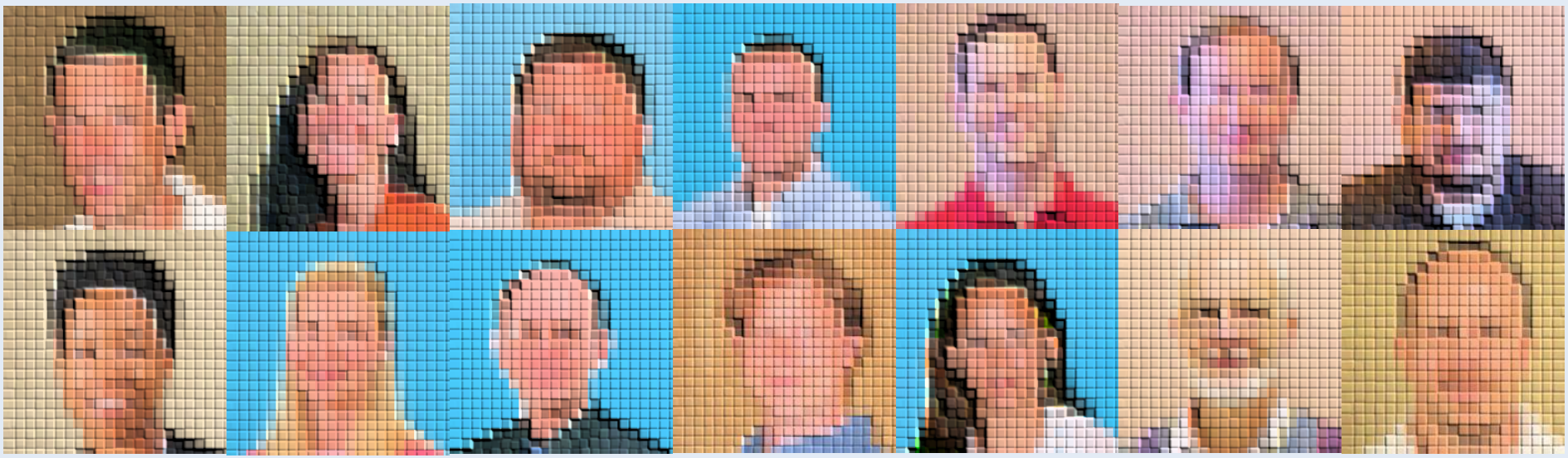
CDRs as Indicators for Monitoring & Assessment

Deke Arndt
National Climatic Data Center
Climate Monitoring Branch
July 2013

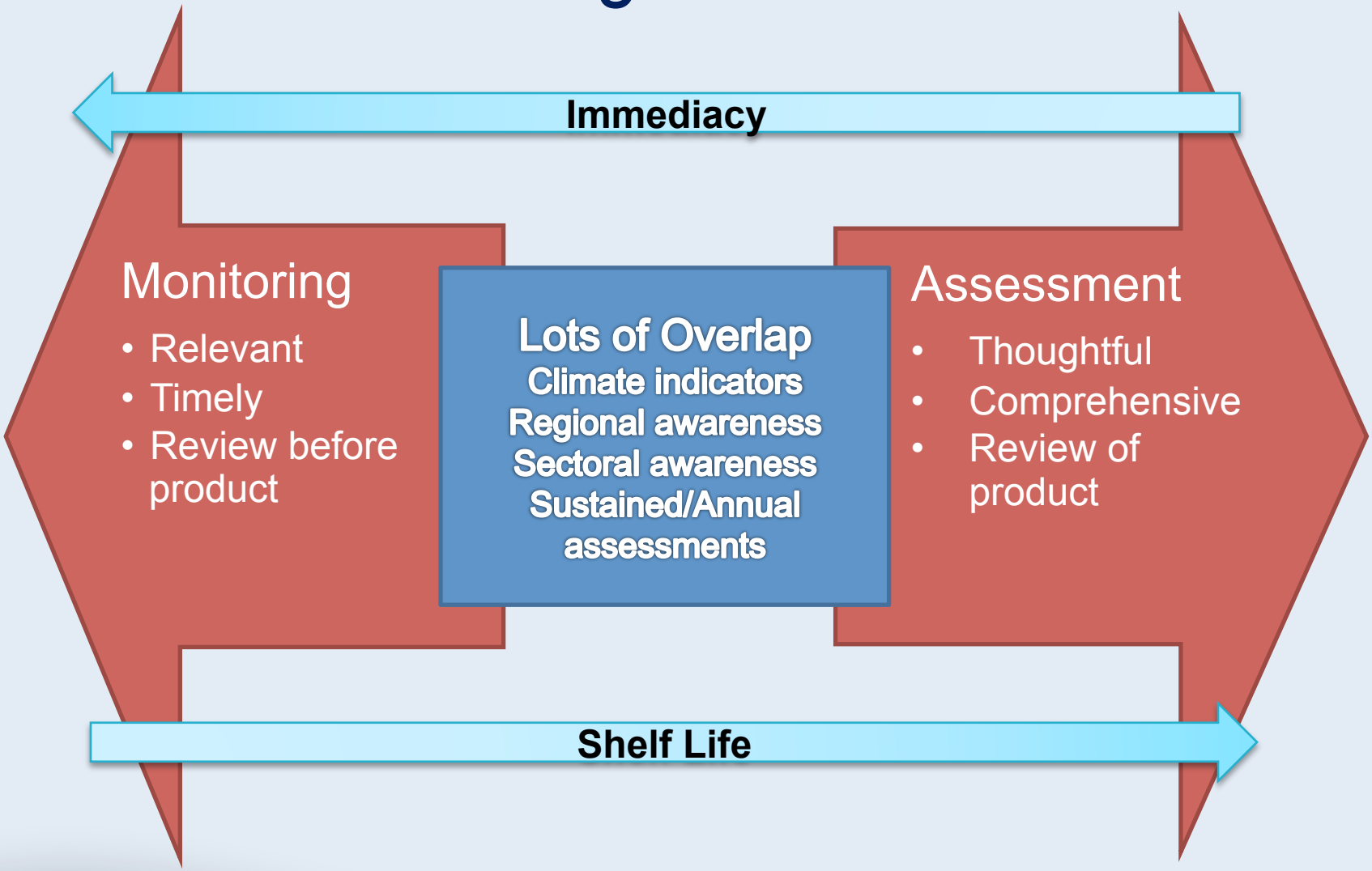
Protecting the past... Revealing the future

NCDC Climate Monitoring Branch



- A unit within NCDC's Services Division
- Home of "State of the Climate" leads
- Home of drought.gov
- A conduit for NCDC "operational scale" information and analyses

