Steps towards an experimental homogenized sub-monthly temperature monitoring tool

Jared Rennie and Ken Kunkel

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

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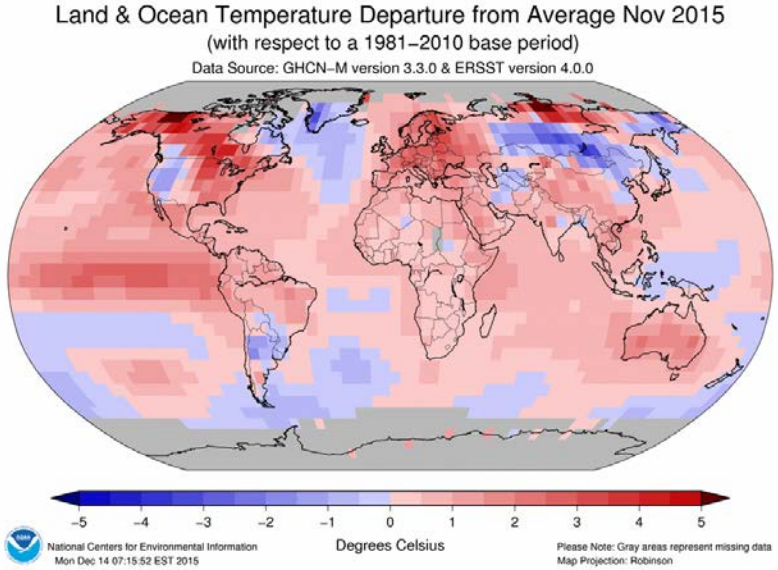
What is Homogenization?

- Distinguishing between climatic and non-climatic changes in the temperature record
  - Step One: Detect the inhomogeneities (through breakpoints)
  - Step Two: Adjust to create more homogeneous record
- Non-climatic changes (inhomogeneities)
  - Local ground conditions
  - Changes in instrumentation
  - Changes in observation procedures
  - Station moves

What is Homogenization?

- Monthly Scale
  - Plenty of Global Products
    - GHCN-Monthly
    - nClimDiv
    - NASA
    - UK MetOffice
- Weekly/Daily Scale
  - No Global or US Products
  - Adjusting for inhomogeneities can be challenging
    - A detected break associated with a true inhomogeneity, OR by chance variation due to natural variability.

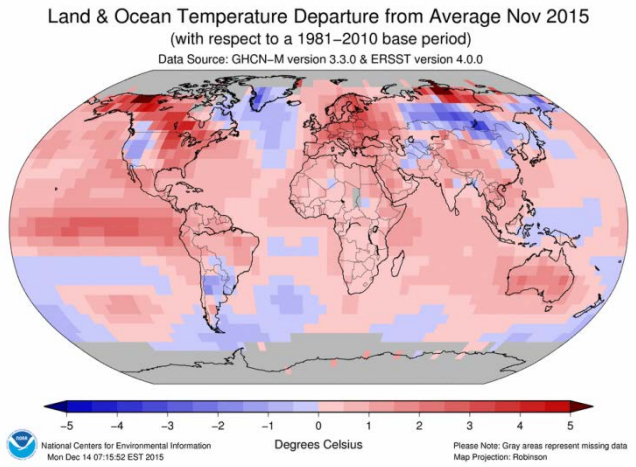


Identify an anomaly

1. Take in raw data
2. Perform Quality Control
3. Apply Adjustments
4. Departure from normal

- GHCN-Monthly
- GHCN-Monthly
- PHA (Menne and Williams, 2009)
- Climate Anomaly Method

