Shaken or Stirred

How Do You Want Your Climate Data?

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Cooperative Institute for Climate and Satellites – North Carolina
National Centers For Environmental Information (NCEI)
Asheville, NC

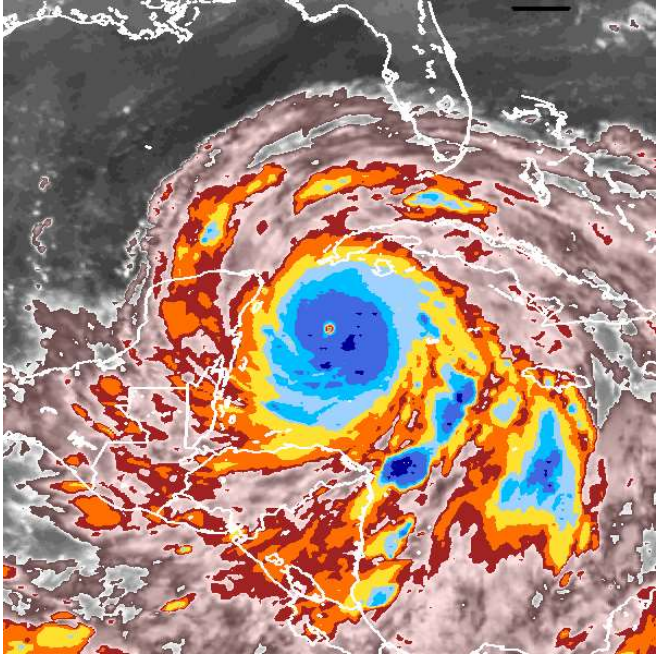
Ask the Audience
Carolinas Climate Resilience
September 13th, 2016

National Centers for Environmental Information

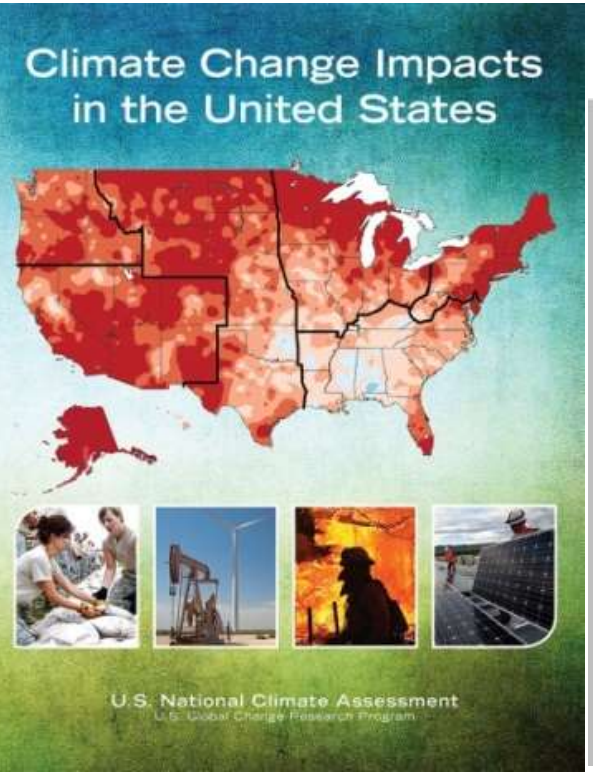
- Responsible for hosting and providing access to comprehensive oceanic, atmospheric and geophysical data of the world
- Center for Weather and Climate located in Asheville, North Carolina

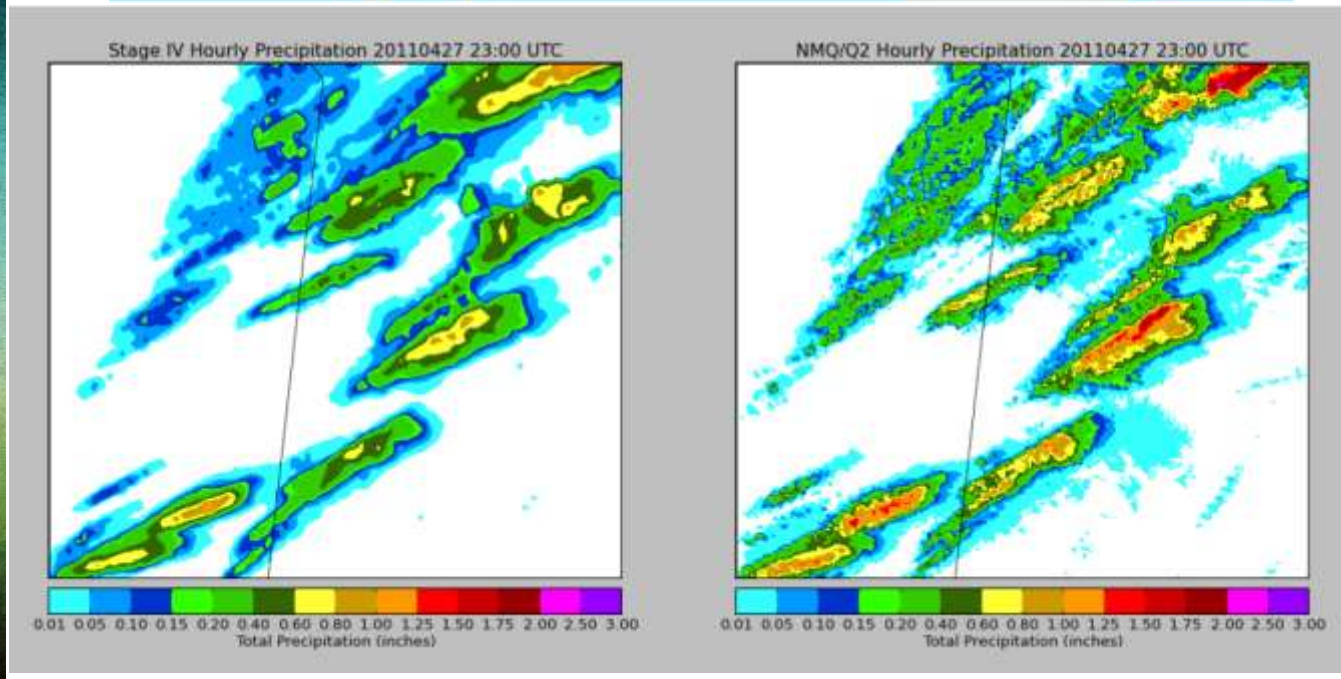
CICS-NC

- Cooperative Institute of Climate and Satellites
  - Silver Spring, MD (NESDIS)
  - Asheville, NC (NCEI)
- Within the North Carolina Institute for Climate Studies, which is part of NC State




Track Attributes
TrackID: 03_1113_1993031218
Start Date: 03-12-1993 18:00
End Date: 03-20-1993 00:00
Number of Members: 56
Track Distance: 8946 km
Track Duration: 174 hr
Average Peak Gradient: 49 hPa/1000km
Mean Pressure: 973hPa
• Track Origin
NC STATE UNIVERSITY


Climate Change Impacts in the United States
U.S. National Climate Assessment
U.S. Global Change Research Program


Stage IV Hourly Precipitation 20110427 23:00 UTC
0.01 0.05 0.10 0.15 0.20 0.40 0.60 0.80 1.00 1.25 1.50 1.75 2.00 2.50 3.00
Total Precipitation (inches)
NMQ/Q2 Hourly Precipitation 20110427 23:00 UTC
0.01 0.05 0.10 0.15 0.20 0.40 0.60 0.80 1.00 1.25 1.50 1.75 2.00 2.50 3.00
Total Precipitation (inches)

