

An aerial photograph of San Antonio, Texas, showing a dense urban landscape with numerous skyscrapers and buildings. The image is slightly faded to serve as a background for the text.

MODIS-based Urban Heat Island Study

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Urban Heat Island?

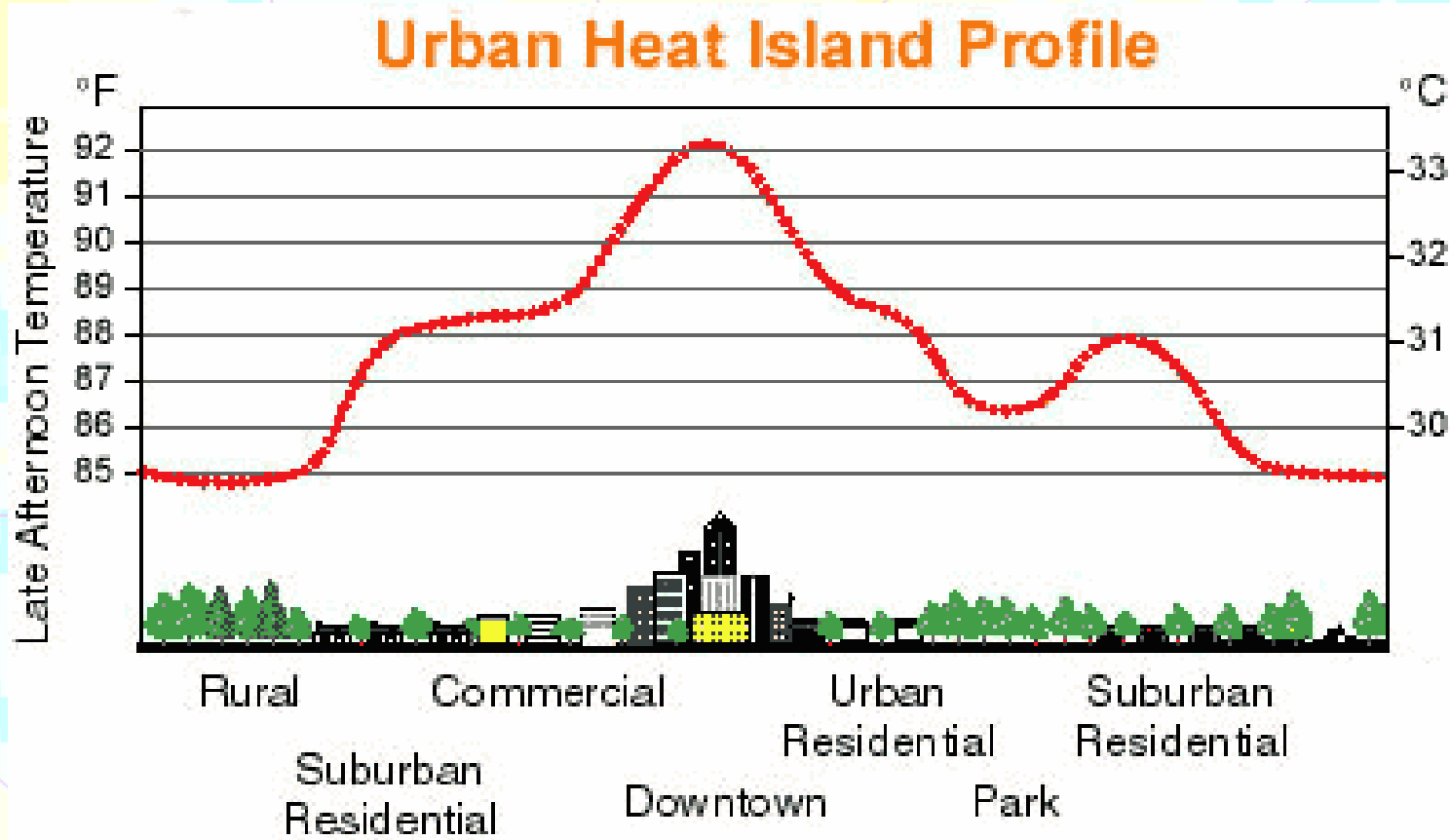
- Metropolitan area is significantly warmer than its surroundings (2-6°C warmer)

As population centers grow in size from village to town to city, they tend to have a corresponding increase in average temperature

Factors Contributing to Urban Heat Island formation

- Change in land cover/surfaces
- Decrease vegetation / increase concrete
Asphalt and concrete have a higher heat capacity and thermal conductivity
Tall buildings provide multiple surfaces for the reflection and absorption of sunlight
- Increased emission of radiated heat
- Buildings block view to cool night sky -
night-time warming

