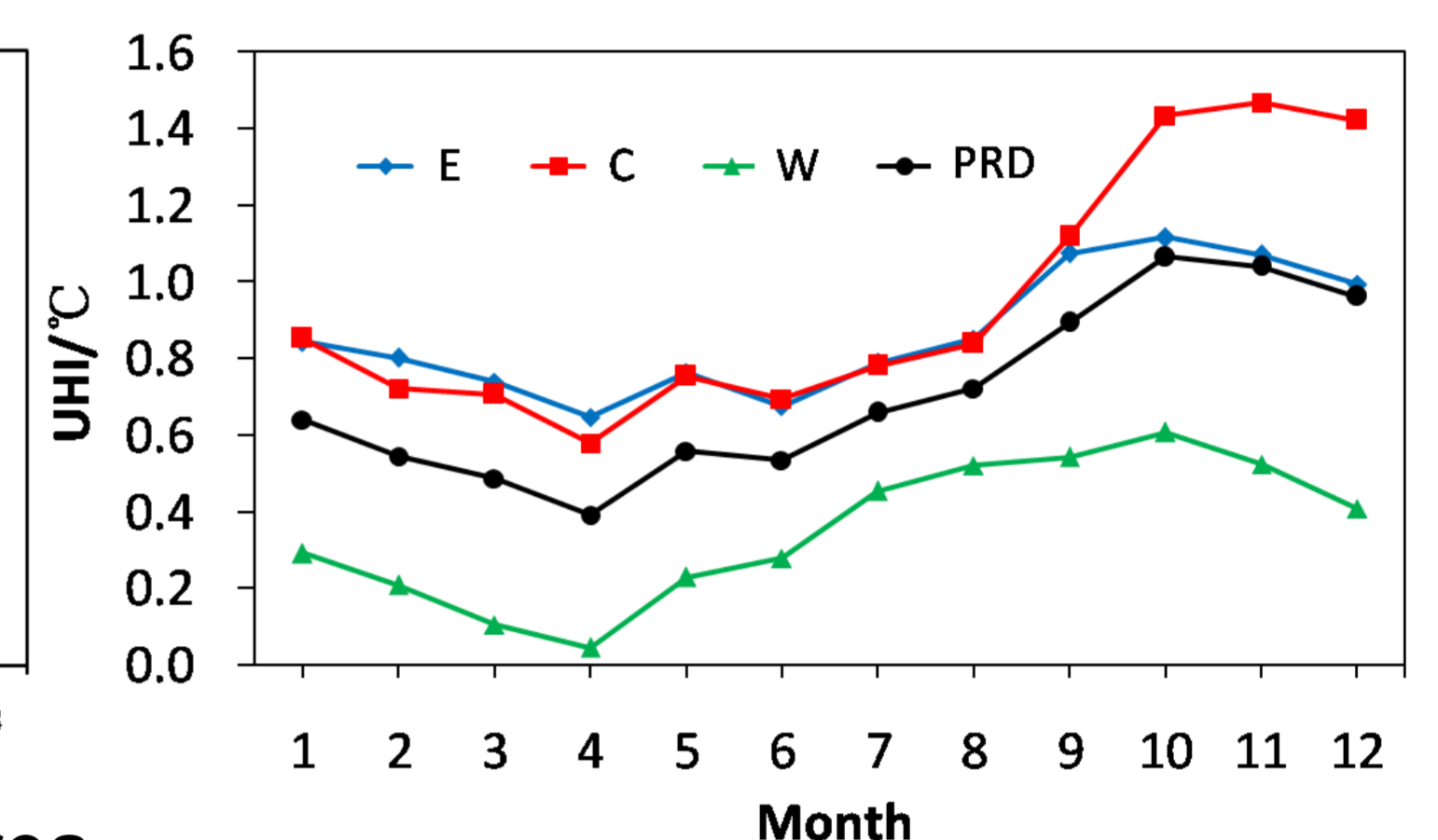


Fig.4 Seasonal change of UHI

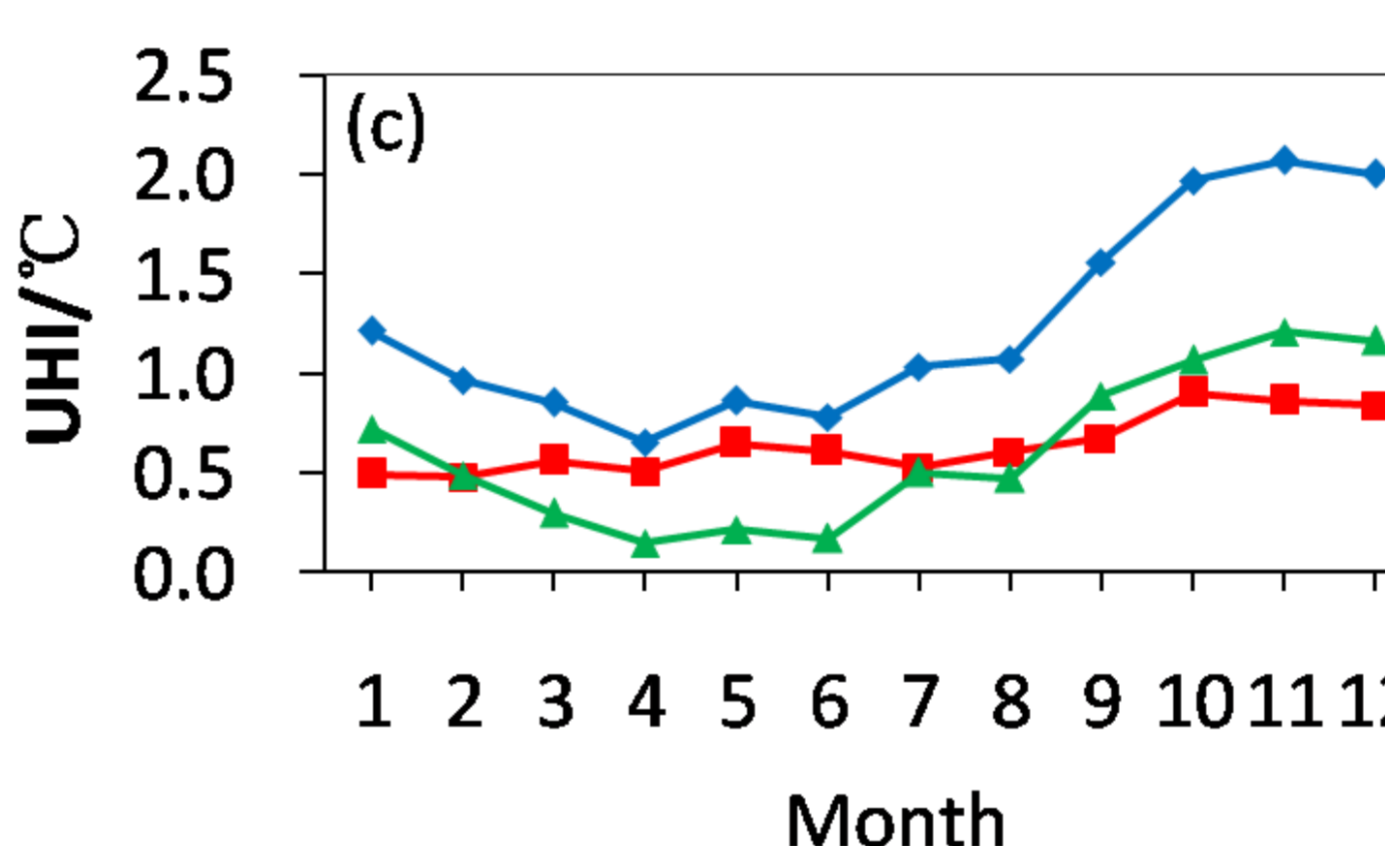