MONTHLY

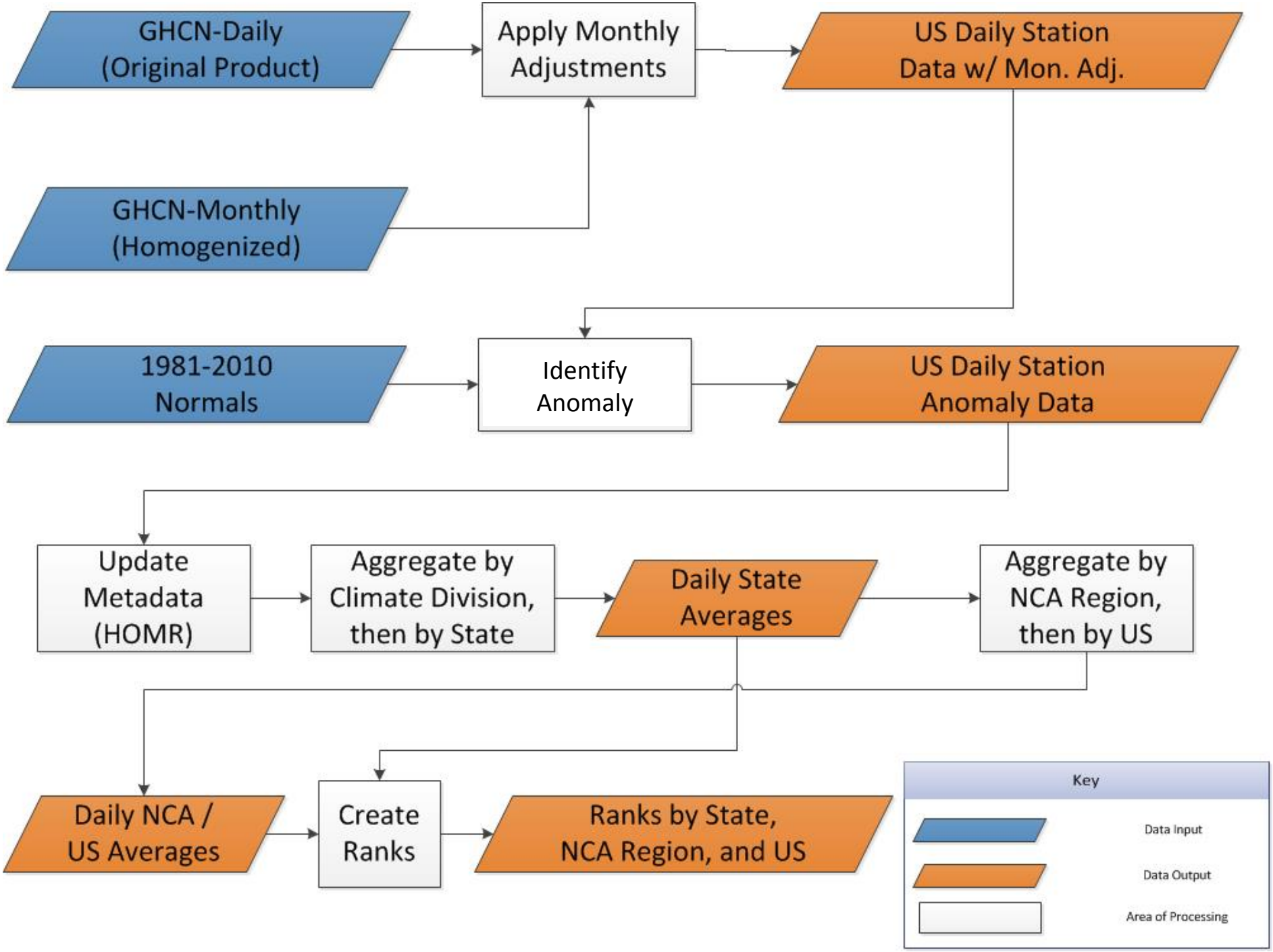


Identify an anomaly

1. Take in raw data
2. Perform Quality Control
3. Apply Adjustments
4. Departure from normal
5. State / NCA / US averages

