

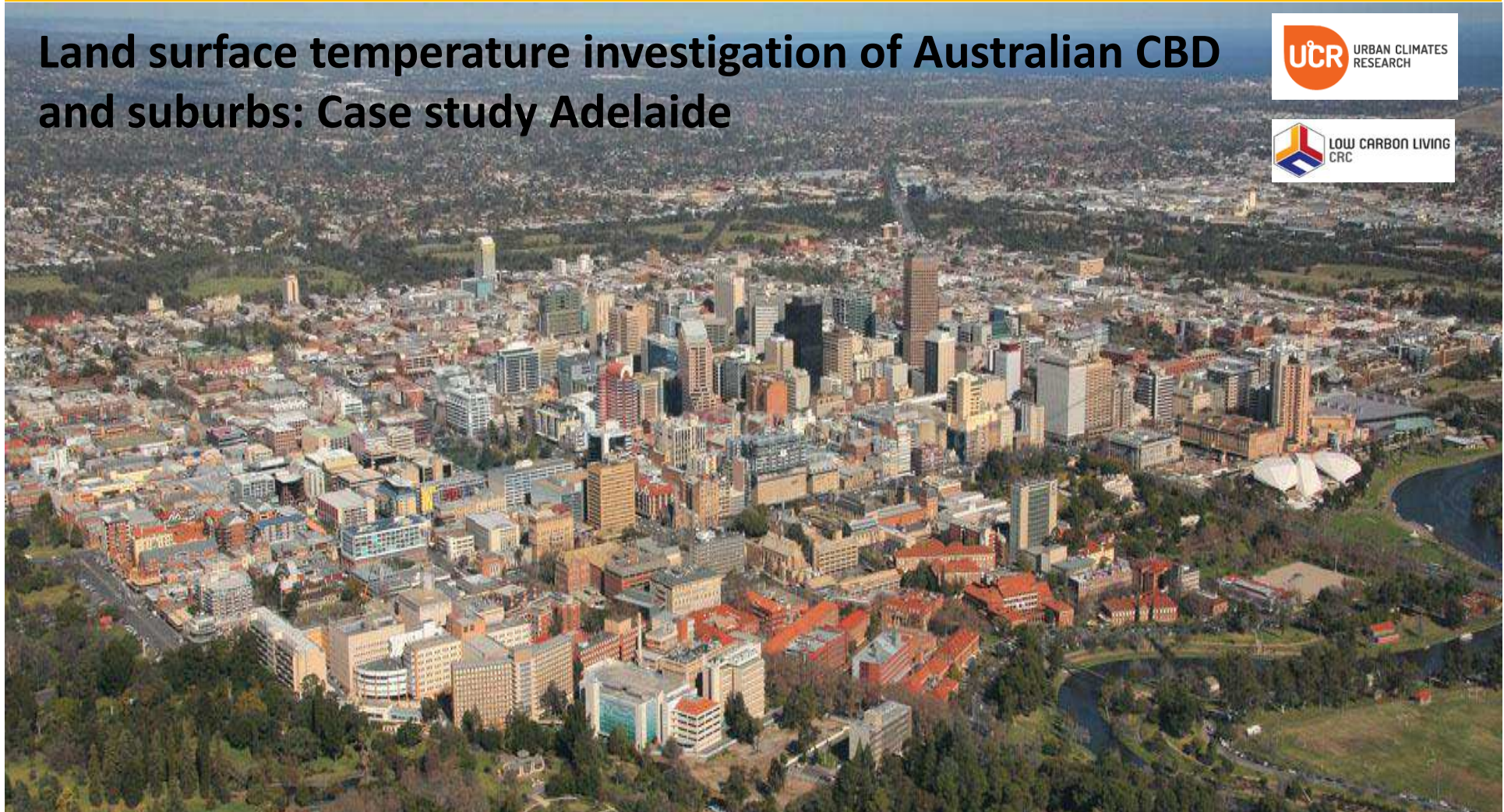


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Zero Waste SA Research Centre for  
Sustainable Design  
and Behaviour

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University of South Australia  
Adelaide, Australia

# Land surface temperature investigation of Australian CBD and suburbs: Case study Adelaide



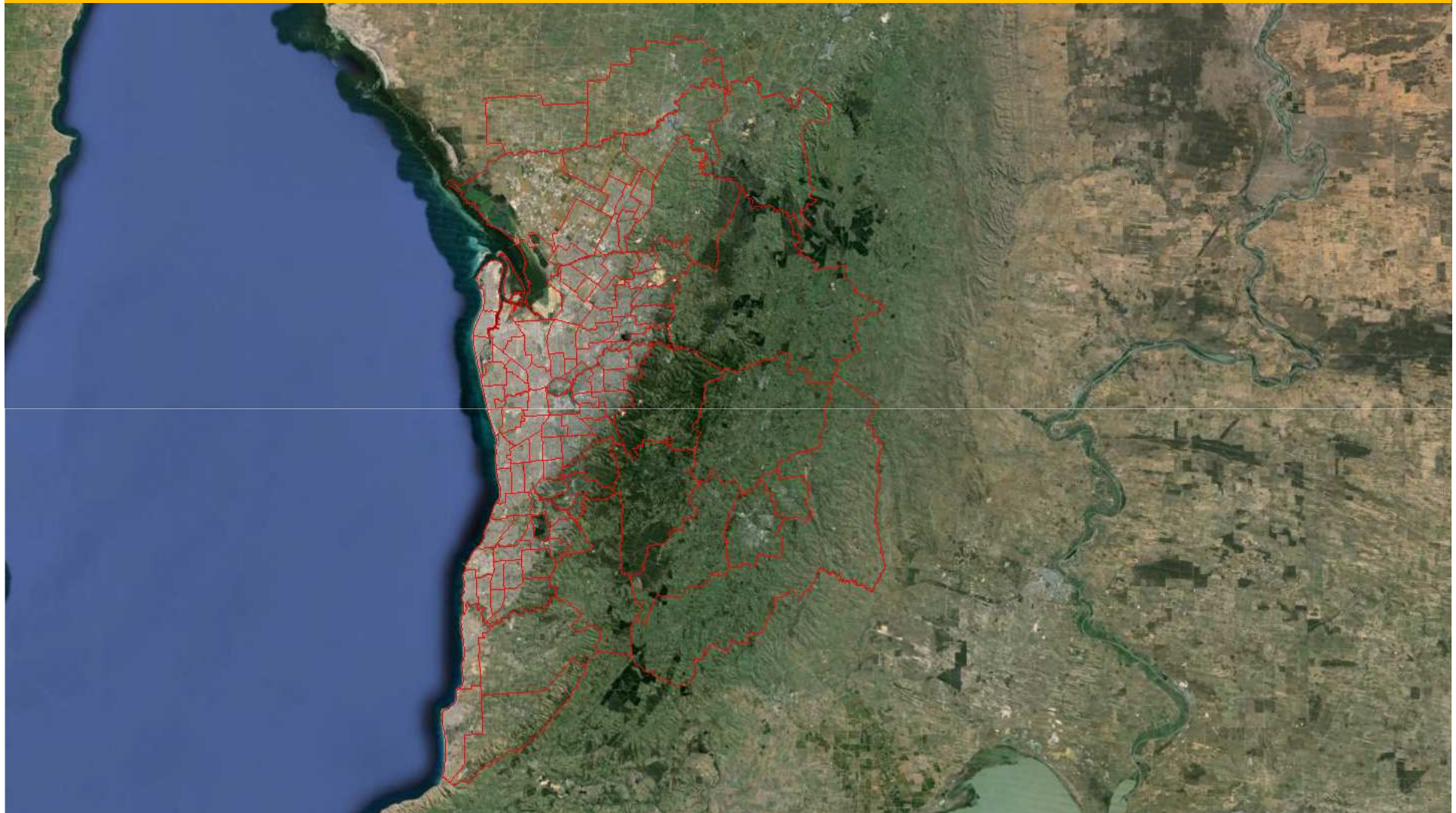
3rd CRC RP2005 Workshop  
26 September 2014, Melbourne



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## Topography of Adelaide



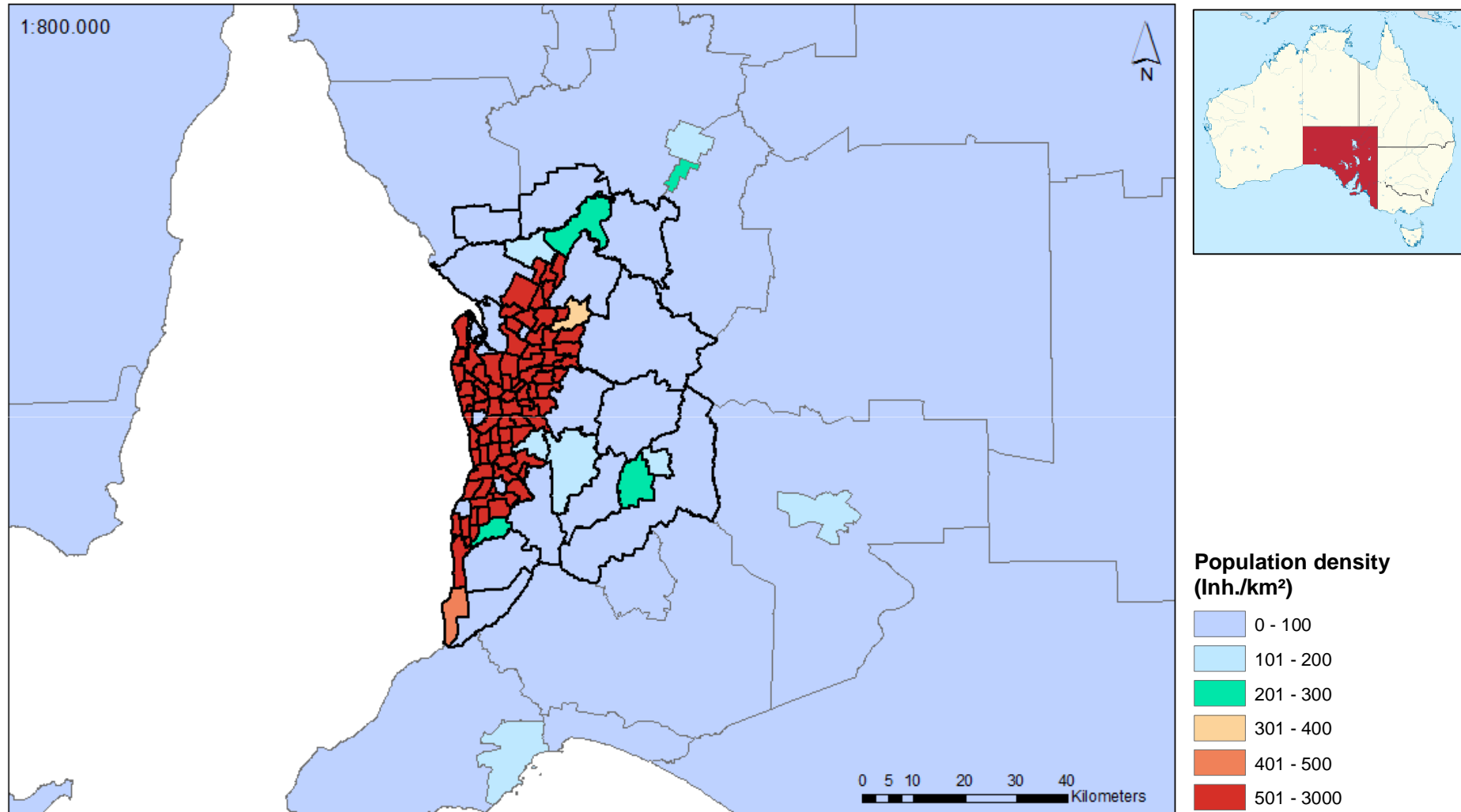
**The SA2 area of Adelaide (marked in red) covers the hills (700 m) and flat area**



