A sunset scene with a bright sun in the upper right corner, casting a warm orange glow over a range of mountains. The mountains are silhouetted against the sky, with the foreground being the darkest part of the image.

# Heat-Health Vulnerability in North Carolina: The Heat – Health Vulnerability Tool (*HHVT*)

**Chip Konrad**

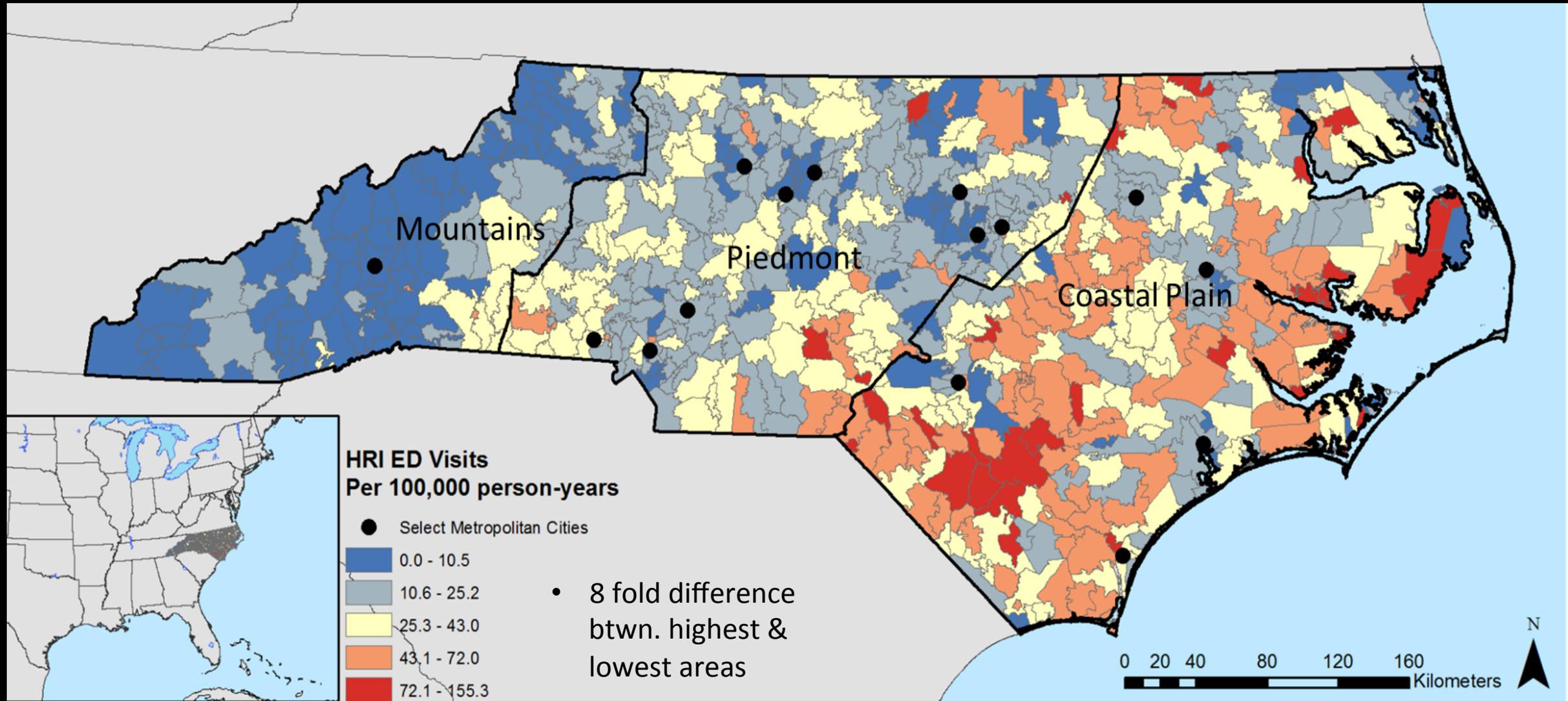
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## Outline

