Spatial interpolation of summer air temperature in high-density cities: The impact of the urban environment in Hong Kong

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Background and Issues

Rising temperature under climate change and increasing frequency and magnitude of extreme hot weather. High-density urban environment and urban heat island further exacerbate the intense heat.

Need for spatially continuous temperature data to consider the urbanization effect. Spatial interpolation techniques are useful to supplement ground-level monitoring network.

Data and Methodology

Temperature data: Hourly air temperature data from 40 ground-level stations operated by the Hong Kong Observatory.

Temperature metrics:
- Average daytime temperature (07-18h)
- Average night-time temperature (19-06h)
- Average daily maximum temperature
- Average daily minimum temperature

Spatial Variation of Temperature

Cokriging improves the spatial resolution by showing the variations in intra-urban temperature. The effect of urbanization becomes visible in average night-time temperature. Built-up areas exhibit higher temperature up to 29°C while the temperature of rural and mountain areas remains relatively lower.

Temporal Variation of Temperature

The temporal change of air temperature during night-time shows that temperature in urban areas can remain above 28°C (classified as Hot Night, an indicator of extreme hot weather used by the Hong Kong Observatory). High night-time temperature causes heat stroke in poorly ventilated residential dwellings and increases the need for air-conditioning. It also reduces the opportunities for human body to recover from daytime heat.

Implications and Further Work

Cokriging is capable of providing a spatially continuous dataset of temperature metrics with high accuracy. It helps to identify areas with potential heat stress, especially during night-time which has been largely ignored in terms of impact assessment. Applications include:
- Weather information services
- Key meteorological stations need to be included in forecasting extreme hot weather
- Warning of extreme hot weather may not be restricted to daytime when high temperature is always observed
- Health impact assessment
- Public health risks can be associated with night-time temperature
- Responses of social and community services need to consider night-time heat

Further work includes the comparison with hindcast data and hence informs the selection of reference stations for the heat stress information services with a view to better representing the potential impacts of extreme heat events.

Automatic Regional Weather Forecast in Hong Kong

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