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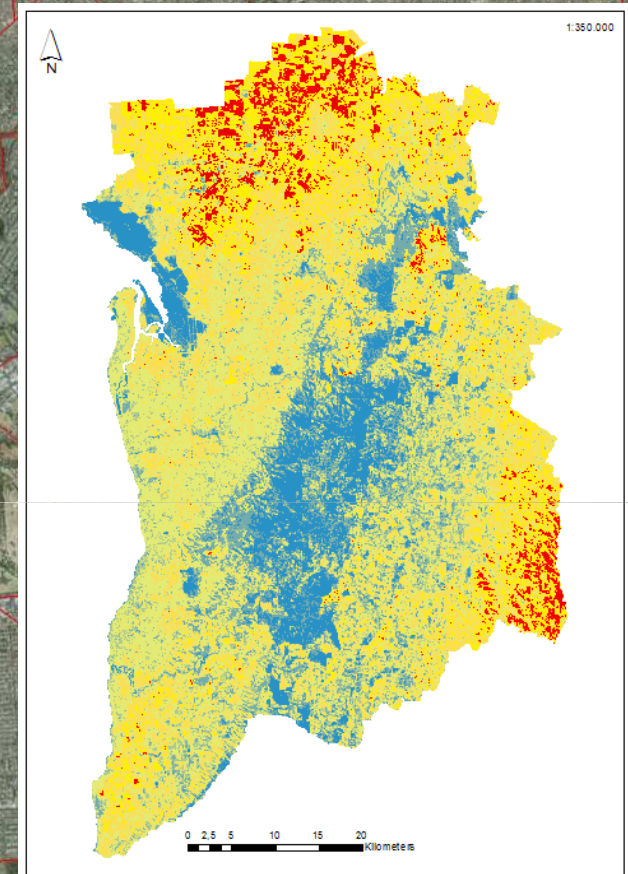
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## Population density of Adelaide (SA 2 area)



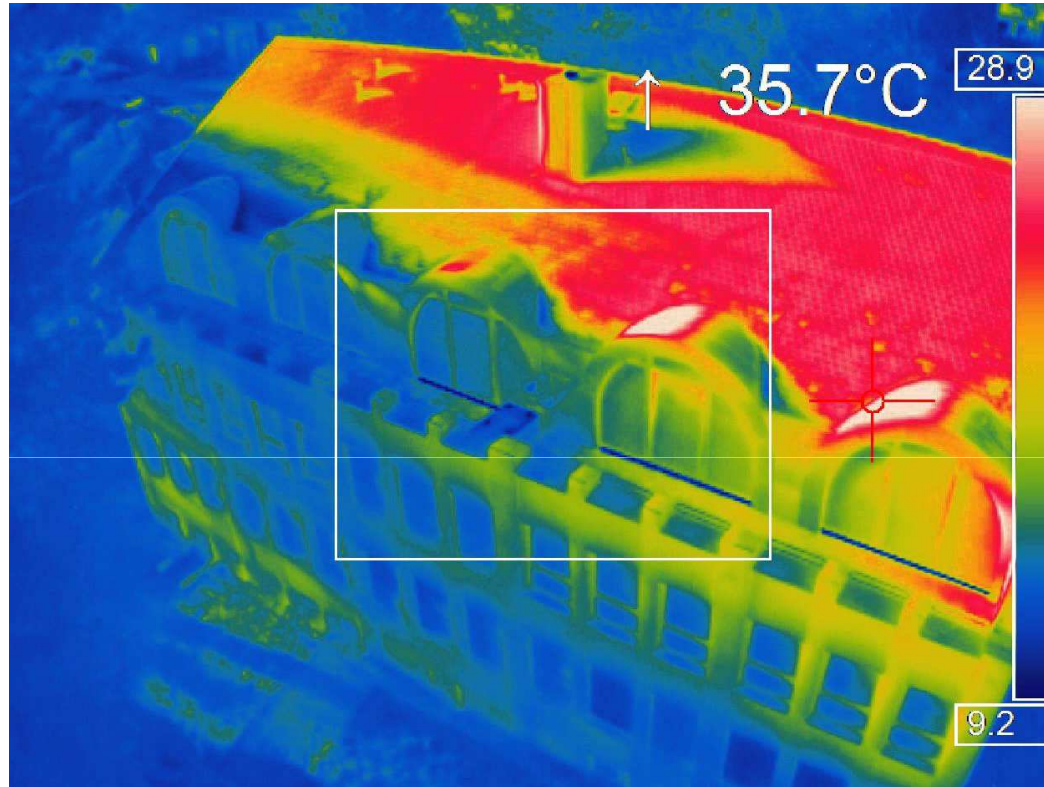
**CBD 10,481 km<sup>2</sup> = 0,6 % of the SA2 area of Adelaide: 109 suburbs and the CBD**

## Land surface temperature investigation



**What are the thermal conditions of the CBD of Adelaide compared to the suburbs?**

## How to measure the surface temperature



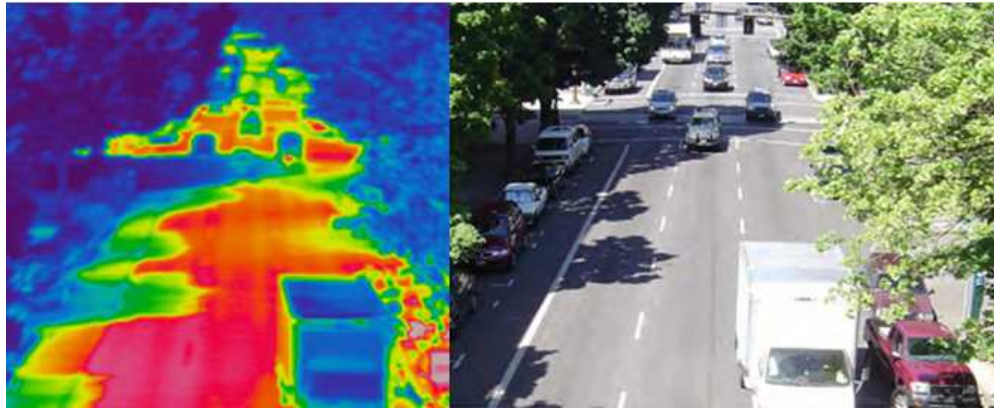
Aerial flyovers using drones with thermal cameras attached

## How to measure the surface temperature



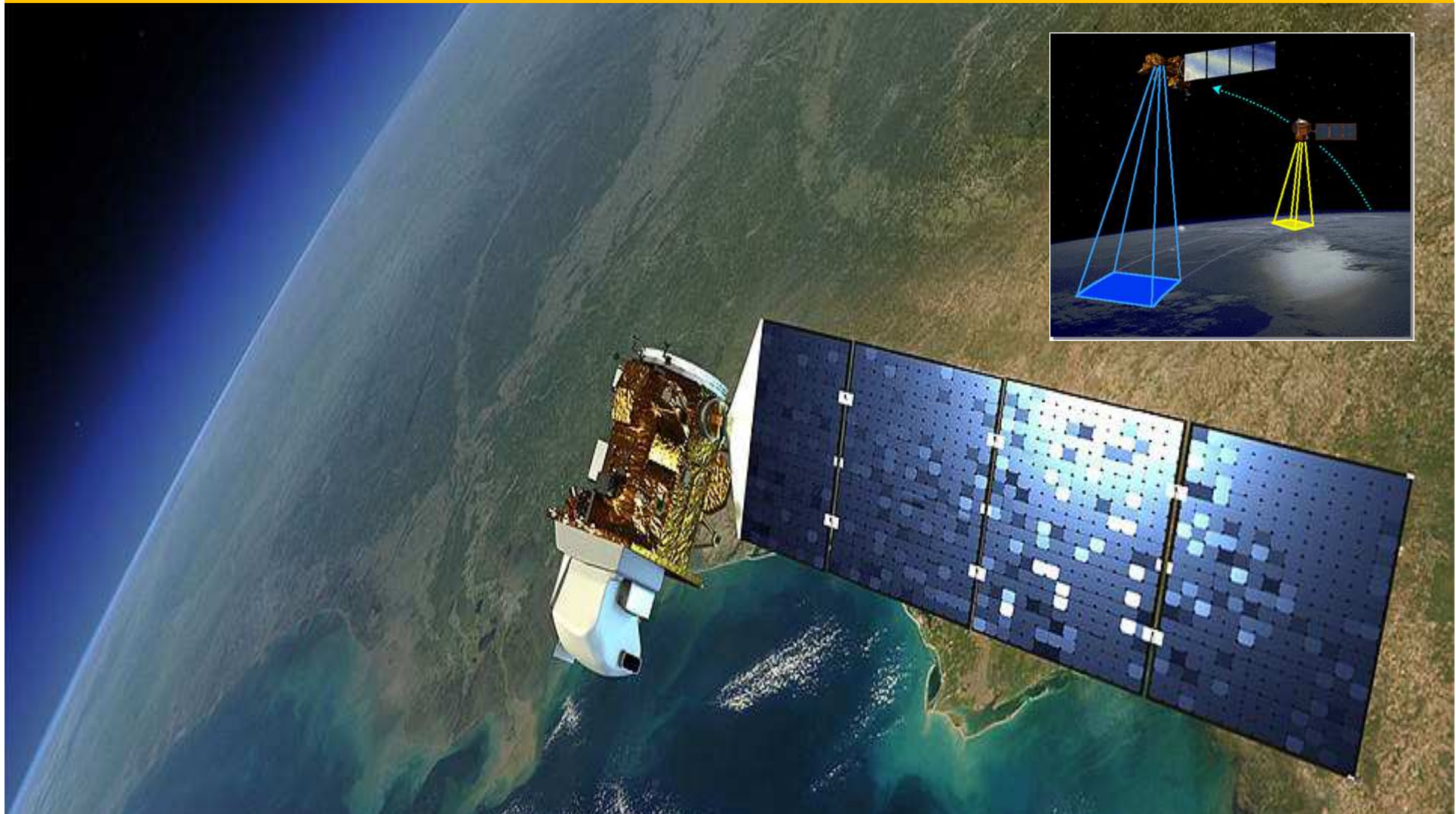
**Aerial flyovers with thermal sensory equipment**