1. Background on heat illness in North Carolina
2. Model development
3. Current 1.0 version of the model
4. Upcoming 2.0 version of the model
5. Applications to longer range forecasts

# Background: Heat Illness in North Carolina



# Model development



# North Carolina Disease Event Tracking and Epidemiologic Tool (NC DETECT)

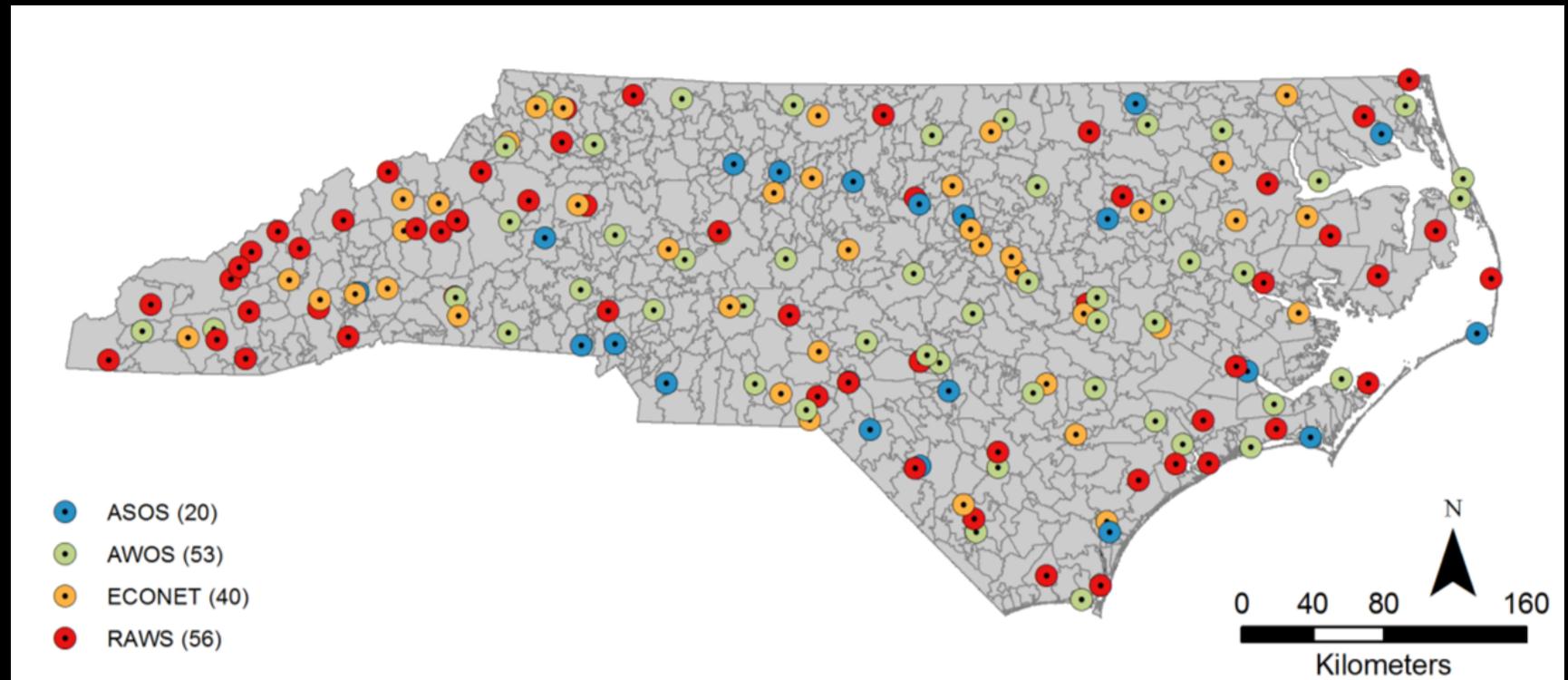
## Model development

- **All ED diagnosed as “heat illness” as a primary, secondary, or tertiary diagnosis**

### NC- DETECT (2007 – 2012)

- Age
- Gender
- Date of Visit
- All diagnostic codes(992)
- Billing address zip code/County