Graphic Example of Urban Heat Island



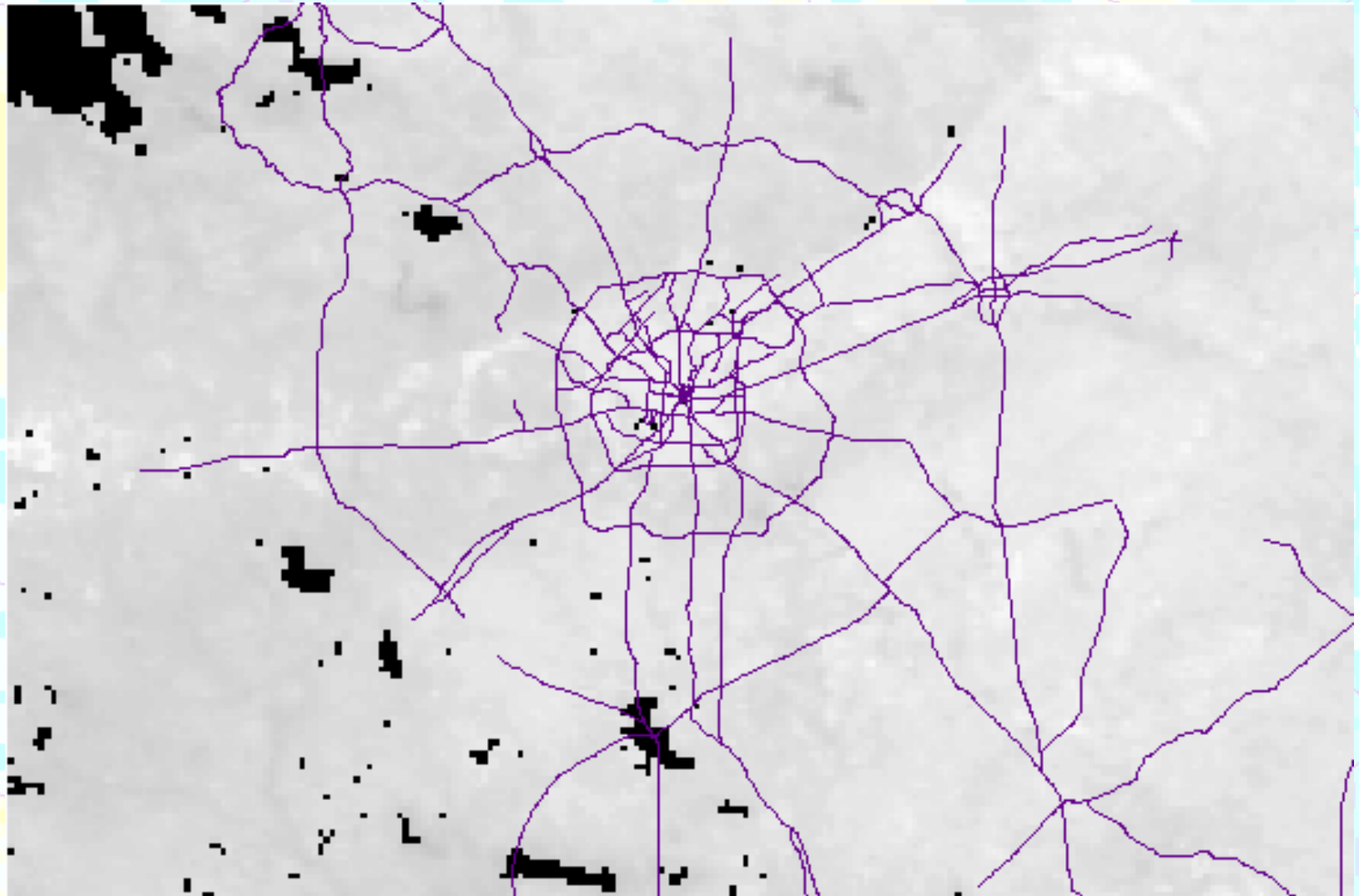
Source: Lawrence Berkeley National Laboratory

Objectives

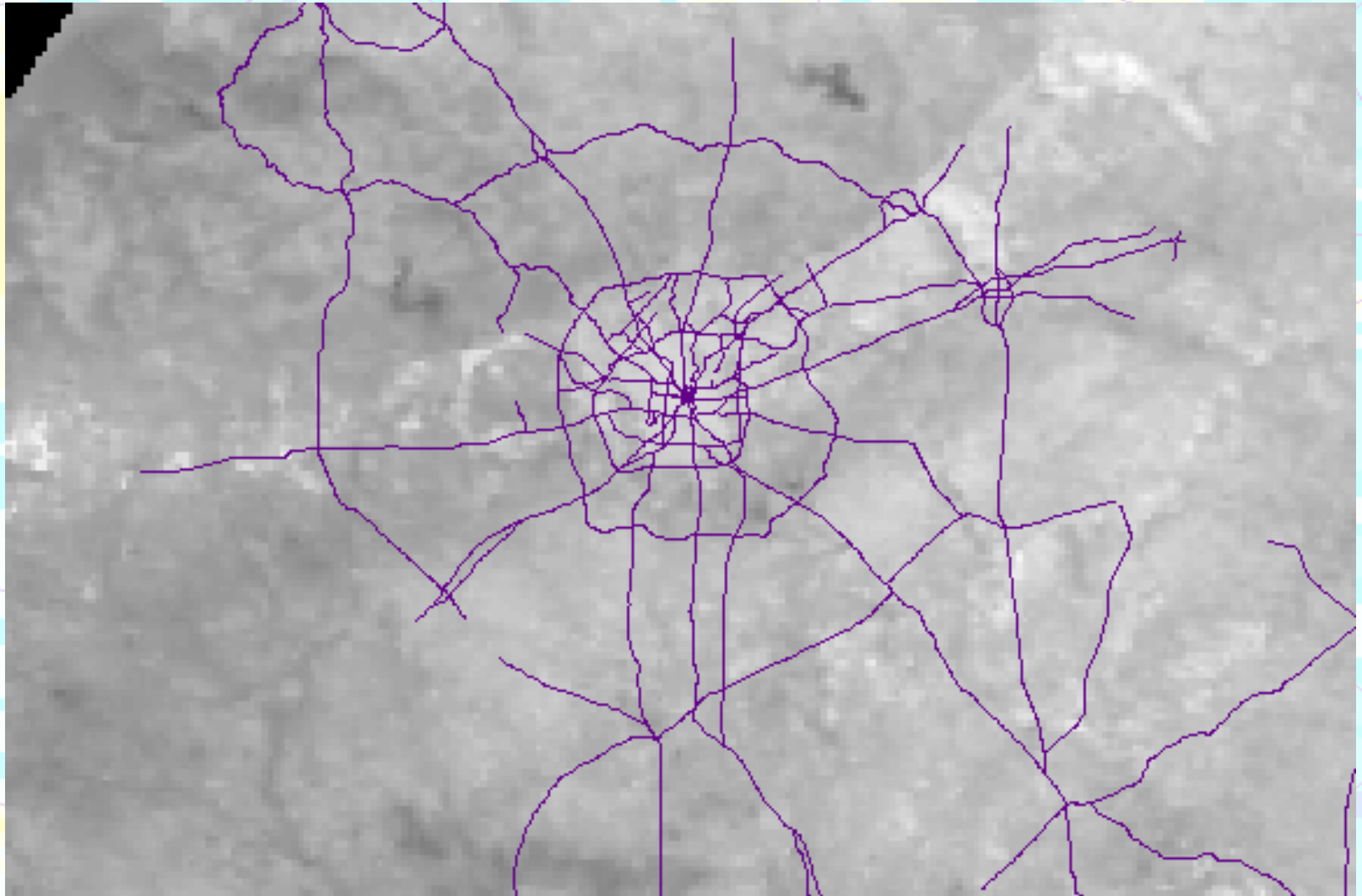
- Show the differences in land temperature (1°C) causing the well defined urban heat islands
- Determine heat island on-set
- Determine heat island off-set
- Examine the relationship between ambient temperature and the urban heat islands