## How to measure the surface temperature



Thermal hand cameras (for example FLIR 7)

## Landsat 7: launched 1999



**Landsat 7 covers the same 200 x 200 km area every 16 days at the same time (+/- 4 min): 10:40 AM**



# Impact of a Greenbelt on a megacity





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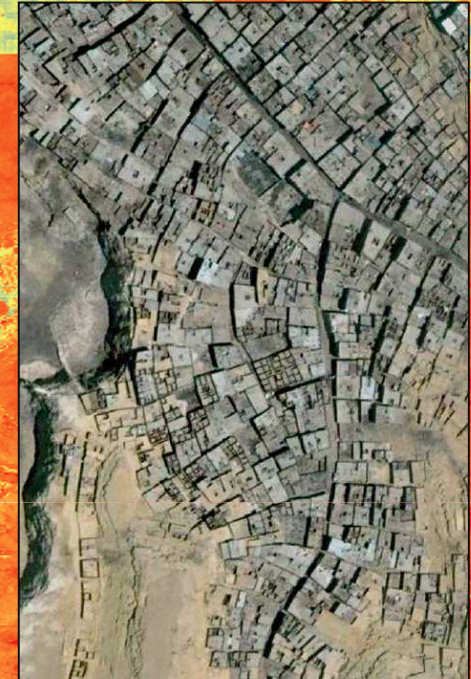
Case study Hong Kong (China)

# Urban heat investigation of high dense areas in Hong Kong



THE HONG KONG  
POLYTECHNIC UNIVERSITY  
香港理工大學

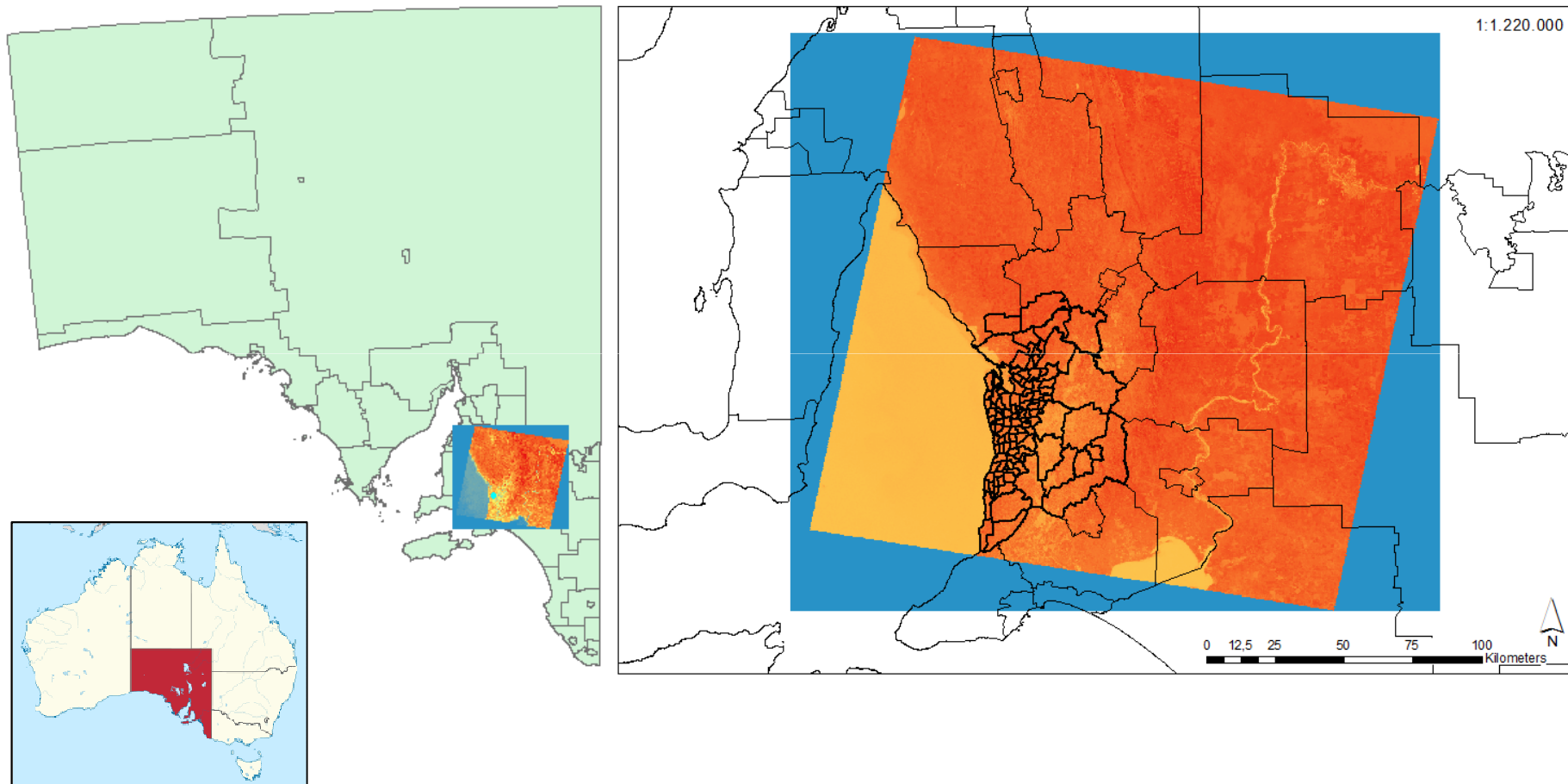
## Case study Cairo (Egypt)



# Urban heat analysis of informal settlements within Cairo

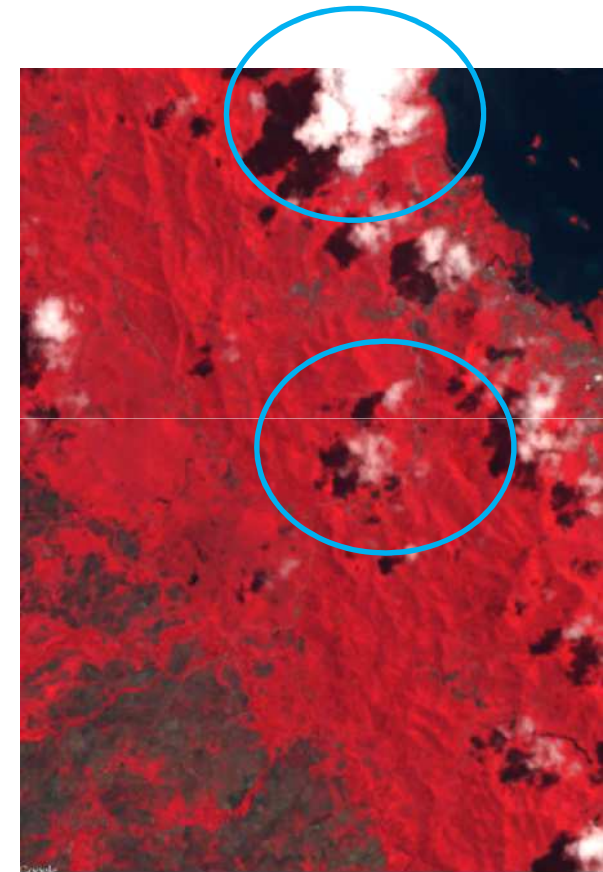
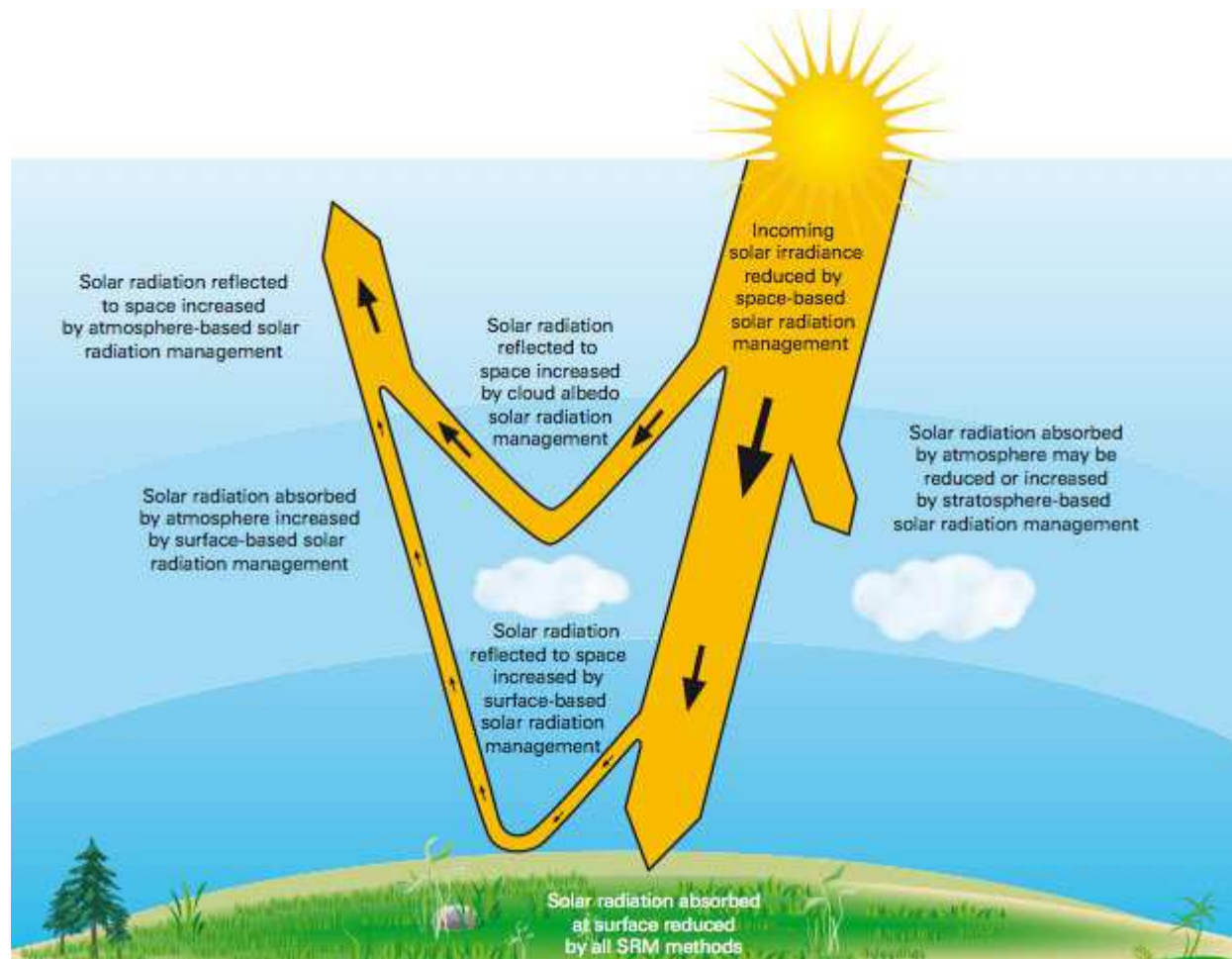
Bauhaus-  
Universität  
Weimar