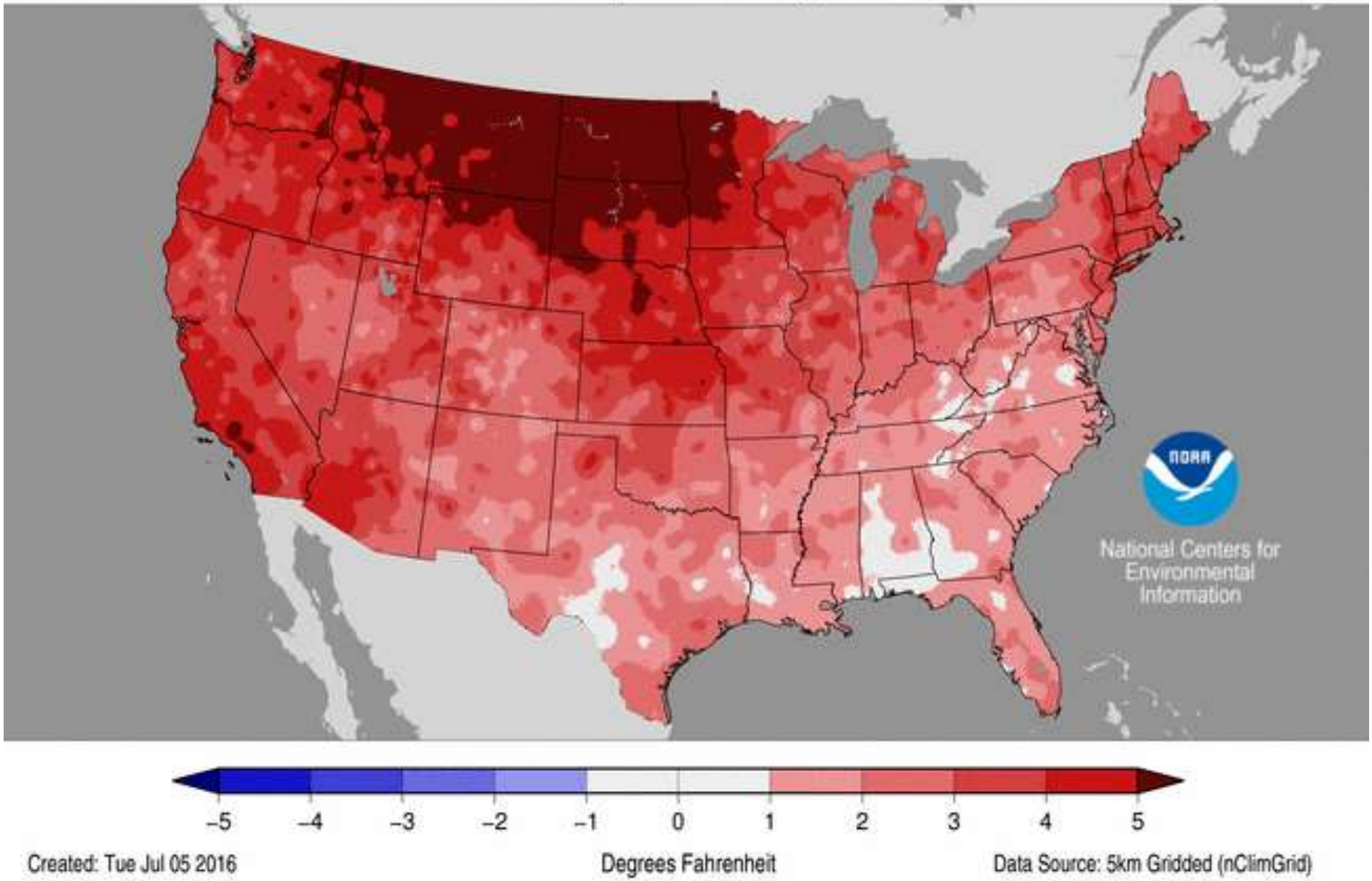
GHCN

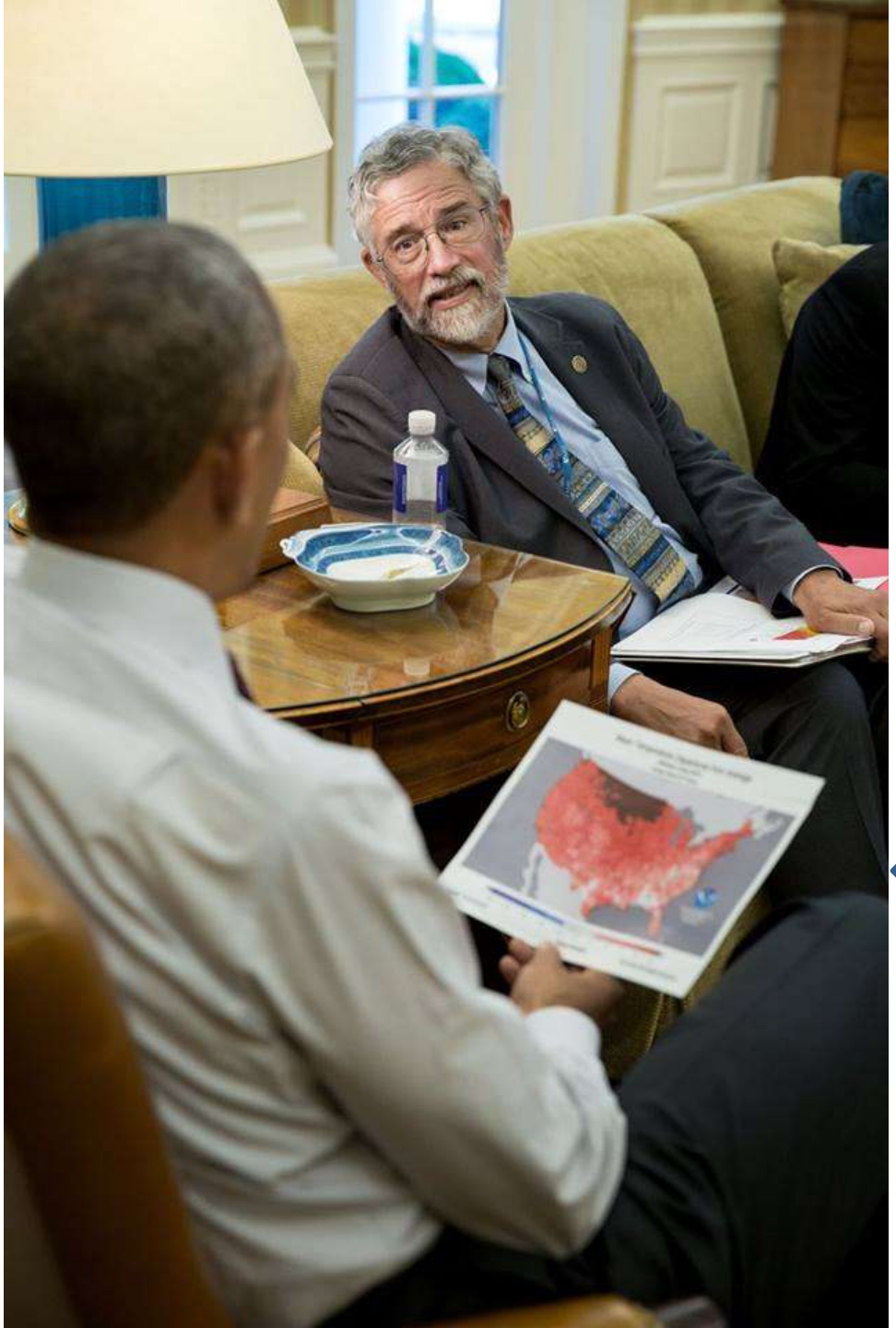
- Global Historical Climatology Network
  - Consolidated global dataset of weather stations used to monitor and assess the state of the climate
- GHCN-Monthly
  - Global summary of monthly temperature and precipitation
  - Main dataset used in monthly monitoring reports
- GHCN-Daily
  - Integrated database of daily climate summaries
    - Temperature, Precipitation, Snowfall, Other Weather Data
  - 100,000 stations worldwide
  - Updates each night with new data
  - Subjected to a common suite of quality assurance

Mean Temperature Departures from Average

January–June 2016

Average Period: 20th Century





Accessing GHCN-Daily

- NCEI FTP
  - Text files (one per station), and csv files (one per year)
  - Requires knowledge of file location, formats, readmes
- NCEI "Climate Data Online" Portal
  - Mapping interface
  - Runs on Oracle Database
  - Custom Text / CSV files
- xmACIS
  - Custom Text / CSV files, Visualizations
  - US Data Only
  - "Only for NWS employees"

How Do You Want Your Climate Data?

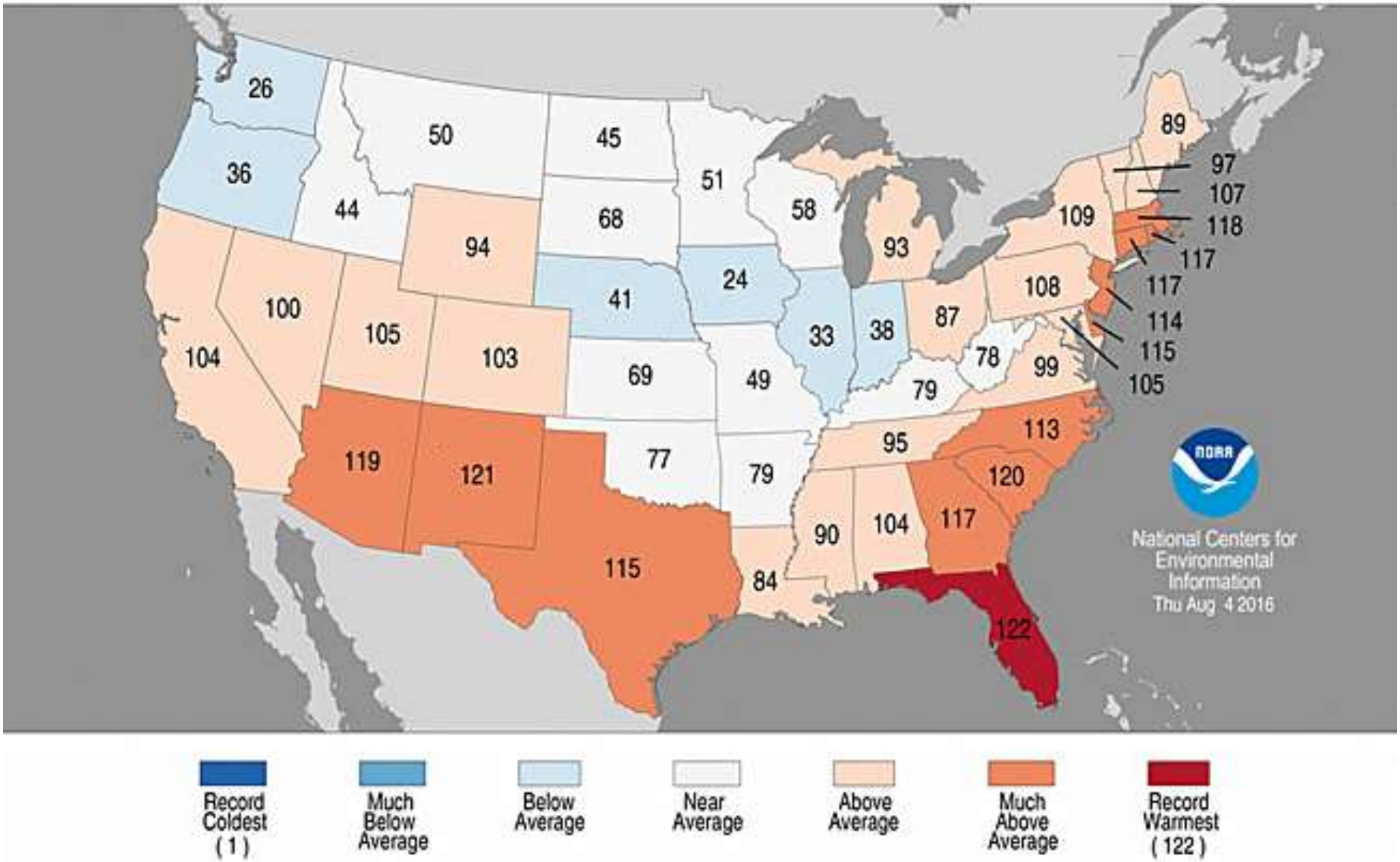
Time Scale

- Monthly
  - Most of NCEI's monitoring and gridded products are on the monthly scale
  - Is this good enough? (Probably Not)