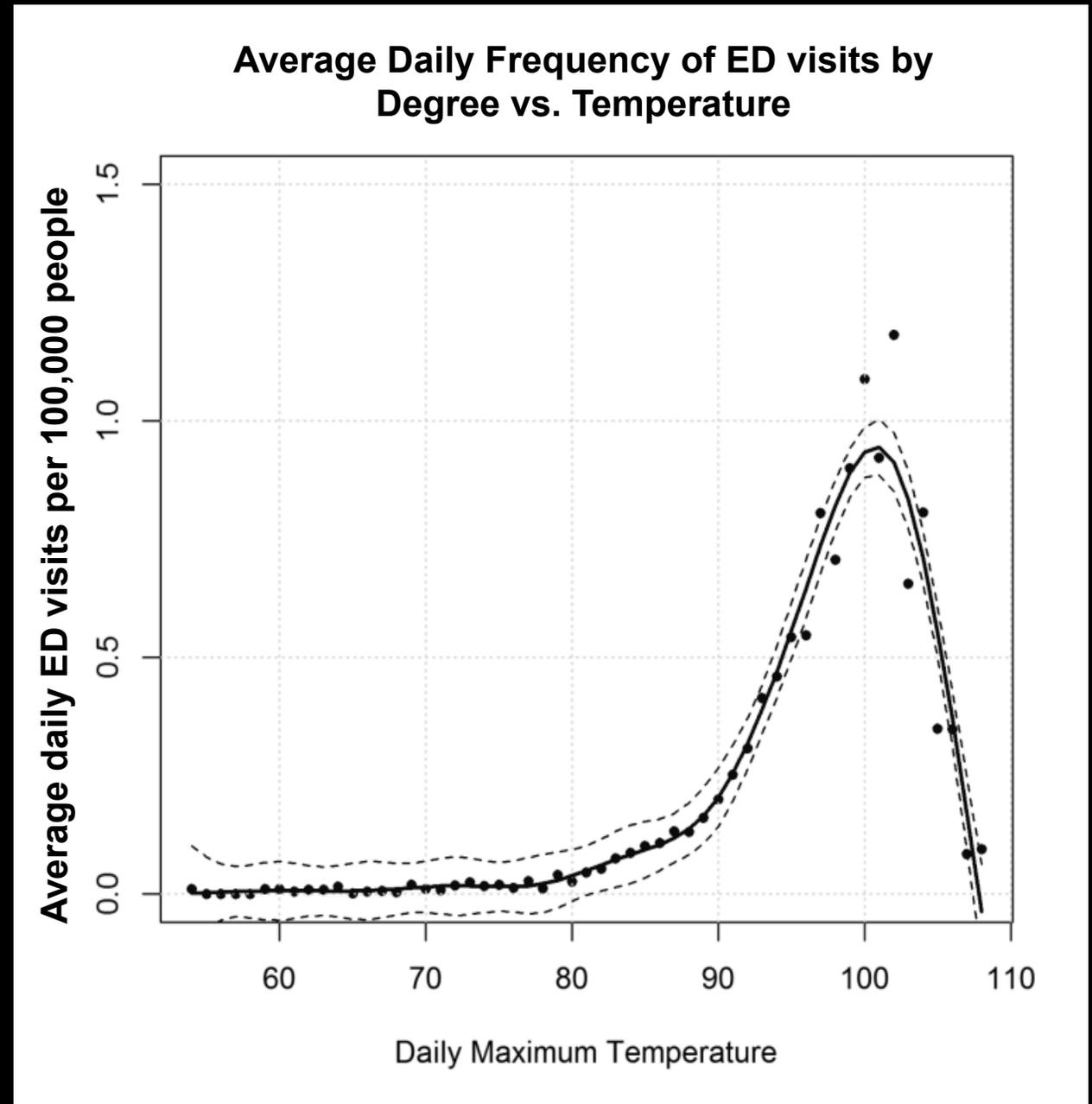
- **Each ED visit linked to the daily maximum temperature at the nearest weather station.**



# Model Development

HRI rates are adjusted for the frequency of temperature observations → Average daily HRI ED Visits Per 100,000 people