Methods

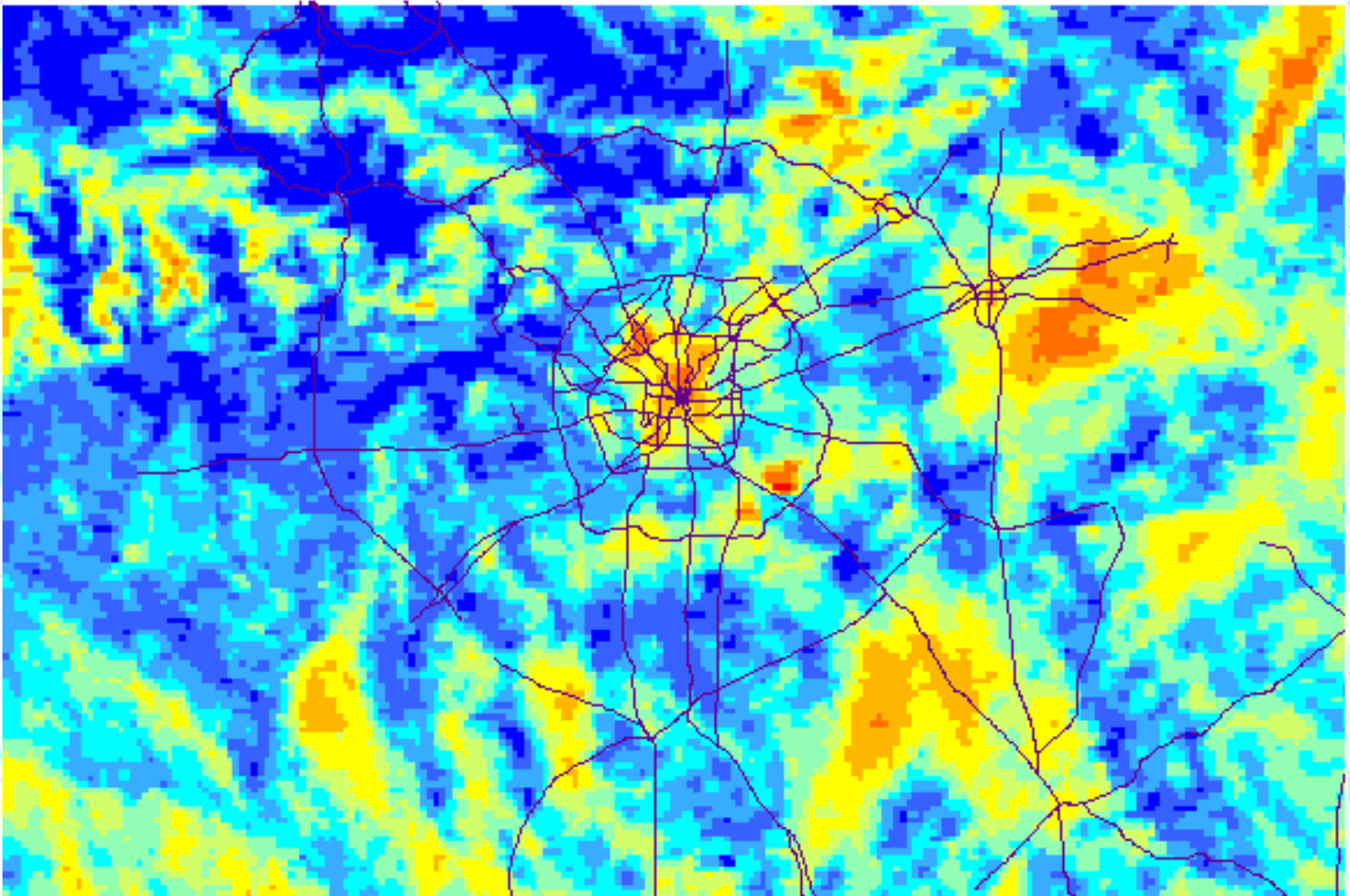
- Download Data – Temperature / Emissivity
MODIS-Terra Data 1km spatial resolution
<http://edcimswww.cr.usgs.gov/pub/imswelcome/>
- Sort the data
- Convert to Kelvin
- Interpolate data
- Classify the data
- Look for heat island on-set
- Look for heat island off-set