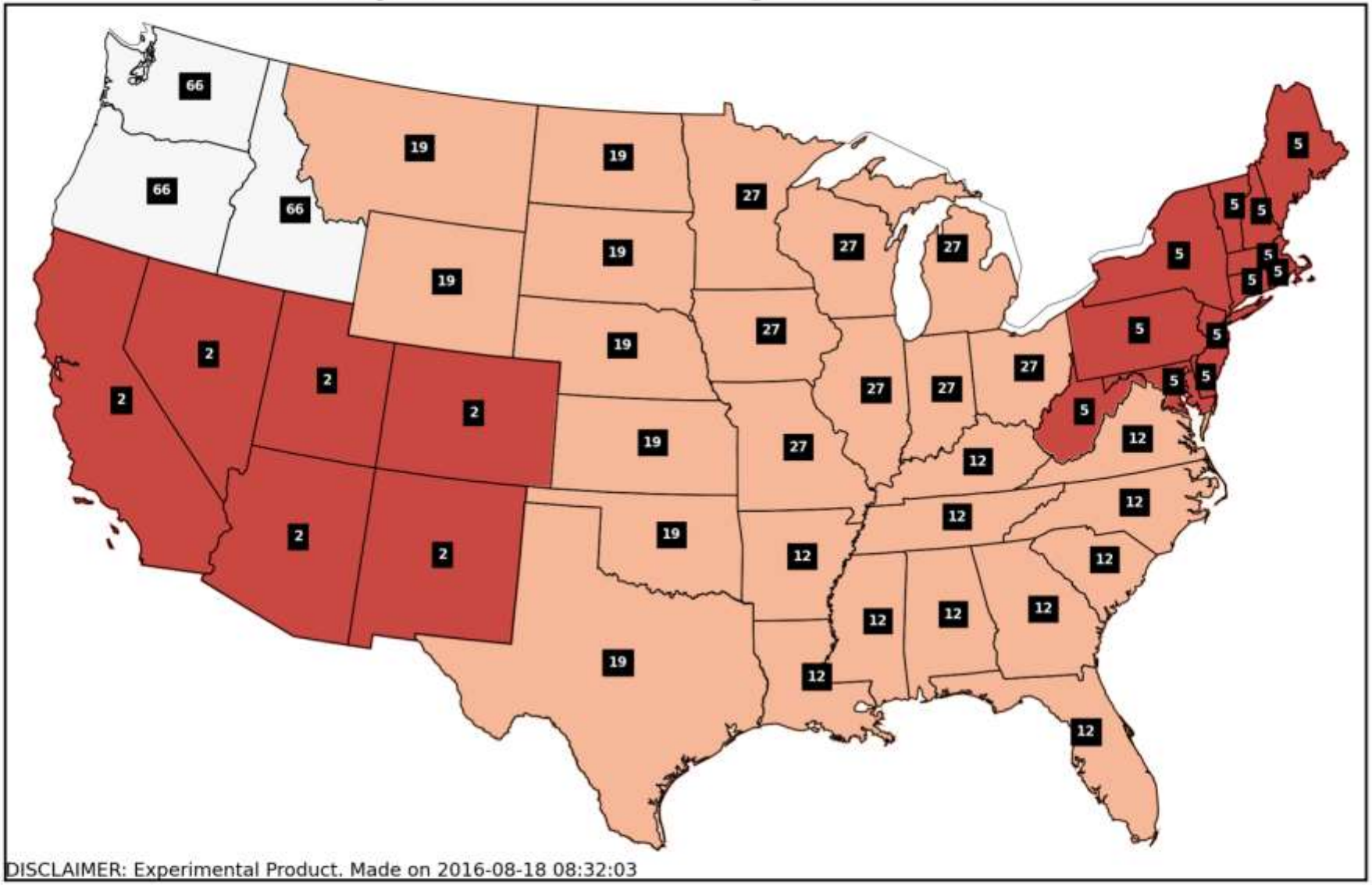
Statewide Maximum Temperature Ranks

July 2016

Period: 1895–2016



4day NCA Ranks Ending On 2016 07 26



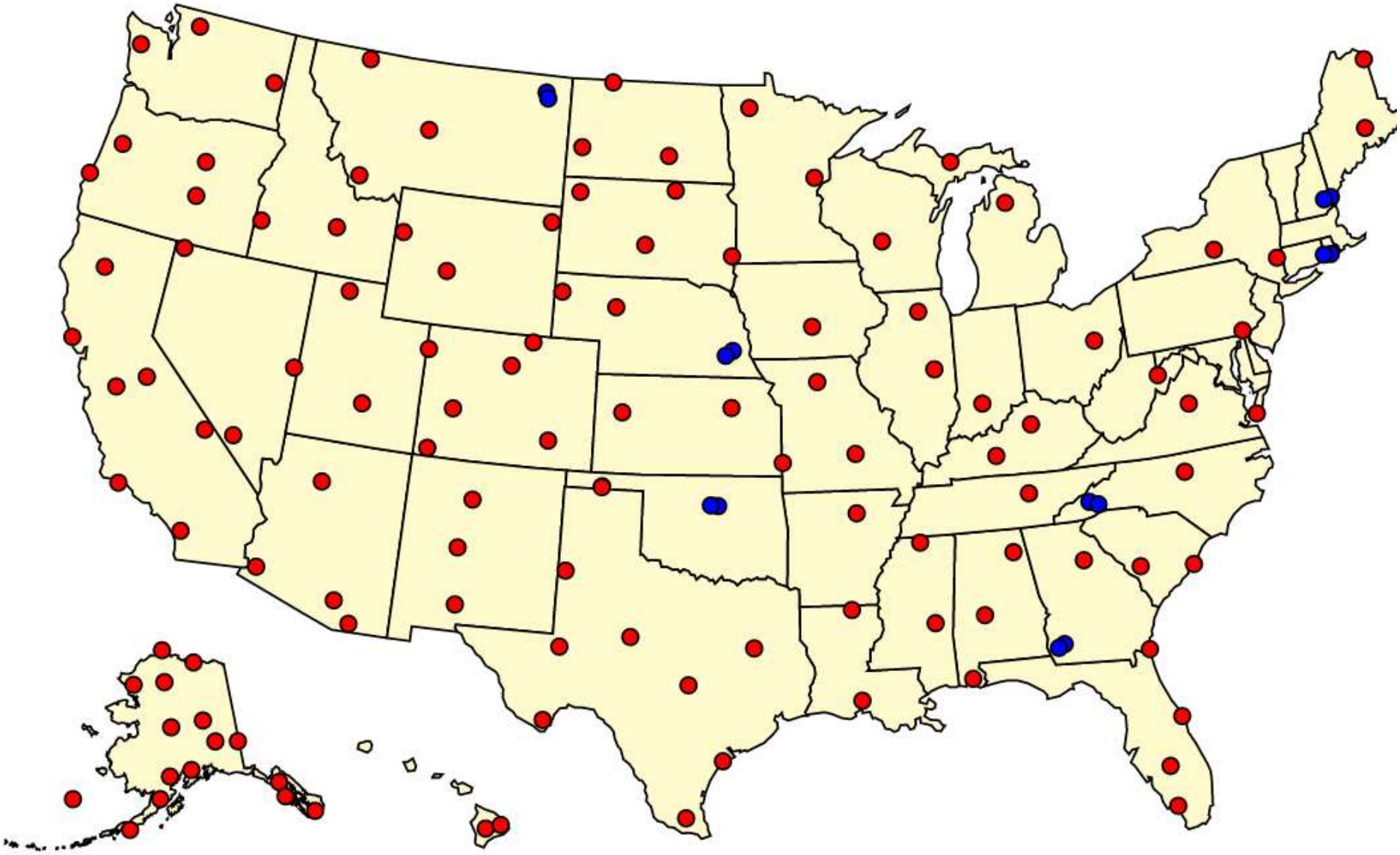
DISCLAIMER: Experimental Product. Made on 2016-08-18 08:32:03

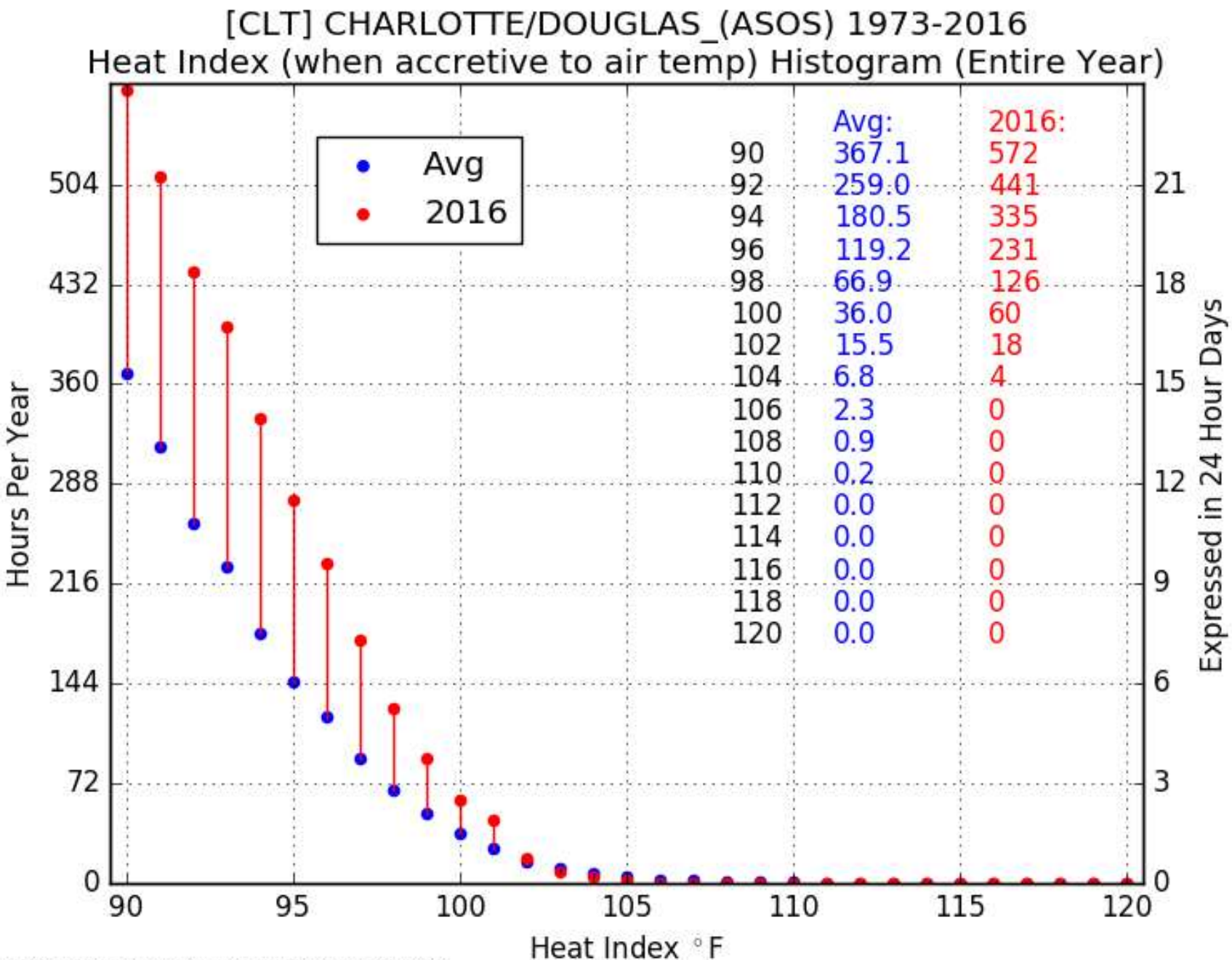
RECORD COLD | TOP 10 COLD | TOP 1/3 COLD | AVERAGE | TOP 1/3 WARM | TOP 10 WARM | RECORD WARM

Time Scale

- Monthly
  - Most of NCEI's monitoring and gridded products are on the monthly scale
  - Is this good enough? (Probably Not)
- Daily
  - Some products are on the daily scale (GHCN-D), but very little gridded.
- Hourly
  - Demand is higher
  - USCRN: More Spaced Out
  - ISD: Duplicate Stations, little QC