Climate Monitoring & Assessment

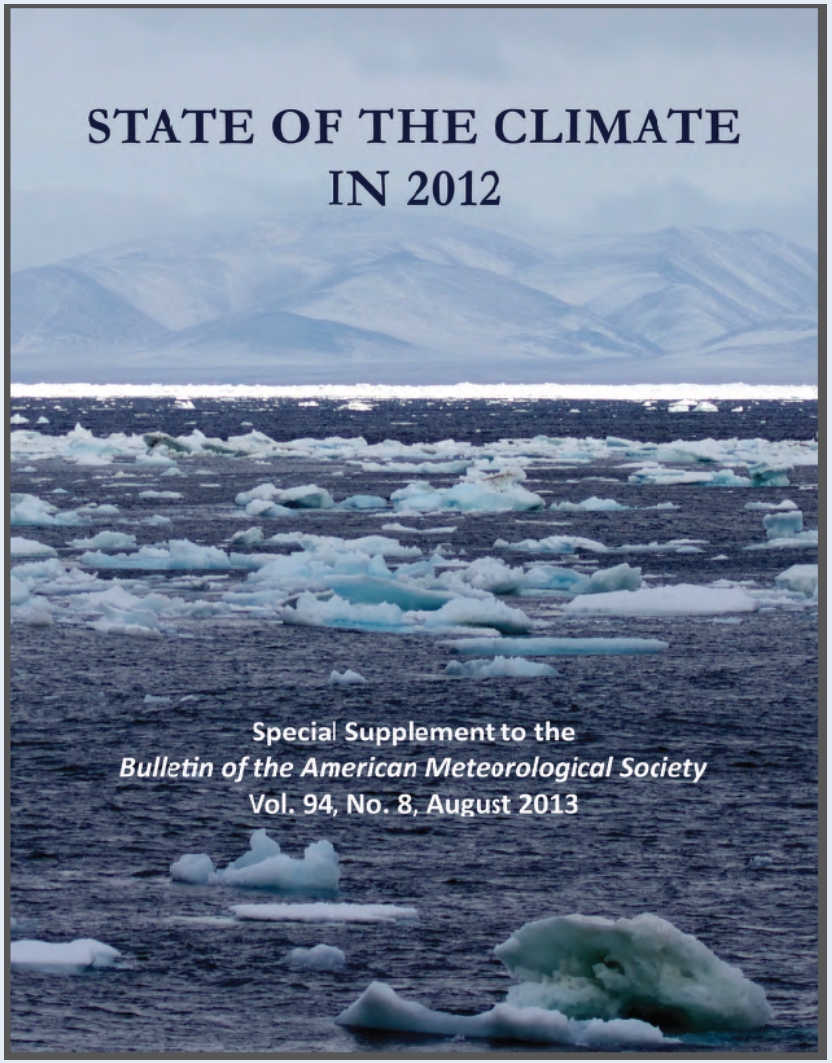


Scale of Scales relevant to Assessment

- “Science”
- IPCC
- National Climate Assessment
- “Sustained Assessments”
- **BAMS State of the Climate**
- **Periodic “operational” state of the climate assessments**
- Occasional Analyses

BAMS: State of the Climate in 2012

- Several CDRs in the doc
  - Sea Ice Extent; Mean-Layer Temperature; SST
- Can add more CDRs as they become operational or known to us, if they enhance the doc
- Data generally "due" late January
- ***New authors welcome …***



BAMS: State of the Climate in 2012

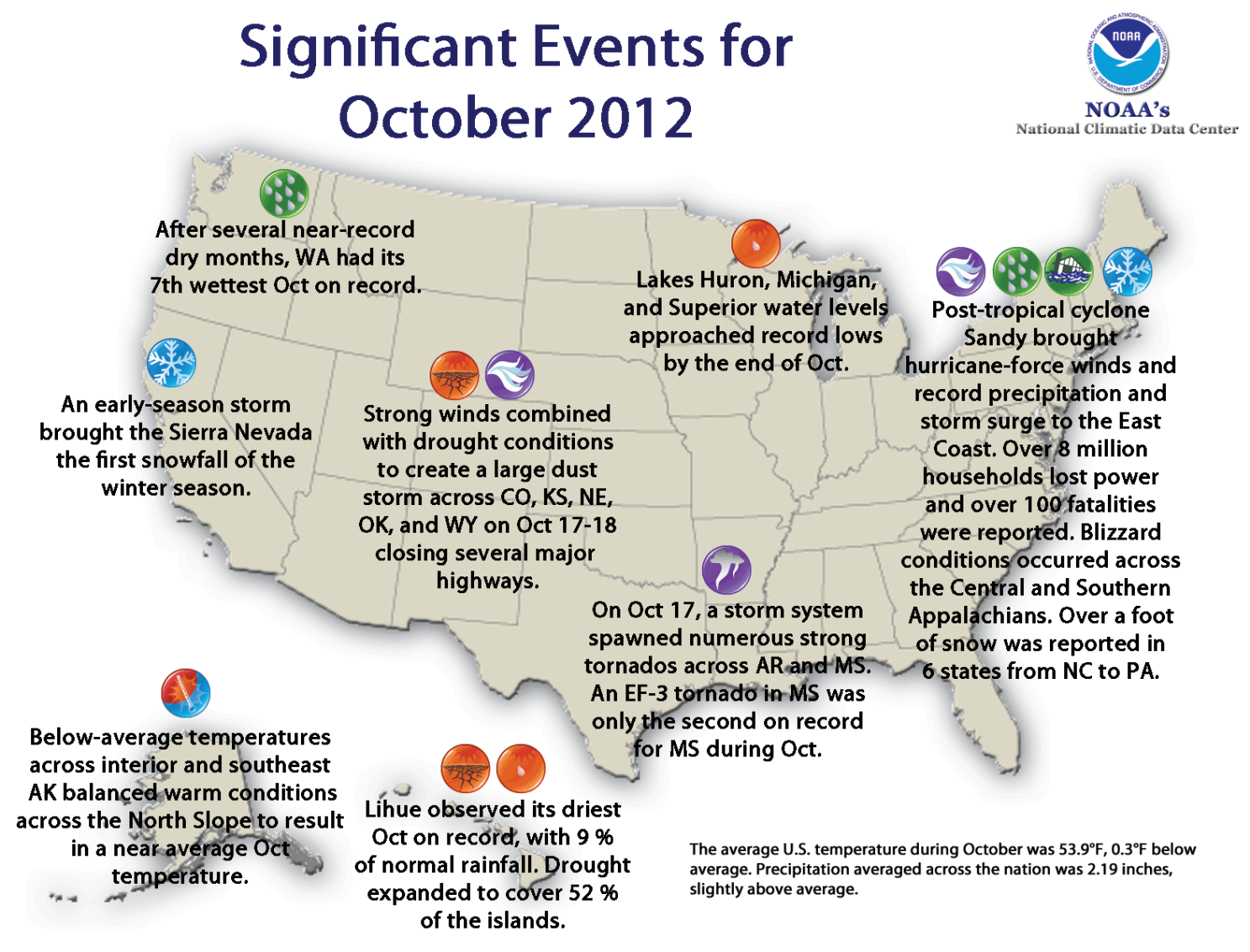
- Lead: Jessica Blunden (NOAA/NCDC, ERT Inc.)
- Chapter Eds.:
  - Kate Willett, [UK] MetOffice – "Global Climate"
  - Brad Hall, NOAA/ESRL – Atmospheric Composition
  - Han Dolman, Univ. Amsterdam – Terrestrial
  - Michele Newlin / Margarita Gregg, NOAA/NODC – Global Ocean

Climate Monitoring

- Mission: monitor and assess the state of the climate
  - Document
  - Describe
  - Differentiate
  - Understand & Anticipate

Regular + Reliable + Ready = Relevant

Event Summaries



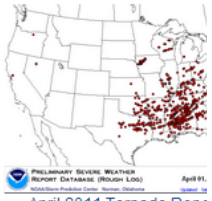
Event Summaries

Spring 2011 "Crazy Spring" Event Summary

Introduction | Tornadoes | Flooding | Drought and Wildfire | Synopsis

Introduction

The spring (March-May) the United States. Torna and each of these extren history. While similar ext occurred in a single mon April alone, and the confi May 2003. Record rainfa caused record flooding a of 1927 and 1937. Above conditions the first five m of acres of land burned. Exceptional [D3-D4] drou



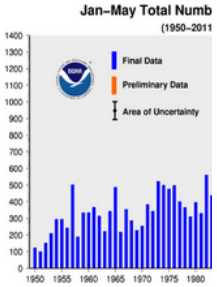
April 2011 Tornado Repo

Southern Plains.

Across the Upper Midwe during late March througl record river crests along

Tornadoes

The period through the en record-breaking tornado y January-May period, acco month of April alone.

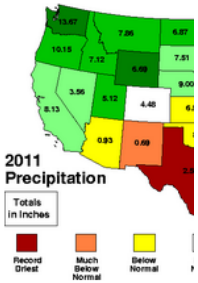


Tornado activity during Ap were 751 tornadoes durin tornadoes (May 2003). Th average for number of Ap tornado outbreaks, mostly in the State of the Climate

Environmental Con

During the month of April, weather across the easte systems to interact with G nation. During April, sever dynamic forcing that allow along and ahead of these thunderstorms, causing th cold fronts and surface lo moist air to surge northwa

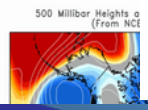
Flooding



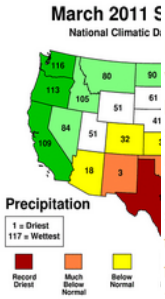
Spring 2011 Statewid

acres of farmland from water for weeks.

The Lower Mississippi Ohio and Upper Missis the U.S. Army Corps of the 35,000 square mile massive flood overwhe 1927, the Army Corps earthen levees, floodwa Mississippi, Arkansas, has been tested over th when extremely wet co historical levels. In 201 unprecedented flooding rivers.