Non-Interpolated Data



Interpolated Data



Classified Data

Classification



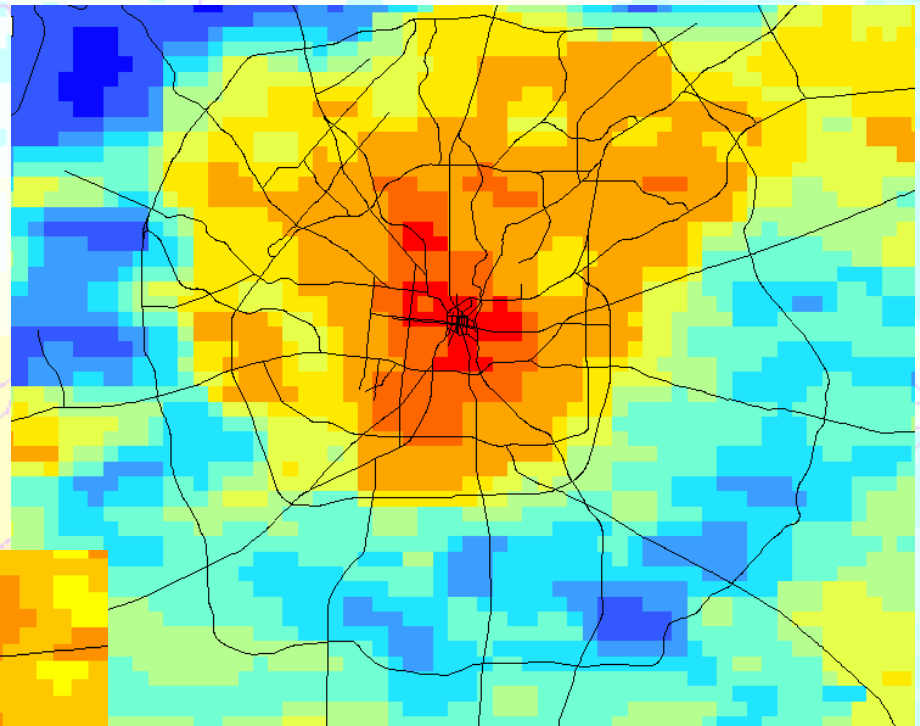
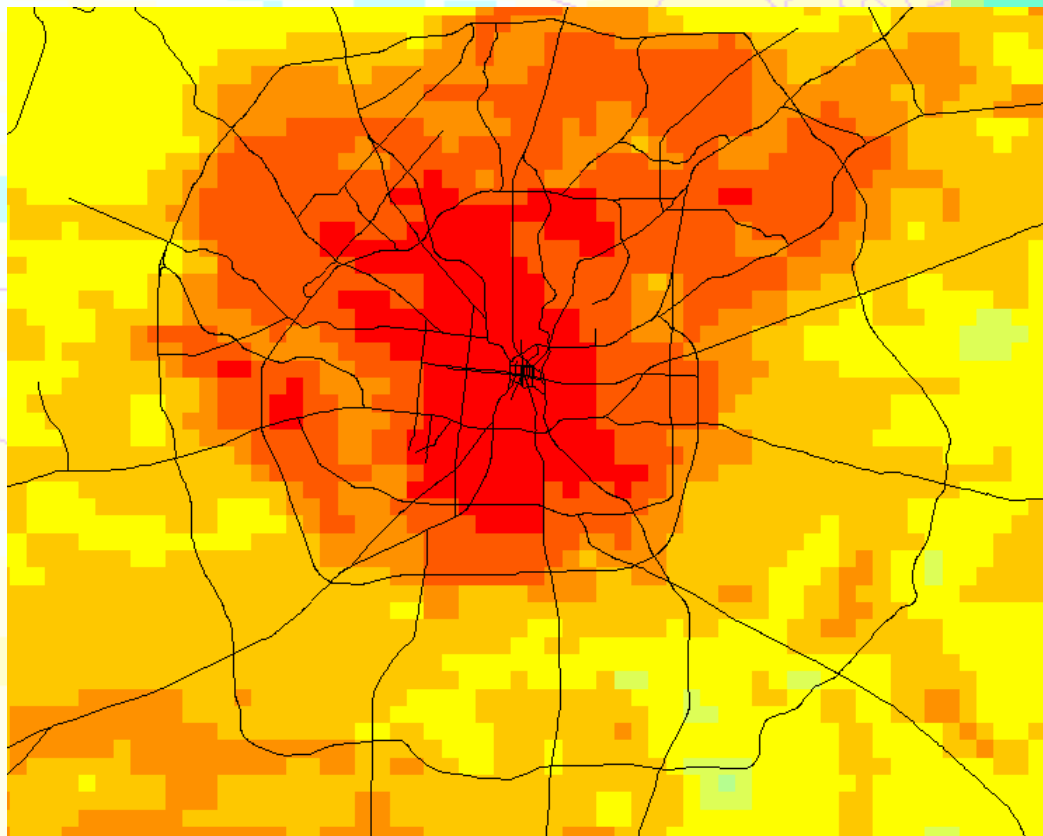
- Day Images 10 – 13 classes
– greater temperature differences
- Night Images 8 -10 classes

Results

- Urban Heat island on-set:
- Day - @ mid-April 2004
- Night - @ early May
 - Heat islands were occasional in April but sustained in early May