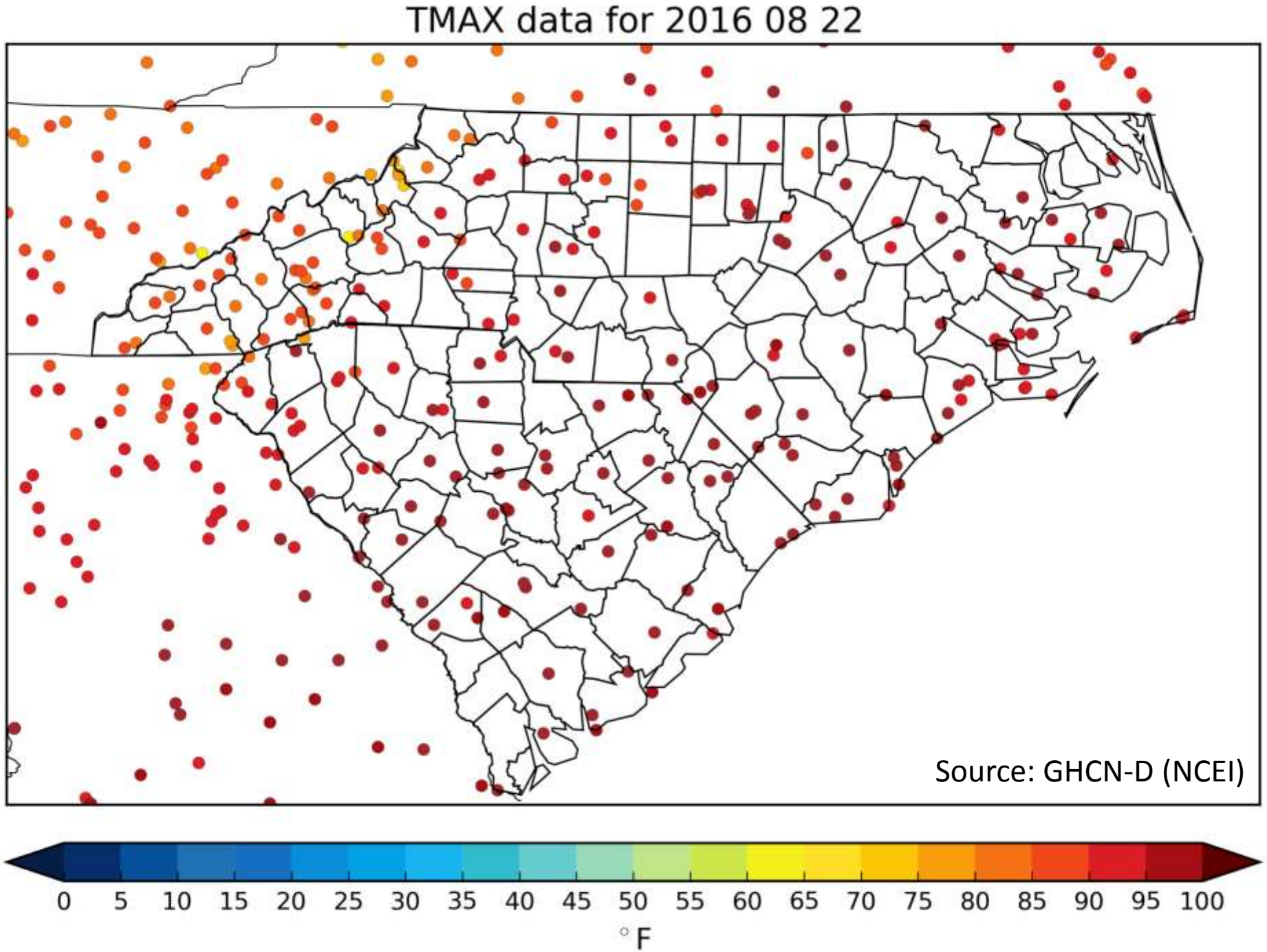
USCRN Stations

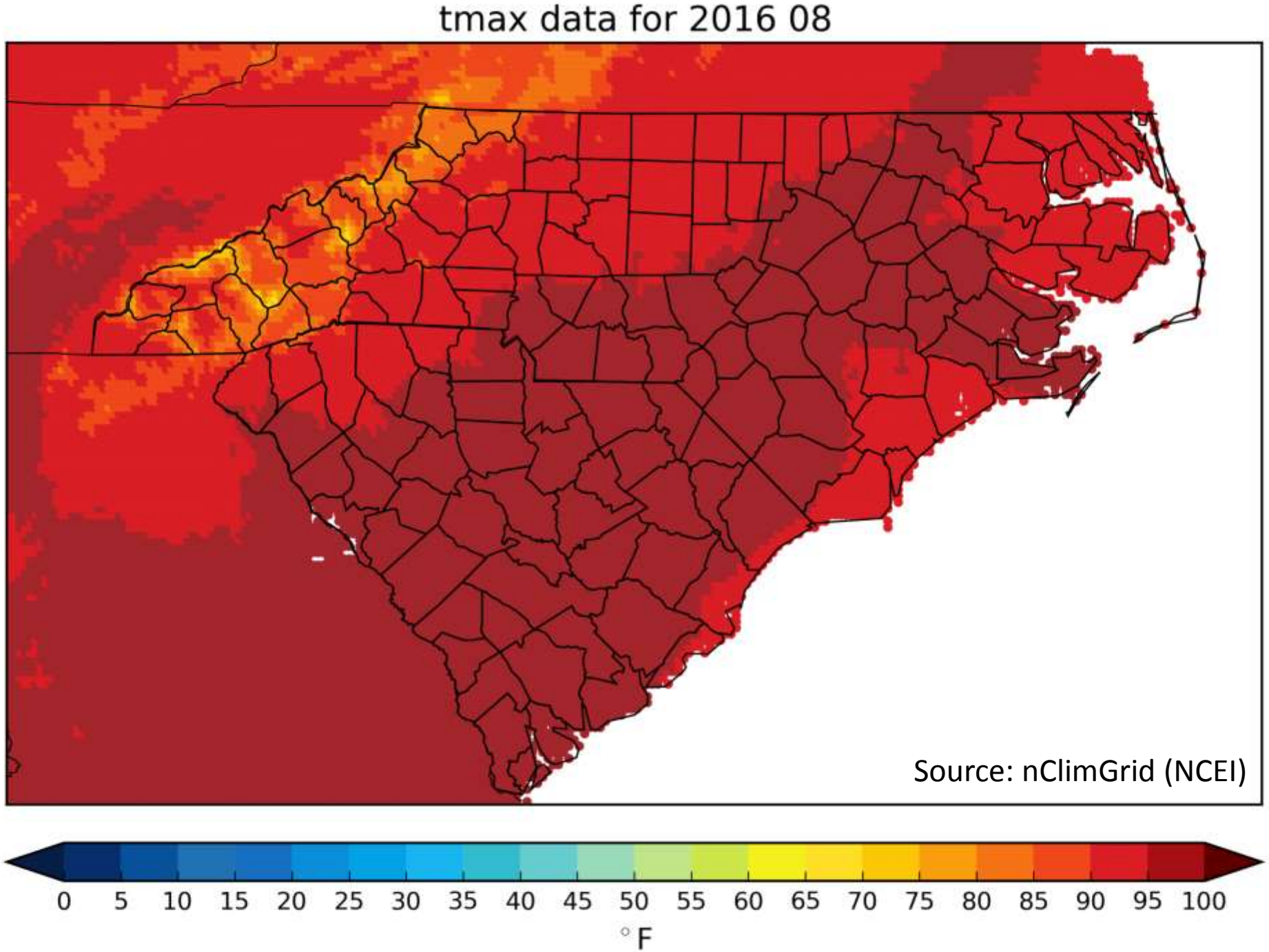



[CLT] CHARLOTTE/DOUGLAS_(ASOS) 1973-2016
Heat Index (when accretive to air temp) Histogram (Entire Year)
Avg
2016
Avg: 2016:
90 367.1 572
92 259.0 441
94 180.5 335
96 119.2 231
98 66.9 126
100 36.0 60
102 15.5 18
104 6.8 4
106 2.3 0
108 0.9 0
110 0.2 0
112 0.0 0
114 0.0 0
116 0.0 0
118 0.0 0
120 0.0 0
Hours Per Year
Expressed in 24 Hour Days
Heat Index °F
0
72
144
216
288
360
432
504
0
3
6
9
12
15
18
21
90
95
100
105
110
115
120

Spatial Scale

- Is station data good enough?
  - Of course there's satellite, but no climatic trends prior to 1970s
- People want gridded data
  - Exists at NCEI, but at monthly time scale
  - Noisy data?


TMAX data for 2016 08 22
Source: GHCN-D (NCEI)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
°F