## Coverage of Landsat 7 in Adelaide



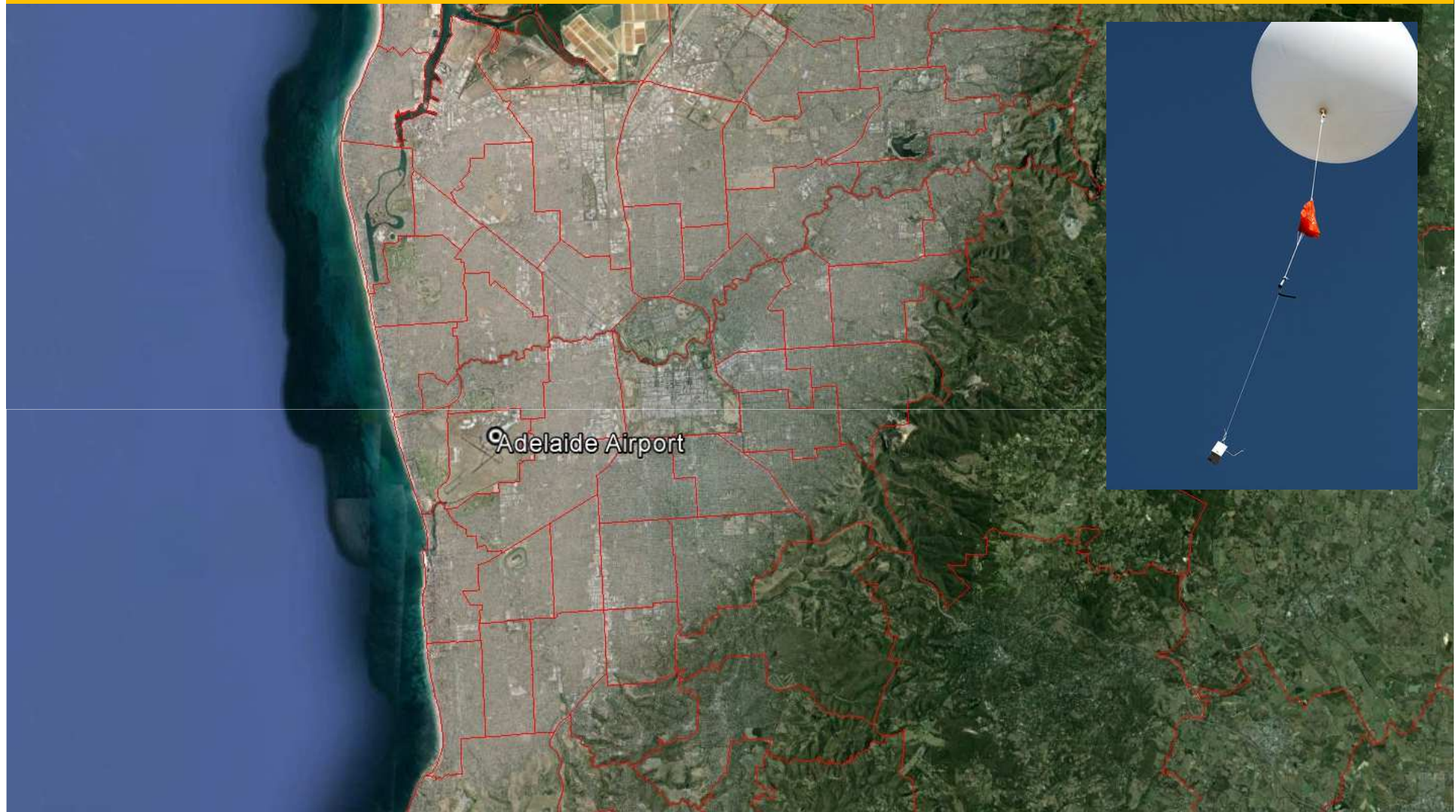
**Landsat 7 scene covers the whole Adelaide SA2 area (109 suburbs and the CBD)**

## Atmospheric correction



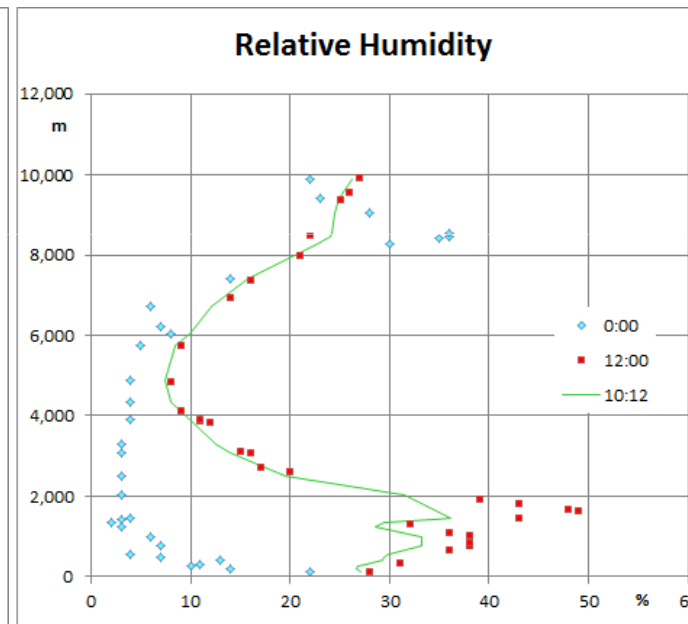
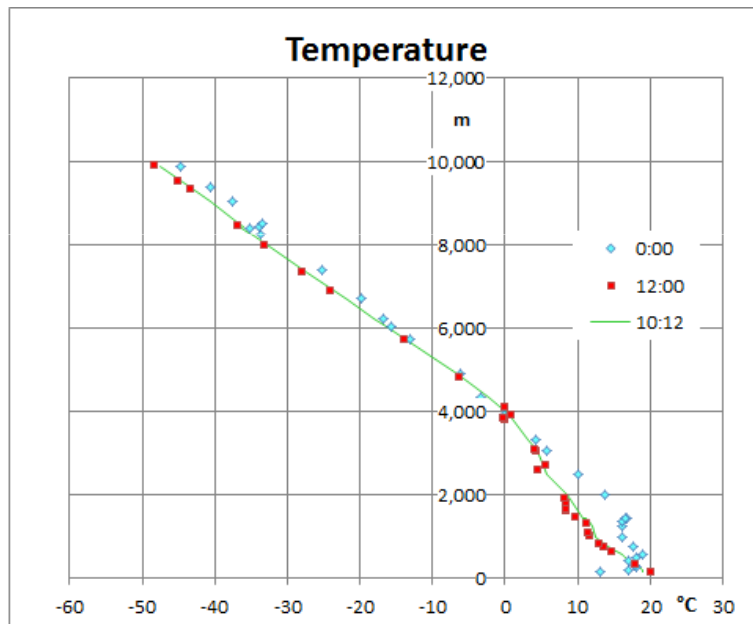
Cloudless images are more suitable for thermal remote sensing investigations

## Weather station 'Adelaide Airport': 8 km west of the CBD



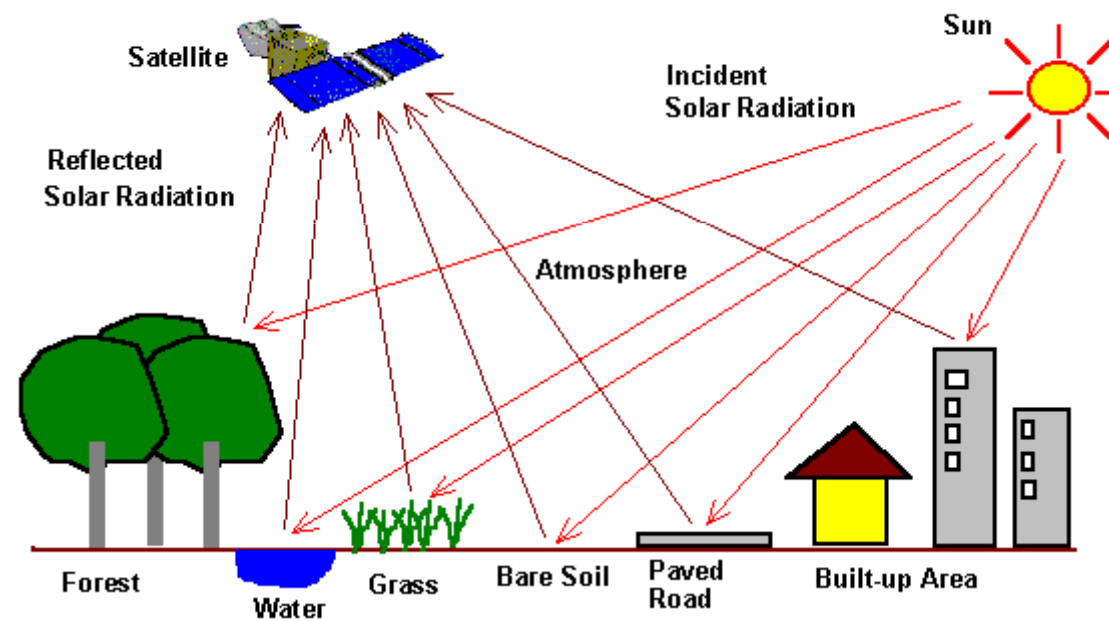
Weather balloon data is important in the investigation of aerial conditions

