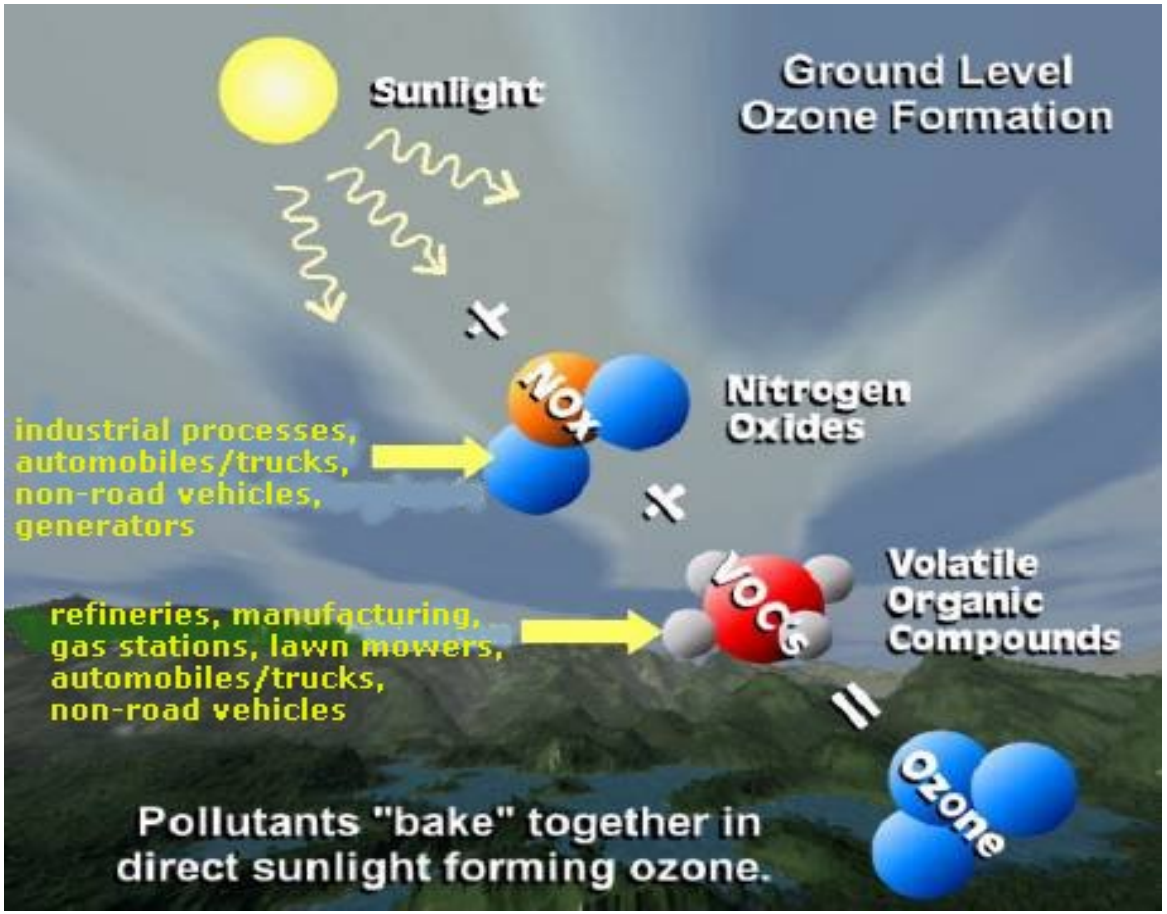
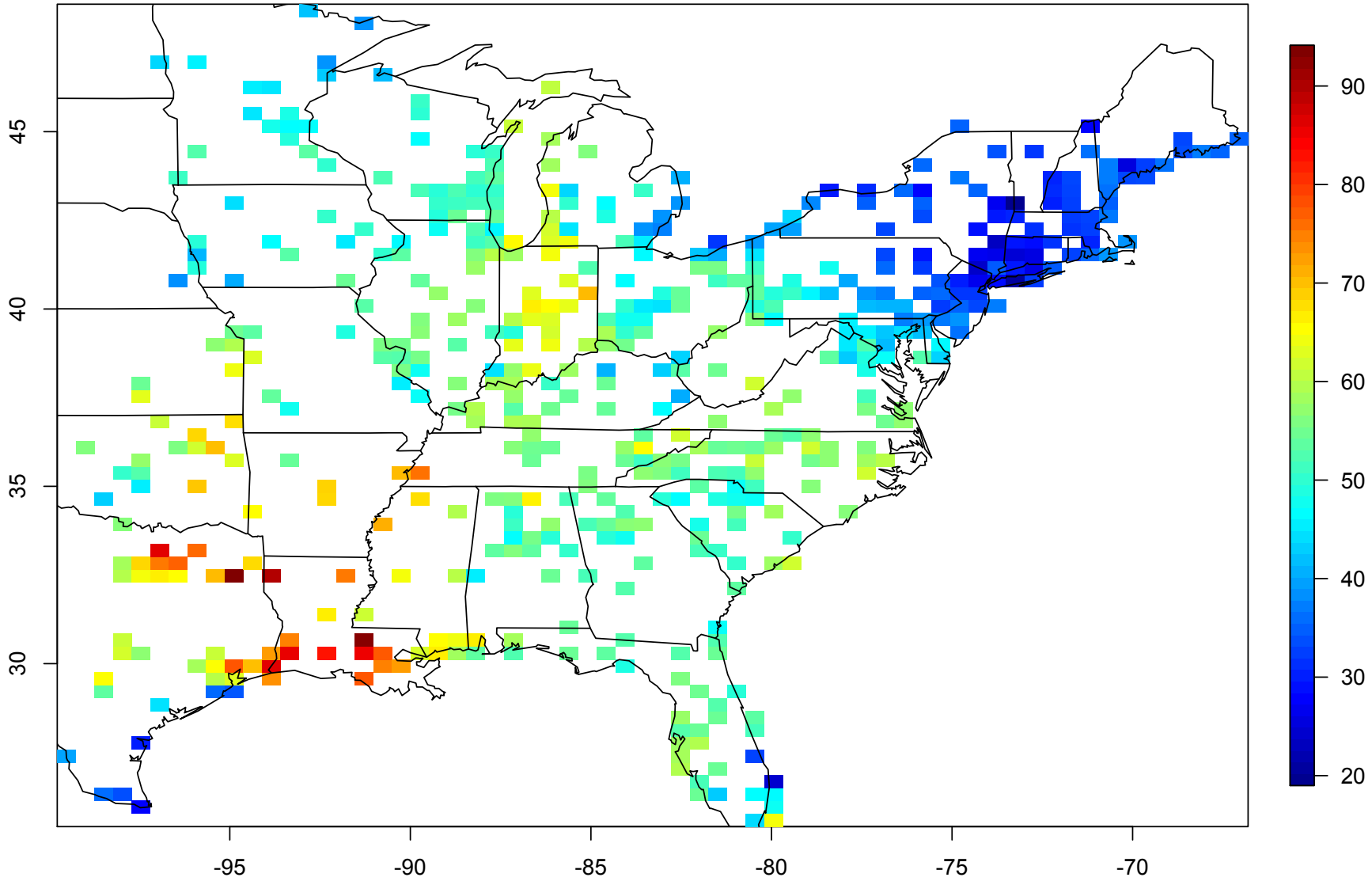
Midterm: Calibrating the Community Scale Air Quality Model for use in Ozone Predictions