tmax data for 2016 08
Source: nClimGrid (NCEI)
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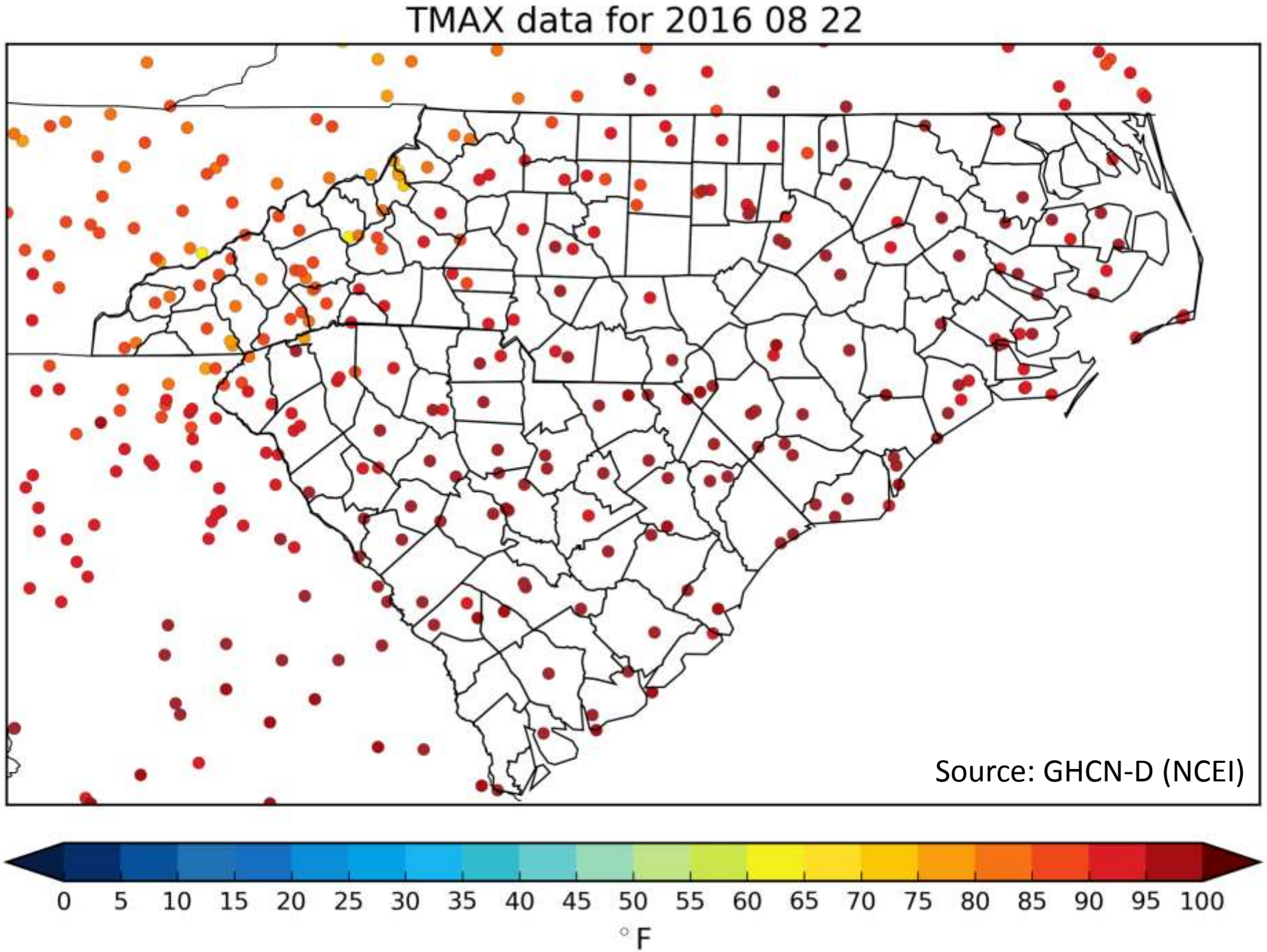
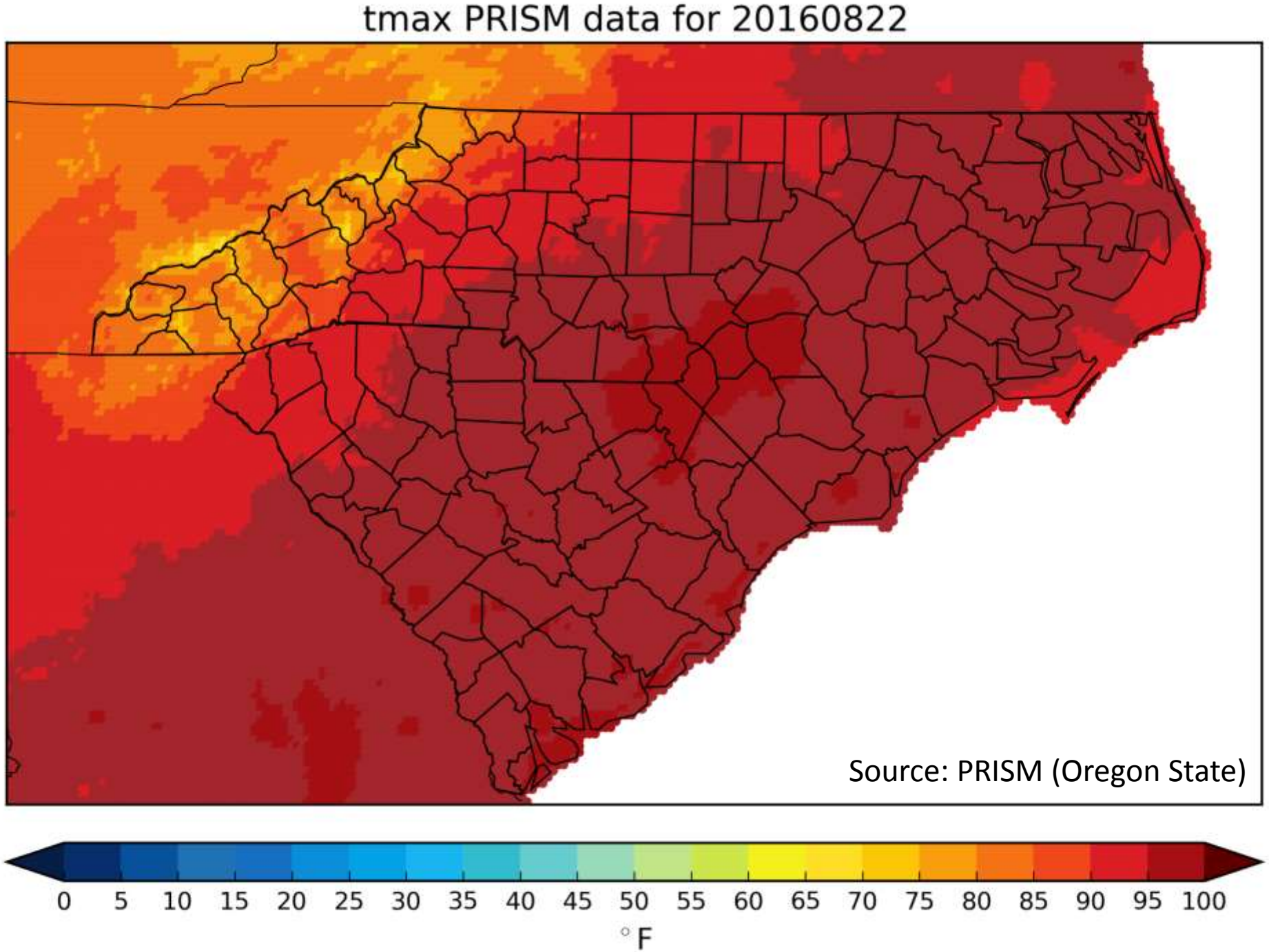
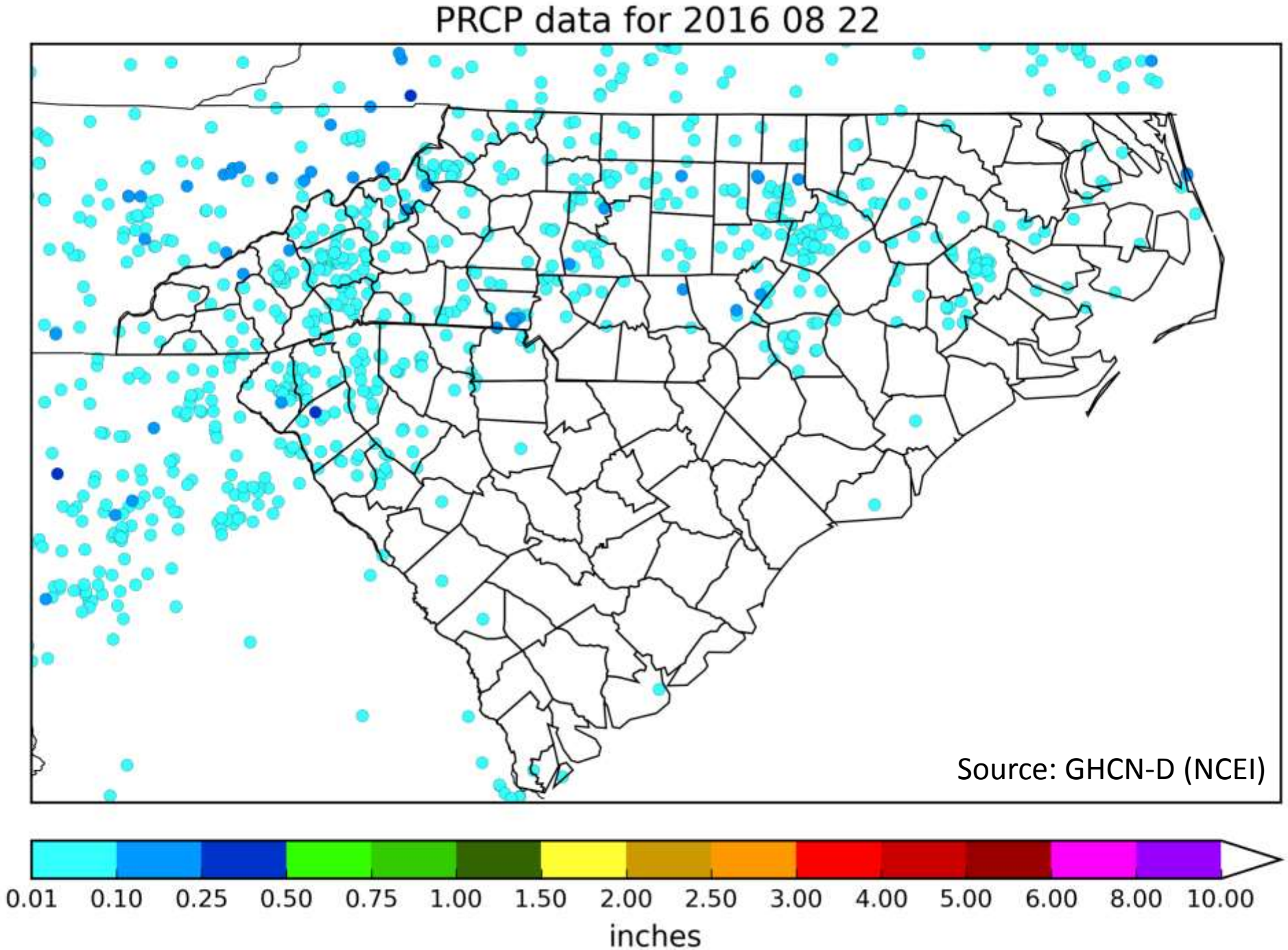
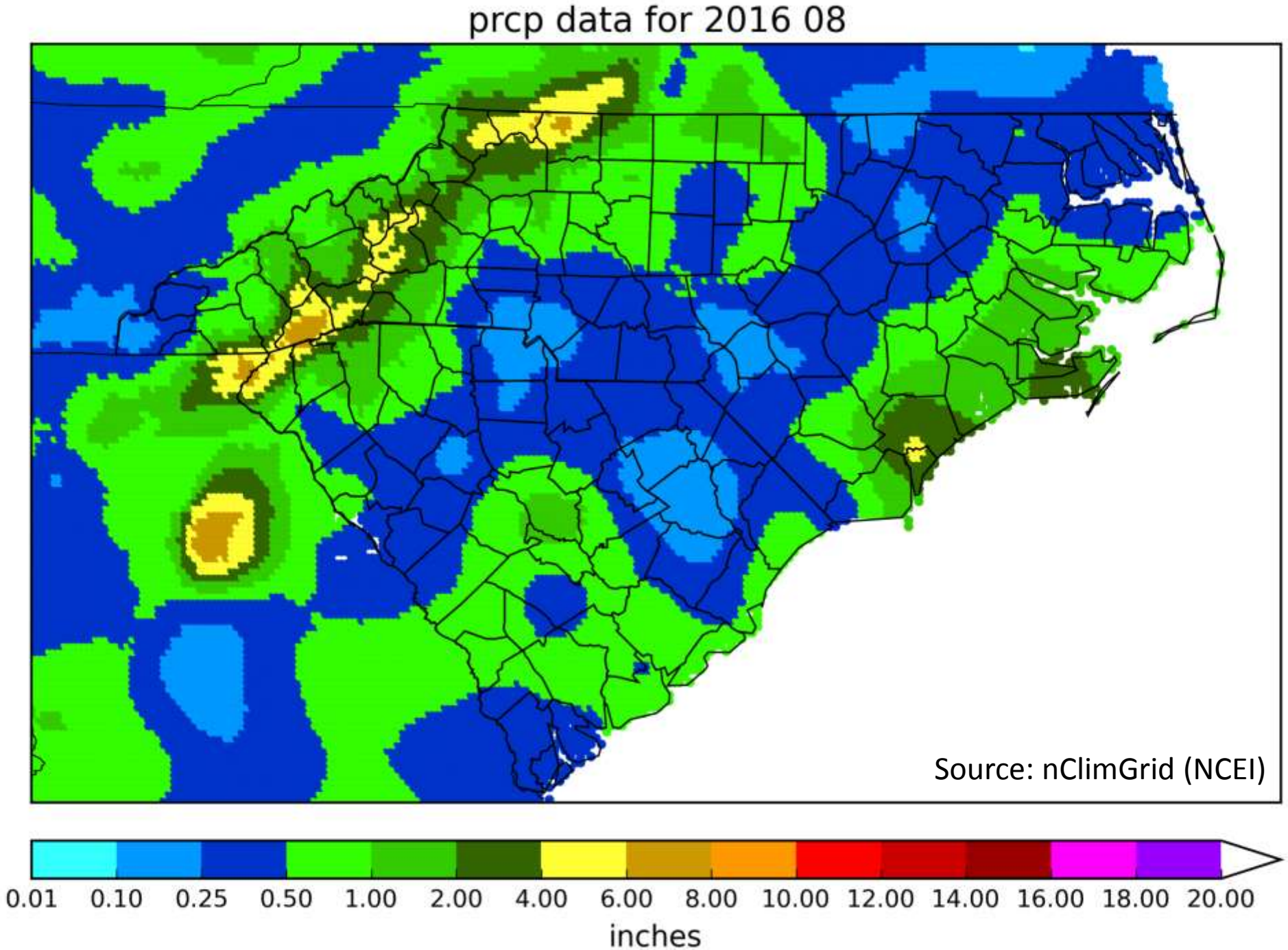
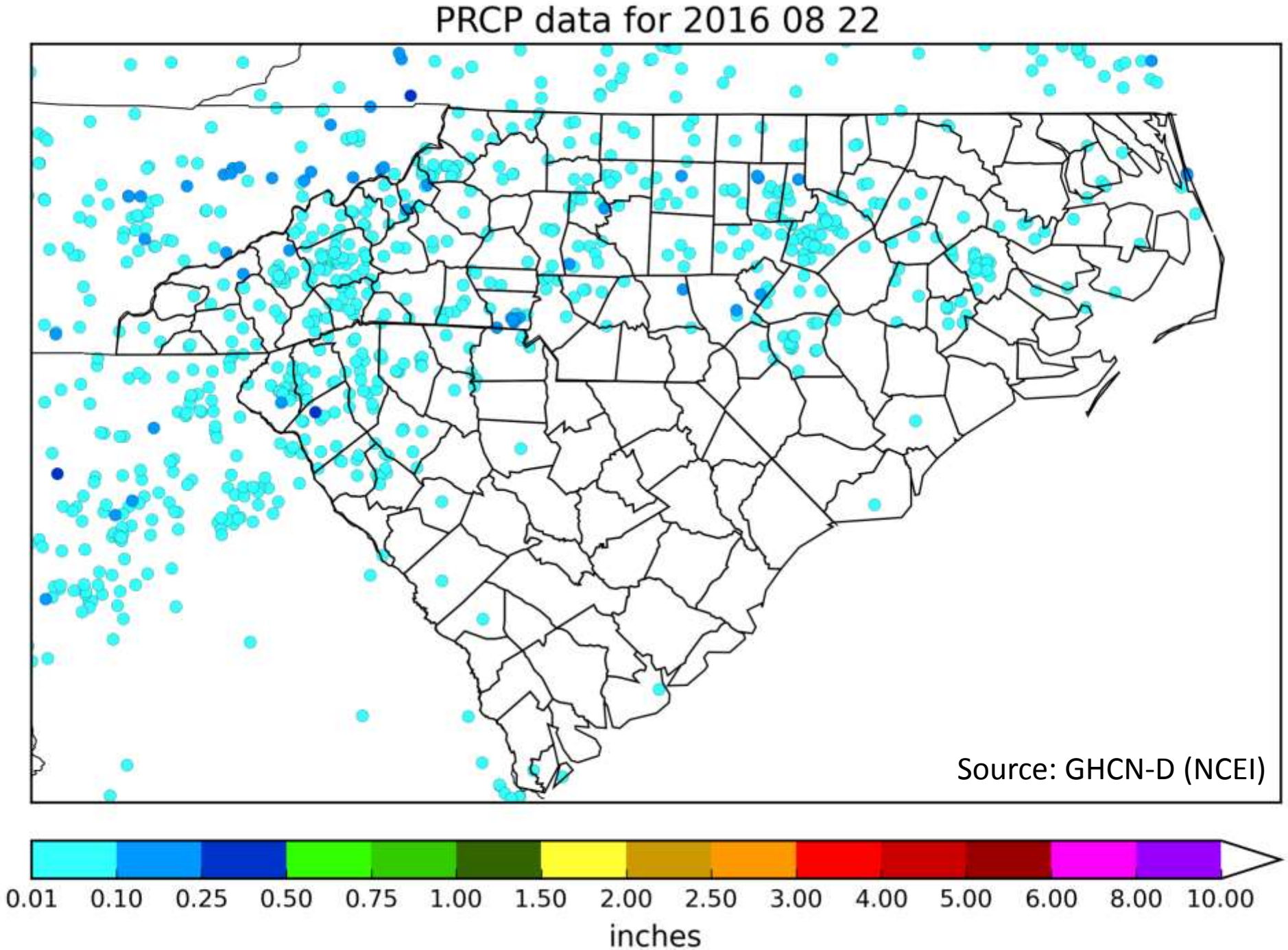
°F