*More ED visits on abnormally hot (95 to 100F) days but marked decrease in HRI rates at the highest temperatures (greater than 100F)*



## Model Development

- All heat illness cases pooled together across four regions according to the urban-ness/rurality

### Rural Urban Commuting Areas (RUCA) Classification

**Metropolitan**

**Rural Metropolitan**

**Rural Town**

**Rural Isolated**

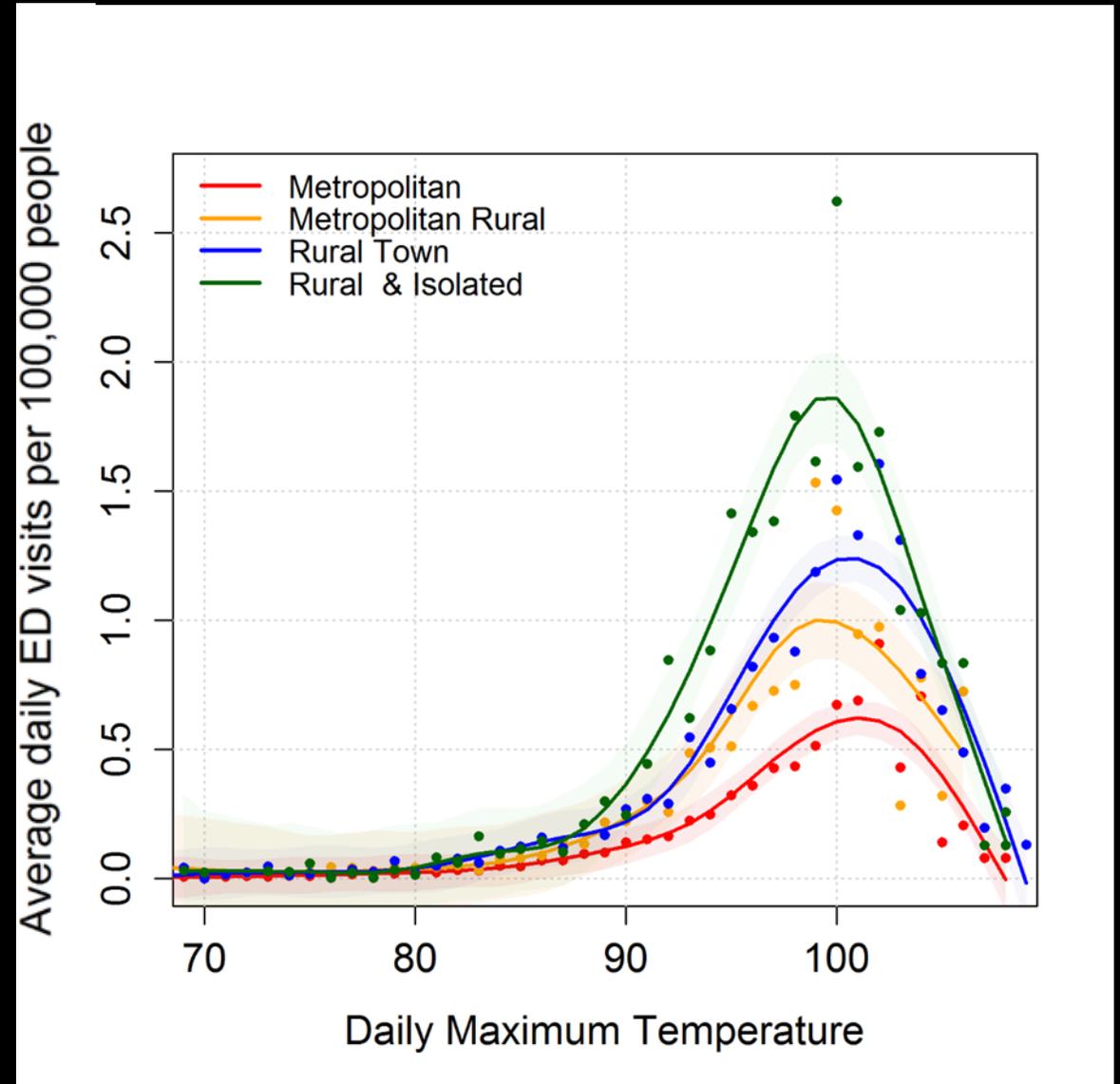


