

MOTIVATION

- How does heterogeneity in land surface modulate the correlation between land surface temperatures (LSTs) and local climate zones (LCZs)?
- What are the range of heterogeneities within which, the usefulness of the LCZ representation is high (or low)?
- Heterogeneity exists in the form of LCZ intensity (Say, number of one class divided by total number of classes) as well as in the form of spatial distribution (How are the classes spread?)

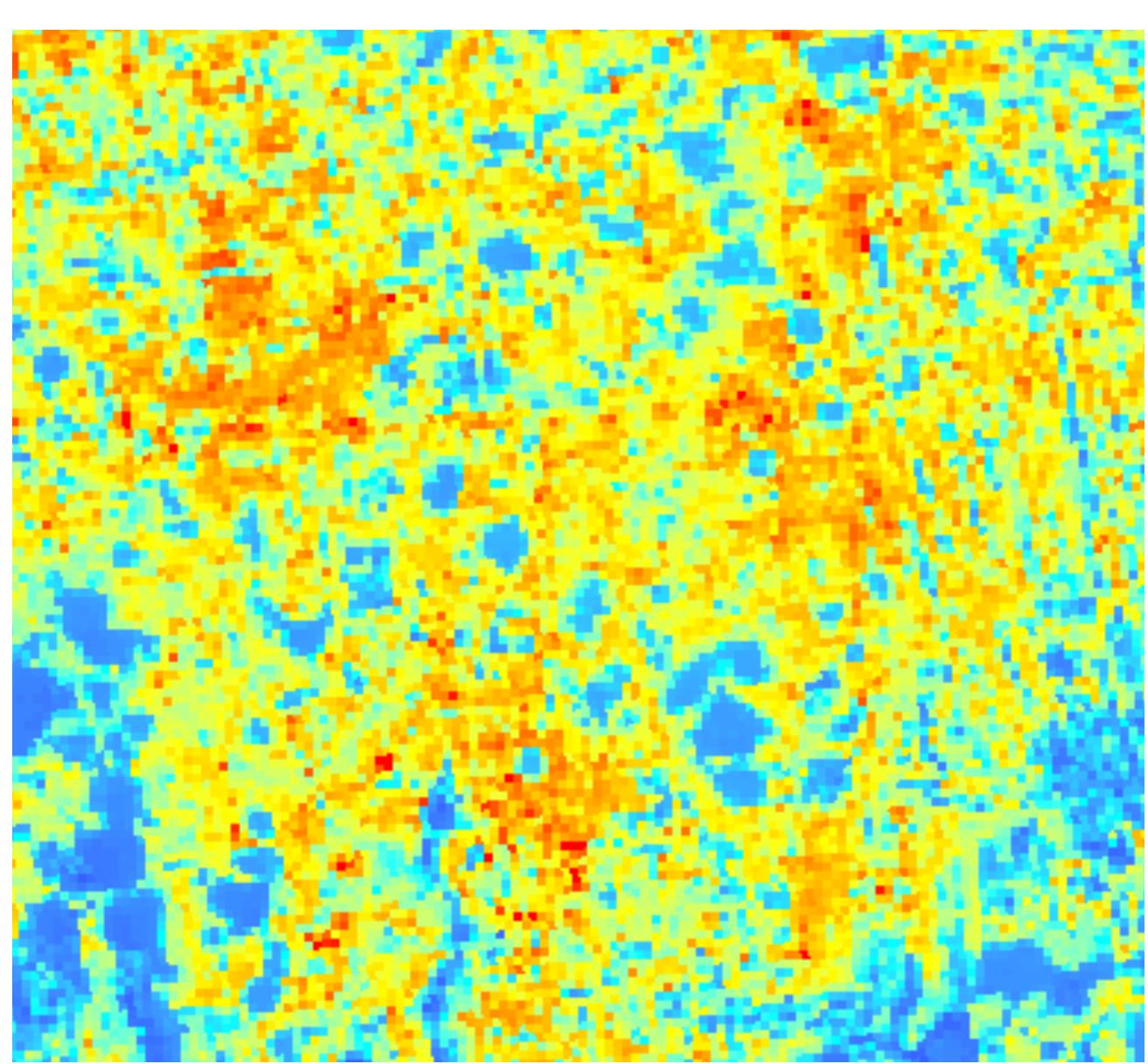


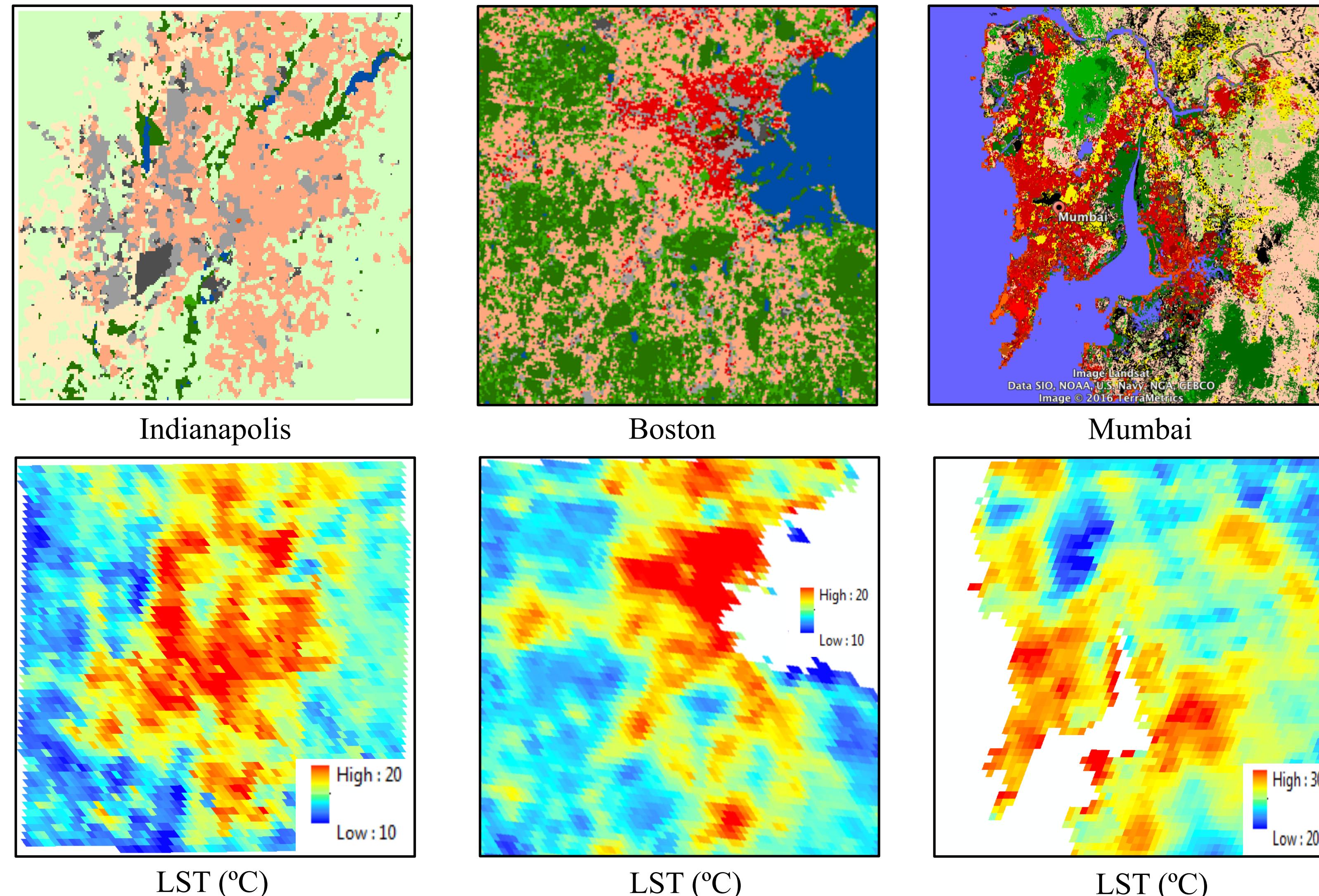
Image: Land Surface Temperature from Landsat 8



Image courtesy: sumedh.info

(Left) Orlando : An example of high spatial heterogeneity in LSTs due to presence of multiple lakes that act to produce "source-sink" pairs. (Right) Mumbai : An example of a stark contrast in LCZs coexisting within a few hundreds meters distance - a trait frequently noted in organically developed cities.