- GHCN-Daily
- GHCN-Daily
- GHCN-Monthly
- 1981-2010 Normals
- Shapefiles

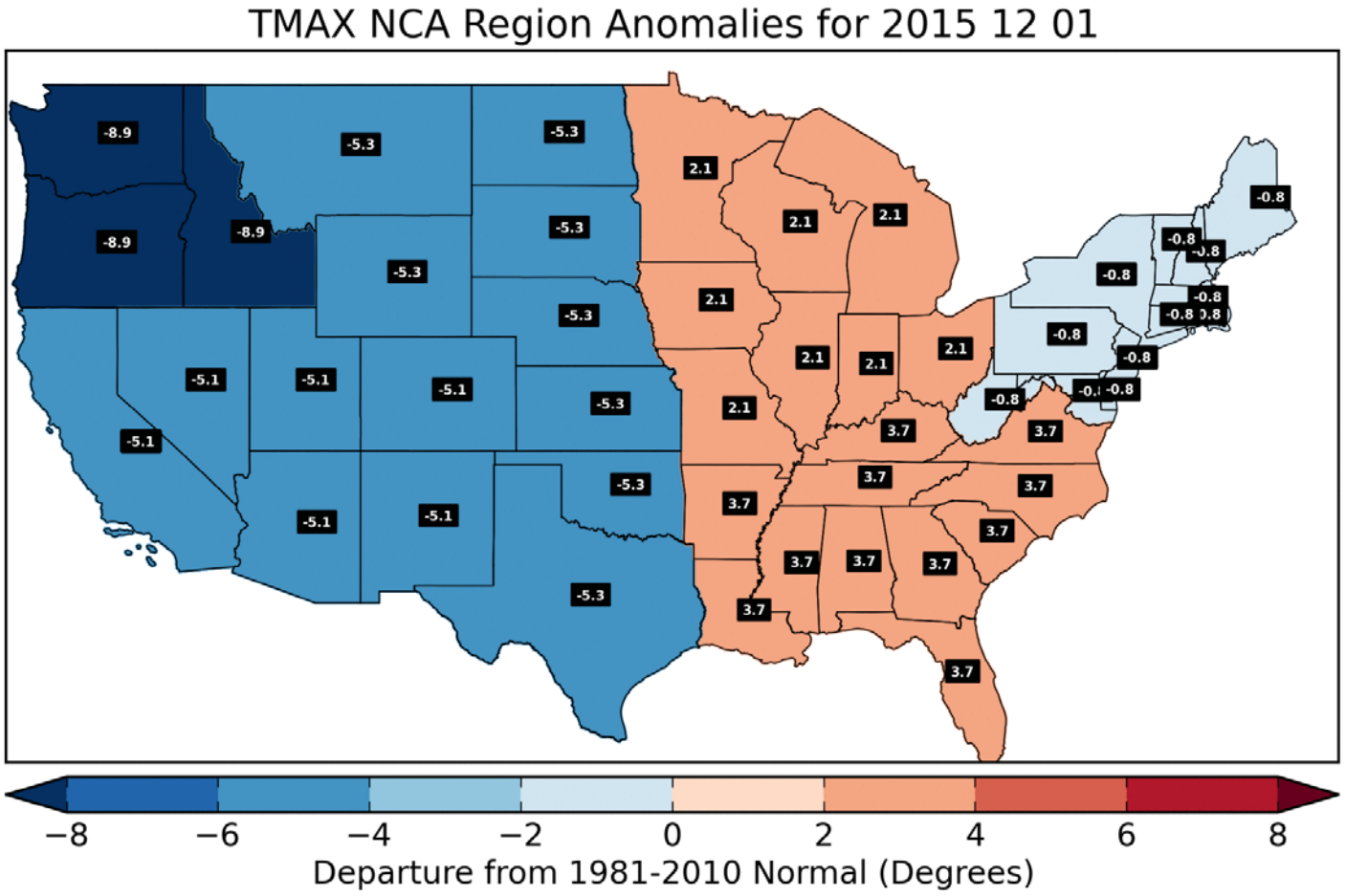
DAILY?


GHCN-Daily
(Original Product)
Apply Monthly
Adjustments
US Daily Station
Data w/ Mon. Adj.
GHCN-Monthly
(Homogenized)
1981-2010
Normals
Identify
Anomaly
US Daily Station
Anomaly Data
Update
Metadata
(HOMR)
Aggregate by
Climate Division,
then by State
Daily State
Averages
Aggregate by
NCA Region,
then by US
Daily NCA /
US Averages
Create
Ranks
Ranks by State,
NCA Region, and US
Key
Data Input
Data Output
Area of Processing

