

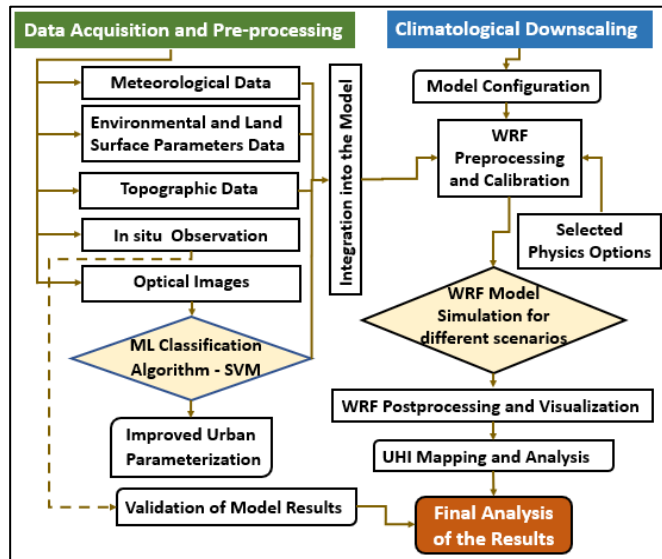
Aim:

The study aims to understand the SUHI (Surface Urban Heat Island and AUHI (Atmospheric Urban Heat Island) conditions of two cities lying on similar climatic regime but having different topographic and morphological structures.

Research Question:

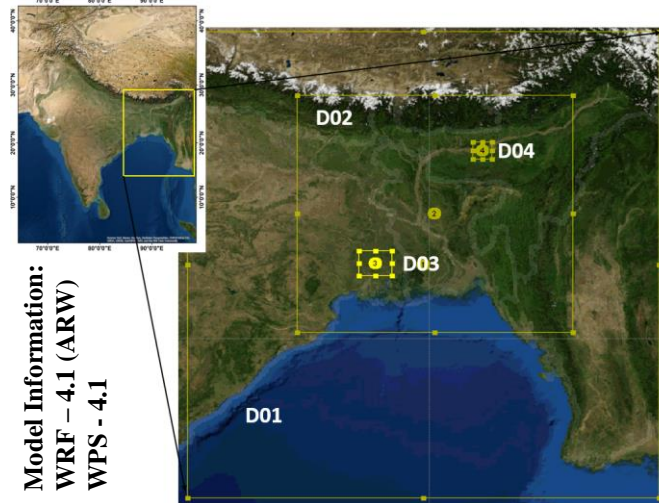
Which has more influence on the local climatic variations of a city: surrounding environment and topography or city geometry and morphology?

Experimental Design:



Data Type	Data Source
Meteorological	NCEP GFS (1 and 0.25 degrees)
Environmental & Land Surface Parameters	NCEP, USGS
Topographical	GTOPO 30; SRTM-30
Optical images	Sentinel-2
In-situ Data	Indian Meteorological Dept.

Model Configuration



Model Information:
WRF - 4.1 (ARW)
WPS - 4.1

Model Calibration Parameters

Domain Name	Geographical Location	Resolution	Model Physics	Selected Physics Scheme
D01	Northern Bay of Bengal and parts of eastern and lower Himalayas	9 km	Micro Physics LW Radiation scheme SW Radiation scheme PBL type	WSM 6 RRTM Dudhia MYJ
D02	Eastern - Northeastern India	3 km	Cumulus scheme	Kain-Fritsch
D03	Kolkata and surroundings	1 km	Land surface scheme	Unified-Noah LSM
D04	Guwahati and surroundings	1 km	Urban Surface Physics scheme	BEP, BEM

- Two-way nested domains were created to dynamically downscale the local climate of Kolkata and Guwahati cities to 1 km horizontal resolution.
- The model was initialized and its boundary conditions defined using existing GCMs; it was then coupled with different physics schemes including BEP and BEM for urban surface
- Simulations were carried for the hottest as well as monsoon affected month (July) of the year 2019 keeping 3 hour time-step.

Results:

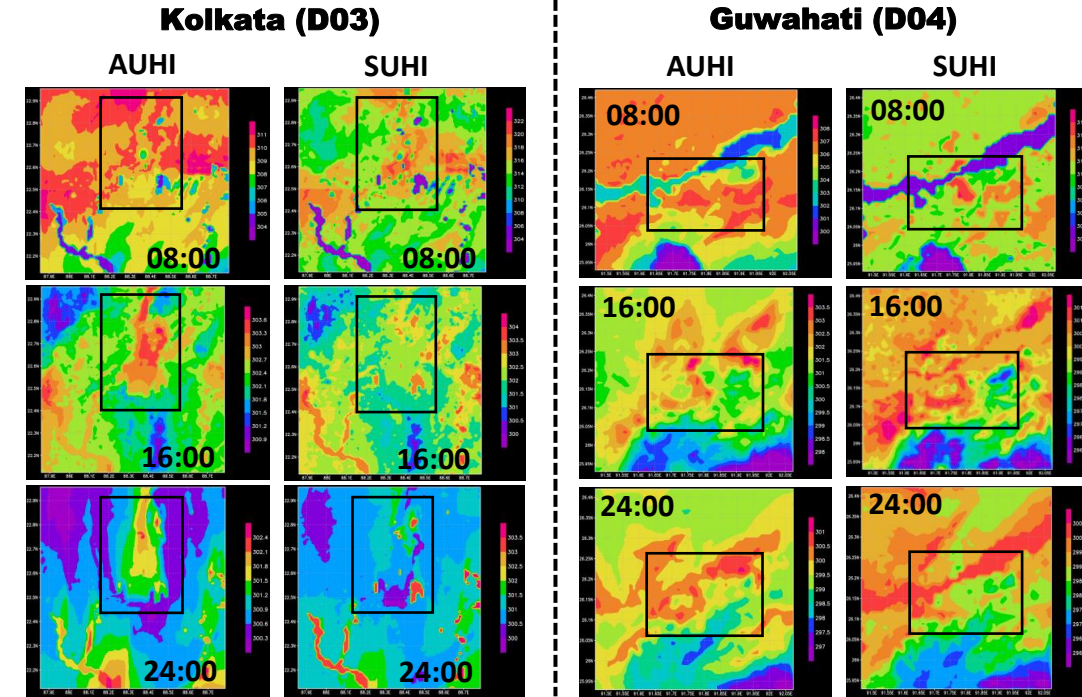


Fig: AUHI (2m air temp) and SUHI (skin temp) conditions over the two cities (black bounding box) and their surrounding during a day at an interval of 8 hours (monthly average)

Conclusion:

- AUHI peaks in the afternoon at Kolkata to 312K which drops at midnight to about 303K as compared to 308K and 300K at Guwahati respectively. However the range is higher for SUHI for both cities, i.e., 322K – 304K for Kolkata and 318K – 301K for Guwahati.
- The model validation shows RMSE values of 1.2 and 1.9 for AUHI and SUHI for Kolkata; and 0.9 and 1.5 for Guwahati respectively.
- There is remarkable difference over daytime as well as nighttime AUHI and SUHI for Kolkata which is the bigger and morphologically more complex of the two cities.
- It is evident from the analysis that urban surface morphology has a greater influence on the local climatic variations of the cities compared to their surrounding topography