

The Faucet: Informal Attribution of the May 2015 Record-Setting Texas Rains

John W. Nielsen-Gammon, Texas A&M University
Texas State Climatologist



TEXAS A&M
UNIVERSITY.

It's a drought!
No, wait, it's a flood!
No, wait, it's a drought again!
No, wait...it's...
How about them Aggies?

John W. Nielsen-Gammon, Texas A&M University
Texas State Climatologist



TEXAS A&M
UNIVERSITY.

U.S. Drought Monitor

Texas

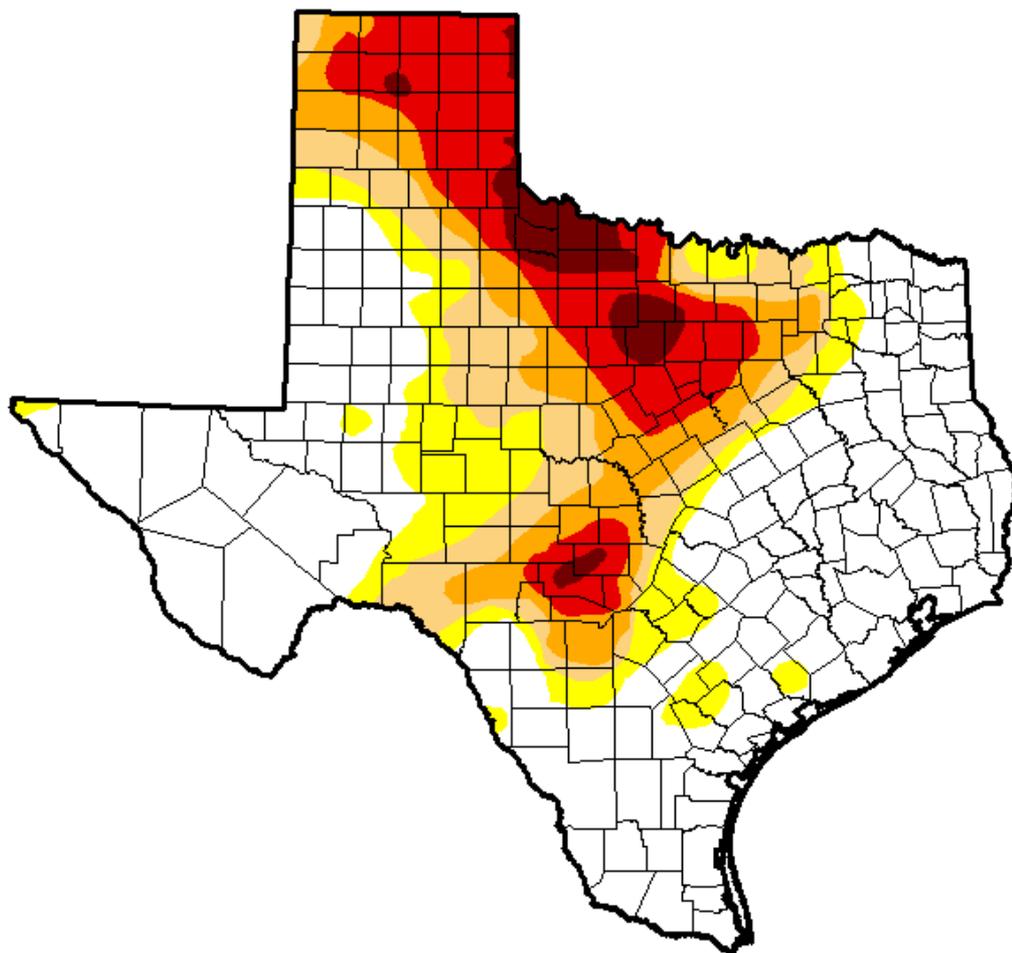
April 14, 2015

(Released Thursday, Apr. 16, 2015)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|--|-------|-------|-------|-------|-------|-------|
| Current | 52.88 | 47.12 | 35.25 | 24.65 | 14.91 | 3.34 |
| Last Week <i>4/7/2015</i> | 51.15 | 48.85 | 36.37 | 25.39 | 15.46 | 3.87 |
| 3 Months Ago <i>1/13/2015</i> | 39.80 | 60.20 | 40.34 | 23.49 | 11.03 | 2.90 |
| Start of Calendar Year <i>12/30/2014</i> | 34.37 | 65.63 | 44.68 | 25.73 | 11.70 | 3.17 |
| Start of Water Year <i>9/30/2014</i> | 28.92 | 71.08 | 48.95 | 29.54 | 11.26 | 2.69 |
| One Year Ago <i>4/15/2014</i> | 17.64 | 82.36 | 65.67 | 44.14 | 28.98 | 10.31 |



Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Michael Brewer
NCDC/NOAA



U.S. Drought Monitor

Texas

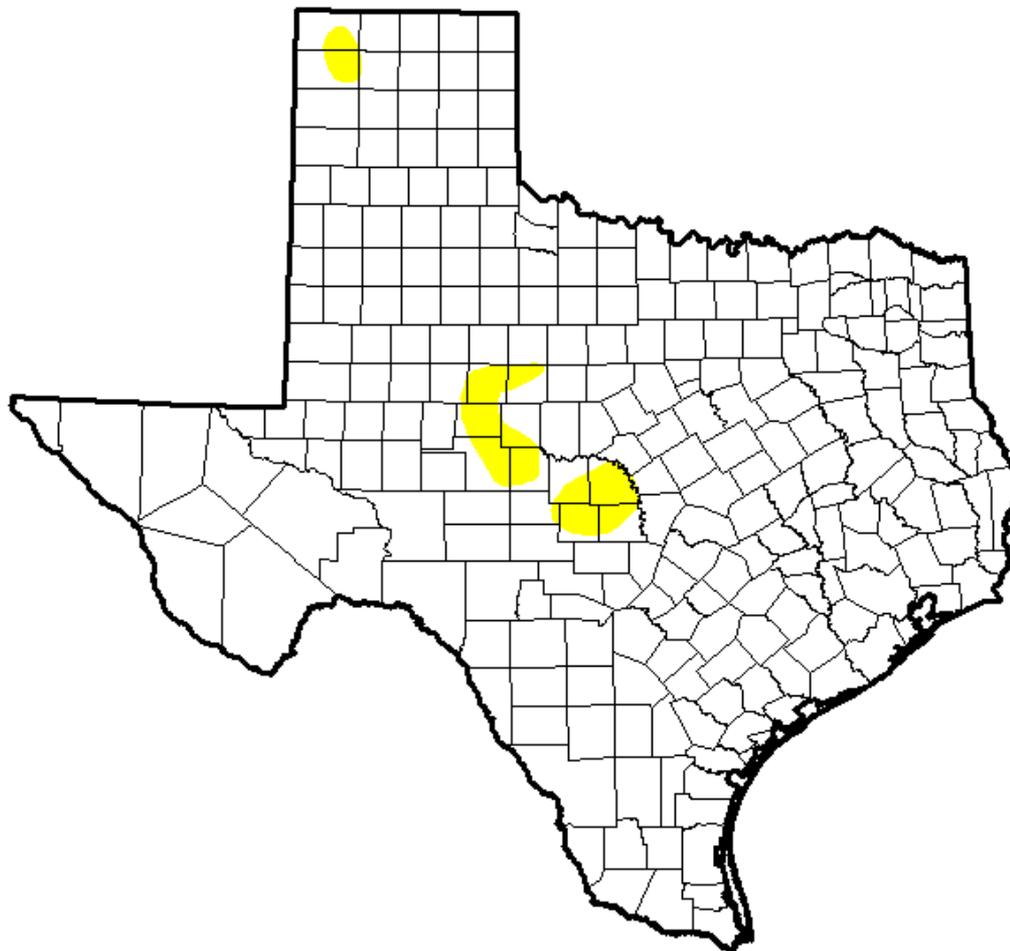
July 14, 2015

(Released Thursday, Jul. 16, 2015)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|--|-------|-------|-------|-------|-------|------|
| Current | 97.16 | 2.84 | 0.00 | 0.00 | 0.00 | 0.00 |
| Last Week <i>7/7/2015</i> | 95.37 | 4.63 | 0.25 | 0.00 | 0.00 | 0.00 |
| 3 Months Ago <i>4/14/2015</i> | 52.88 | 47.12 | 35.25 | 24.65 | 14.91 | 3.34 |