RESULTS

http://monitor.cicsnc.org/sub

NCA Region Daily Max Anomaly



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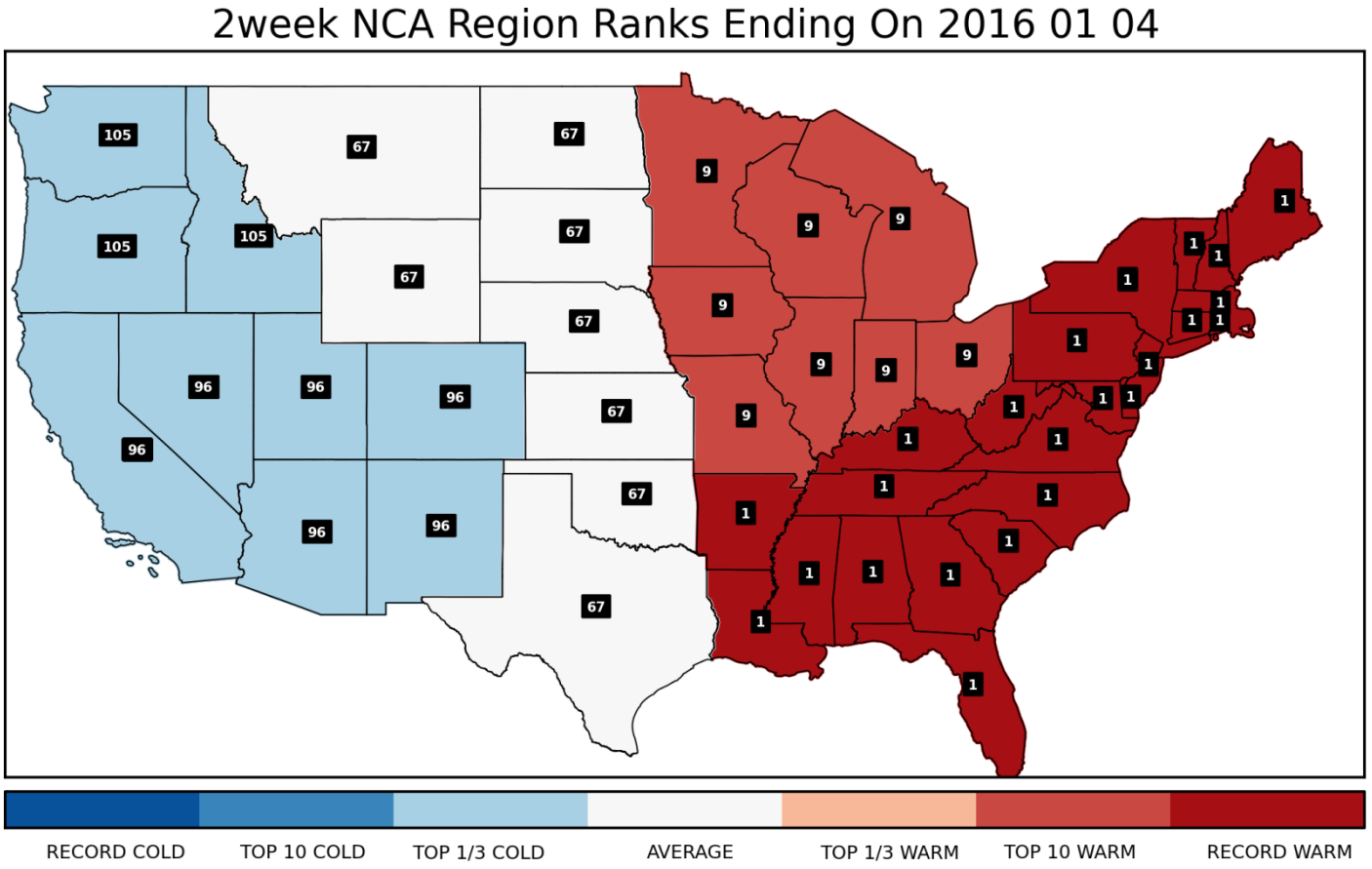
NCA Region Temperature Ranks



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Ranks: Louisiana

Date	Duration	#years	Rank	Value (F)	Anomaly
Jan 04 2016	3-day	122	74	45.7	-2.5
Jan 04 2016	4-day	122	80	45.6	-2.9
Jan 04 2016	1-week	121	68	47.6	-1.5
Jan 04 2016	2-week	121	4	58.7	9.4
Jan 04 2016	3-week	121	4	57.2	7.8
Jan 04 2016	1-mon	121	3	58.6	8.5
Jan 04 2016	3-mon	121	1	63.1	5.7
Jan 04 2016	6-mon	121	1	72.2	3.5
Jan 04 2016	9-mon	121	1	73.5	2.9
Jan 04 2016	1-year	121	6	68.4	1.9

