Estimating the impacts of 2021 heatwaves in the western United States



Objectives & Motivation

An extreme heatwave attacked Western North America in 2021 summertime, which caused some of the highest temperatures ever recorded | > 20 in the western U.S. This natural hazard was widely reported due to its severe health impacts. However, no study comprehensively and quantitatively analyzed this event yet. This research provides a validated modeling study of this extreme event and its associated effects on urban heat islands in major cities in the western U.S. This work includes details of evaluations, configurations and model synoptical analysis of heatwaves, estimations of the spatiotemporal dynamic of weather parameters from mesoscales to microscales and quantitatively investigate of the urban heat island intensity and associated effects of heatwaves.

Methods

Weather Research and Forecasting (WRF)

- 4km coarse domain with 1km nested domain
- 31 vertical layers
- NAM 12km NCEP inputs
- NLCD and NUDAPT for land use

Urban Heat Island Intensity

- Linear regression fitting
- $T_urban = K \times Fraction_urban + T_veg$







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| UHII (ºC)** | | T_veg (ºC) * | | R | |
|-------------|---------|--------------|--------|-------|--|
| HW* | Non-HW* | HW | Non-HW | HW | |
| 0.79 | 1.23 | 26.10 | 22.18 | 0.82 | |
| -2.33 | -1.18 | 24.91 | 21.19 | 0.31 | |
| 2.10 | 2.06 | 22.36 | 15.78 | 0.90 | |
| 1.53 | 1.36 | 33.33 | 28.99 | 0.82 | |
| 1.64 | 1.56 | 20.73 | 14.65 | 0.80 | |
| 1.93 | 1.88 | 23.33 | 20.78 | 0.74 | |
| 0.80 | 0.43 | 14.34 | 12.40 | -0.81 | |
| 1.13 | 0.67 | 29.03 | 21.14 | 0.70 | |
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