



Assessing Vulnerability to Heat Stress Trends in the Southeast United States

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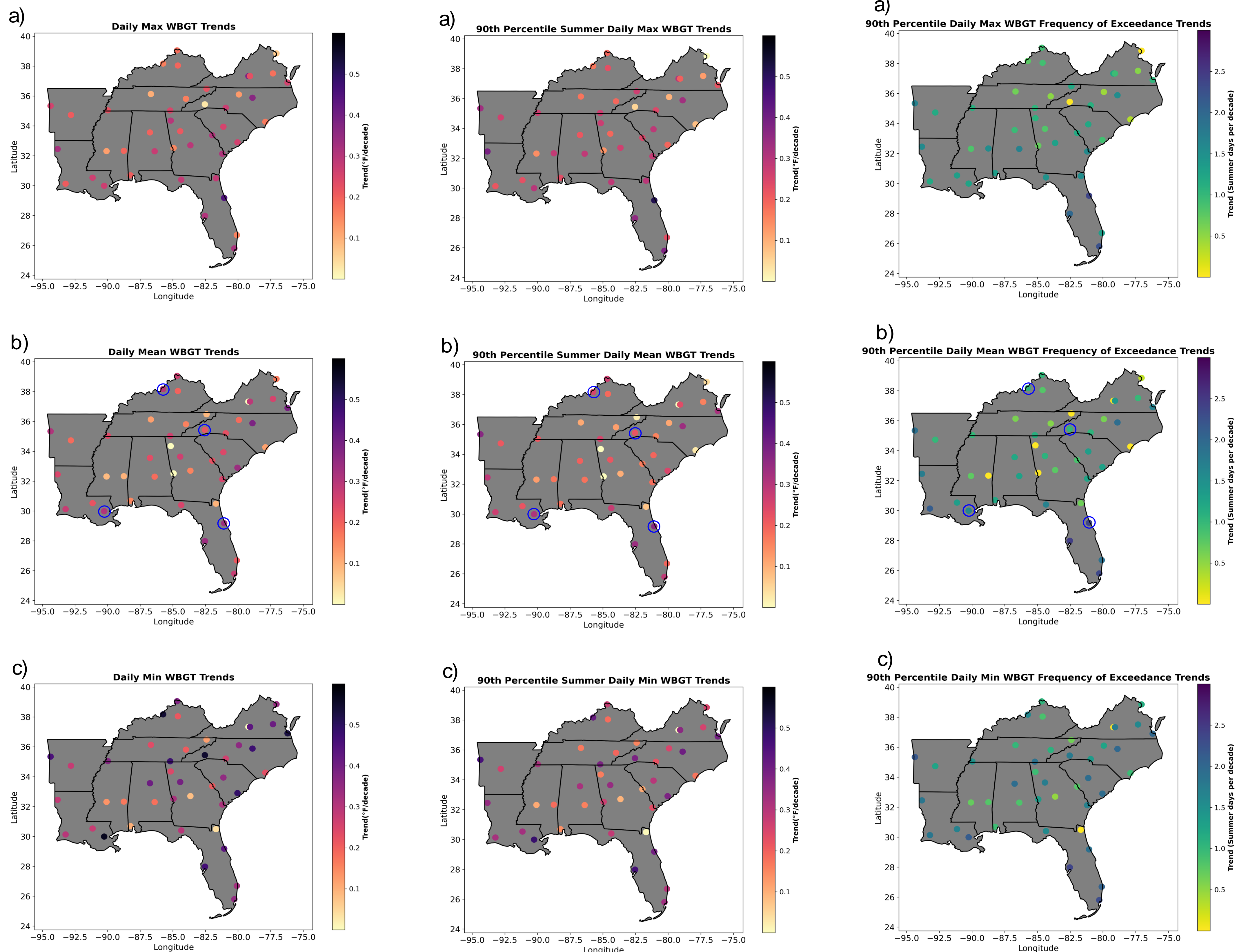
1. Motivation

The 5th National Climate Assessment identified extreme heat as a pressing threat to human health in the Southeast U.S. Adverse health impacts are exacerbated throughout the region by climate change, an older and rapidly growing population, and dramatic urbanization. Extreme heat disproportionately affects different social groups, industries, and people such as lower-income individuals and workers in outdoor labor. For human health applications, wet bulb globe temperature (WBGT) has been shown to be the most representative heat stress metric.