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Ranks: Southeast NCA Region

(VA, KY, TN, NC, SC, GA, FL, AL, MS, AR, LA)

Date	Duration	#years	Rank	Value (F)	Anomaly
Jan 04 2016	3-day	122	72	42.2	-1.1
Jan 04 2016	4-day	122	57	43.6	0.1
Jan 04 2016	1-week	121	23	49.2	5.2
Jan 04 2016	2-week	121	1	57.1	13.1
Jan 04 2016	3-week	121	2	54.9	10.9
Jan 04 2016	1-mon	121	1	55.5	10.8
Jan 04 2016	3-mon	121	1	58.6	6.2
Jan 04 2016	6-mon	121	1	67.9	3.4
Jan 04 2016	9-mon	121	1	69.4	2.9
Jan 04 2016	1-year	121	5	63.8	1.8

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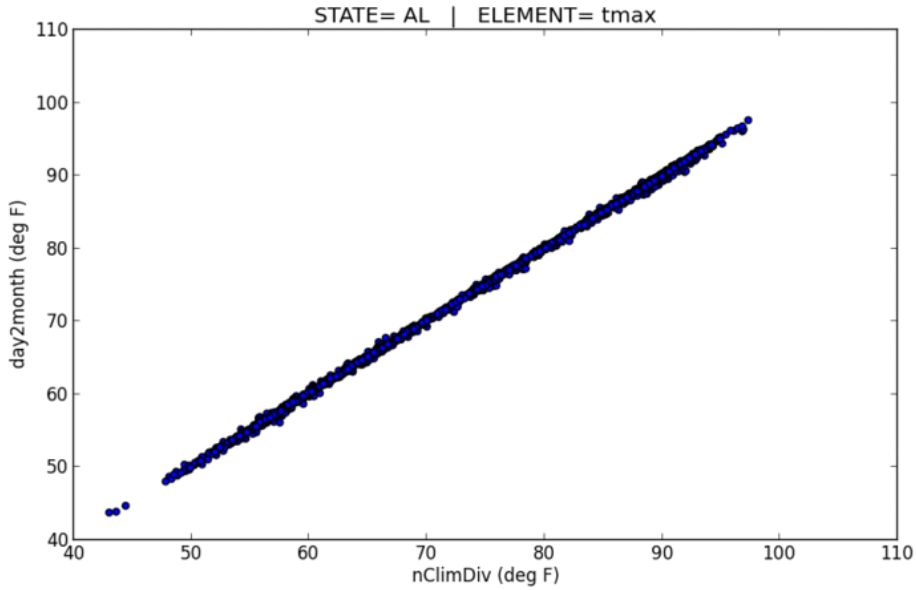
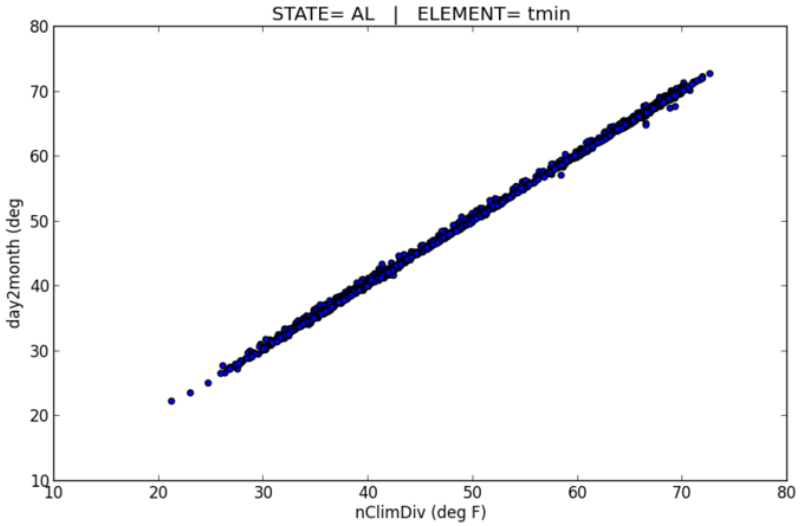
Comparing with nClimDiv



← TMAX

TMIN →



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Issues/Assumptions

- Daily Variability of Homogeneity Adjustments
  - We are counting on the randomness of such variability. If so, averaging over large areas (NCA region or larger) will minimize uncertainties
- Time shifting
  - For AM observers, TMAX at time of observation usually occurred the previous day. Sometimes even unknown.
  - By averaging to no less than 3 days, we hope this will minimize the temporal uncertainty (although may not always be the case).