TMAX data for 2016 08 22
Source: GHCN-D (NCEI)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
°F


tmax PRISM data for 20160822
Source: PRISM (Oregon State)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
°F


PRCP data for 2016 08 22
Source: GHCN-D (NCEI)
0.01
0.10
0.25
0.50
0.75
1.00
1.50
2.00
2.50
3.00
4.00
5.00
6.00
8.00
10.00
inches


prcp data for 2016 08
Source: nClimGrid (NCEI)
0.01
0.10
0.25
0.50
1.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
inches


PRCP data for 2016 08 22
Source: GHCN-D (NCEI)
0.01
0.10
0.25
0.50
0.75
1.00
1.50
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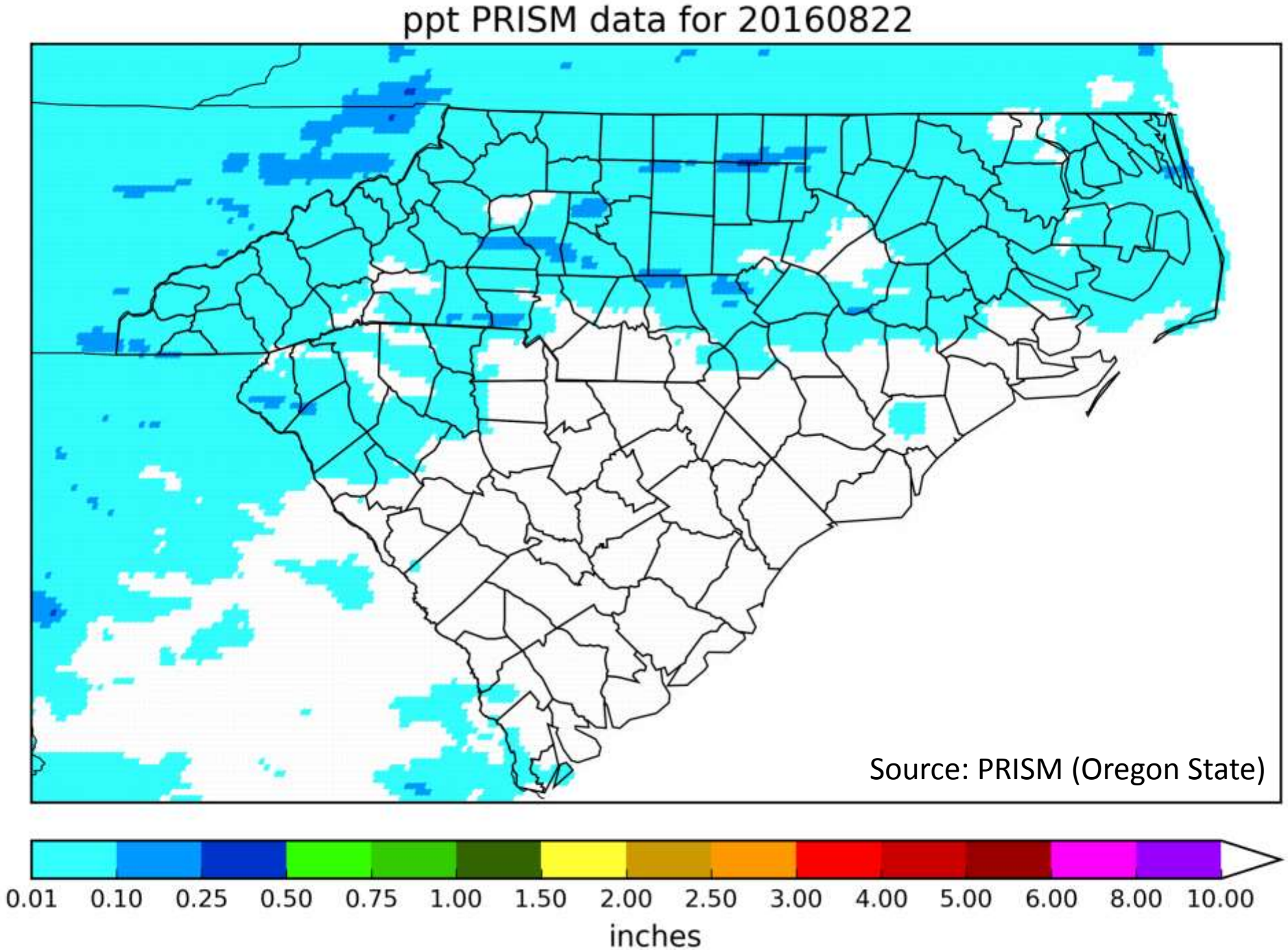
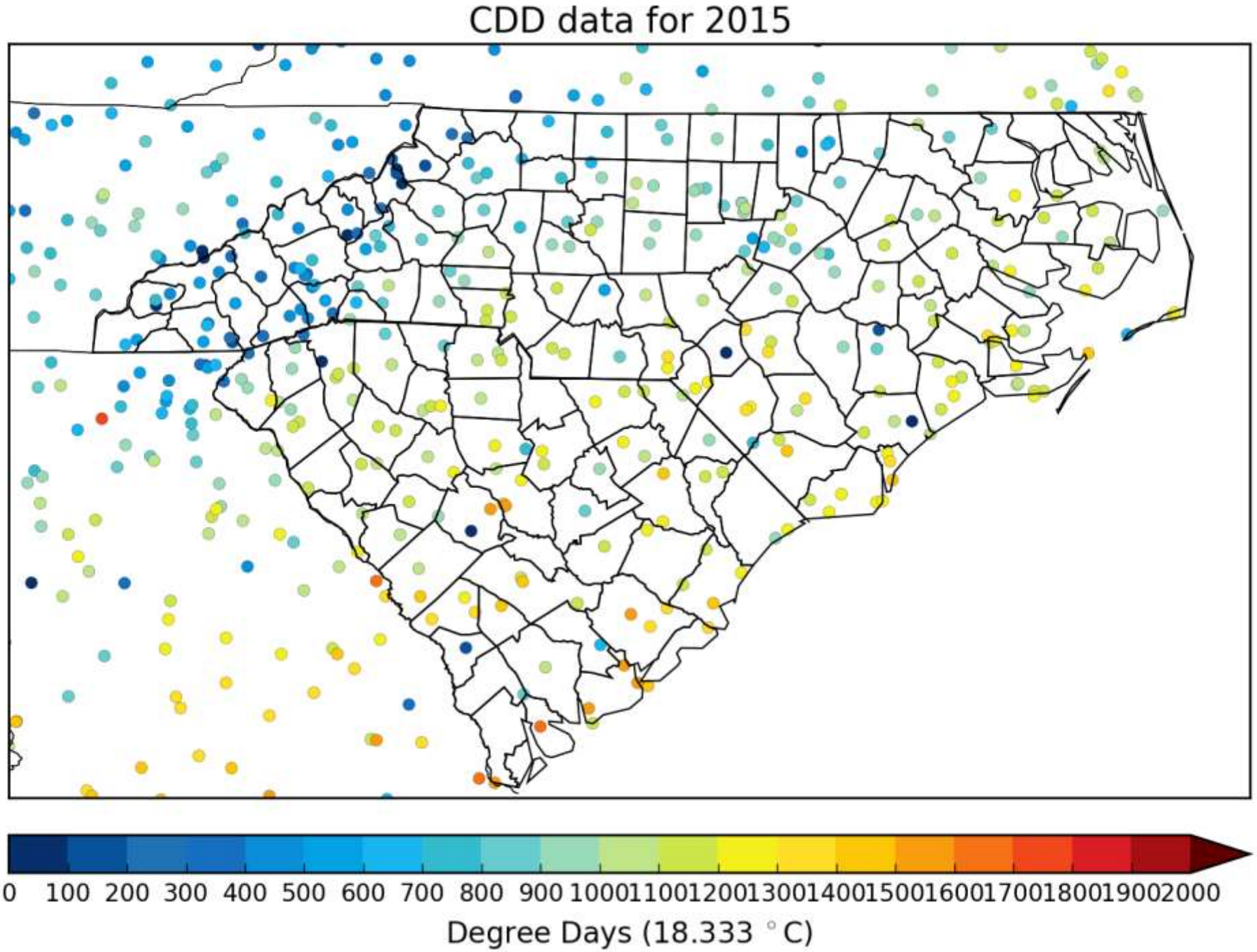
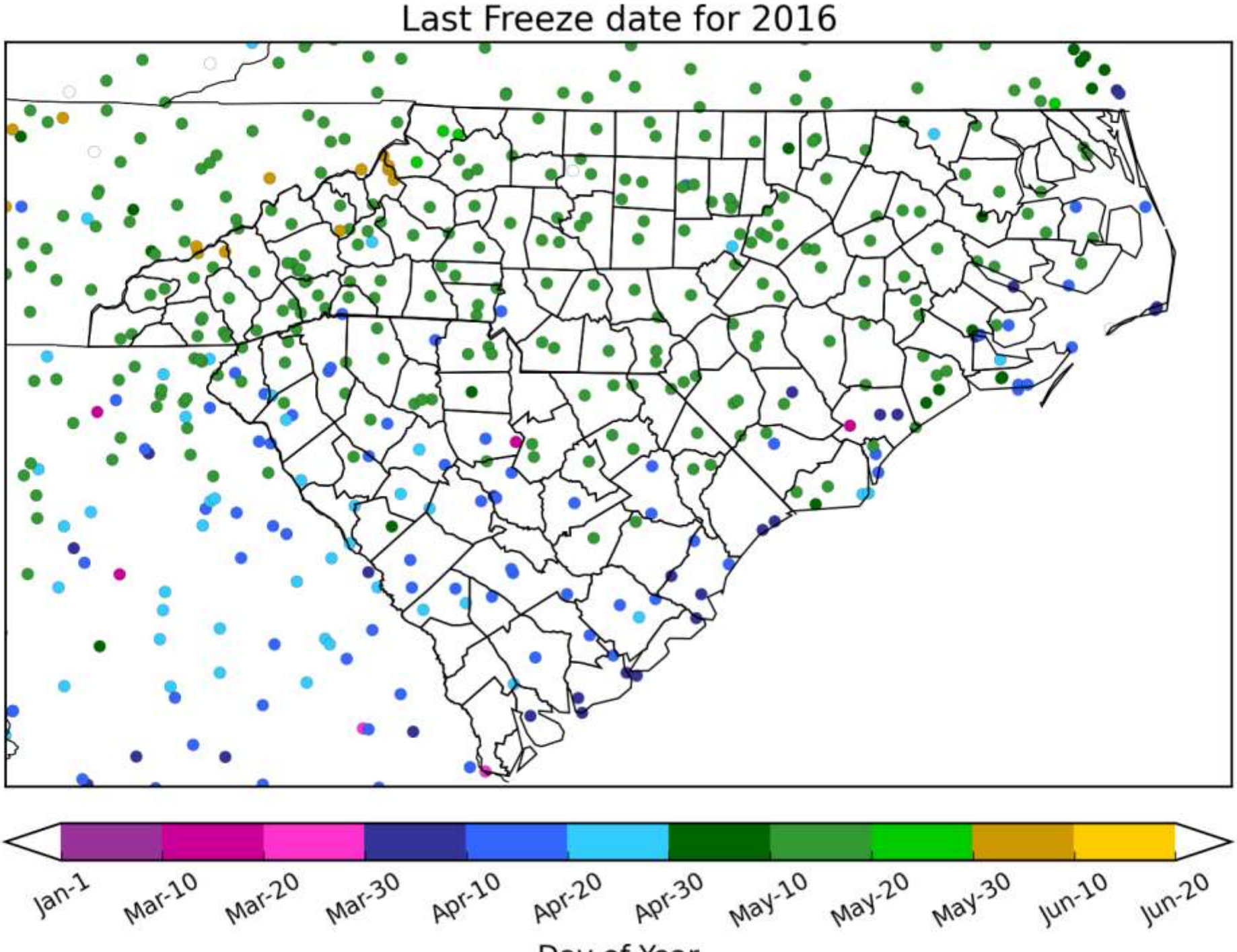
4.00
5.00
6.00
8.00
10.00
inches


ppt PRISM data for 20160822
Source: PRISM (Oregon State)
0.01
0.10
0.25
0.50
0.75
1.00
1.50
2.00
2.50
3.00
4.00
5.00
6.00
8.00
10.00
inches