Ground Level Ozone Analysis

Background on Ground-level Ozone (O3):



1. Main component of smog
2. Breathing high concentration of O3 triggers:
   - chest pain
   - bronchitis
   - emphysema
   - asthma
3. Monitored by EPA



Ozone Data:
800 station measurements of max.
8 hour O3 on May 22, 2005

```
library(maps)
library(LatticeKrig)
quilt.plot(Lon,Lat,o3)
map('state',add=TRUE)
```

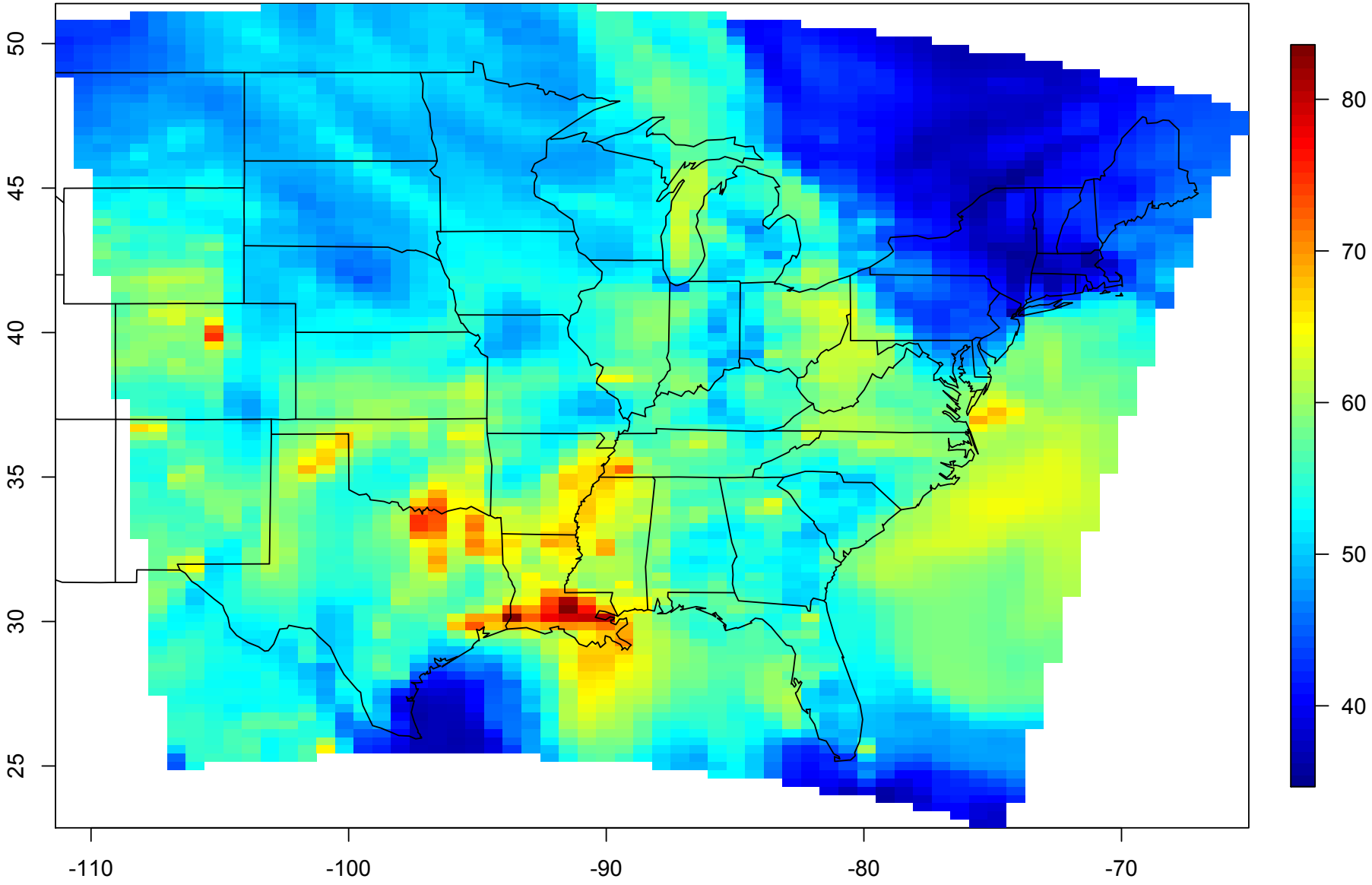
Ground Level Ozone Analysis

Community Multi-scale Air Quality Model (CMAQ):

- Mathematically simulates (on a fine spatial scale) formulation of ozone based on ground characteristics, temperatures, urban density, etc.

Issues with using CMAQ:

1. Doesn't reproduce observations exactly.
2. Returns an average O3 level for the area surrounding the location. So, trying to get the CMAQ and O3 locations to line up isn't worth the effort because the "location" of the CMAQ value is somewhat arbitrary (any location in the square is the same so they just report the centroid).



CMAQ Data:

66,960 Surrogate CMAQ O3 Measurements

```
quilt.plot(CLon,CLat,CMAQ)
map('state',add=TRUE)
```

Ground Level Ozone

Research Goals:

1. Scientists know that CMAQ is wrong:
   - Understand the relationship between CMAQ and Station Measurement.
2. Want ground-level O3 predictions at lots of locations
   - Prediction locations provided on website

Ground Level Ozone

Statistical Goals and Issues to consider:

1. Estimating relationship between ground level O3 and CMAQ:
   - Specifying a Model: How to deal with positive support? How are you going to define predictors (what is your X matrix)? How many predictors are you going to use (high dimensional)? Collinearity? Is the relationship linear?
   - No IID Errors: Station measurements are not independent but are spatially correlated.
2. Predicting O3:
   - Correlation: Ozone is correlated across Lon/Lat.
   - Prediction Accuracy: How are you going to assess how accurate your predictions are?

Ground Level Ozone

Rules for the Midterm:

1. Written reports to be done individually – I want to see what you come up with.
2. I am available to answer questions related to HOW to do something not WHAT you should do.

Ground Level Ozone

A Few Expectations:

1. Justify your model: why did you do what you did? Does it answer the questions? Does it account for intricacies in the data?
2. Justify your assumptions.
3. I want to see your estimates/predictions.
4. I want to see uncertainties.
5. Interpretations in terms of the problem.