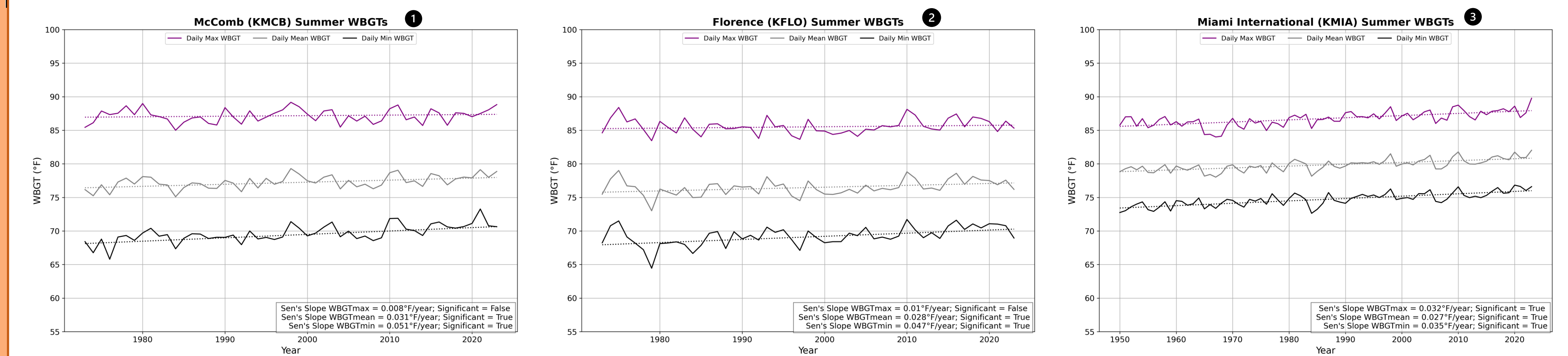
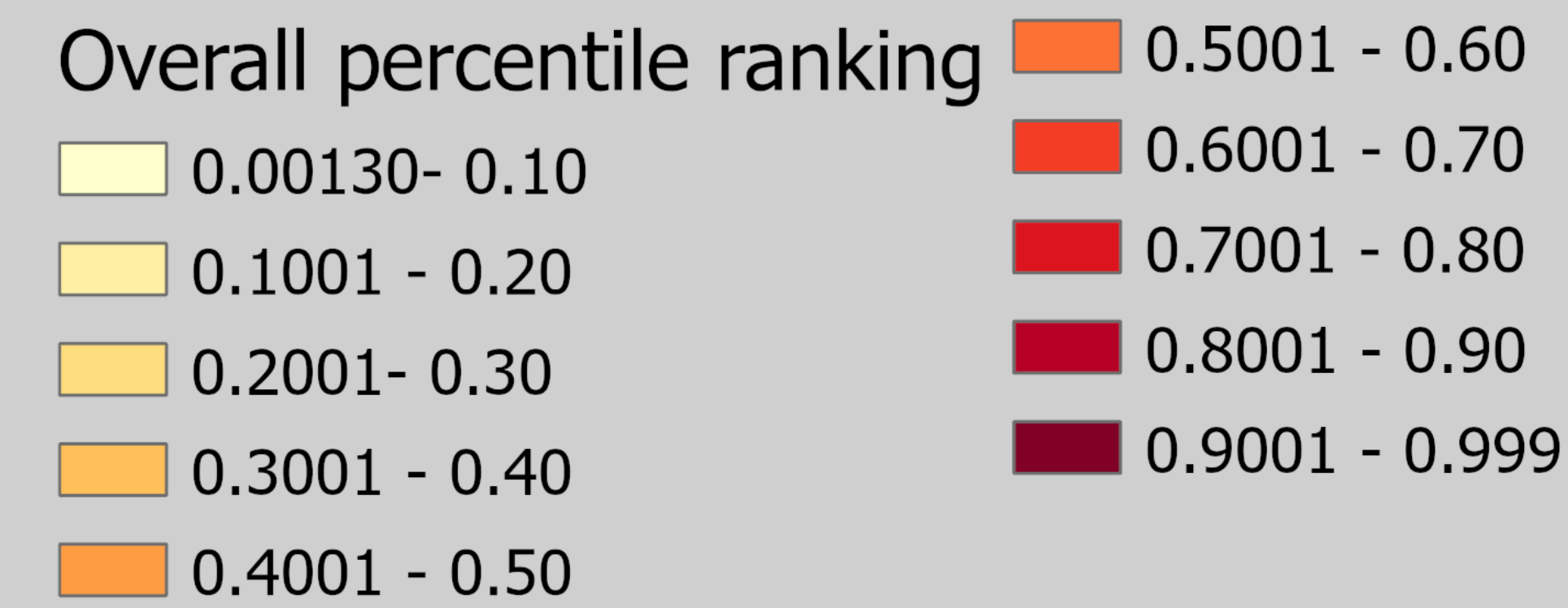
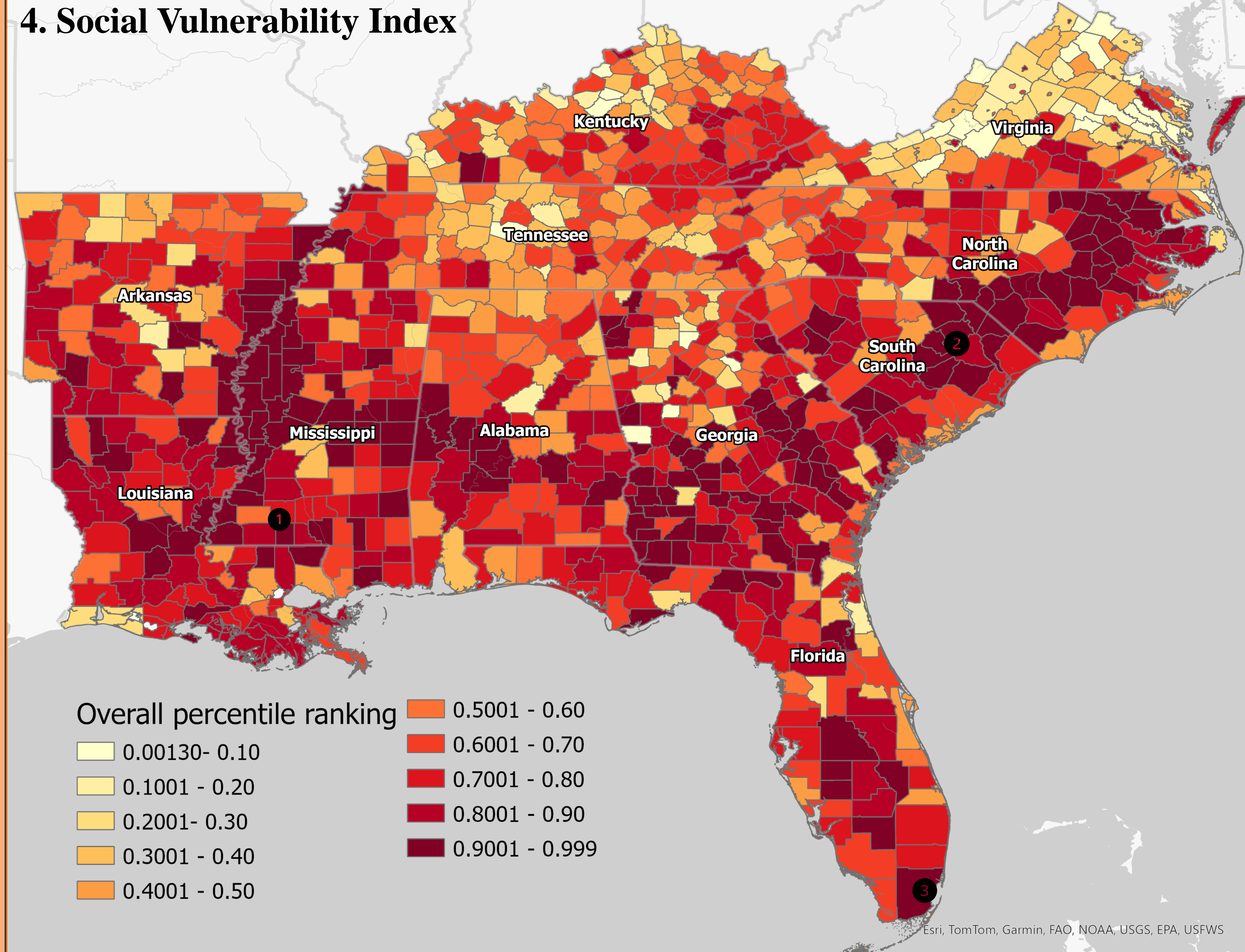
2. Data and Methods