**Most Urban**

**Most Rural**

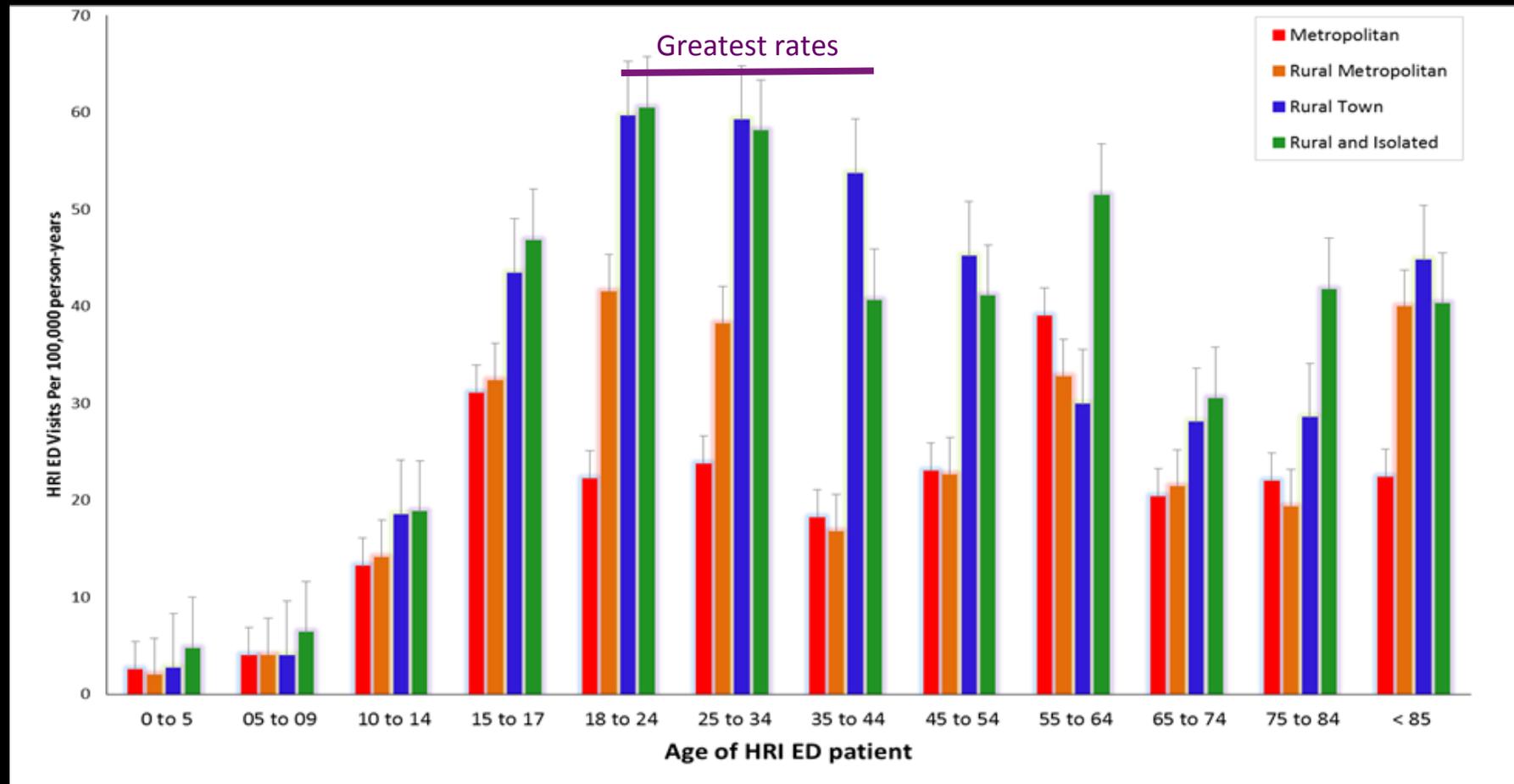
# Model Development

## Differences in rates of heat illness across four regions



# Model Development

## Rates of heat illness by region & age groups



# Current version of model

Inputs NWS maximum temperature forecasts and translates these values into predictions of the number of cases of heat illness.