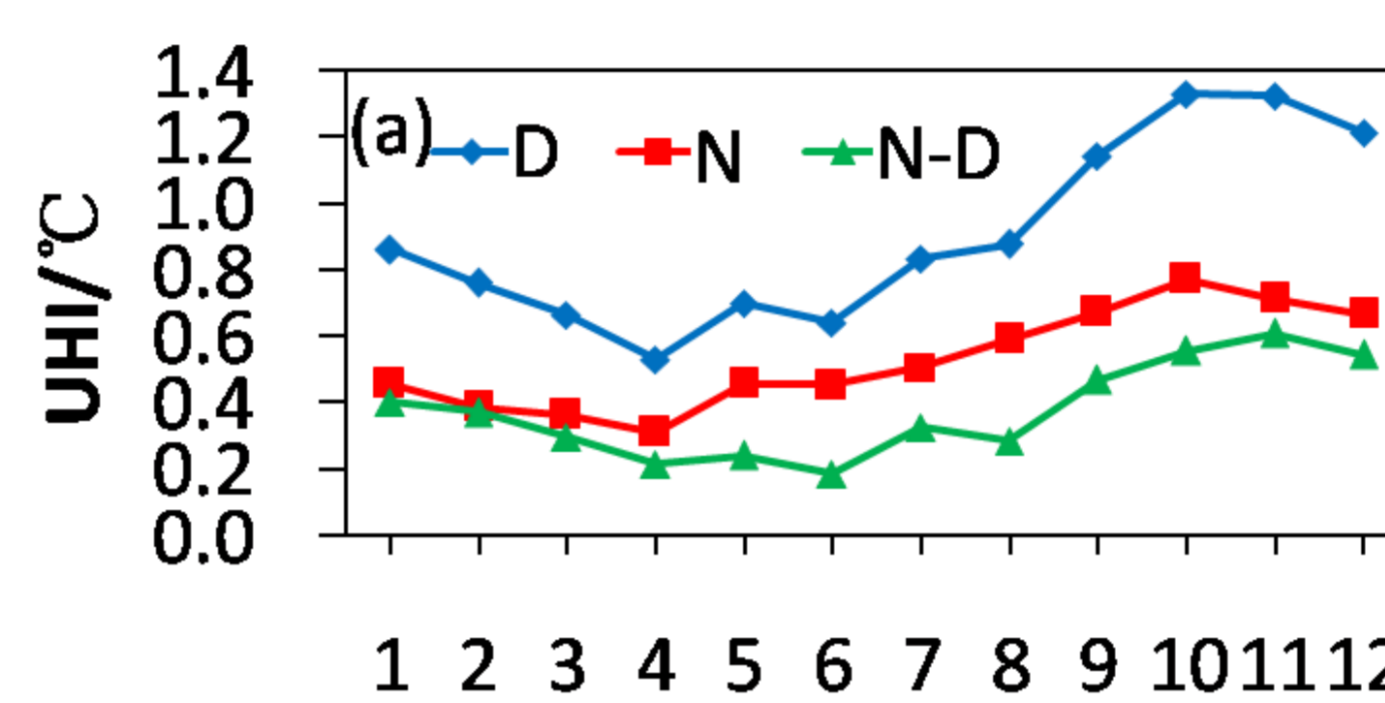
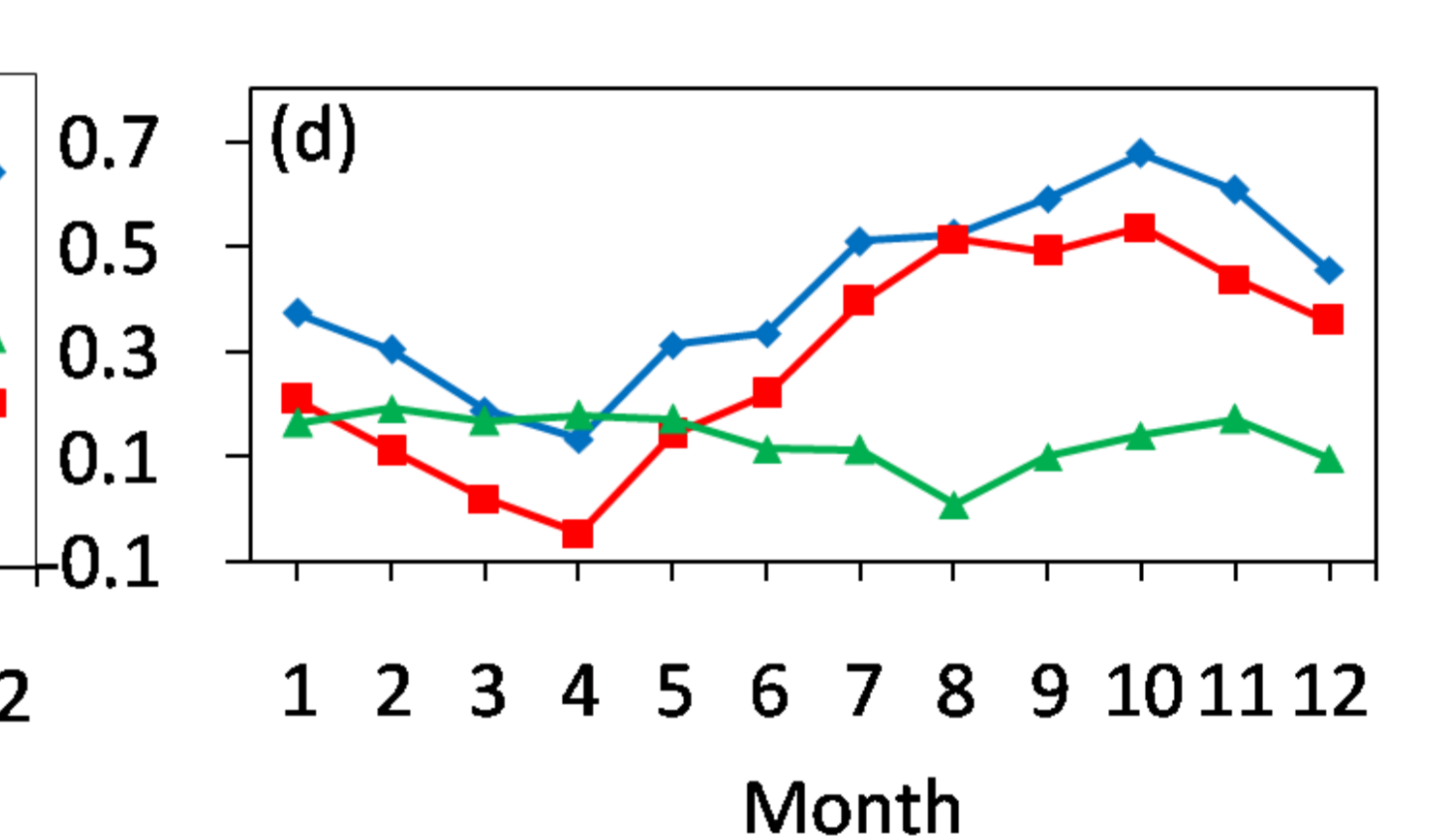
