NASA ARSET

LAND SURFACE TEMPERATURE – BASED URBAN HEAT ISLAND MAPPING

**Urban Heat Islands (UHI)**:

There are two types of Urban heat islands:

1. Surface Urban Heat Islands
2. Atmospheric (i.e. air) Urban Heat Islands

**Surface Urban Heat Islands (SUHI)**: These represent the radiative temperature difference between impervious and natural surfaces. SUHIs are primarily measured by remote sensing in the thermal infrared (TIR) region of the electromagnetic (EM) spectrum.

**Atmospheric Urban Heat Islands (AUHI)**: Warmer air in urban areas as compared to cooler air in rural surrounding areas defines atmospheric urban heat islands. AUHI can be categorized into two layers, namely; (a) Canopy Layer Heat Island (CLHI): this is the layer of air from ground to the tops of trees and buildings. (b) Boundary Layer Heat Islands (BLHI): these extend from treetops/rooftops to where urban landscapes no longer influence the atmosphere (~1.5 km).

Limitations of Satellite Remote Sensing for Urban Heat Islands

1. Data acquisition times of sun-synchronous satellites usually do not coincide with the time of day where the SUHI is at a minimum or maximum.
2. The most widely used satellite for SUHI detection (i.e. Landsat) only has daytime data.
3. Optical sensors cannot penetrate clouds or vegetative cover, which can lead to data gap or decrease in data utility.
4. The accuracy of land surface temperature (LST) estimates depends strongly on corrections for atmospheric effects and an accurate estimate of surface emissivity.
5. Radiance received by sensors are influenced by sensor-viewing angle.
6. It is difficult to obtain high spectral, spatial, and temporal resolution with the same instrument.
7. A large amount of data exists in various spatial and temporal resolutions, file formats, sizes, and from multiple sources.

Benefits of Satellite Remote Sensing for Urban Heat Islands

1. Continuous spatial coverage compared to in situ data
2. Provides data where no systematic in situ measurements are available and augments where they are.
3. Simultaneous observations of LST, surface emissivity, and land cover from various satellites (e.g. Landsat/TM, ETM+, OLI & TIRS, MODIS, VIIRS, AVHRR)
4. Global, consistent, data coverage from many satellites
5. Availability of open-source data