- County or region level
- Rural-ness/urban-ness
- Age group & gender

**NC Heat Health Vulnerability Tool**

**Select a county:**  
Bladen County

**Select a model:**  
Isolated Rural (Per Capita Degree)

**Category**

- PerCapitaDegree
- Upper / Lower

*Choose a display color:* Red

**Choose a valid forecast date:**  
August 10 2013

**Graph**

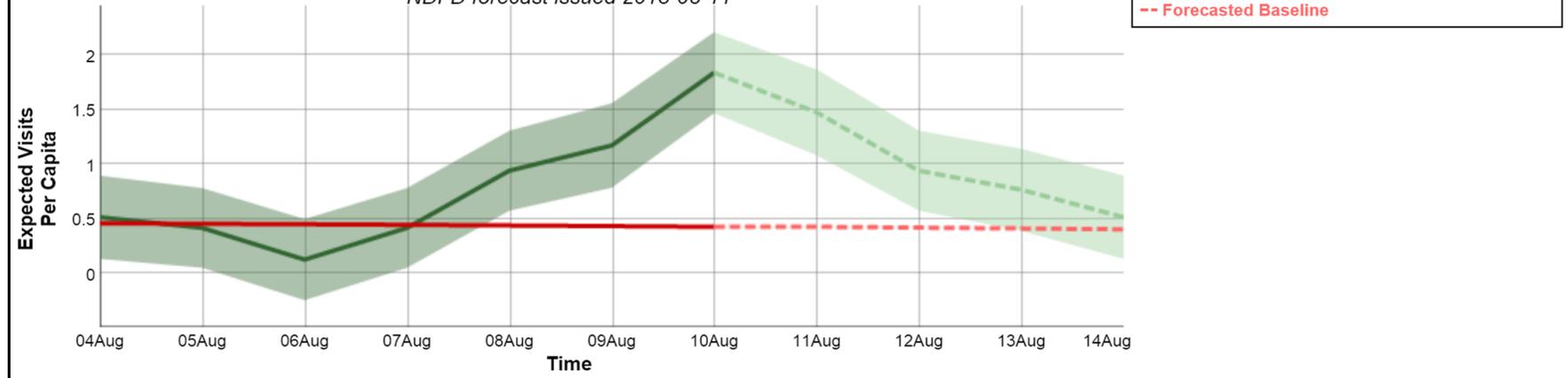
# Current version of model

## Example of Output

**Piedmont/Coastal Plain Rural Metropolitan (Male 18-45 years old) Model for Robeson County at Lumberton Municipal Airport (KLBT)**