Drought and Wildfi



March Statewi

During March and Apri Texas, and New Mexic off the Southern Plains with the upper level tro the region. The combi out-of-control wildfires to the record precipitat severe weather outbre

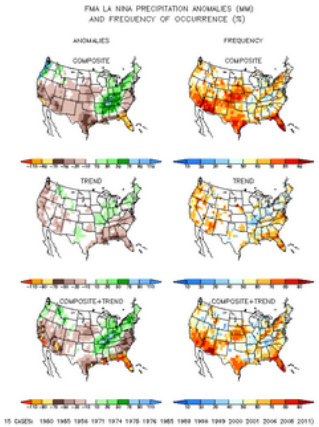
Environmental C

Starting in March, and pressure consistently essentially blocking st This led to Oklahoma March, and Texas to h brought continued dry New Mexico, and Texa

Synopsis

Large-Scale Drivers

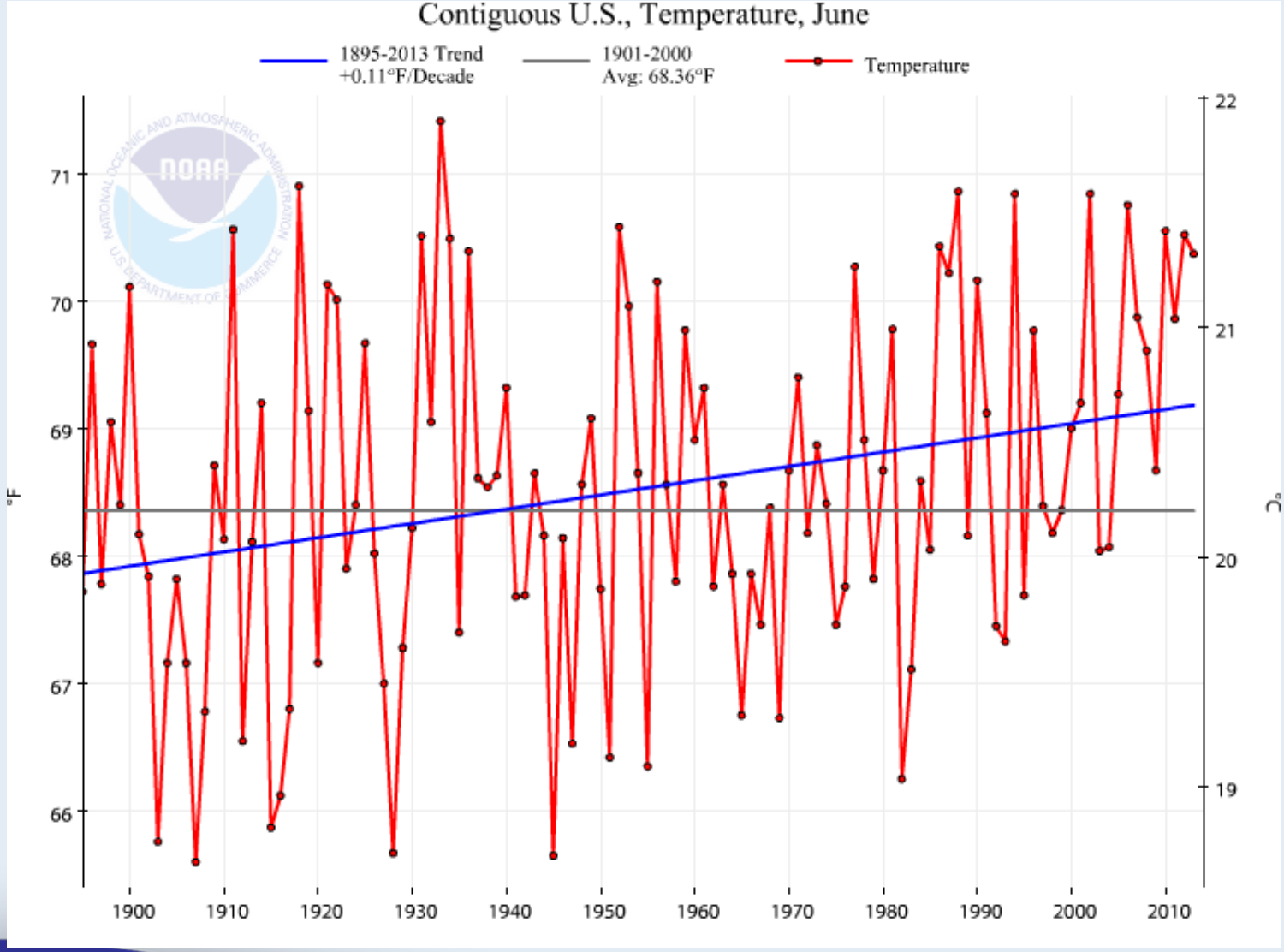
Large-scale climate and synoptic drivers played a role in the extreme weather events during April 2011, including the presence of La Niña, a persistent upper atmosphere storm track, and near historical sea surface temperatures across the Gulf of Mexico. Under a La Niña regime, an upper level ridge typically sets up across the southwestern U.S. and storms travel along the northern edge of the ridge and southward along the eastern side, bringing above-normal precipitation to the Canadian Border States and the Ohio Valley, but often blocks storms from entering the Southern Plains. This was the case during the 2010-2011 winter and into the spring, causing above-normal snowfall and snowpack across the Upper Midwest and parts of the Ohio River Valley. Once spring emerged across the region, the warm temperatures rapidly melted the snowpack, and combined with the continued above-average precipitation to cause rivers to swell. The limited storm activity across the Southern Plains and the Gulf Coast caused below-average precipitation during winter and spring across the region, and is consistent with expectations during La Niña. The nearly stationary ridge across the southwestern U.S. brought extremely dry and windy conditions to the Southern Plains during April. The windy conditions were reinforced by the active storm track to the north. When these storms intensified, wind speeds increased across New Mexico and Texas, causing rapid wildfire growth.



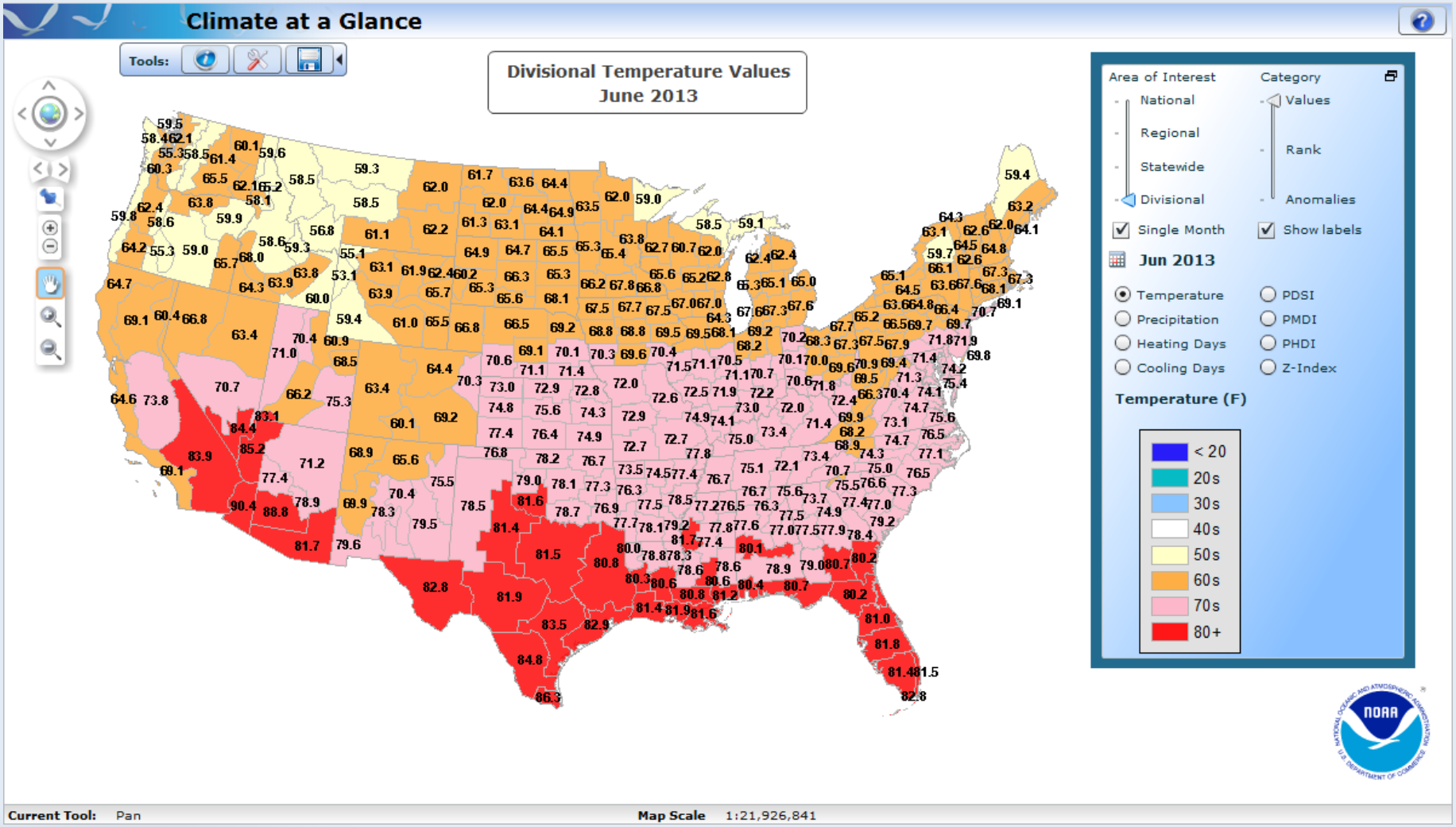
February-April La Niña Precipitation Composite Anomalies
Source: CPC