For our trend analysis, we developed summer (June- August) WBGT climatologies based on hourly data, with the start year varying based on each ASOS station's period of record. To calculate hourly WBGT values during all climatological summers, we used the pywbgt package developed through this work. WBGT values were calculated from NOAA NCEI Integrated Surface Database (ISD) hourly temperature, dewpoint, sea level pressure, and wind speed data, as well as ERA5 hourly solar radiation. The ASOS station reports were filtered and rounded to the nearest hour and matched with ERA5 solar radiation. We also examined WBGT extremes, which we defined as the 90th percentile for stations. The Centers for Disease Control (CDC) has a Social Vulnerability Index (SVI), which incorporates county and census-tract level demographic, social, and economic metrics to identify at-risk communities. Using ArcGIS software, the overall percentile of at-risk communities in each county in the Southeast was extracted from the data.

3. WBGT Trends of the Southeast



4. Social Vulnerability Index



5. Conclusions and Future Work

Conclusions: Trend magnitudes were generally larger at night (daily min WBGT), but not universally so. The largest trends were spread throughout the region, with no obvious proclivity for certain coastal proximities or station elevations. The largest concurrent increases in extreme nighttime heat stress frequency and intensity were most commonly found in coastal locations in the Florida Peninsula and Louisiana. The SVI shows the Southeast has areas with very high vulnerability to heat stress, such as the Mississippi River Valley. Our trends and extremes results emphasize that as the climate continues to warm, heat stress has and will continue to become an increasing threat to human health and industry throughout the Southeast, especially for those most vulnerable to its impacts.

Future Work: Create a gridded Heat Stress Vulnerability Index (HSVI) for the entire Southeast U.S. by combining the SVI and WBGT trends to display and rank areas where individuals are most susceptible to WBGT trends. Use the HSVI as an operational alert system for impending heat stress extremes.