| Start of Calendar Year <i>12/30/2014</i> | 34.37 | 65.63 | 44.68 | 25.73 | 11.70 | 3.17 |
| Start of Water Year <i>9/30/2014</i> | 28.92 | 71.08 | 48.95 | 29.54 | 11.26 | 2.69 |
| One Year Ago <i>7/15/2014</i> | 12.72 | 87.28 | 63.36 | 36.80 | 18.36 | 3.77 |



Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

David Simeral

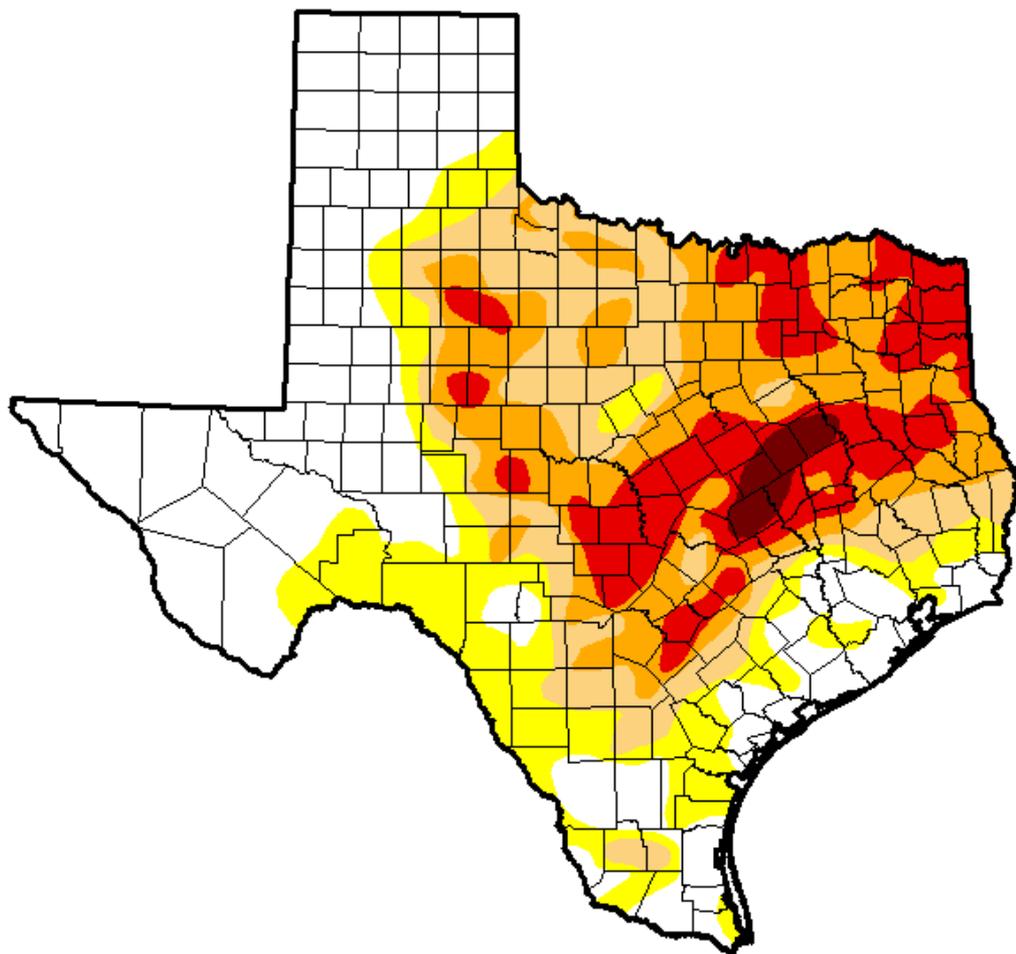
Western Regional Climate Center



U.S. Drought Monitor

Texas

October 13, 2015
 (Released Thursday, Oct. 15, 2015)
 Valid 8 a.m. EDT



Drought Conditions (Percent Area)