## Atmospheric correction



Temperature and relative humidity are used as basic parameters for thermal calculations

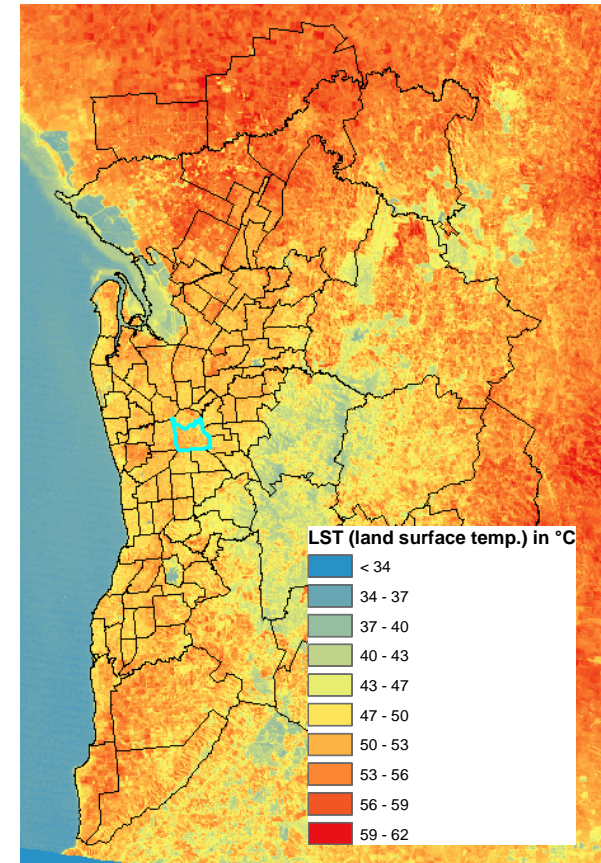
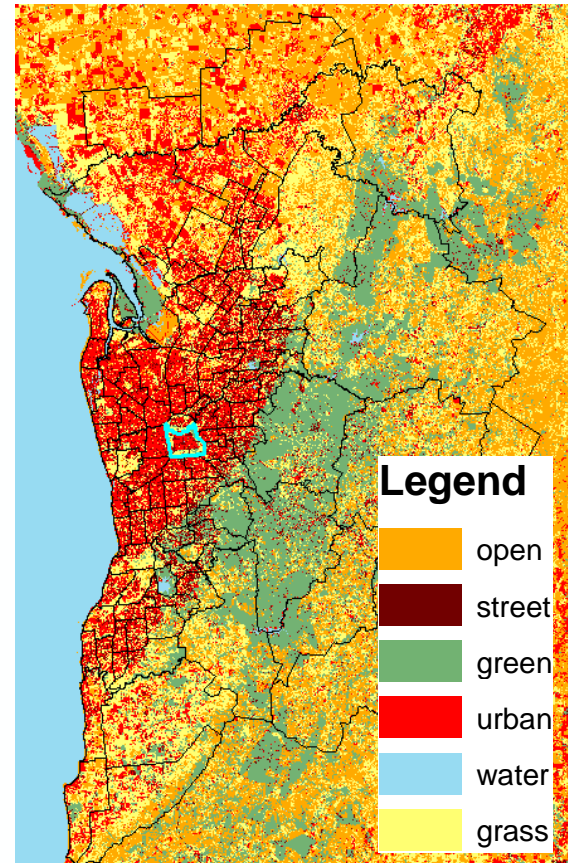
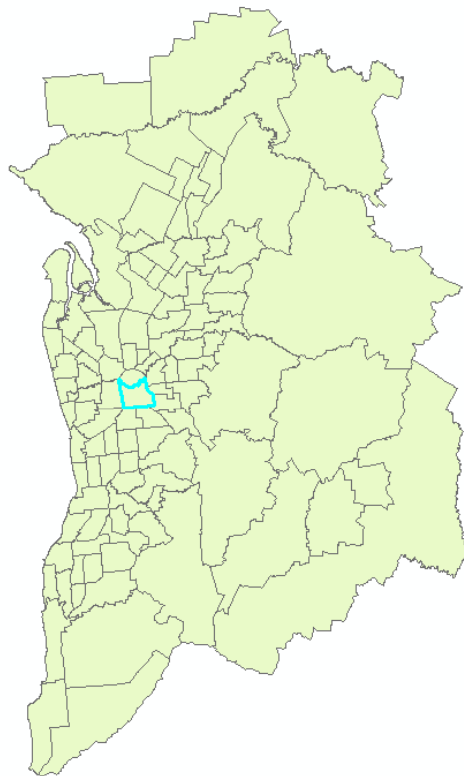
## Landsat: reflection of different land use types



Different correction values (epsilon) for different land use types

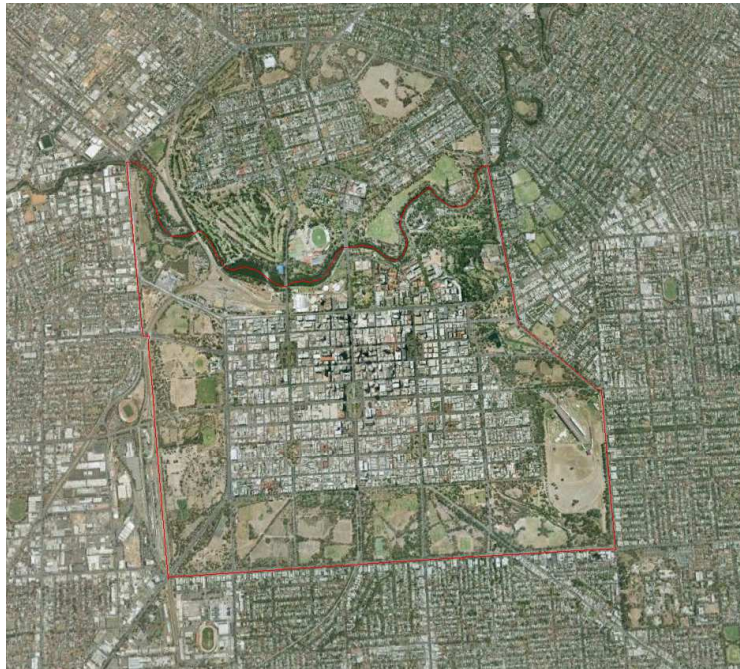


## LST and LUT map of Adelaide (SA2 area)

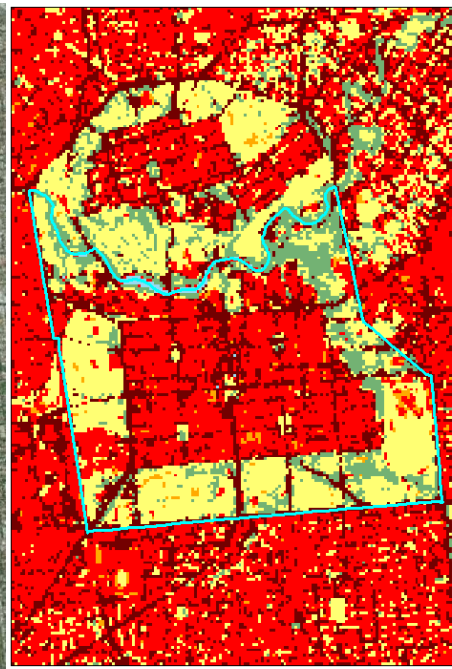


6 land use types reconstructed via the software ENVI (middle)  
Land surface temperature map (right)

## Comparison of different layer with GIS (ArcGIS and QuantumGIS)



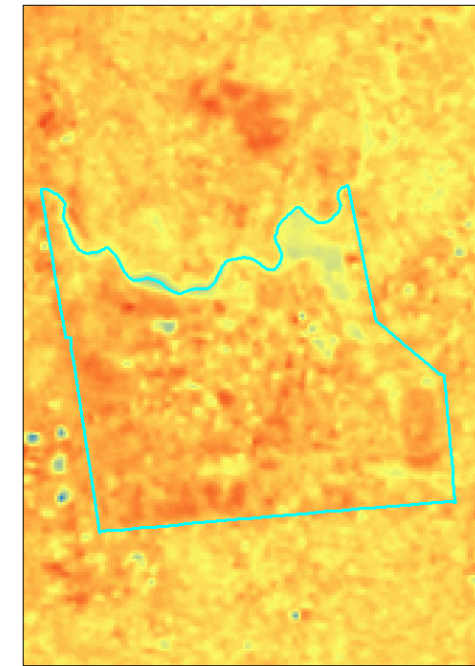
satellite image (visible band)