Issues/Assumptions

- Based on these assumptions, this product is meant as a source of general public information, and more work needs to be done before it is suitable for scientific trend analysis

Next Steps

- Include new Alaska Climate Divisions
- Incorporate precipitation
- Address uncertainty
- Hammer out any issues with community

Thank you!

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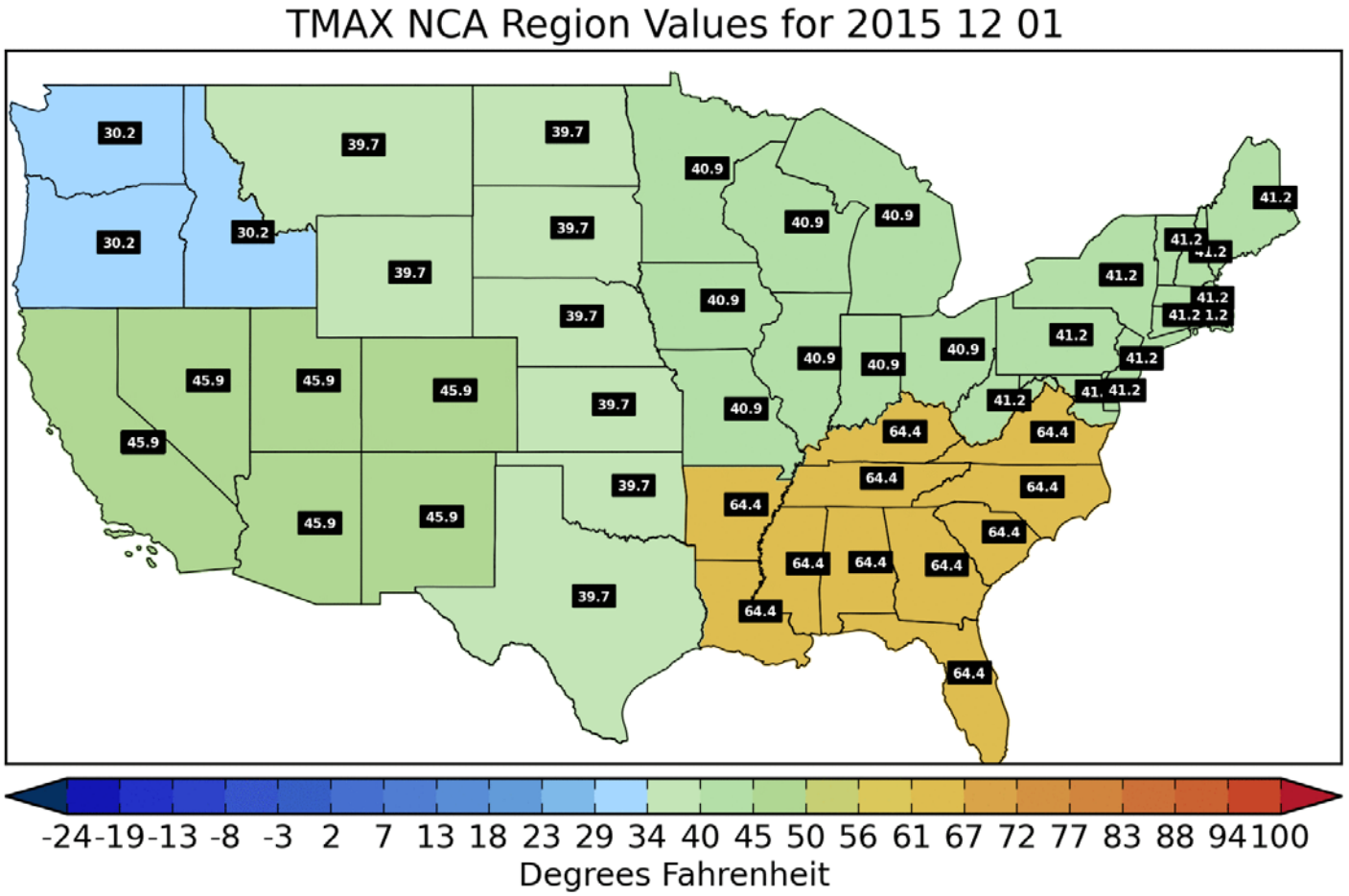
E-Mail: jared@cicsnc.org