Observations from 2013-08-04 through 2013-08-10

*NDFD forecast issued 2013-08-11*



**Maximum Temperature for Robeson County at Lumberton Municipal Airport (KLBT)**

Observations from 2013-08-04 through 2013-08-10

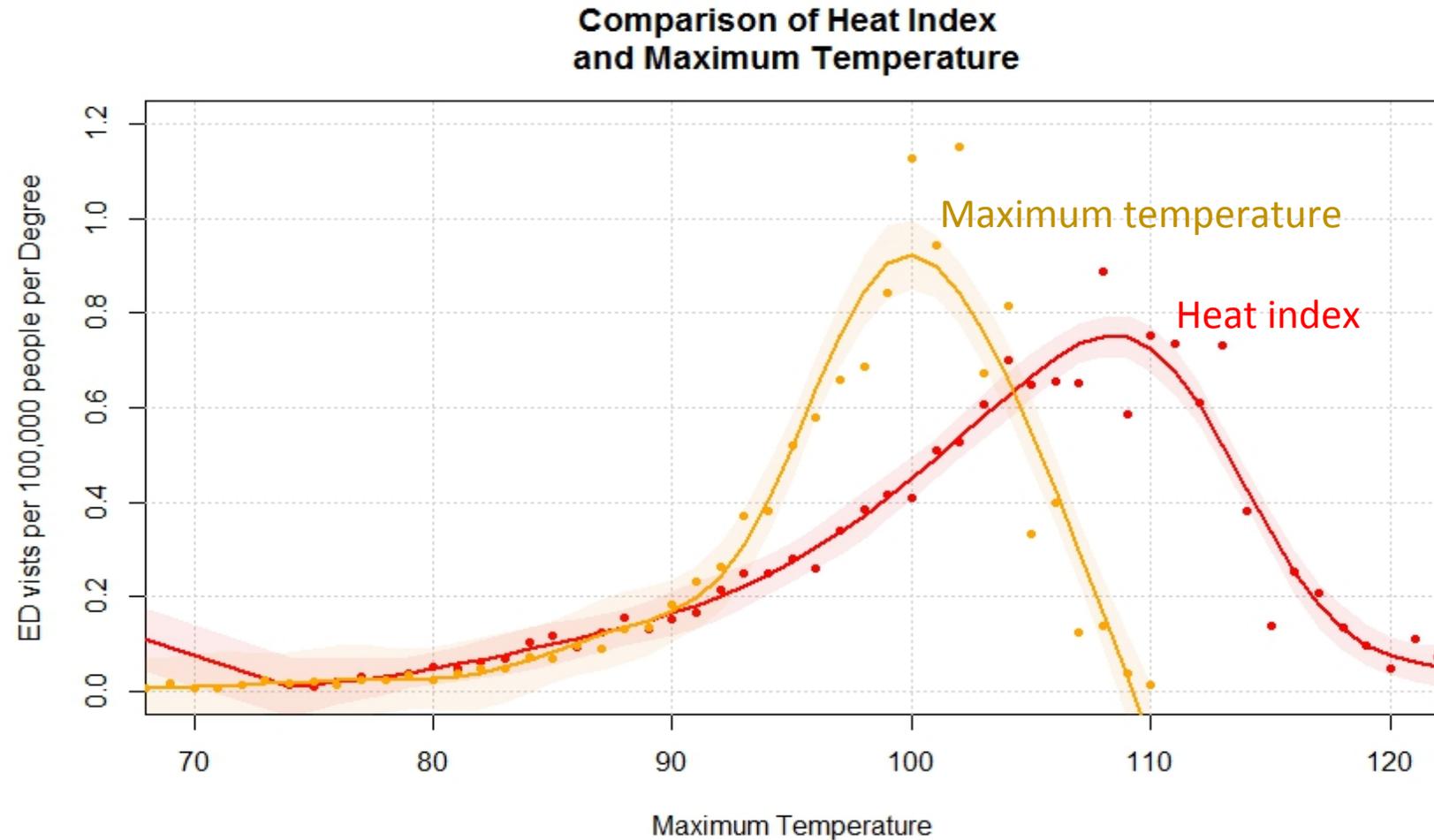
*NDFD forecast issued 2013-08-11*



# Upcoming 2.0 version of model

## Major upgrades

1. Use the 18Z heat index. Model provides a better fit



# Upcoming 2.0 version of model

## Major upgrades

2. Provide a measure of the level of danger

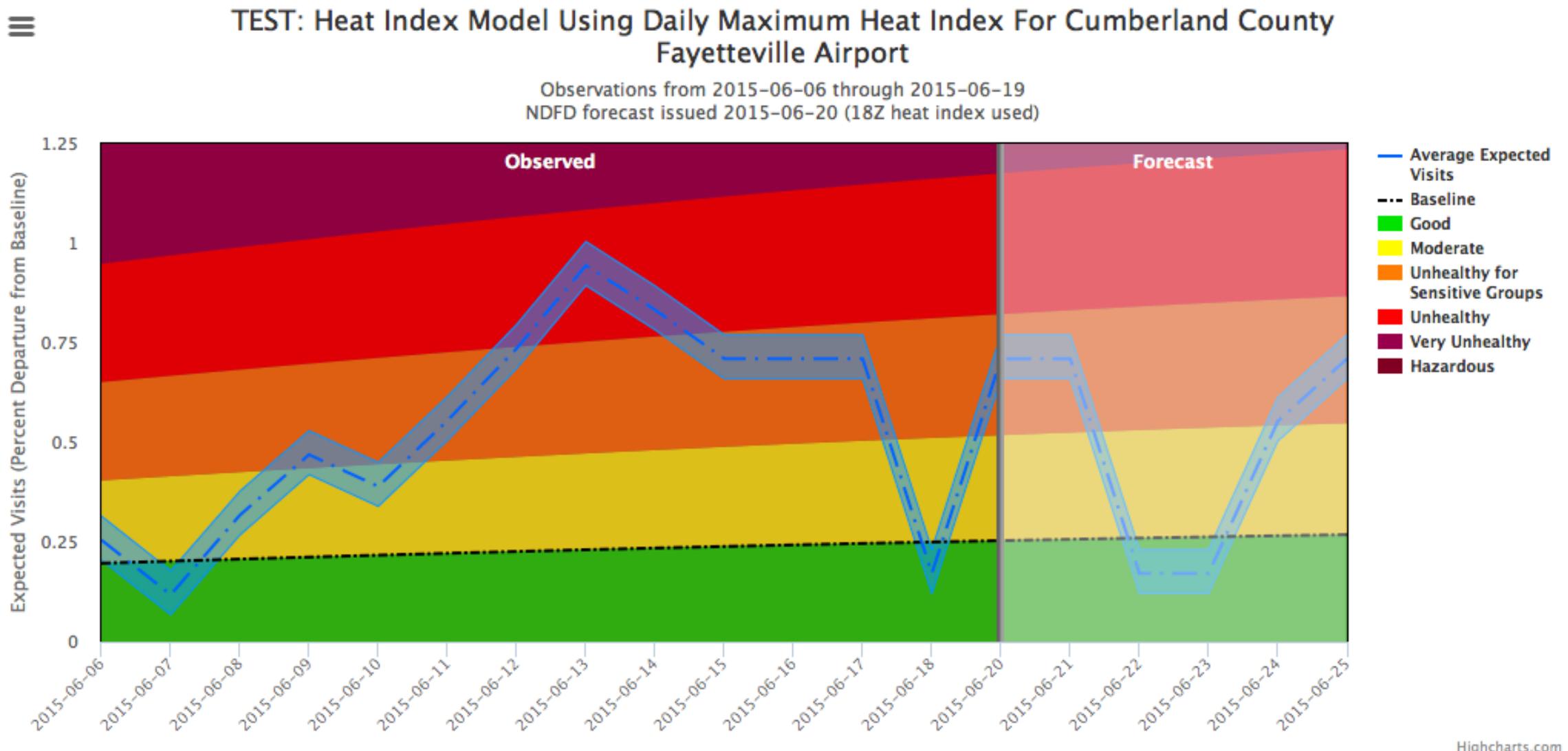
Model after the Air Quality Index (AQI)

Rates of heat illness

### AIR QUALITY INDEX

Air Quality Index (AQI) Values	Levels of Health Concern	Health Effects
0 to 50	Good	Little or no risk
51 to 100	Moderate	Acceptable quality
101 to 150	Unhealthy for Sensitive Groups	General Public not likely affected
151 to 200	Unhealthy	All may experience some effects
201 to 300	Very Unhealthy	All may experience more serious effects
301 to 500	Hazardous	Emergency conditions

# Upcoming 2.0 version of model – Example of output



# Application to long range forecasts

## Categorical long range forecast outputs

“Below normal”

“Equal chances”

“Above normal”

- Over period in which emergency room visit data is available, identify rates of heat illness for each category of temperature departure.
- This can be broken down by region, demographic, and socioeconomic group (e.g. 18-45 year males in rural NC)

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The NC DETECT Data Oversight Committee does not take responsibility for the scientific validity or accuracy of methodology, results, statistical analyses or conclusions presented.

[Heat Health Vulnerability Tool--http://sercc.com/hhvt](http://sercc.com/hhvt)