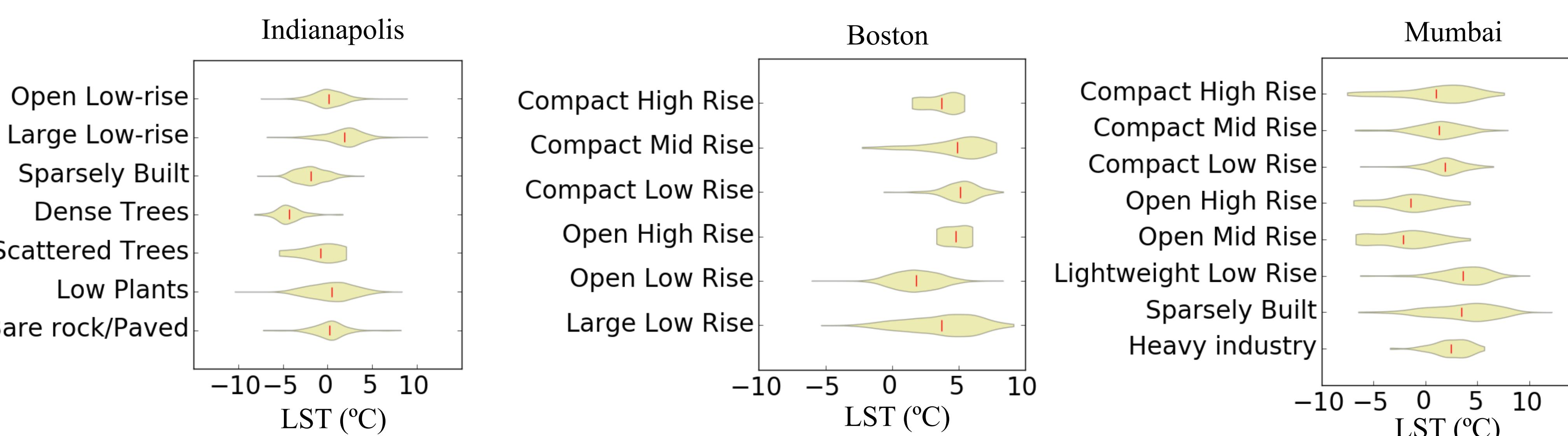
DATA USED



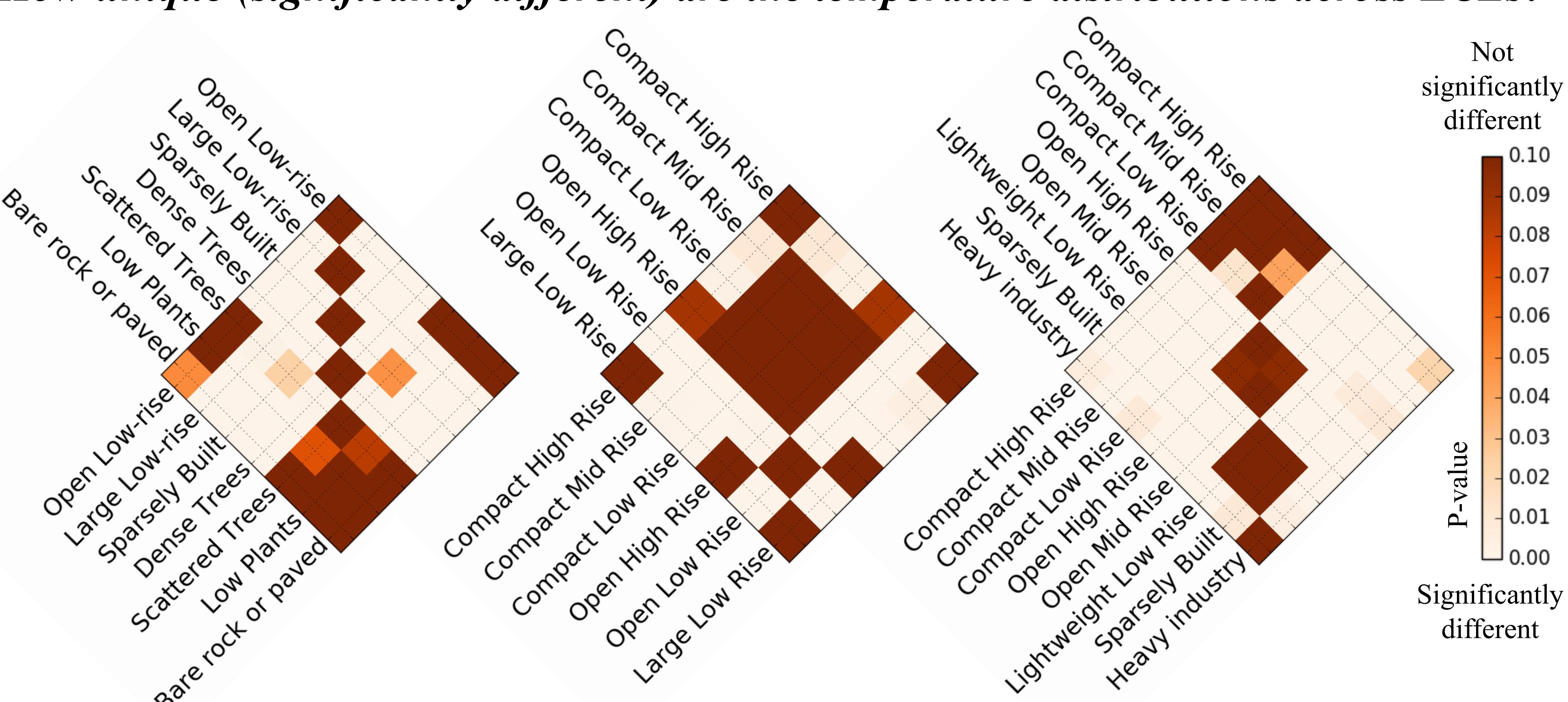
Land use maps made using Local Climate Zones, Land Surface Temperature generated using MODIS data

