Introduction & Motivation
Urban areas tend to be consistently warmer than their rural surroundings due to altered evapotranspiration properties (Taha 1997), increased anthropogenic heat output (Oke 1982), and higher heat capacities of urban materials (Taha 1991). The induced horizontal temperature gradients associated with urban heat islands (UHIs) are known to influence convection and subsequent mesoscale circulations (Baik et al. 2001), thus having the potential to modify precipitation distribution within, and adjacent to, the urban center (Shepherd et al. 2002, Dixon & Motie 2002, Dou et al. 2013). Aside from confirming its existence (Debbage & Shepherd 2015, Kandel et al. 2016), relatively little work has been conducted on the Miami urban heat island. The city's unique climate and topography further increase the need for such a study. The primary goals of this study are to:

1) Further verify the presence of the Miami urban heat island
2) Assess its strength and variability
3) Evaluate its potential influence on precipitation distribution in south Florida

Data
Temperature:
- National Centers for Environmental Information (NCEI) surface station daily minimum 2-m temperature (°C)
- Livneh 0.06° x 0.06° gridded daily minimum 2-m temperature (°C) (Livneh et al. 2015)

Precipitation:
- Livneh 0.06° x 0.06° gridded daily total precipitation (mm)

Methodology
Daily minimum 2-m temperatures ($T_{min}$) observed at eight NCEI surface climate stations over the period 2002-2011 are utilized for analysis. Stations are classified as urban (Miami International Airport – MIA, Miami Beach – MB, Hialeah – HA, Opa-Locka Airport – OPF) and rural (Ten Mile Corner – TEN, Oasis Ranger Station – OAS, Ochopee – OCH, Raccoon Point – RAC) based on land use classifications and proximity to Census-defined urban Miami. The daily urban-rural difference in $T_{min}$ provides the working proxy for UHI intensity (defined as $T_{urban} - T_{rural}$). Each daily average $T_{min}$ is an average of the four urban and four rural representative surface station sites, respectively. Daily UHI intensity ($I_{UHI}$) are then categorized by magnitude:

- Strong (> 2.78°C)
- Average (2.28°C - 2.78°C)
- Weak (0°C - 2.28°C)
- Negative (< 0°C)

and analyzed on monthly, seasonal, and yearly timescales. Gridded daily precipitation accumulation (mm) is then analyzed against urban UHI in an effort to investigate potential relationships between UHI and precipitation distribution.

Miami Urban Heat Island: Presence and Variability

Seasonal Variability

Upcoming Investigation
Future analysis will employ several additional datasets and analysis techniques to further our understanding of the behavior of the Miami urban heat island and evaluate potential relationships between its magnitude, mesoscale wind patterns, and precipitation distribution in South Florida on daily, seasonal, and yearly timescales. Datasets we will employ include:

Preticipitation:
- North American Regional Reanalysis (NARR) 0.03° x 0.03° gridded daily total precipitation (kg/m2)
- South Florida Water Management District (SFWMD) 2 km. x 2 km. gridded daily total precipitation estimates (in.) (NEXRAD-derived)

Temperature:
- Livneh 0.06° x 0.06° gridded daily minimum 2-m temperature (°C)
- Moderate Resolution Imaging Spectroradiometer (MODIS) 0.05° x 0.05° gridded monthly average Land Surface Temperatures (LST) (K)

Wind Velocity:
- NARR 0.03° x 0.03° gridded daily wind velocities (m/s)

Livneh 2-m gridded temperature data and MODIS LST data will be utilized to assess the validity of station-derived UHI analysis. Urban and rural representitive grids will be defined to assist quantitative analysis of urban heat island magnitude and precipitation distribution with respect to upward and downwind designated regions, in line with methodology employed in Shepherd et al. 2002.

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