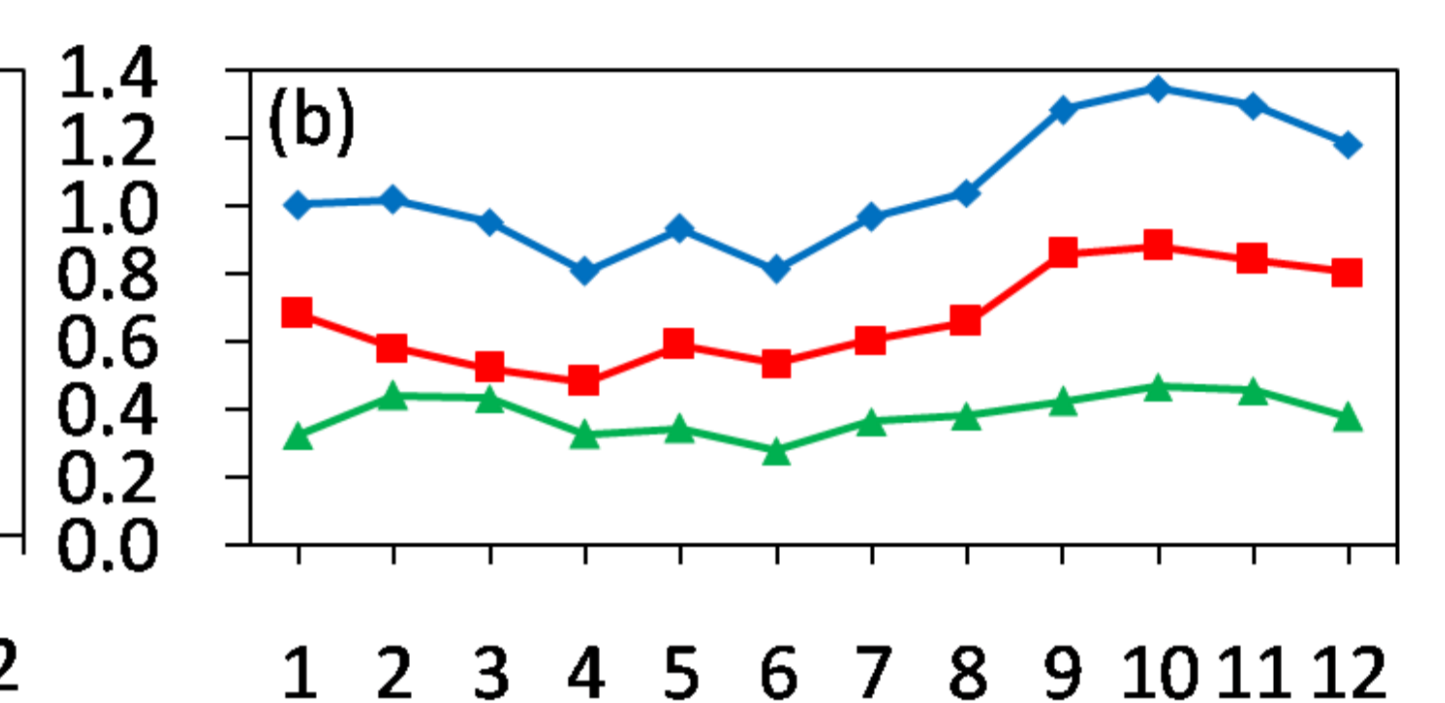


Fig. 5 Diurnal change of UHI intensity over PRD (a), East area (b), Center area (c) and West area (d). D represents Day, N Night and N-D the difference of Night and Day UHI intensity.