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|--|-------|-------|-------|-------|-------|------|
| Current | 36.47 | 63.53 | 47.03 | 31.88 | 13.89 | 1.42 |
| Last Week <i>10/6/2015</i> | 29.70 | 70.30 | 48.43 | 24.66 | 10.17 | 0.00 |
| 3 Months Ago <i>7/14/2015</i> | 97.16 | 2.84 | 0.00 | 0.00 | 0.00 | 0.00 |
| Start of Calendar Year <i>12/30/2014</i> | 34.37 | 65.63 | 44.68 | 25.73 | 11.70 | 3.17 |
| Start of Water Year <i>9/29/2015</i> | 34.51 | 65.49 | 38.32 | 17.55 | 6.27 | 0.00 |
| One Year Ago <i>10/14/2014</i> | 30.96 | 69.04 | 48.42 | 27.50 | 10.97 | 2.88 |

Intensity:

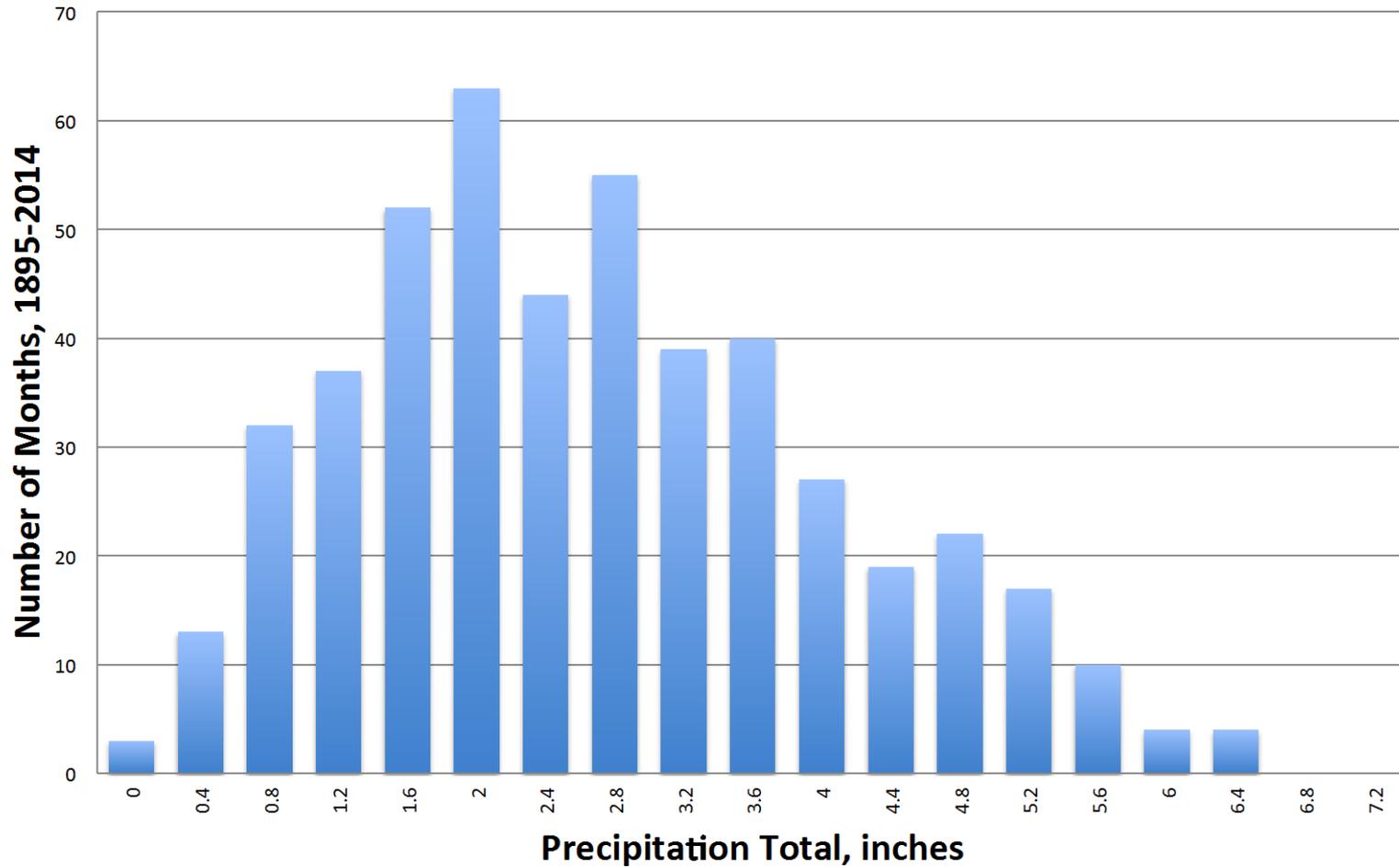
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