During spring, the seasonal re-emergence of warmer temperatures started across the southern regions of the U.S. and moved northward. During April, the boundary between the cooler air to the north and the warmer air to the south provided energy and dynamic forcing for storms to strengthen as they moved through the country. Ahead of these storm systems, warm southerly flow brought much-above-average temperatures and moisture from the Gulf of Mexico, where sea surface temperatures were about 1.0 °C (1.8 °F) above average. The above-average sea surface temperatures in the Gulf of Mexico contributed to above-average water vapor content in the atmosphere, increasing the amount of energy available for severe weather outbreaks. North of the temperature boundary, along the Ohio Valley, record precipitation fell, and to the southwest much-below-normal precipitation was observed. For the month of April, record statewide precipitation amounts fell in Indiana, Illinois, Kentucky, Ohio, Pennsylvania, and

Temporal Trend

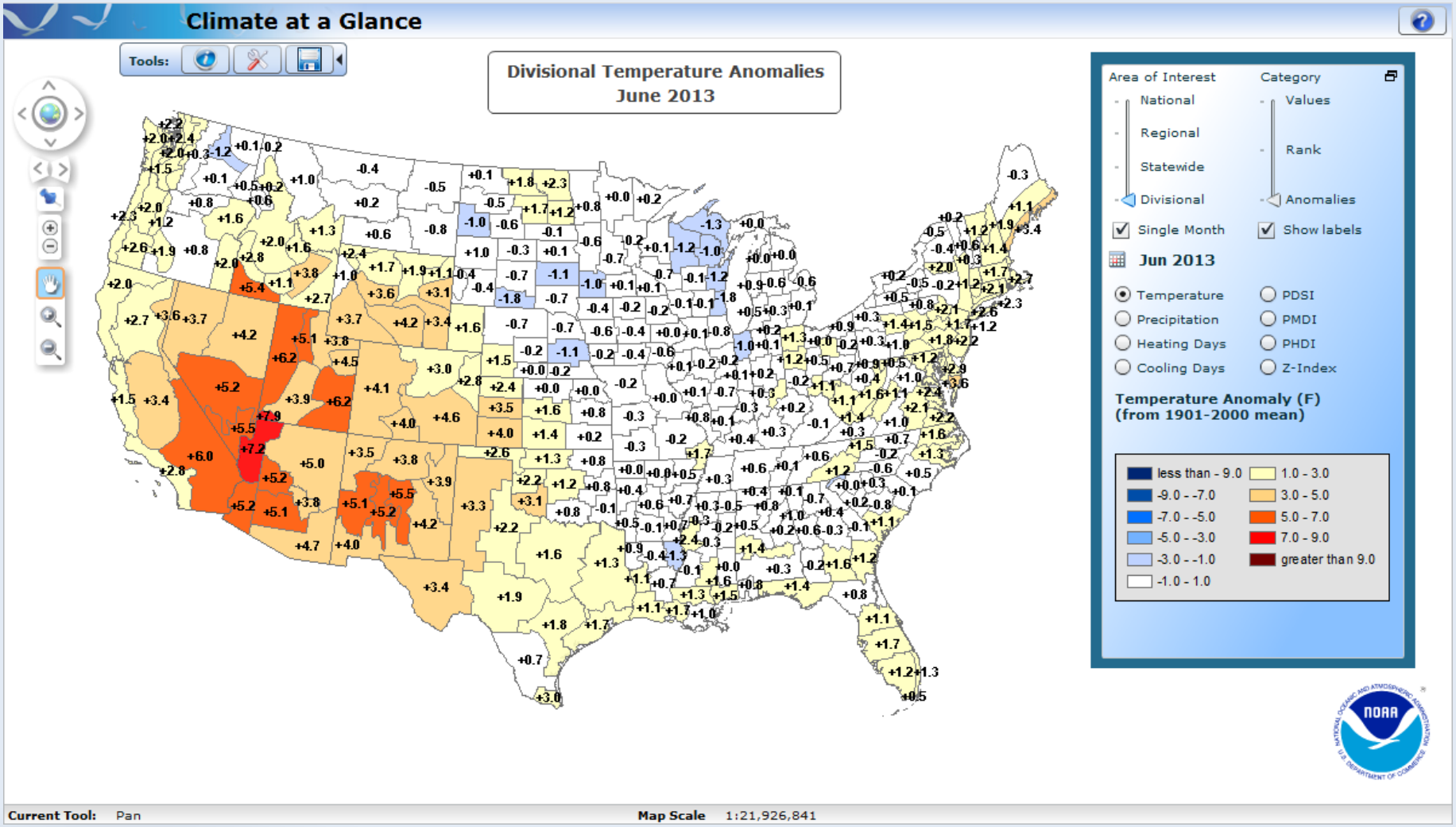


Absolutes

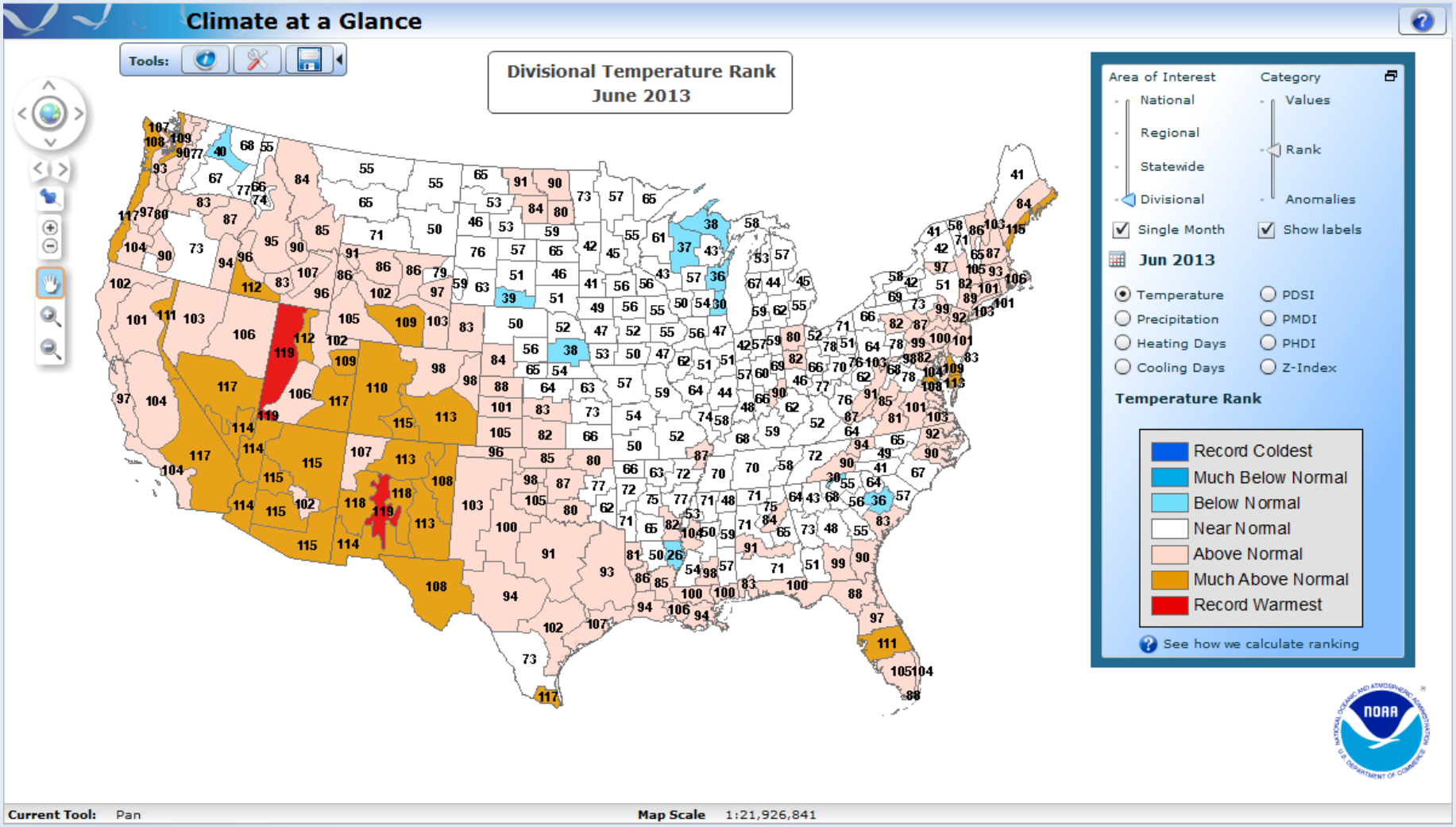


http://www.ncdc.noaa.gov/cag/

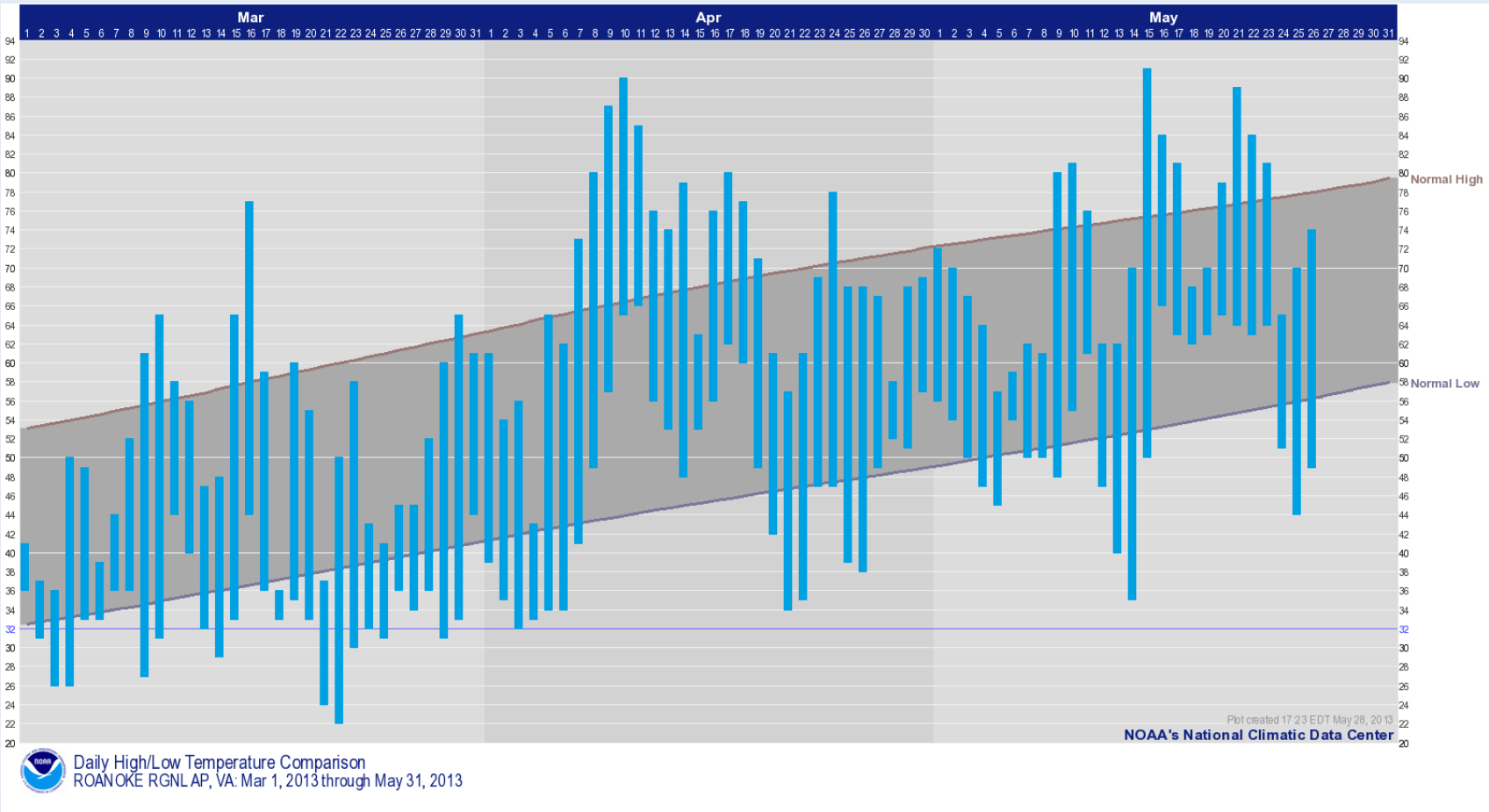
Anomalies


Climate at a Glance
Tools:
Divisional Temperature Anomalies
June 2013
Area of Interest
National
Regional
Statewide
Divisional
Category
Values
Rank
Anomalies
Single Month
Show labels
Jun 2013
Temperature
Precipitation
Heating Days
Cooling Days
PDSI
PMDI
PHDI
Z-Index
Temperature Anomaly (F)
(from 1901-2000 mean)
less than - 9.0
-9.0 - -7.0
-7.0 - -5.0
-5.0 - -3.0
-3.0 - -1.0
-1.0 - 1.0
1.0 - 3.0
3.0 - 5.0
5.0 - 7.0
7.0 - 9.0
greater than 9.0
Current Tool: Pan
Map Scale 1:21,926,841