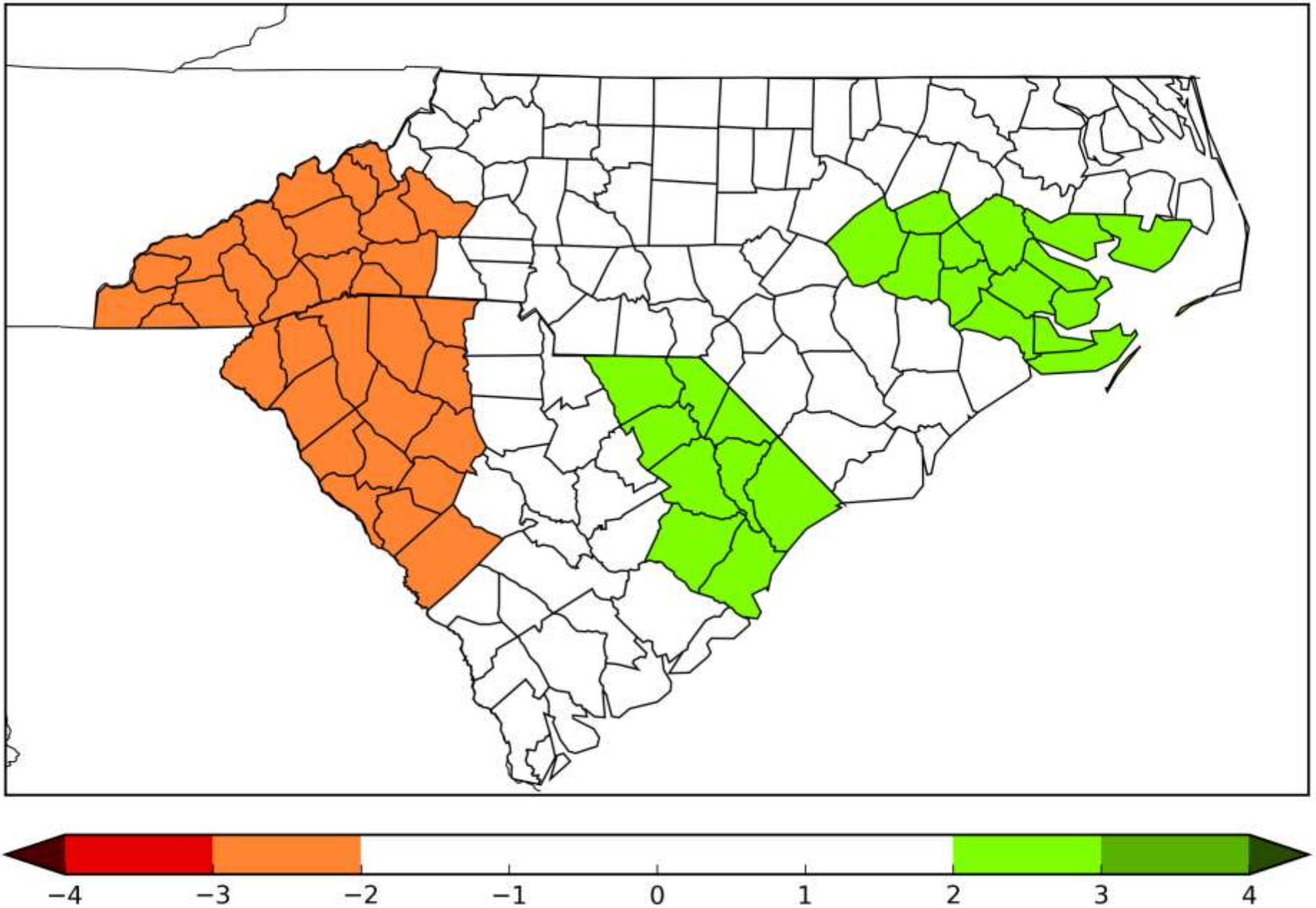
Derived Variables

- Can easily make derived variables from both temperature and precipitation
- Energy Sector
  - Heating / Cooling Degree Days
- Agriculture Sector
  - Growing Degree Days, First / Last Day of Frost
  - Drought indices: PDSI, SPI, SPEI
- Others?


CDD data for 2015
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000
Degree Days (18.333 °C)


Last Freeze date for 2016
Jan-1
Mar-10
Mar-20
Mar-30
Apr-10
Apr-20
Apr-30
May-10
May-20
May-30
Jun-10
Jun-20
Day of Year