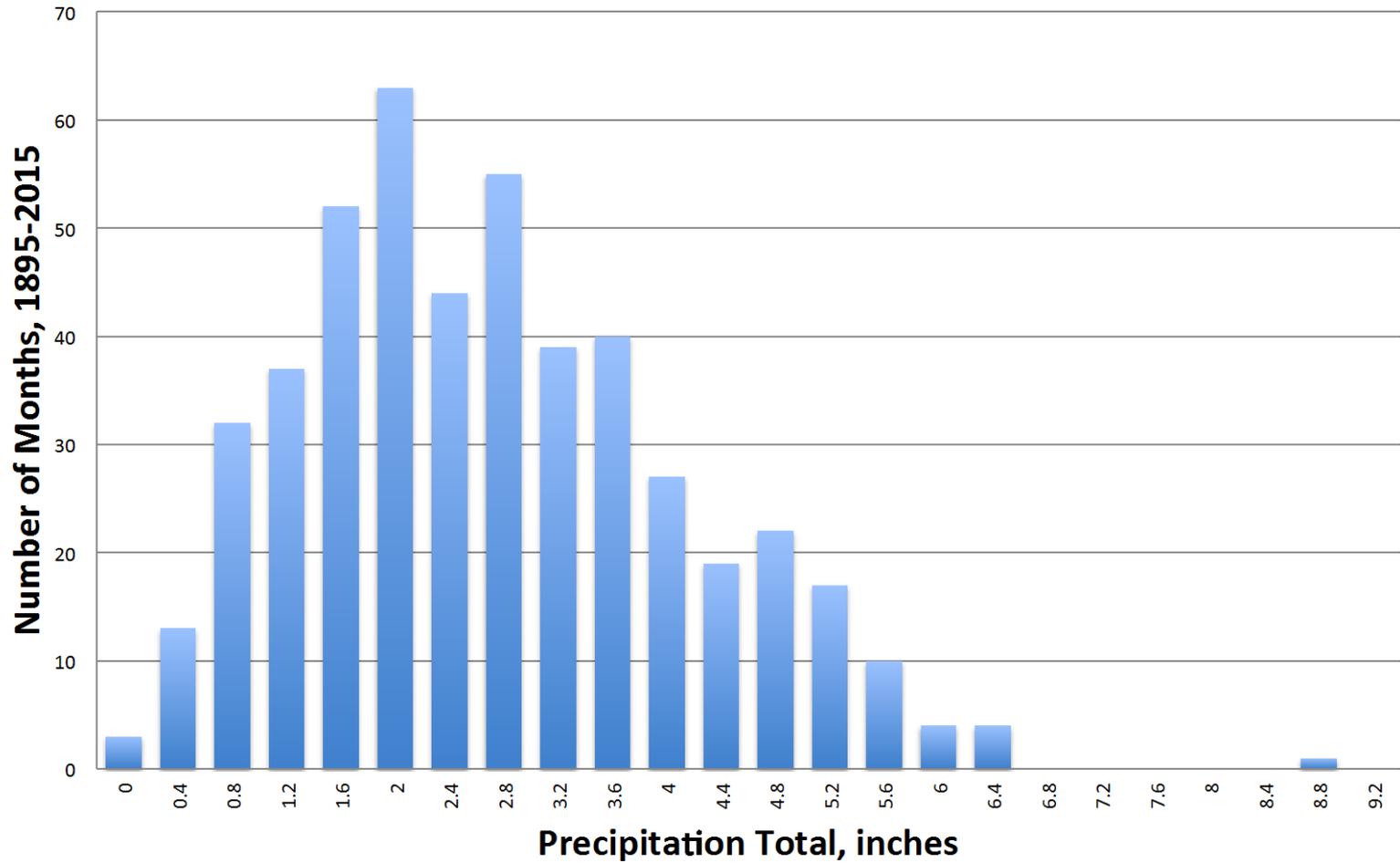
Author:
 David Miskus
 NOAA/NWS/NCEP/CPC