land use map

### Legend

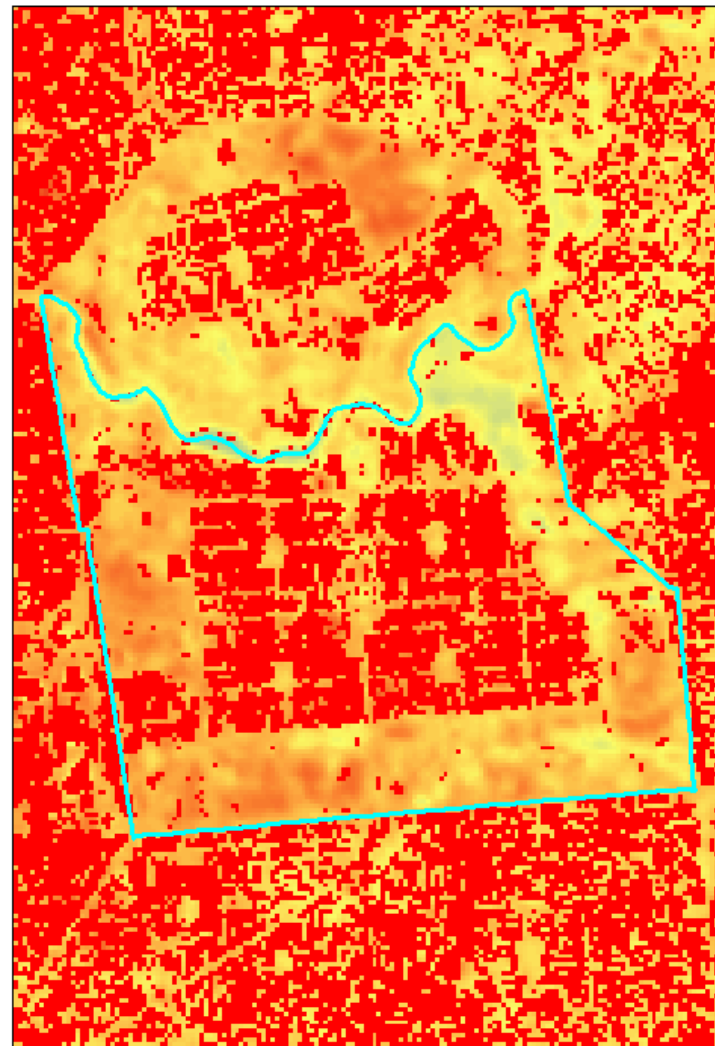
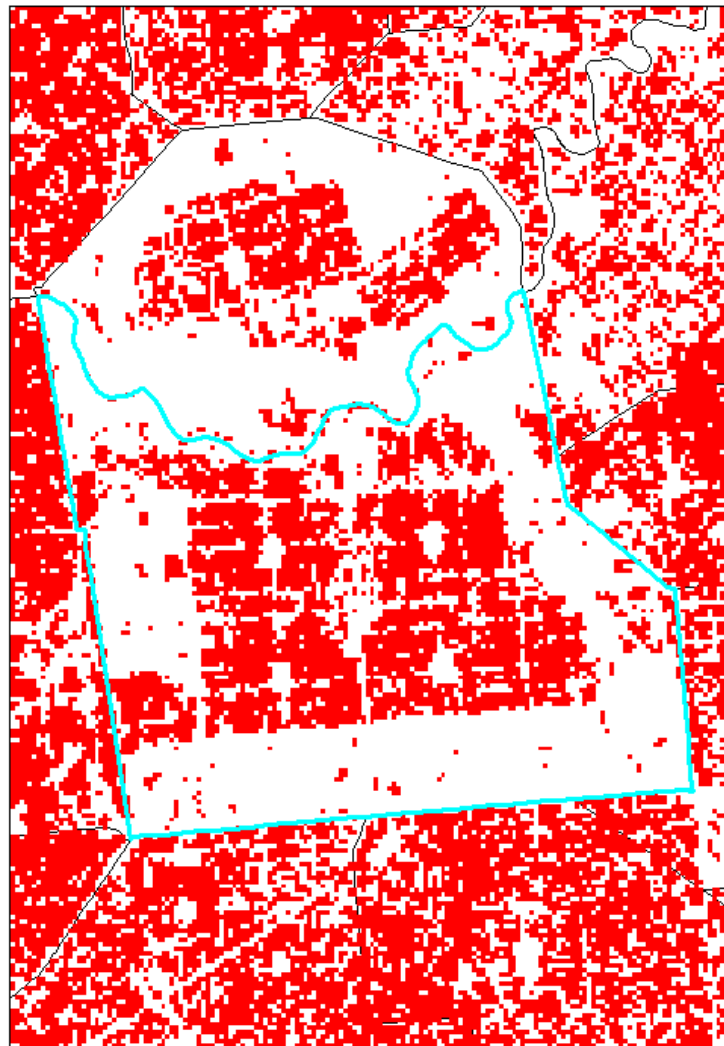
- open
- street
- green
- urban
- water
- grass



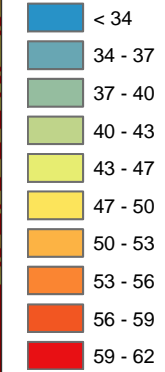
land surface temperature

Every pixel with a resolution of 30x30 m

## Adelaide's CBD

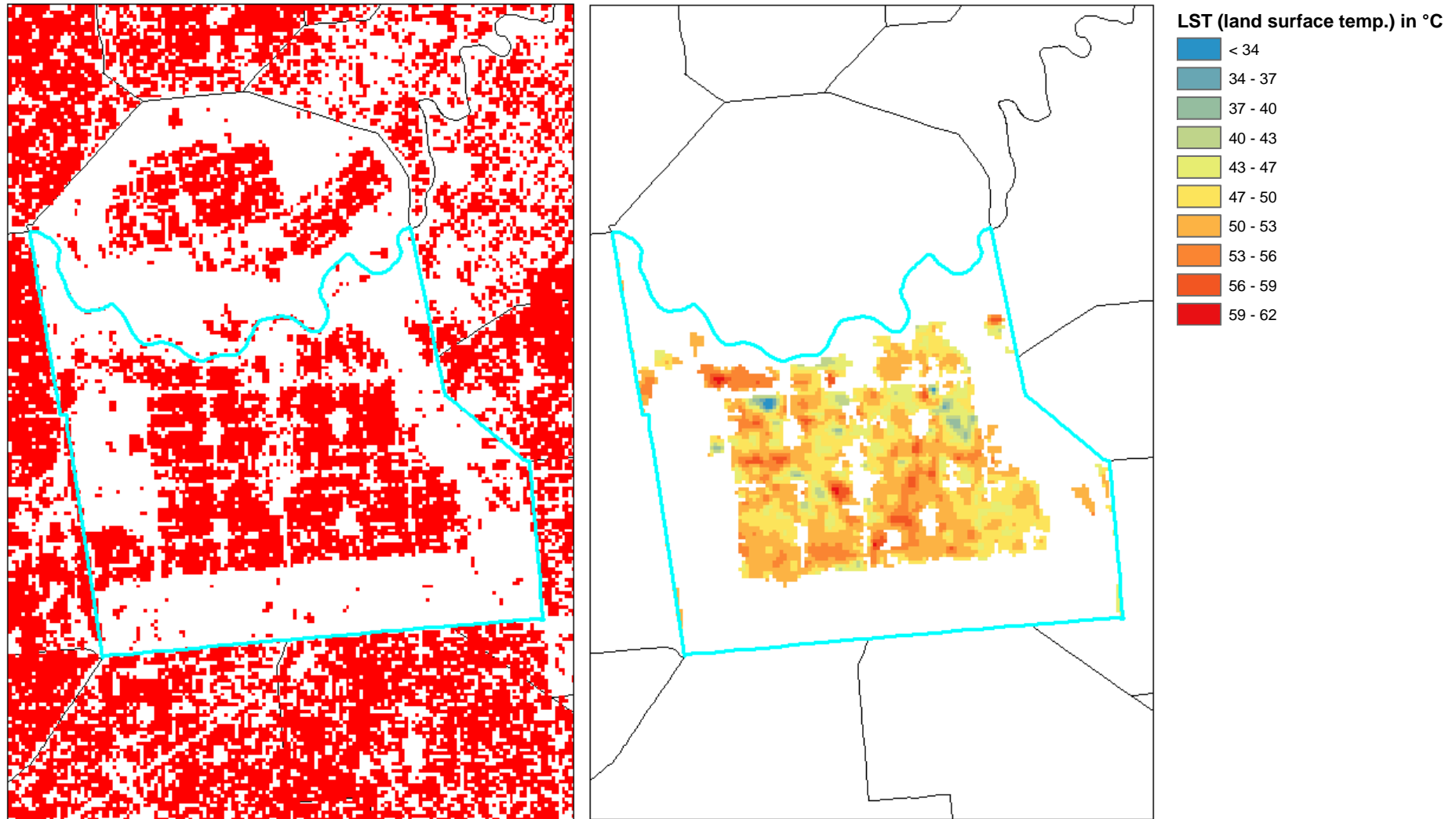


LST (land surface temp.) in °C



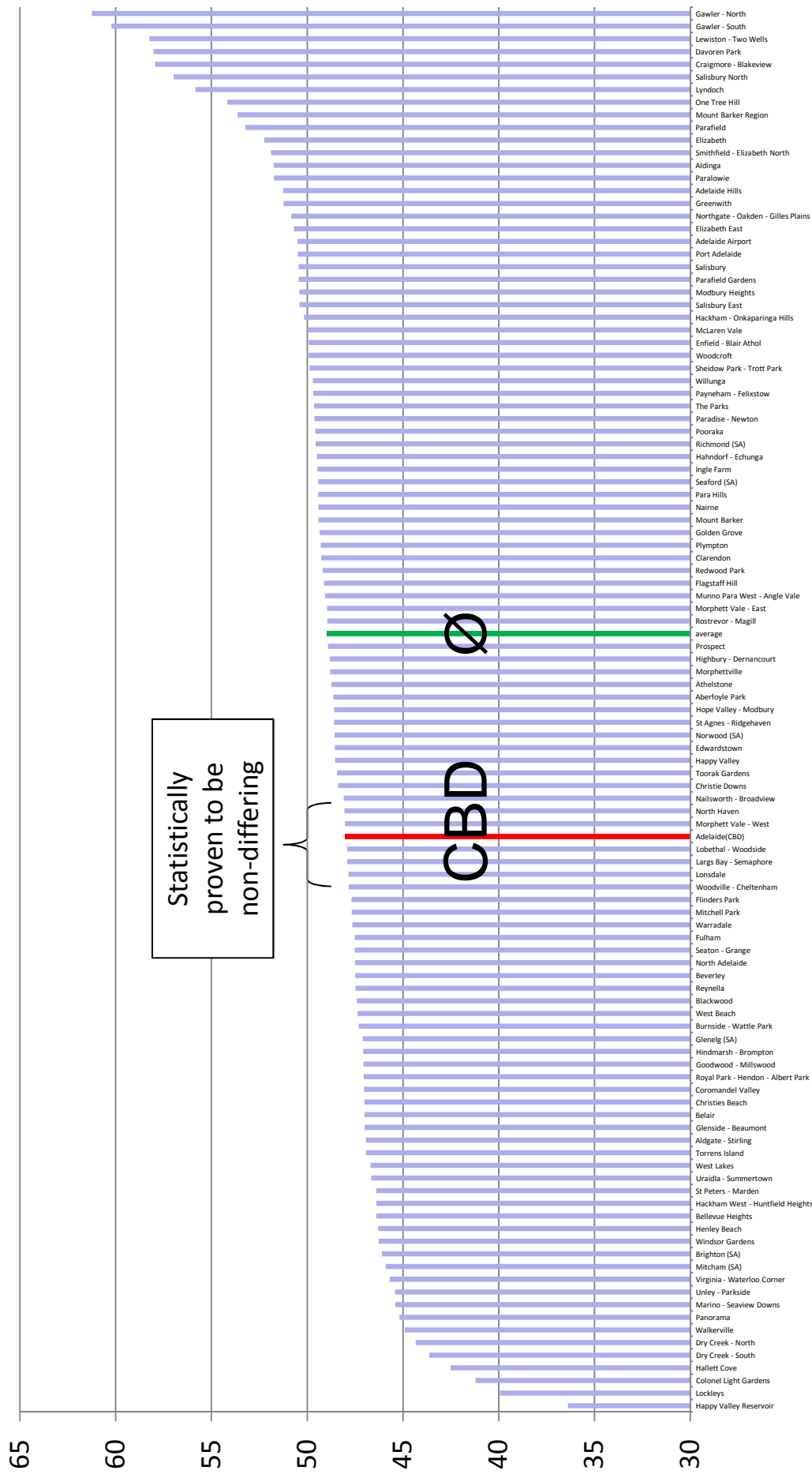
Urban areas of the CBD in Adelaide with the land surface map

