

# TEMPERATURE-LAND COVER INTERACTIONS: THE INVERSION OF URBAN HEAT ISLAND PHENOMENON IN DESERT CITY AREAS



Michele Lazzarini, Prashanth R. Marpu, Hosni Ghedira

Earth Observation and Environmental Remote Sensing Laboratory, Masdar Institute, PO Box 54224, Abu Dhabi, UAE

Email addresses: mlazzarini@masdar.ac.ae, pmarpu@masdar.ac.ae, hghedira@masdar.ac.ae

## 1. Introduction

- Remote sensing data from both ASTER and MODIS sensors were utilized to assess land cover-temperature interactions in Abu Dhabi City area for the period 2000-2010
- Low resolution data from MODIS sensor with high revisiting time have been used to analyze the continuous variation of Land Surface Temperature (LST), the derived Surface Urban Heat Island (SUHI), and Normalized Difference Vegetation Index (NDVI) at city level
- Medium resolution data from ASTER sensor have been considered for spot assessment of the above mentioned parameters at district level and the evolution of Impervious Surface Areas (ISAs) for the study period

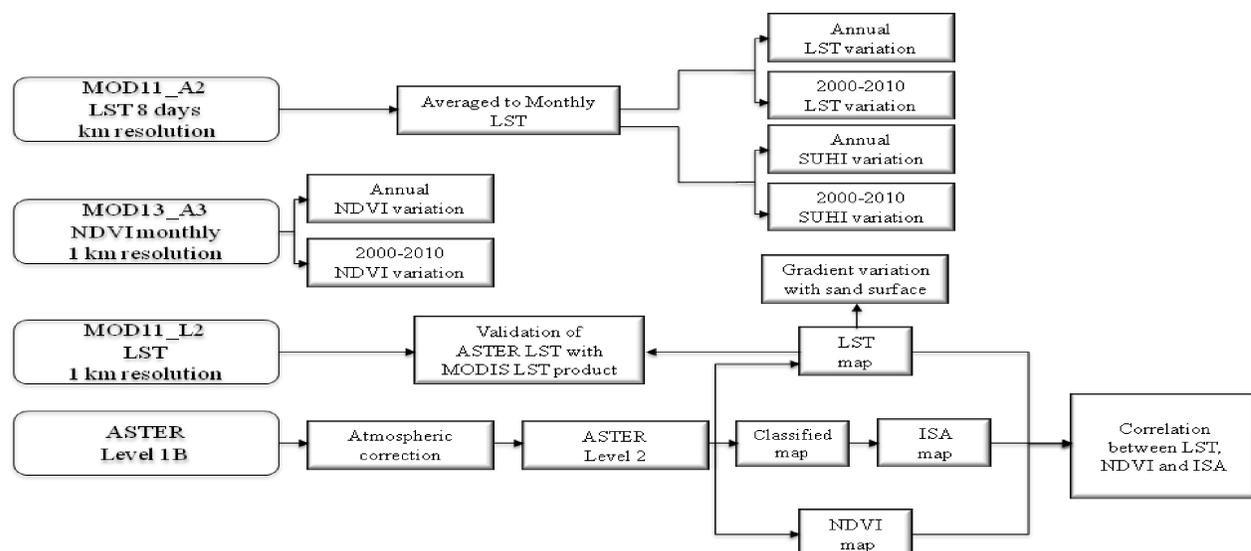
## 2. Study Area

Abu Dhabi is witnessing a fast and continuous urban expansion over the last few decades, requiring the conversion of desert areas (located outside the main island) to residential use (i.e., Khalifa City) and industrial use (i.e., Mussafah).

Abu Dhabi has a predominantly hot and arid climate. The months from June through September are generally hot and humid with daily mean temperatures averaging above 36 °C. The period from November to February is relatively cold, with average daily temperatures of around 19 °C. Precipitations are rare and occur only during colder months.