Unusualness: Ranks

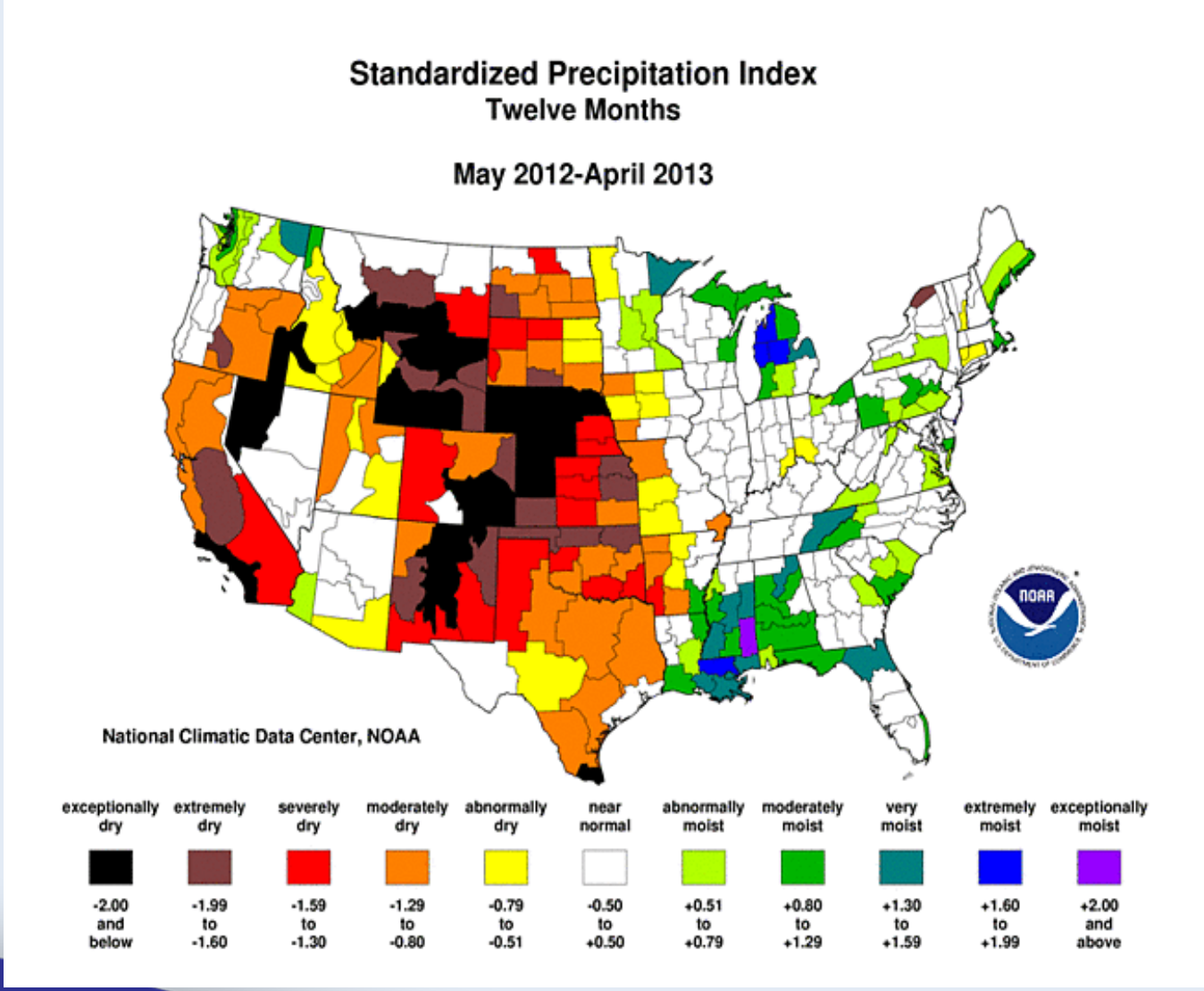


Variability within a scale/season

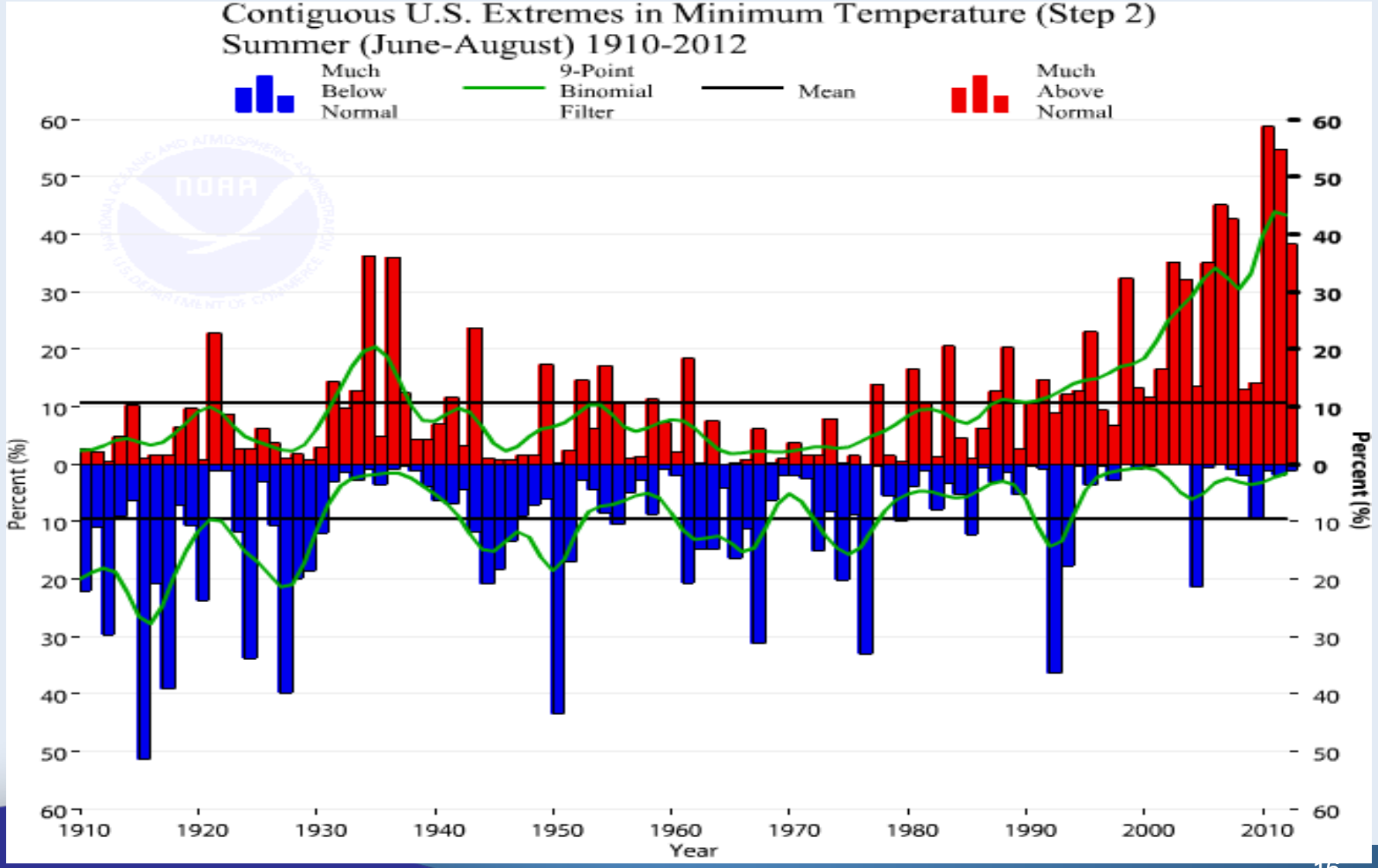


A “near normal” spring in Roanoke featured lots of ups and downs

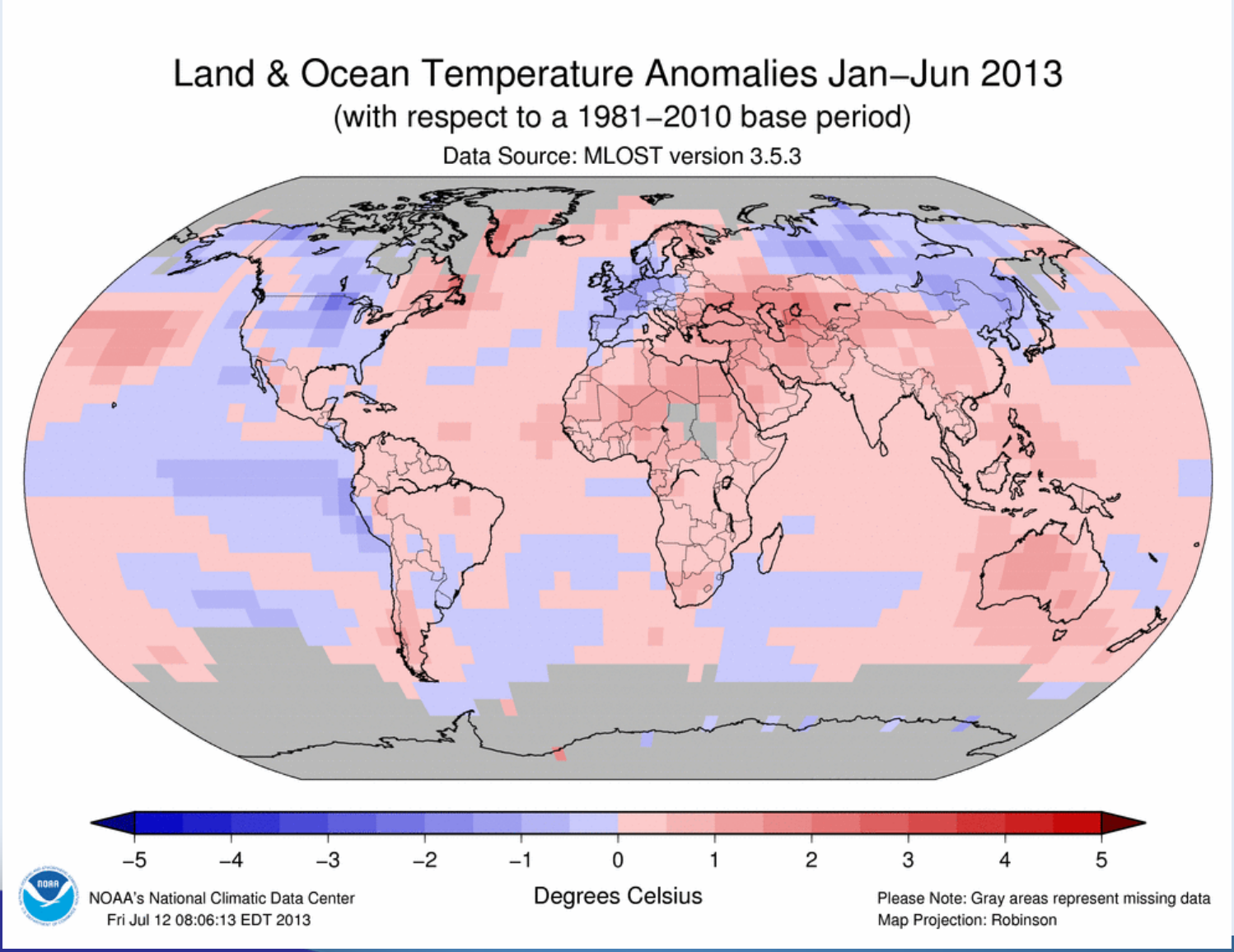
Unusualness: SPI



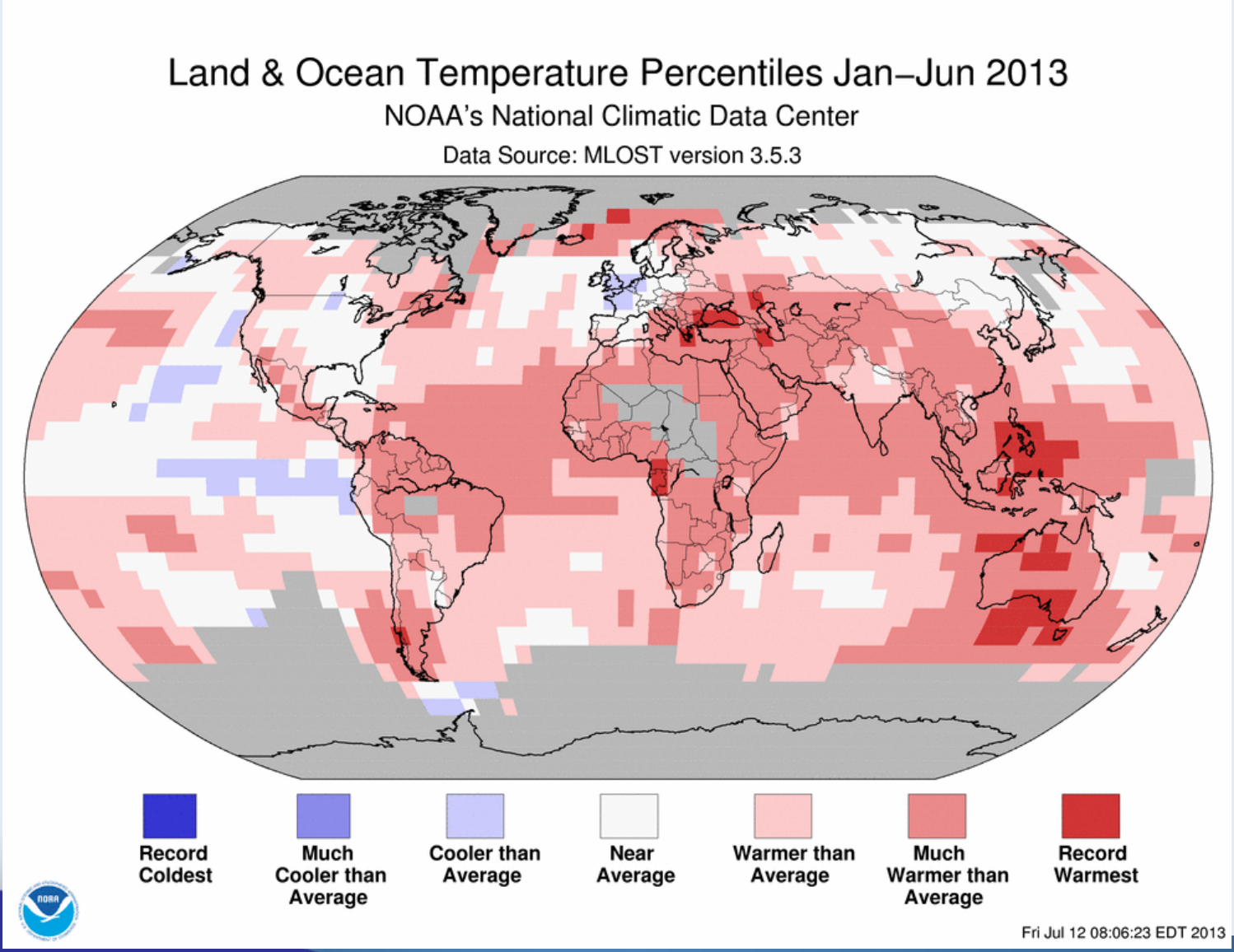
Develop Indices to Characterize Extremes



Global Sfc Temps: First ½ 2013



Global Sfc Temps: First ½ 2013



Aspects of a Monitoring Product

- **Latency**
  - how "real time" is it? 24 hours? 3 days?
- **Frequency**
  - how often is it updated? Daily? monthly? etc.
- **Utility**
  - is it broadly applicable (or more of a "designer" niche?)
- **Context**
  - absolute or anomaly data? What is the base period? Are these derivations? How stable are the relationships over a range of climate? In which situations does it thrive? In which situations should it defer to other analyses?
- **Resolution**
  - how detailed can/should we get with this?
- **Aggregability in space**
  - can we combine points/pixels into larger chunks (broad-brush) without violating some principles?
- **Aggregability in time**
  - can we combine time steps into larger chunks (broad-brush) without violating some principles?