PDSI 2016 07



Data Formats

- Text file

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USW00013881201601TMAX  133  W  106  W  117  W   72  W   44  W   78  W  144  W   78  W   94  W  150  W   78  W  117  W   83  W  156  W   89  W  156  W   83  W   33  W   22  W   39  W   94
W   39  W   33  W   89  W  122  W  144  W  122  W   83  W  150  W  144  W  189  W
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W  -38  W  -38  W  -60  W  -16  W  -10  W   56  W   -5  W  -16  W  -43  W   17  W
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W  208  W    3  W    0  W    0  W    0  W   13  W    0  W    0  W    0  W    0  W
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W   50  W   50  W   50  W   30  W    0  W    0  W    0  W    0  W    0  W    0  W
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W   53  W   41  W   18  W   21  W   18  W   25  W   16  W   20  W   24  W   34  W
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19H S    5H S  -14H S    4H S   44H S   70H S   98H S   54H S   60H S   59H S   99H S
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W   50  W  310  W  170  W  200  W  210  W   20  W  360  W  320  W  190  W  210  W
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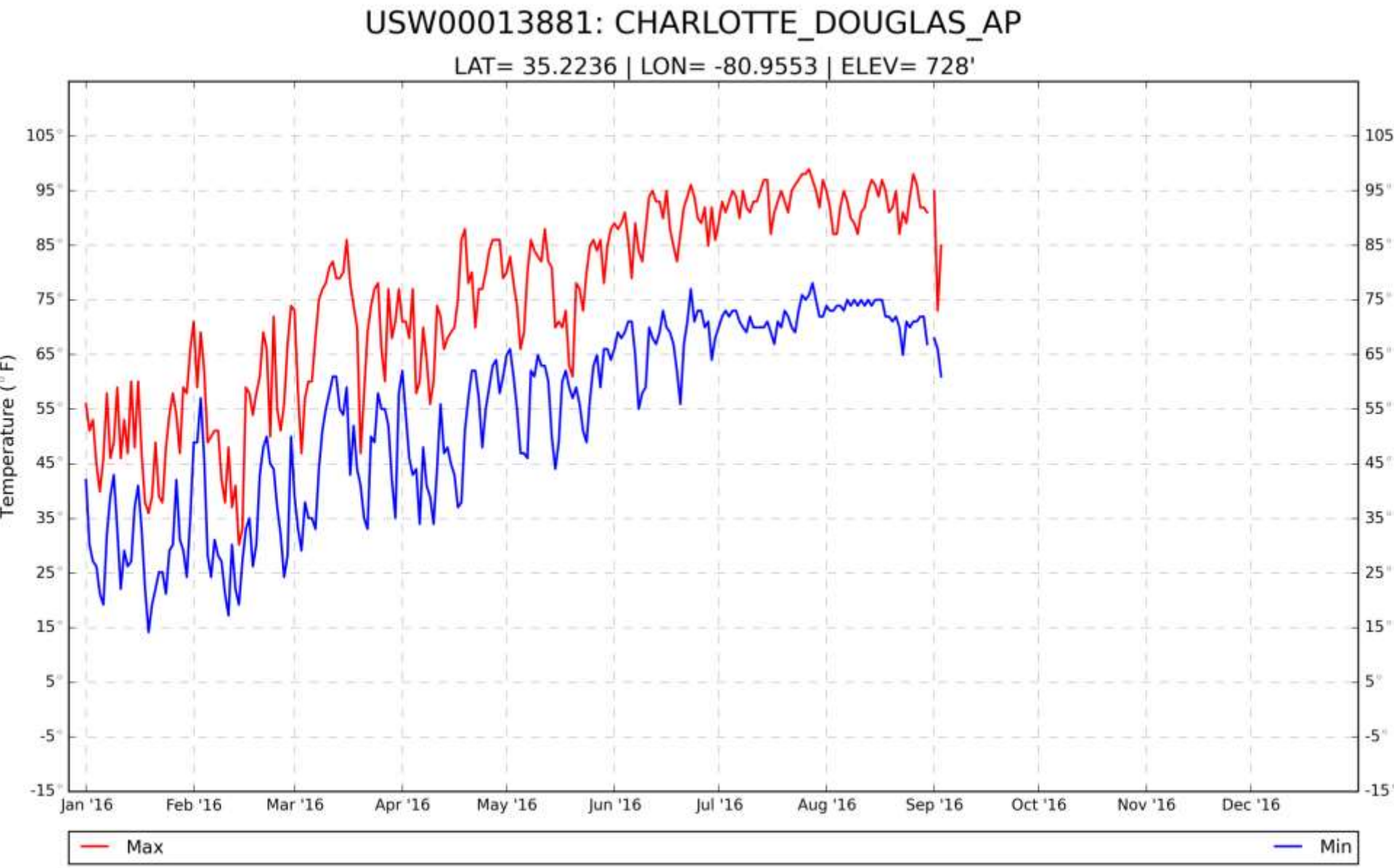
1  W    1  W-9999   -9999   -9999   -9999   -9999   -9999   -9999   -9999
USW00013881201602TMAX  217  W  150  W  206  W  167  W   94  W  100  W  106  W  106  W   56  W   33  W   89  W   28  W   50  W  -10  W    6  W  150  W  144  W  122  W  144  W  161  W  206
W  189  W  100  W  222  W  128  W  106  W  133  W  194  W  233  W-9999   -9999
USW00013881201602TMIN   94  W   94  W  139  W   78  W  -21  W  -43  W   -5  W  -21  W  -27  W  -60  W  -82  W  -10  W  -55  W  -71  W  -27  W    6  W   17  W  -32  W  -10  W   61  W   89
W  100  W   72  W   67  W   28  W    0  W  -43  W  -21  W  100  W-9999   -9999
USW00013881201602PRCP    0  W    0T W  188  W    0  W    0T W    0  W    0  W    3  W    0  W    0  W    0  W    0T W    0  W    0  W   58  W  183  W    0T W    0  W    0  W    3  W
0T W  472  W   99  W  137  W    0  W    0  W    0  W    0  W    0  W-9999   -9999
```

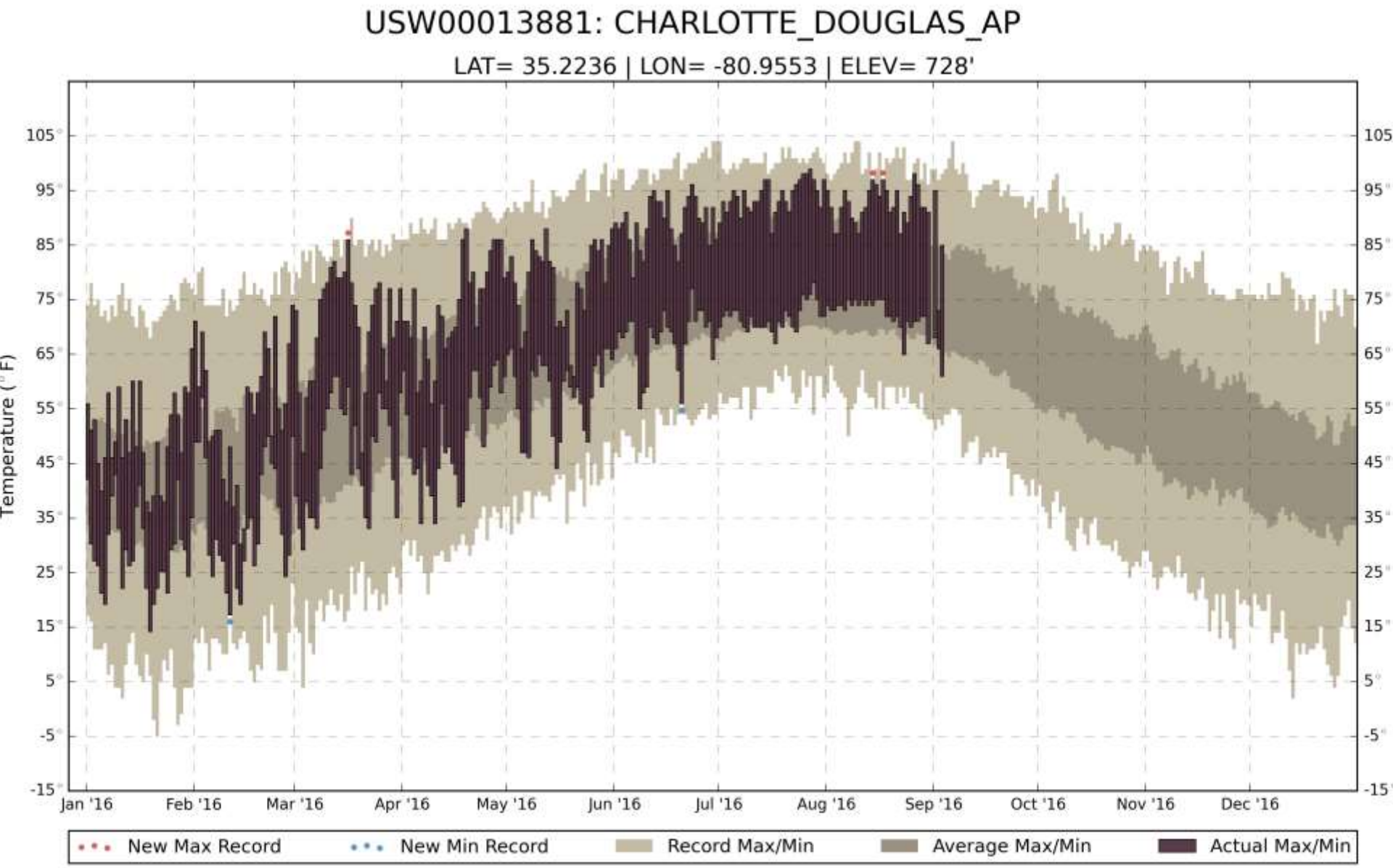
Data Formats

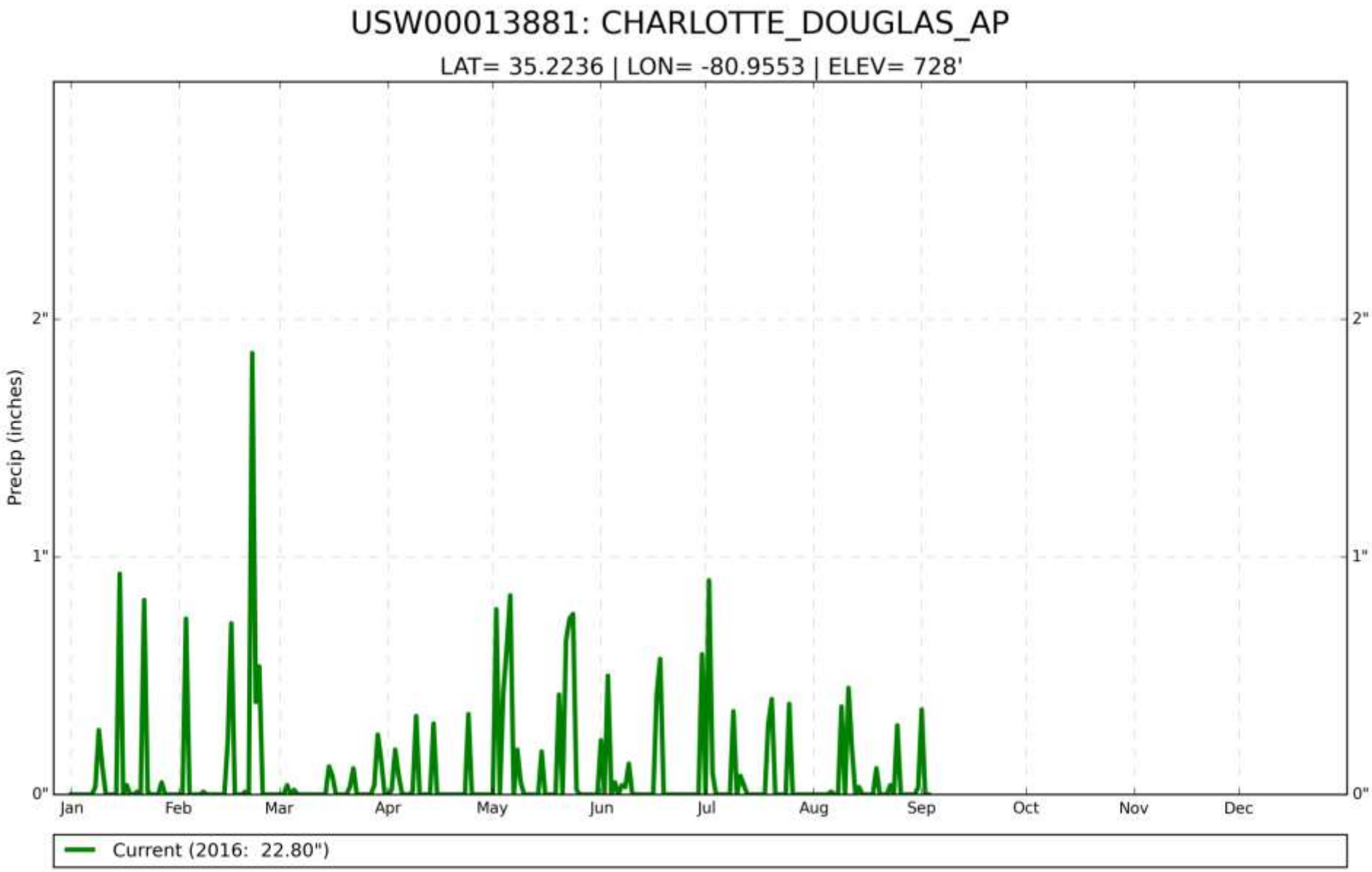
- Text file
- Comma delimited file
- Excel
- netCDF File with CF Compliance
- GIS Files
- Others?

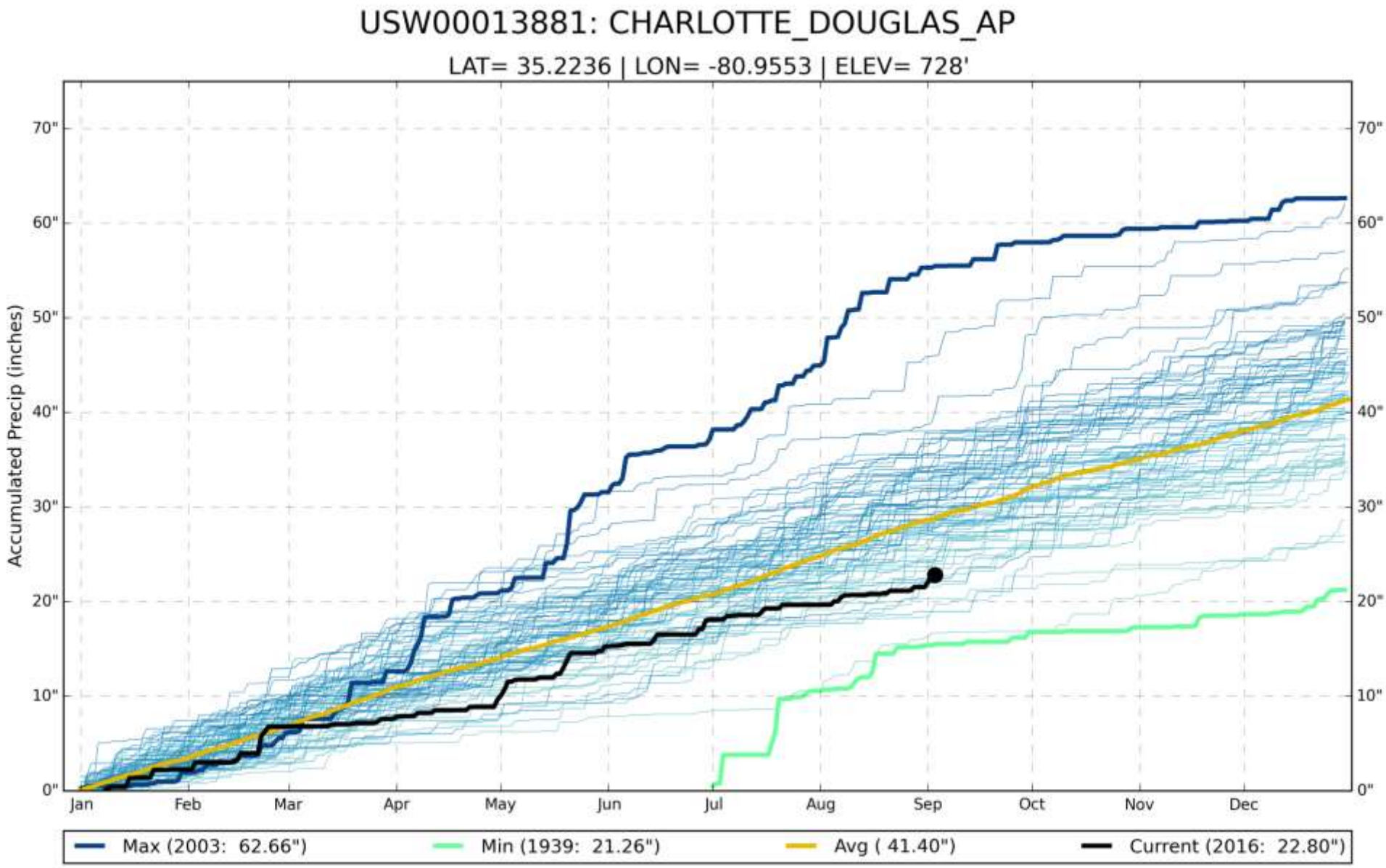
Visualizations

- Need to find ways to show data so the end user can understand


USW00013881: CHARLOTTE_DOUGLAS_AP
LAT= 35.2236 | LON= -80.9553 | ELEV= 728'
Temperature (°F)
105°
95°
85°
75°
65°
55°
45°
35°
25°
15°
5°
-5°
-15°
Jan '16
Feb '16
Mar '16
Apr '16
May '16
Jun '16
Jul '16
Aug '16
Sep '16
Oct '16
Nov '16
Dec '16
Max
Min


USW00013881: CHARLOTTE_DOUGLAS_AP
LAT= 35.2236 | LON= -80.9553 | ELEV= 728'
Temperature (°F)
105°
95°
85°
75°
65°
55°
45°
35°
25°
15°
5°
-5°
-15°
Jan '16
Feb '16
Mar '16
Apr '16
May '16
Jun '16
Jul '16
Aug '16
Sep '16
Oct '16
Nov '16
Dec '16
New Max Record
New Min Record
Record Max/Min
Average Max/Min
Actual Max/Min


USW00013881: CHARLOTTE_DOUGLAS_AP
LAT= 35.2236 | LON= -80.9553 | ELEV= 728'
Precip (inches)
2"
1"
0"
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Current (2016: 22.80")


USW00013881: CHARLOTTE_DOUGLAS_AP
LAT= 35.2236 | LON= -80.9553 | ELEV= 728'
Accumulated Precip (inches)
0"
10"
20"
30"
40"
50"
60"
70"
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Max (2003: 62.66")
Min (1939: 21.26")
Avg (41.40")
Current (2016: 22.80")

How Do You Want Your Climate Data?

- Time scale?
- Spatial Scale?
- Derived Variables?
- Data Formats?
- Visualizations?
- Anything else?

Thank You!

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