ANALYSIS AND RESULTS

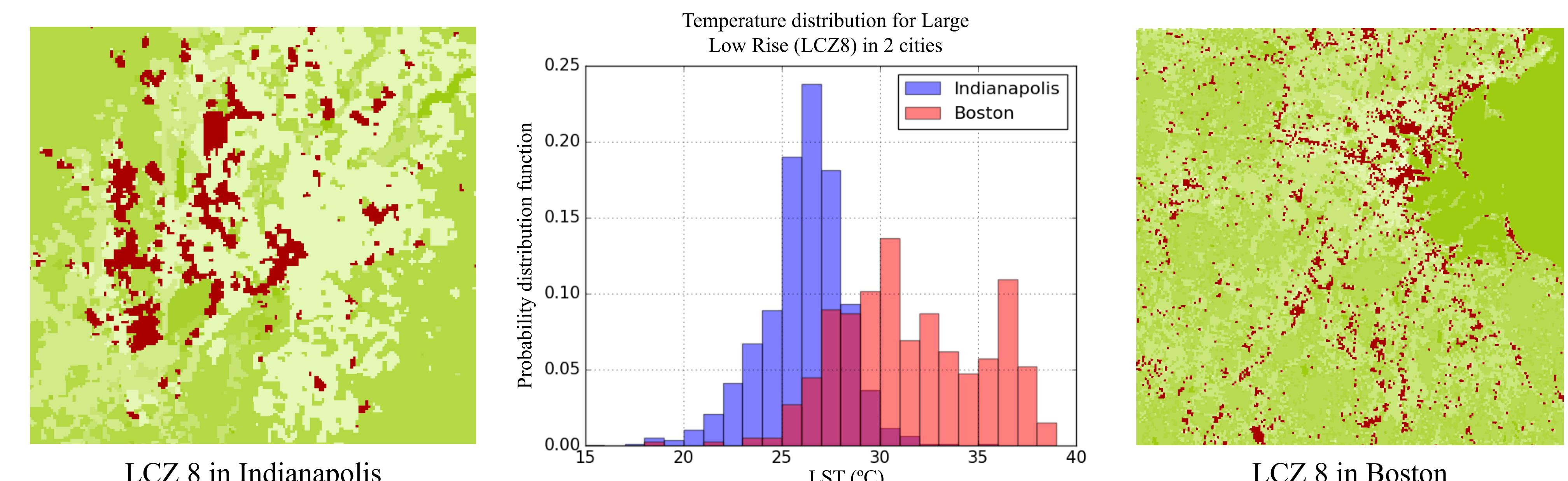
PDFs of deviation of Land Surface Temperature for each LCZ



How unique (significantly different) are the temperature distributions across LCZs?



How do the temperature distributions vary for the same LCZ under different heterogeneities?



ONGOING WORK

- Characterize heterogeneities (population based as well as spatial) based on Shannon's entropy estimates.
- Develop LCZ maps of archetype cities representing varying degrees of heterogeneities.
- Understand the role of factors such as winds, stability of the atmosphere, or time of the day that might affect the impact of land surface heterogeneities.
- Study the evolution of a city and its resultant land surface temperature over time.

DATA AND METHODS

- Urban land use clustering and classification system employed – **Local Climate Zones** (Stewart and Oke, 2012)
- LST data obtained from Landsat 8
- Mann Whitney's U test used to estimate statistical significance in the difference between LST populations

$$U = n_1 n_2 + \frac{n_2(n_2 + 1)}{2} - \sum_{i=n_1+1}^{n_2} R_i$$

Where,
U = Mann-Whitney U test; Ri = Rank of the sample size
n1 = sample size one; n2 = sample size two

LCZ 1 Compact high-rise
LCZ 2 Compact mid-rise
LCZ 3 Compact low-rise
LCZ 4 Open high-rise
LCZ 5 Open mid-rise
LCZ 6 Open low-rise
LCZ 7 Lightweight low-rise
LCZ 8 Large low-rise
LCZ 9 Sparsely built
LCZ 10 Heavy industry
LCZ A Dense trees
LCZ B Scattered trees
LCZ C Bush, scrub
LCZ D Low plants
LCZ E Bare rock or paved
LCZ F Bare soil or sand
LCZ G Water

Local Climate Zones (LCZ) classes:
where 1-10 are the urban land use types, and A-G are non-urban

REFERENCES

- Stewart, Ian D., and Tim R. Oke. "Local climate zones for urban temperature studies." *Bulletin of the American Meteorological Society* 93.12 (2012): 1879-1900.

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