Twitter: @jjrennie

Extra Slides

NCA Region Daily Max Temperature



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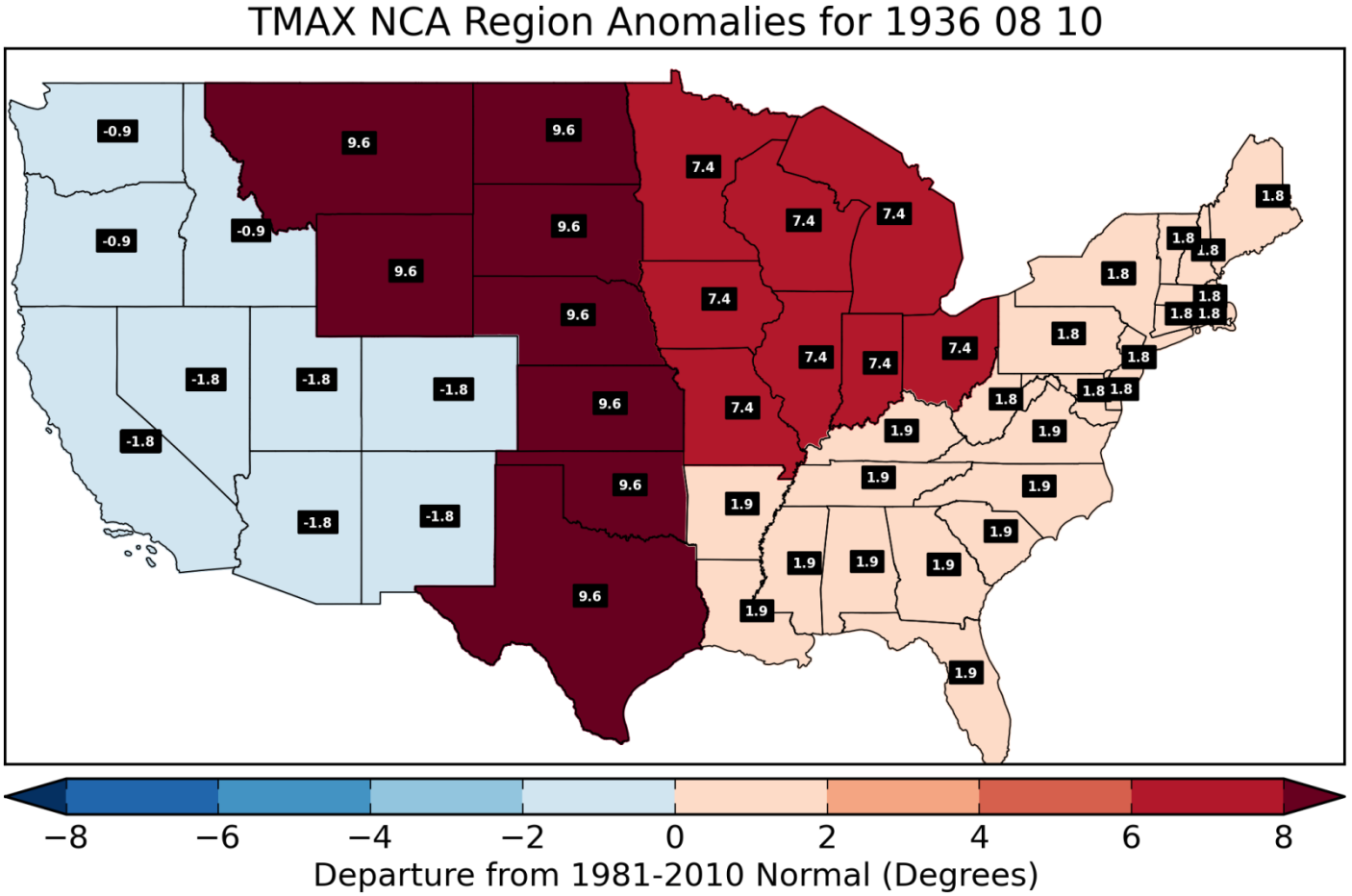
Archive Analysis



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