5. Impact of meteorological elements on UHIF

- The UHI intensity decreases with increasing low cloud cover, relative humidity, wind speed and precipitation. Details are shown in Figure 7.

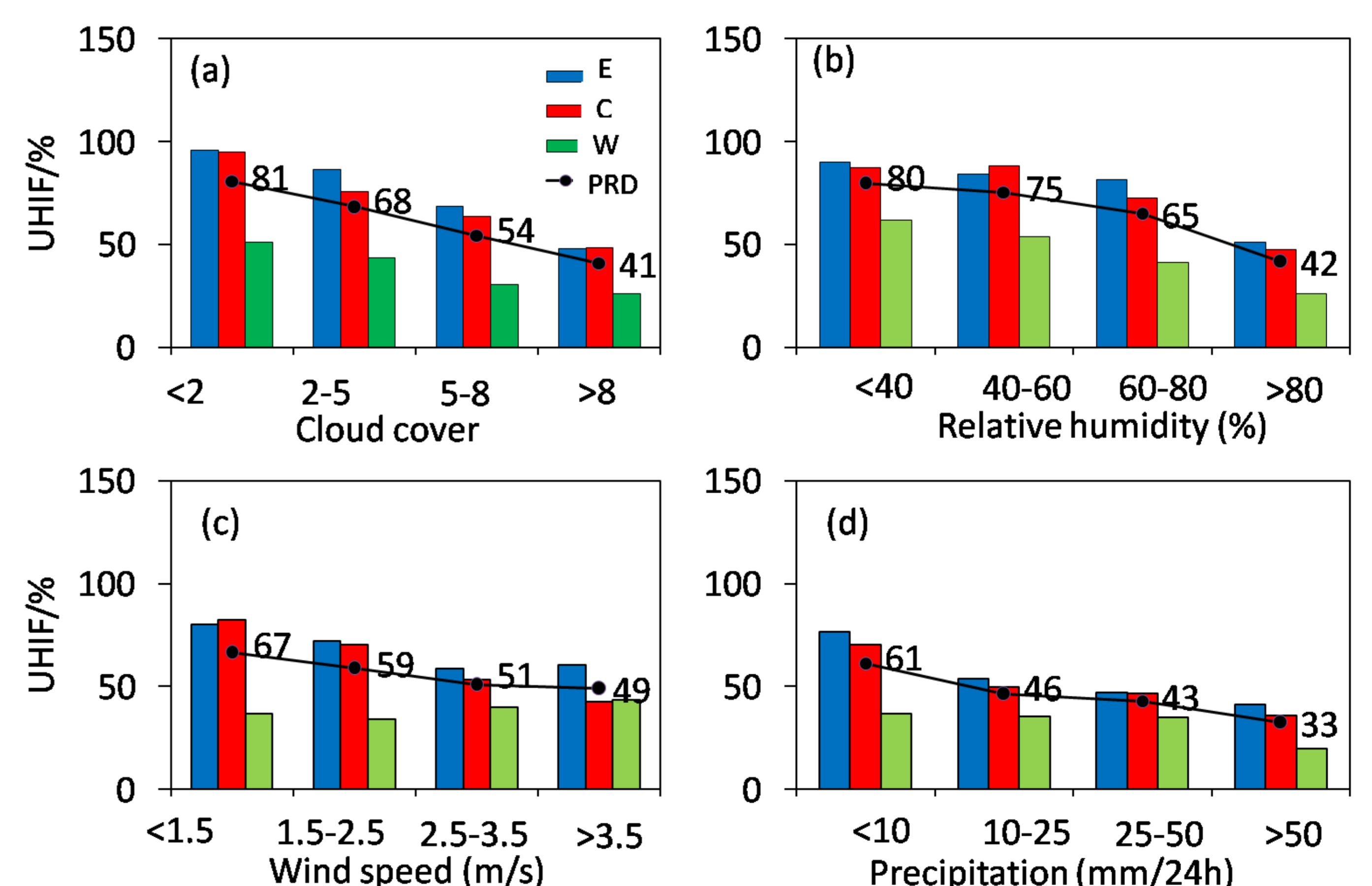


Fig. 7 Impact of meteorological elements on UHIF. Cloud cover (a), Relative humidity (b), wind speed (c) and precipitation (d). E represents East area, C Central area and W West area.