## CBD of Adelaide



Urban areas of the CBD in Adelaide with the ,clipped' LST of the urban areas

# Mean land surface temperature (°C): CBD and 109 suburbs

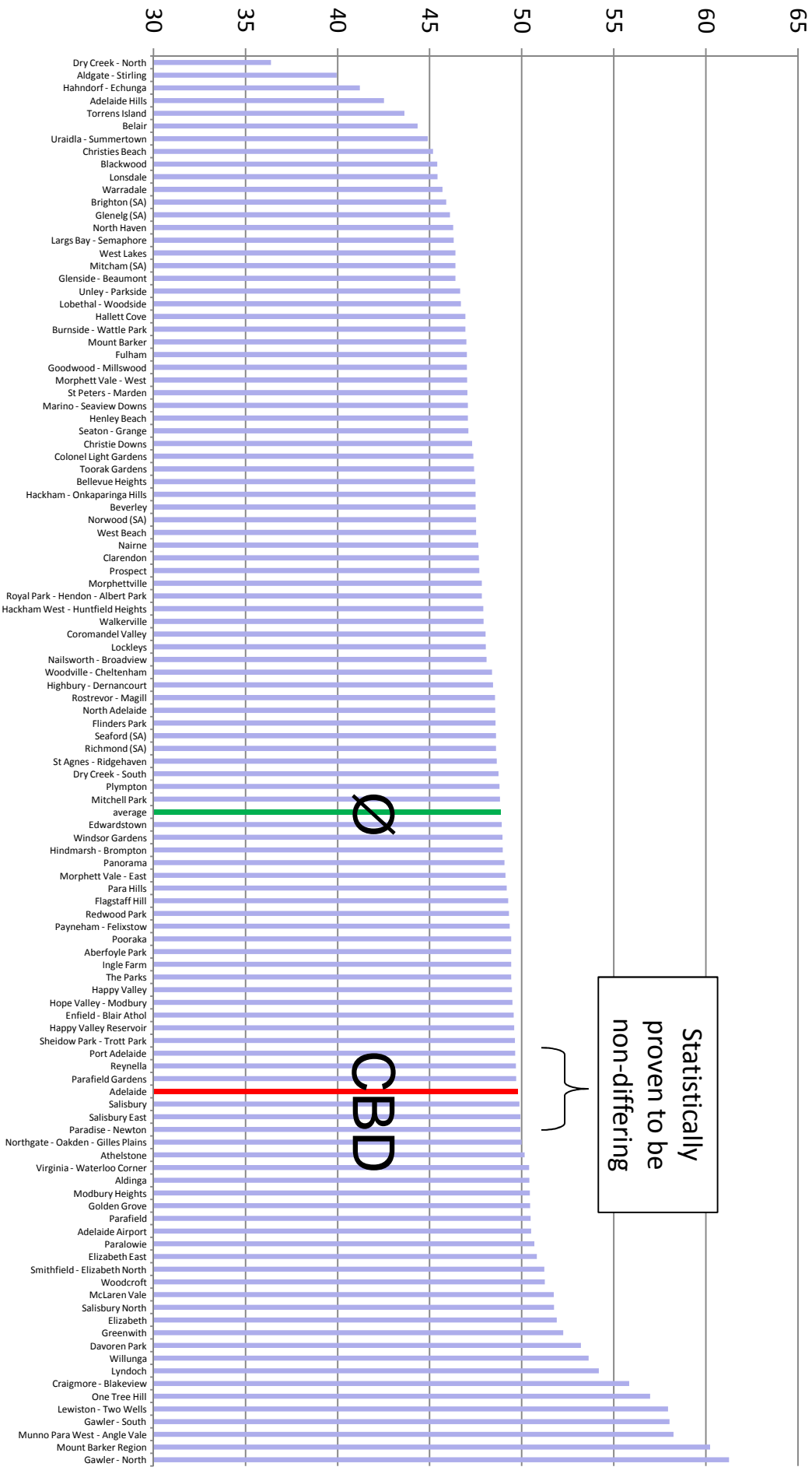


Average land surface temperature of all six land use types (red: CBD and green: average, 3 January 2000, Friday)