Day Time Images

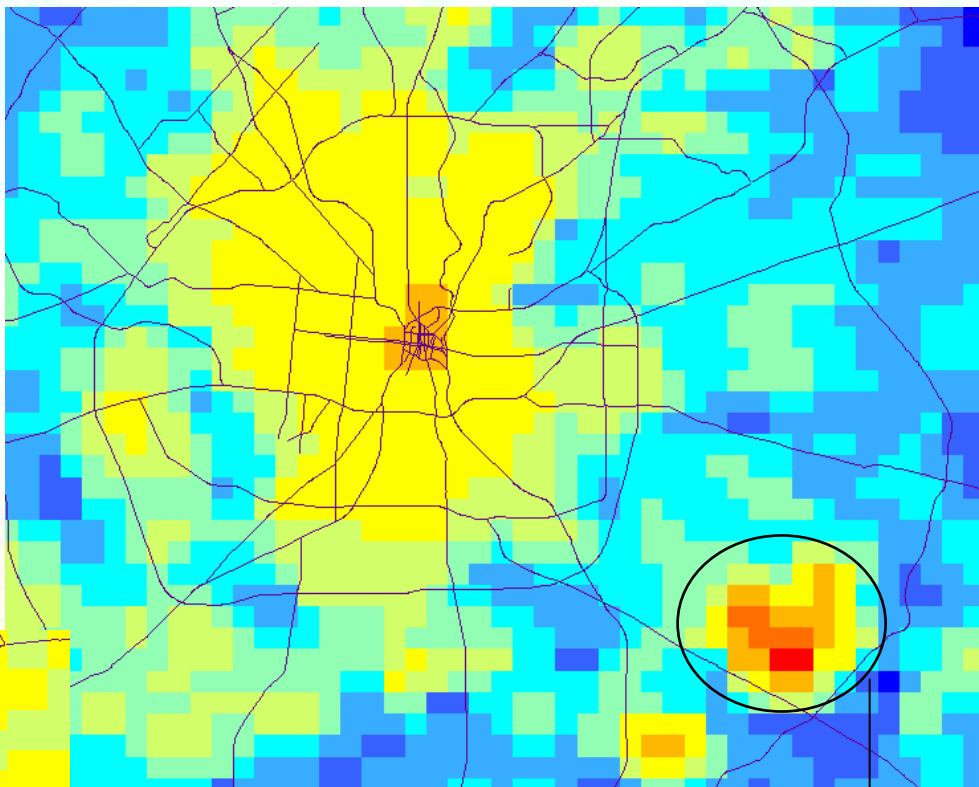
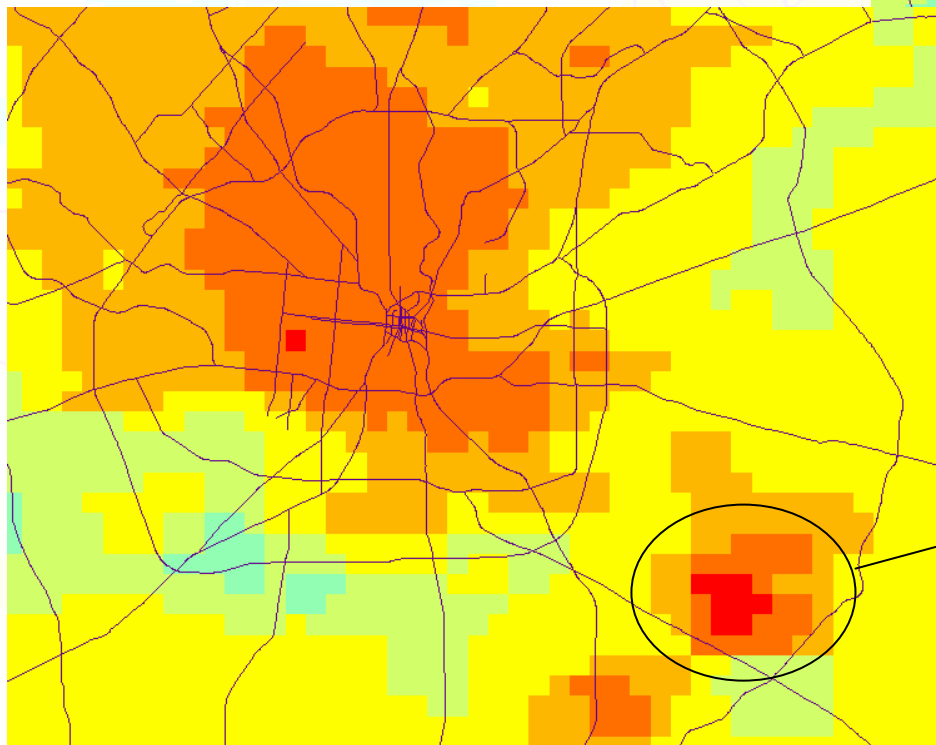
April 13, 2004