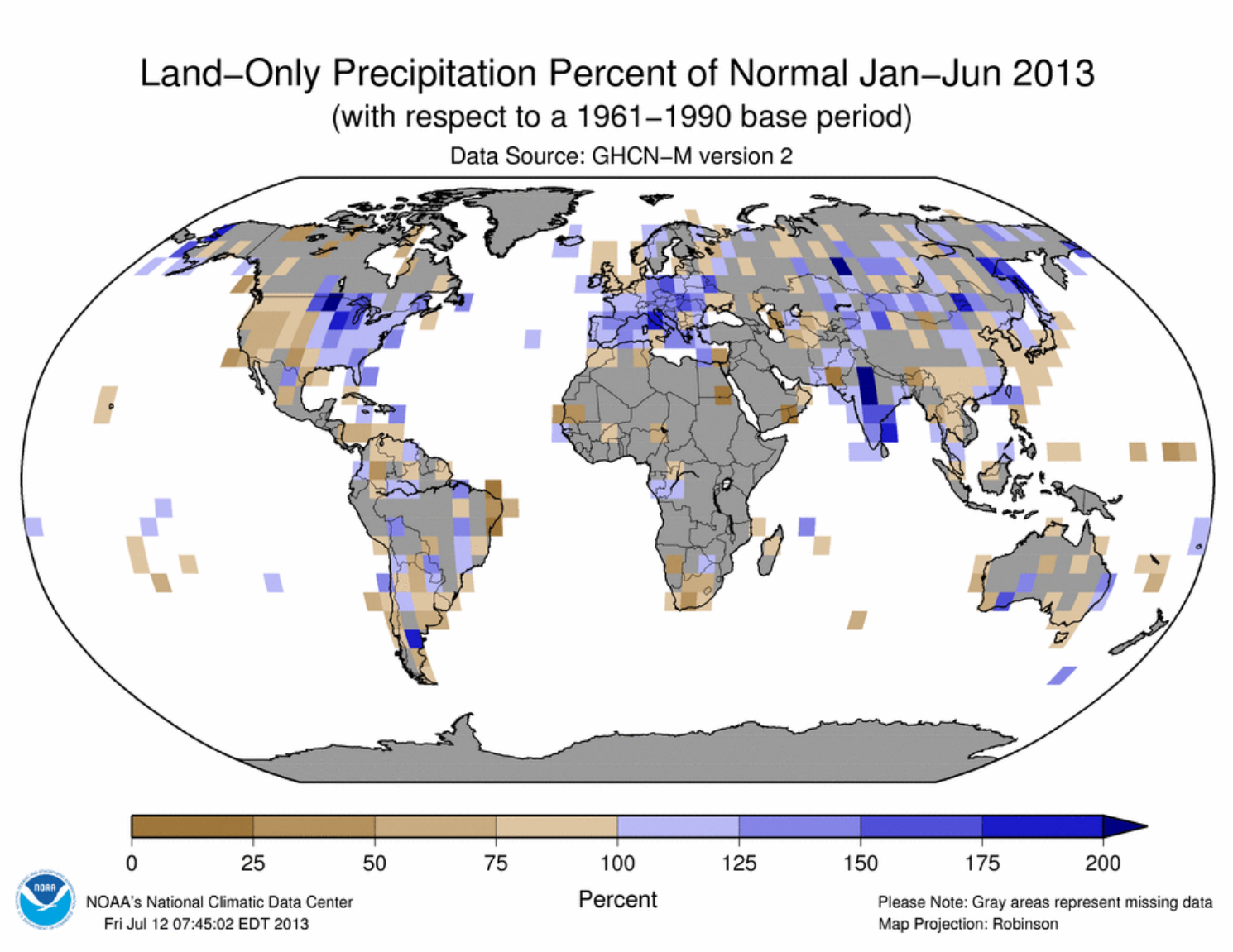
Unusualness: Records / Extremes

WARMEST COOLEST WETTEST DRIEST

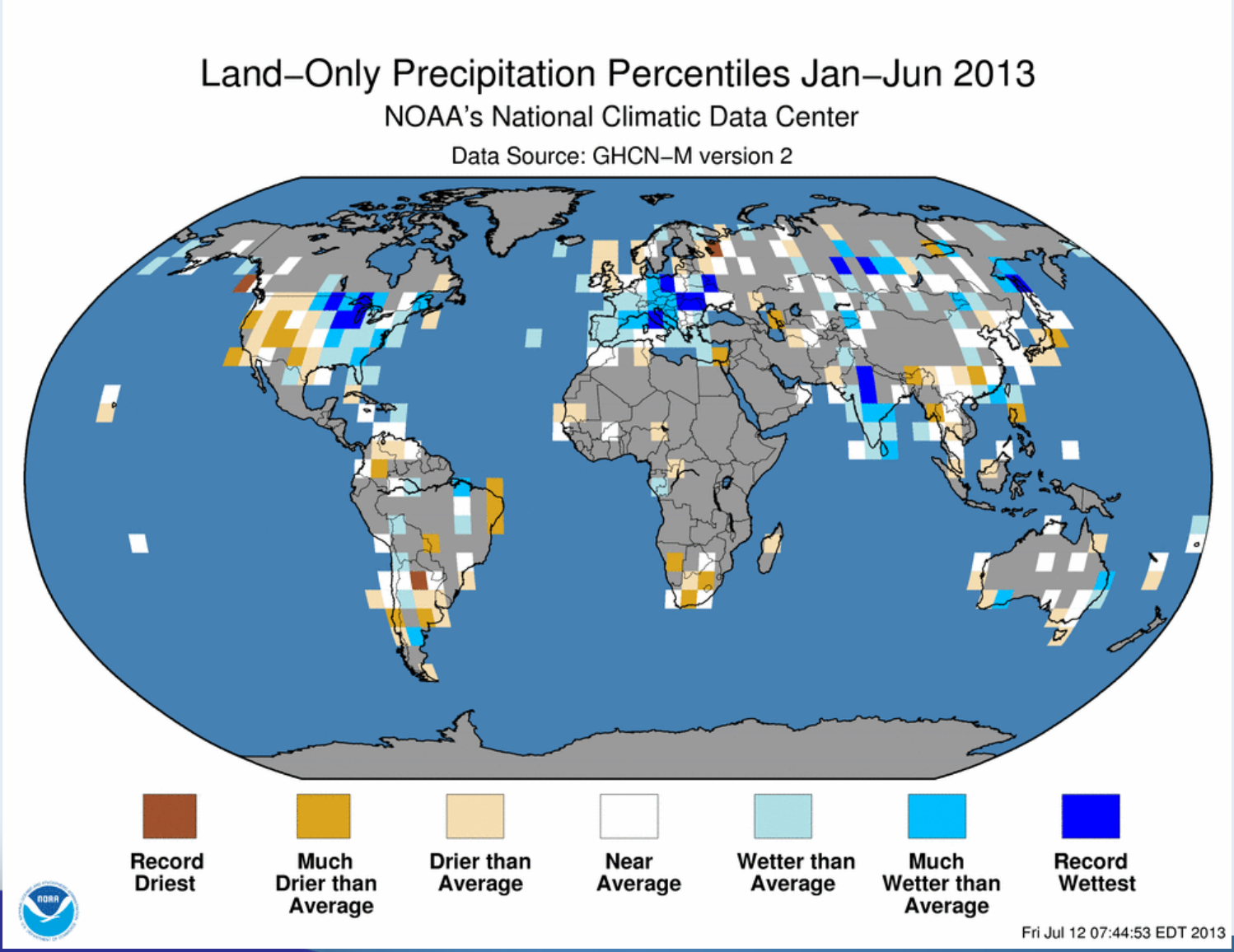
Mar 2010: MA NJ RI
Apr 2010: IL NJ CT RI ME
May 2010: LA
Jun 2010: DE LA* MD NC NJ RI VA IA MI
Jul 2010: DE RI
Aug 2010: FL* LA*
Sep 2010: NM MN
Oct 2010: FL
Dec 2010: FL GA NV UT
Apr 2011: IL IN KY NY OH PA WV
Jun 2011: LA TX NM
Jul 2011: OK TX
Aug 2011: AZ CO FL LA NM OK TX NH NJ NY VT
Sep 2011: OR PA
Mar 2012: CONUS AR CT GA IL IN IA KS KY MI MN MS MO NE NH NJ NY OH OK PA RI SC SD TN VT WV WI WY CO
Jun 2012: CO WY FL
Jul 2012: CONUS VA
Aug 2012: NV NE WA WY
Sep 2012: MN MT ND SD
Feb 2013: GA
Apr 2013: ND IA MI
May 2013: IA
Jun 2013: DE NJ UT

1Q 2010: FL ME NH* VT*
Spr 2010: CT* MA* ME MI* NH* NJ* NY* RI VT*
2Q 2010: CT DE LA MA ME MD NC NH NJ RI VA
Sum 2010: AL DE FL GA MD MS NC NJ RI SC TN VA WI
3Q 2010: FL MA WI
4Q 2010: NV FL
CY 2010: NH* RI* ND
Spr 2011: IN KY MT NY OH PA VT WA WV WY TX
2Q 2011: OR WA TX IN KY MI OH NM
Sum 2011: LA NM OK TX CT NJ TX
3Q 2011: NM TX MD NJ VT
Aut 2011: OH PA
4Q 2011: MA NH RI VT
CY 2011: CT IN KY NJ NY OH PA
1Q 2012: CONUS CT DE IA IL IN KS KY MA MI MN MO ND NH NJ NY OH OK PA RI SD TN VA VT WI WV CT
Spr 2012: CONUS AL AR CO CT DE GA IA IL IN KS KY LA MA MD MI MN MO MS NC NE NH NJ NY OH OK SC SD TN TX VA VT WI WV WY DE
2Q 2012: CO KS AR
Sum 2012: CO WY FL NE WY
3Q 2012: NV WY MS MT NE SD
Aut 2012: NV
CY 2012: CONUS CT DE IL KS MA MO NE NH NJ NM NY OH OK RI SD TX UT VT WY NE WY
1Q 2013: CA
Spr 2013: IA
2Q 2013: IA MI WI

Global Precipitation: First ½ 2013



Global Precipitation: First ½ 2013



How a Monitoring Product Succeeds

- It is timely
- It has appropriate resolution
- It lends itself well to notions of “unusualness”
- Its parts can be aggregated/composited with a straight face
- It is vetted, published, cited
- It has an available expert
- Its operational stewards know the product

Thank you

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Protecting the past... Revealing the future