# Mean land surface temperature (°C): urban areas: CBD and 109 suburbs

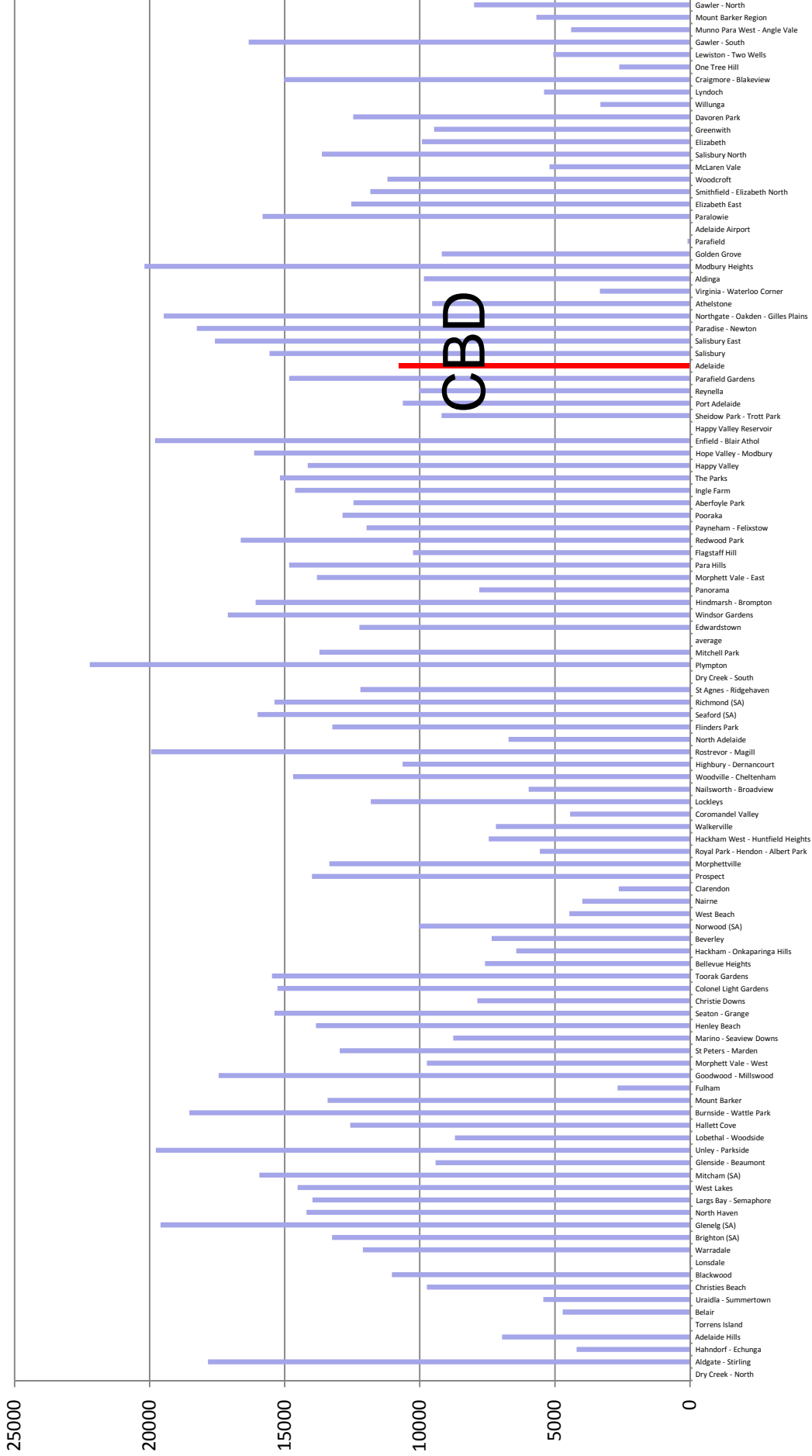


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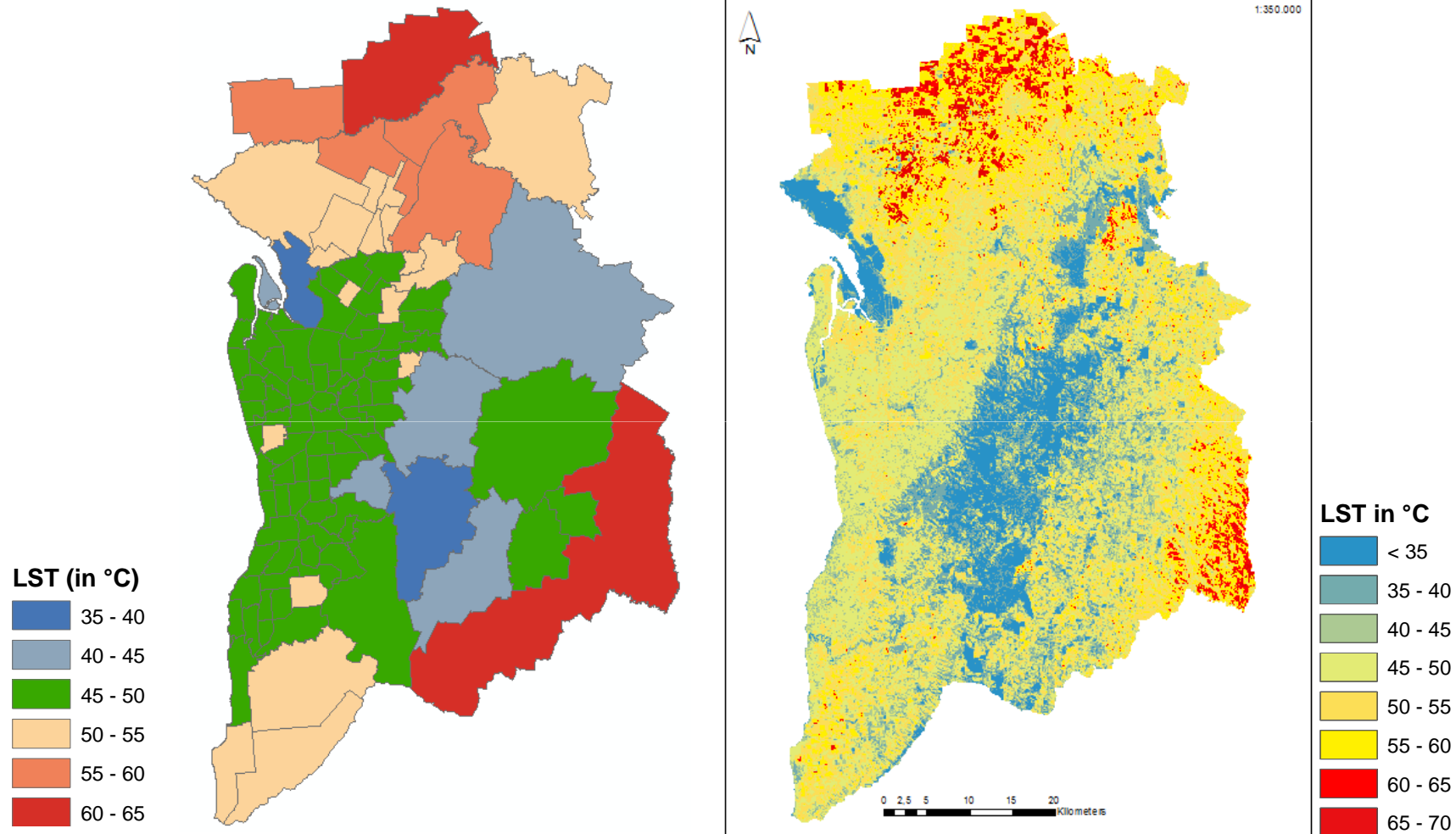
Average land surface temperature of urban areas within the CBD and suburbs (red: CBD and green: average, 3 January 2000, Friday)

# Population from coldest to hottest suburbs



290,961 (24 %) inhabitants in Adelaide are living in hotter areas than the CBD

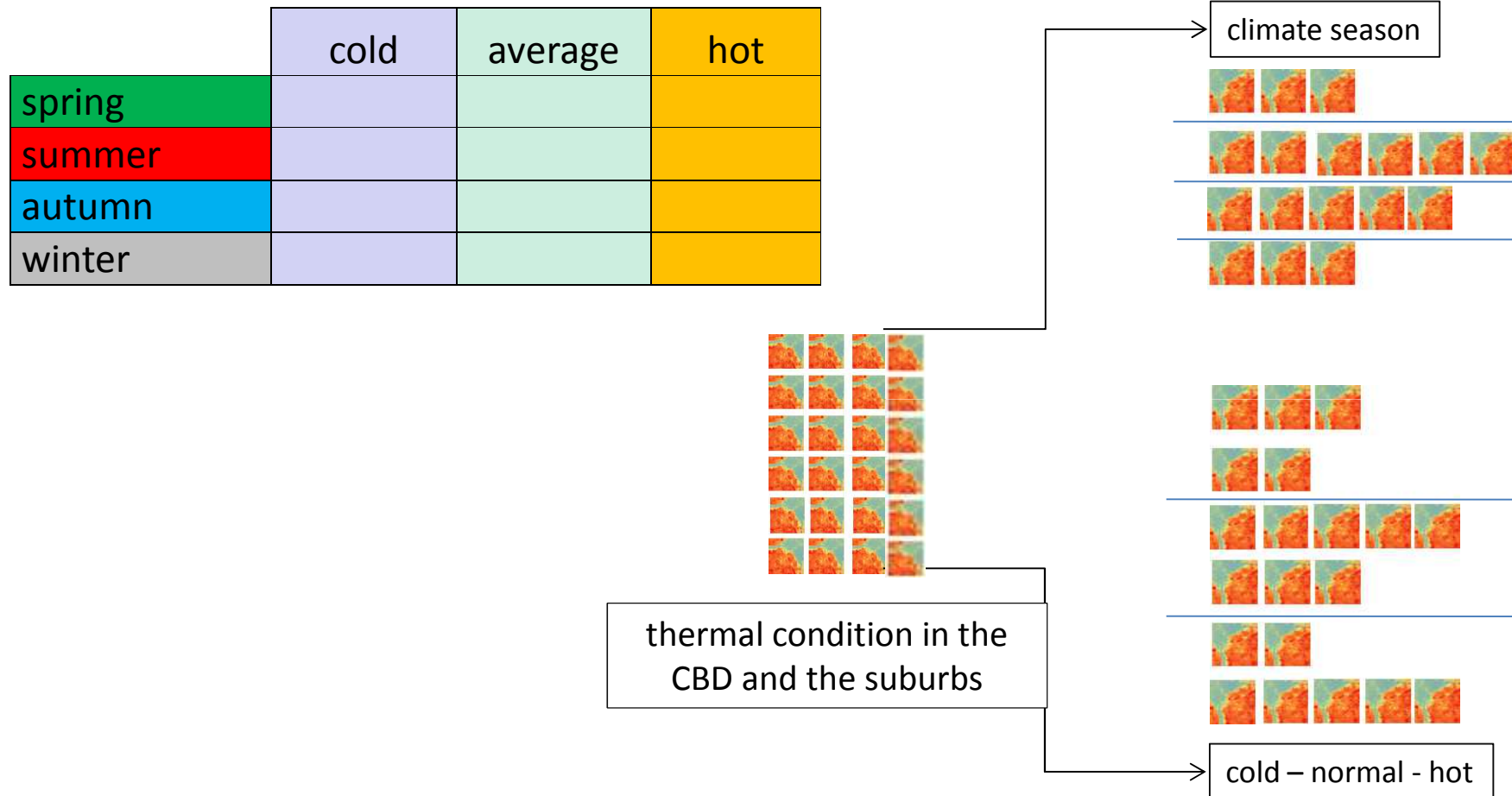
## Land surface temperature (Adelaide, SA2)



Urban LST (left) and land surface temperature (right)



# Investigation into seasonal differences



up to 100 Landsat images to analyse: several per season for cold .. normal .. hot conditions

## Conclusion

- urban areas and street are the hottest area in the city
- green and water are ,cool' land use types
- suburbs in the periphery are the hottest areas
- suburbs in the hills are the coldest areas
- airport is the hottest suburb of the central areas
- CBD of Adelaide is not the hottest area of the city

## Further investigations

- different seasons of the year
- comparison of the data going back to 1999
- cold, hot and normal weather conditions
- different Australian cities with different climates



## Further investigations in different Australian cities

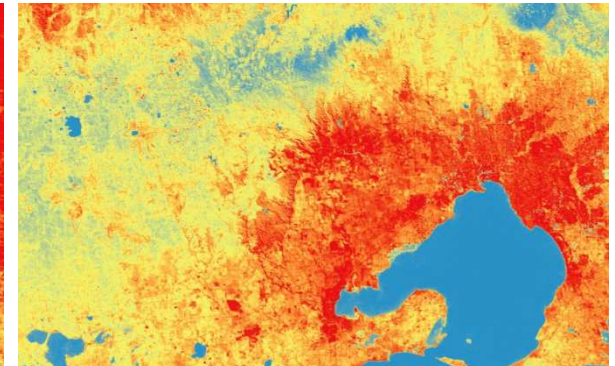
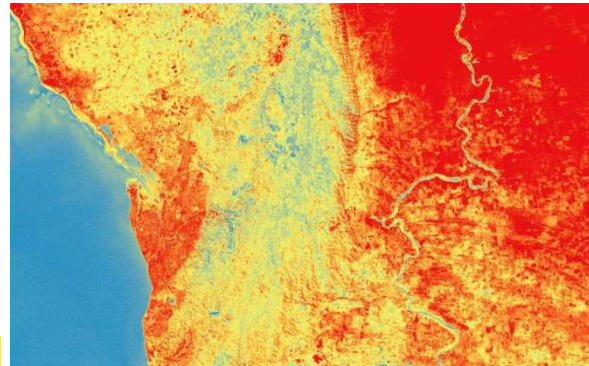
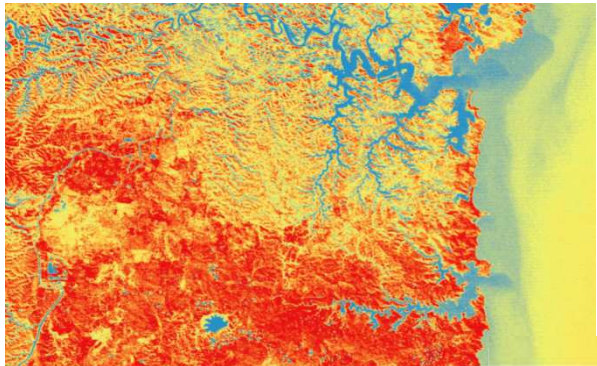
Sydney



Adelaide



Melbourne



**Thanks for your attention!**