April 15, 2004

Night Time Images

April 16, 2004

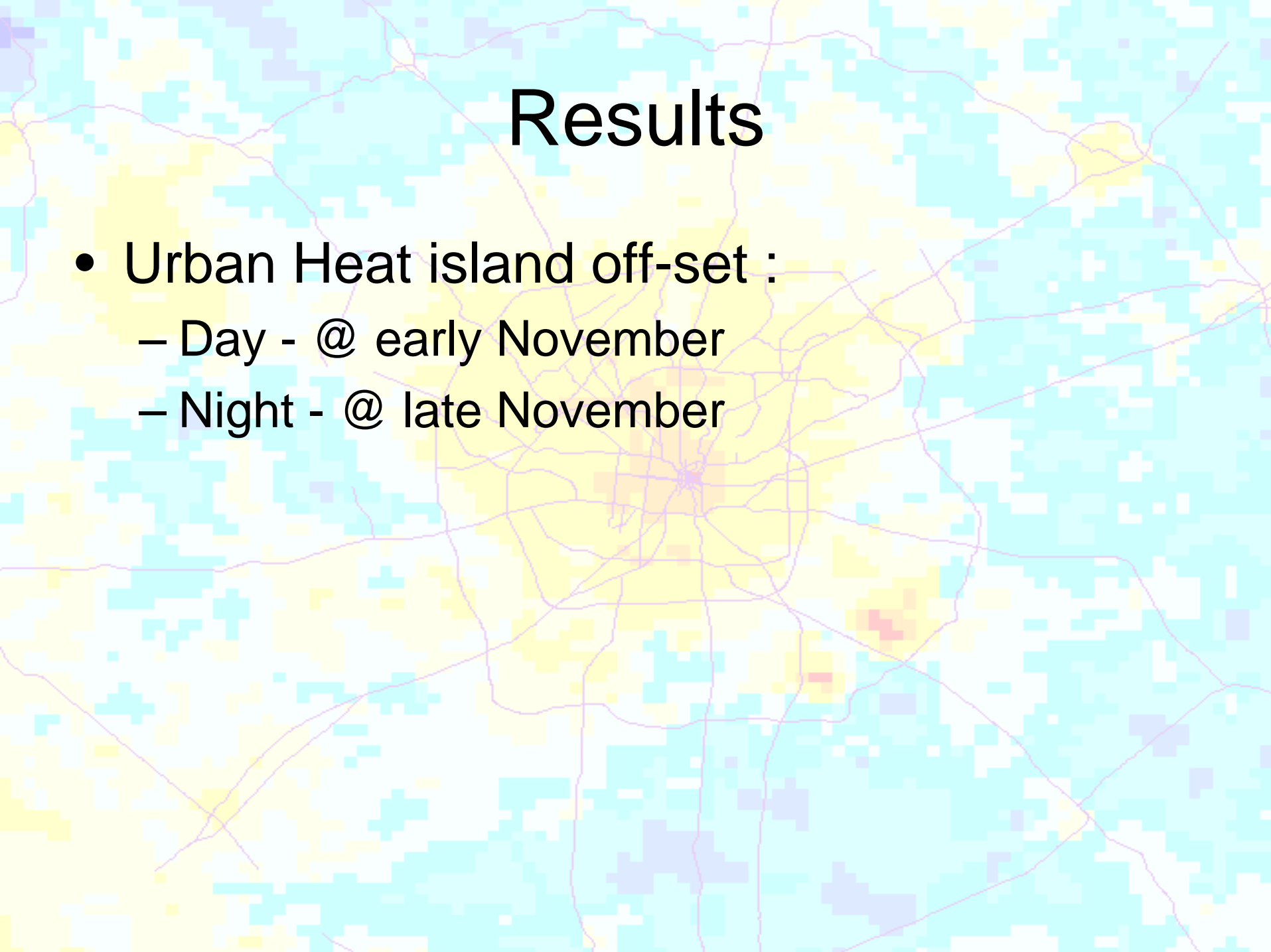


May 4, 2004

Calaveras Lake

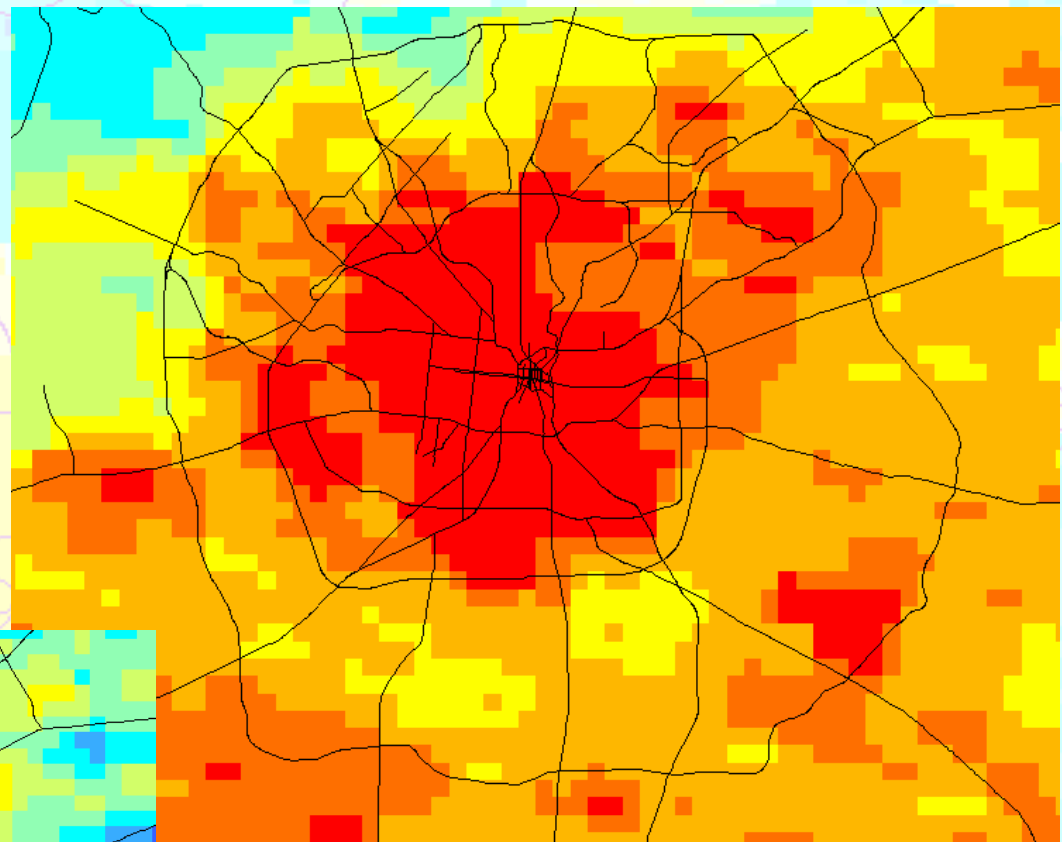
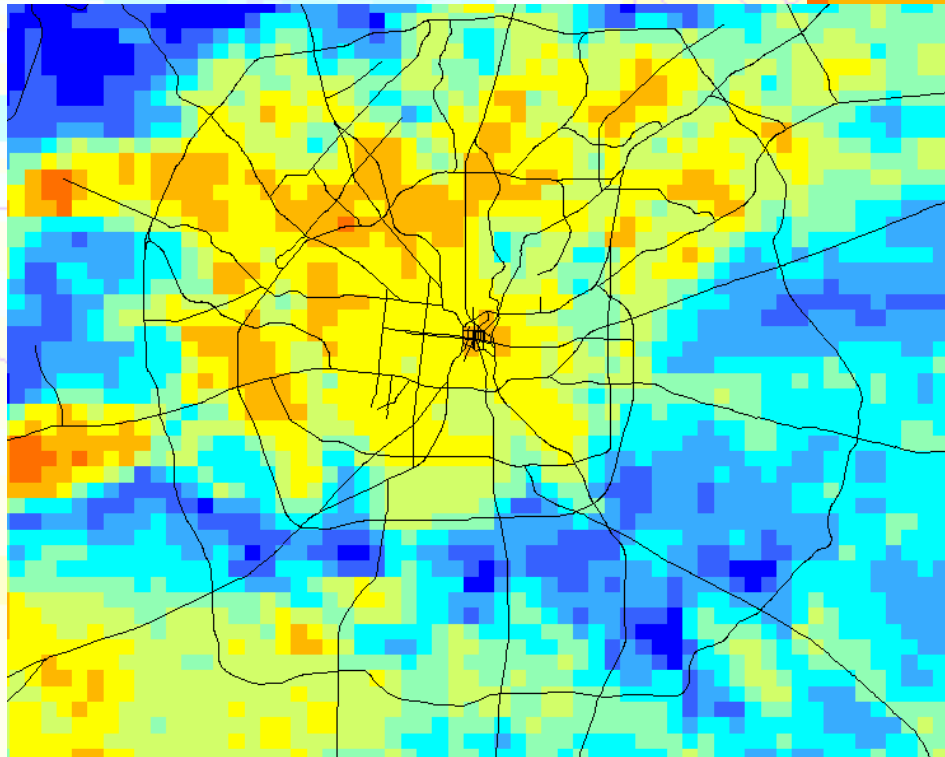
Results