Texas Monthly Precipitation, May/June/September/October

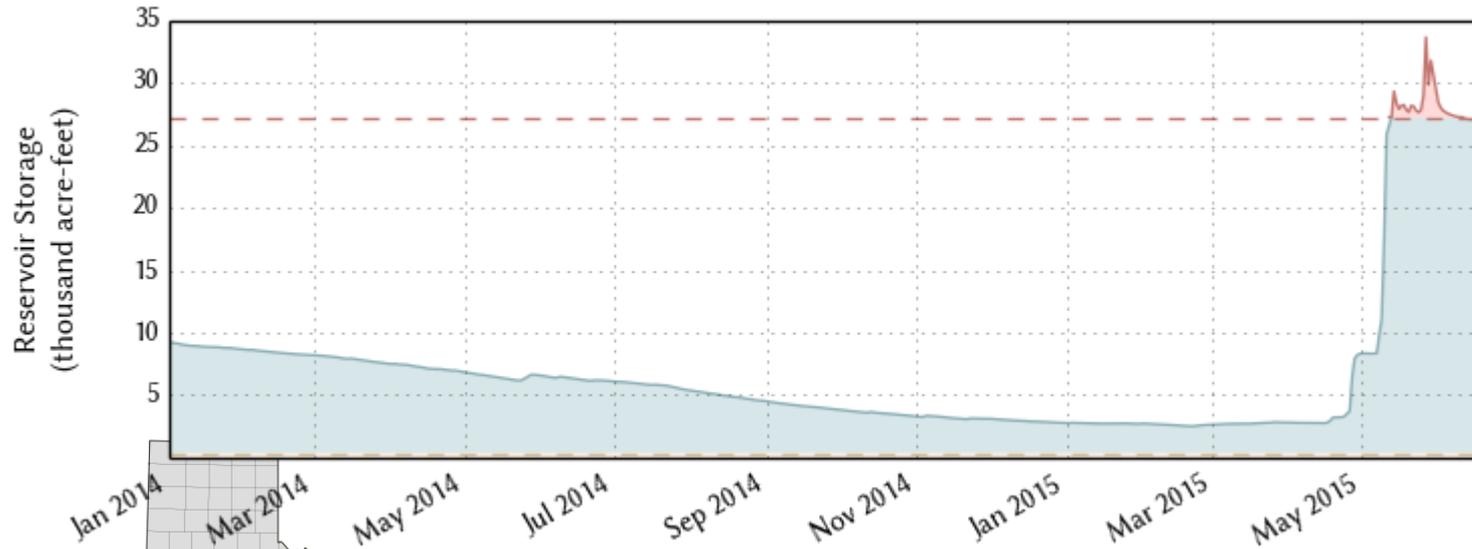