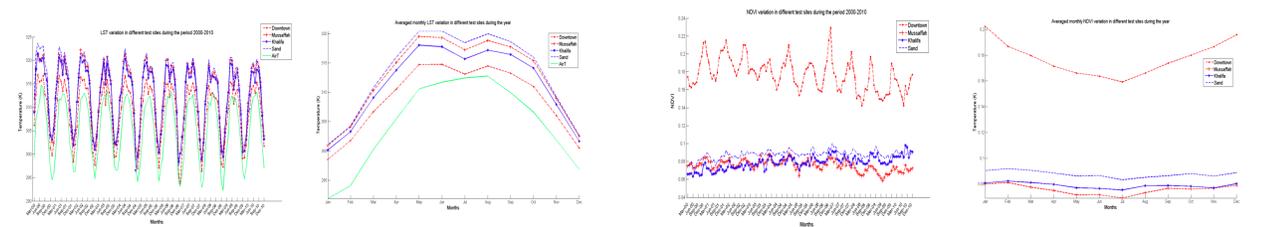
## 3. Methodology



## References

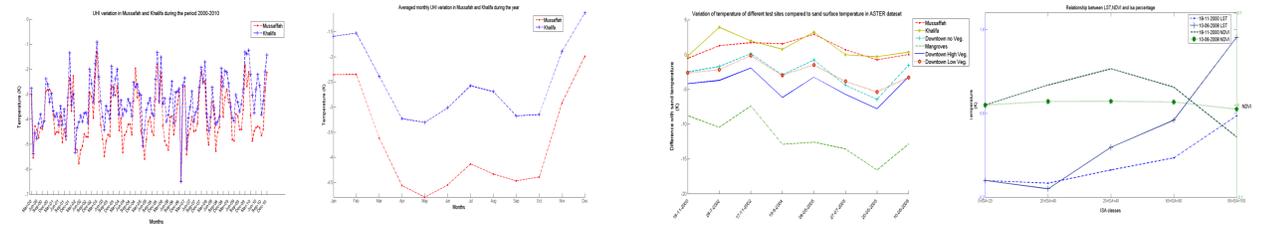
Complete list of references in: Lazzarini, M., Marpu, P. R., Ghedira, H., 2012. Temperature-land cover interactions: the inversion of Urban Heat Island phenomenon in desert city areas, *submitted to Remote Sensing of Environment*.

## 4. Results



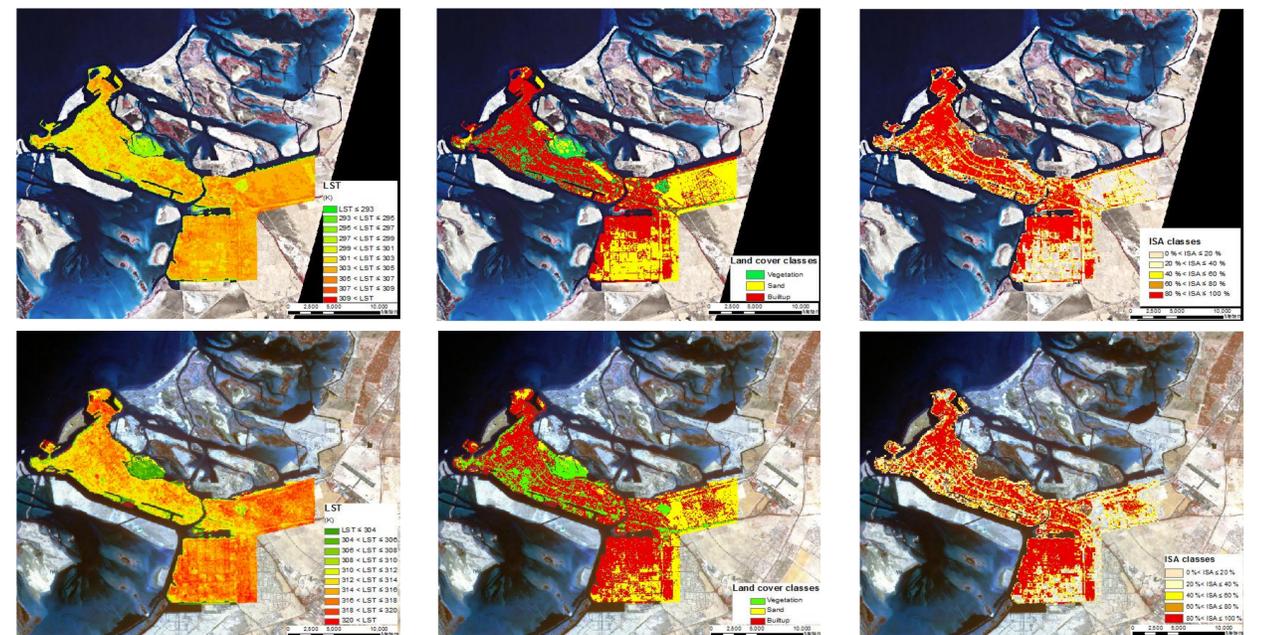
MODIS LST and Air Temperature variation for the period 2000-2010 (left) and monthly average (right)

MODIS NDVI variation for the period 2000-2010 (left) and monthly average (right)



MODIS SUHI variation for the period 2000-2010 (left) and monthly average (right)

ASTER LST normalized values (Site Temperature – Sand Temperature) in different test sites (left) and LST and NDVI variations in different ISA classes (right)



ASTER maps of LST, land cover and ISA percentage for 18<sup>th</sup> November 2000 (above) and LST, land cover and ISA percentage for 10<sup>th</sup> June 2008 (bottom)

## 5. Conclusions

- The obtained results showed an inversion of the standard SUHI with a difference of 5-6 °K during summer months and 2-3 °K during winter with both the datasets
- In downtown areas a difference of 3° K can be found between areas with highest presence of vegetation (lower LST) compared to buildup surfaces (higher LST)
- With high percentage of ISA there is an average increment of 1.0 ° K during the year and the vegetation is more abundant at ISA values between 20 and 40 %