- Urban Heat island off-set :
 - Day - @ early November
 - Night - @ late November



Day Time Images

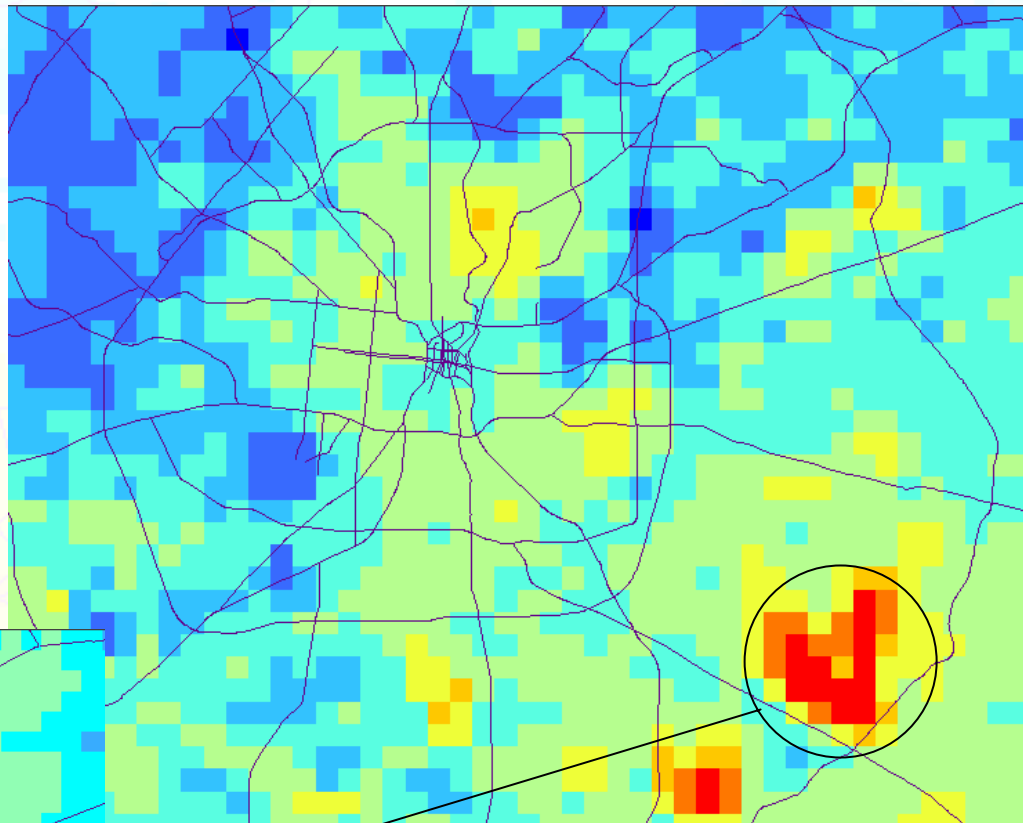
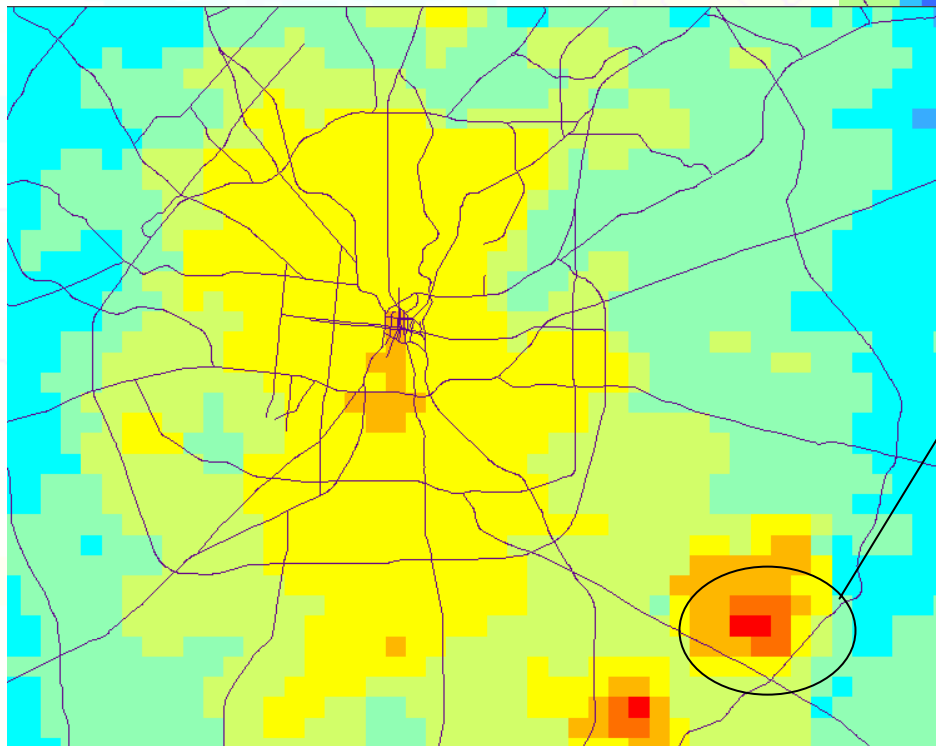
October 16, 2004



November 4, 2004

Night time Images

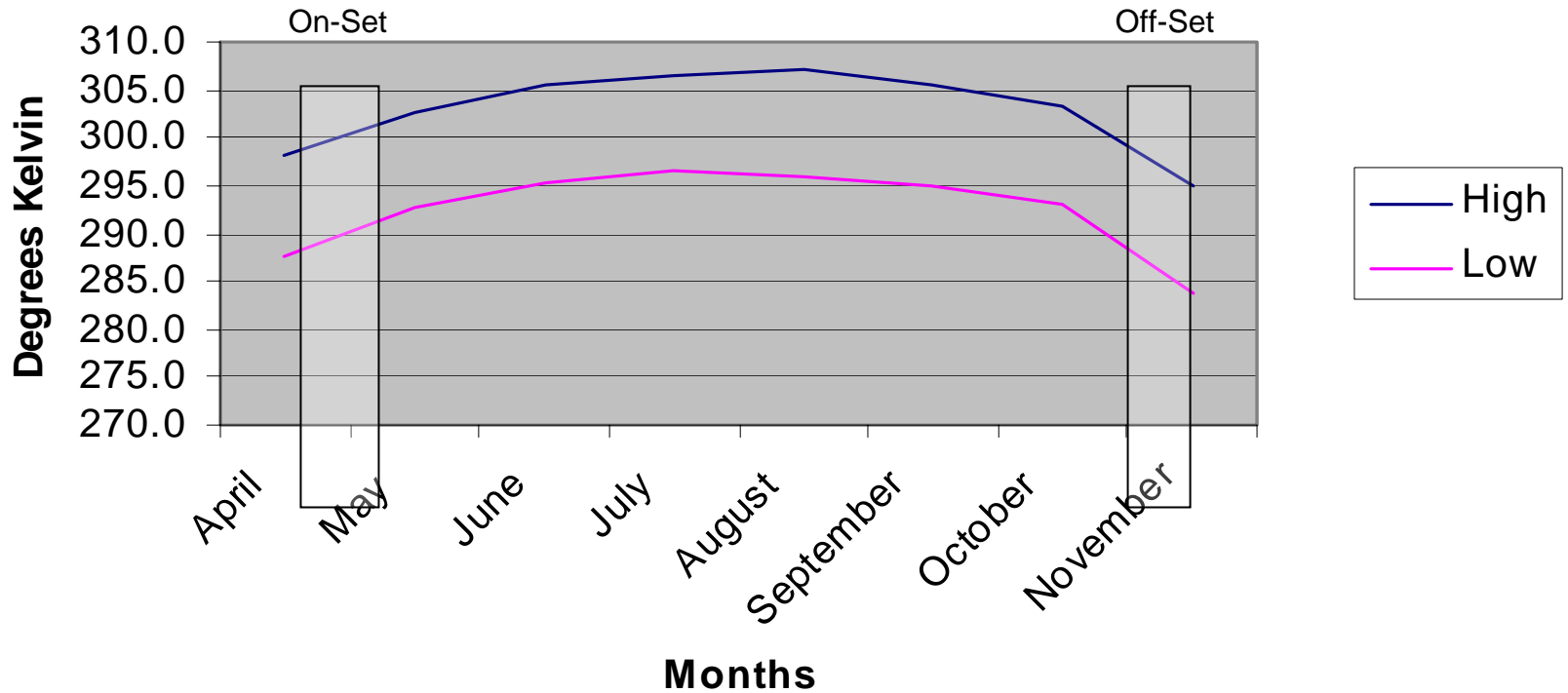
November 17, 2004



Calaveras Lake

November 25, 2004

Average High / Low



The shaded areas represent on-set and off-set of the urban heat islands.

on-set high 77° F and low 57° F

off-set high 71° F and low 51° F

Blue and pink lines represent the average high and low temperatures for the study period

Conclusion

- Heat island on-set occurs in late Spring
- Heat island off-set occurs in early Fall
- Data corruption attributed to low image count (60/480)
- Further research is needed to improve the image acquisition process
- Heat island prediction will help with future climate modeling



Questions ?