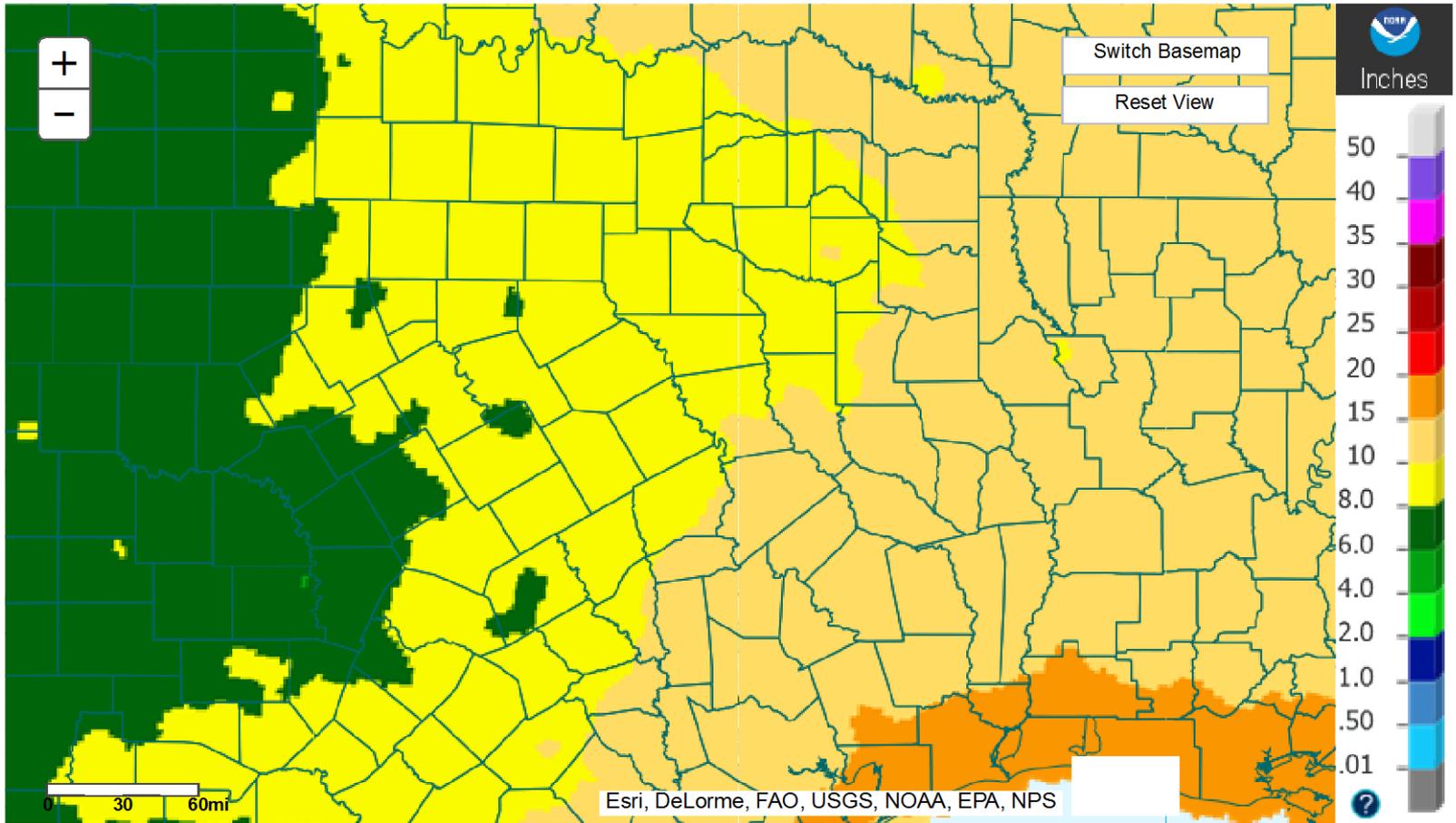
Texas Monthly Precipitation, May/June/September/October



Palo Pinto Reservoir

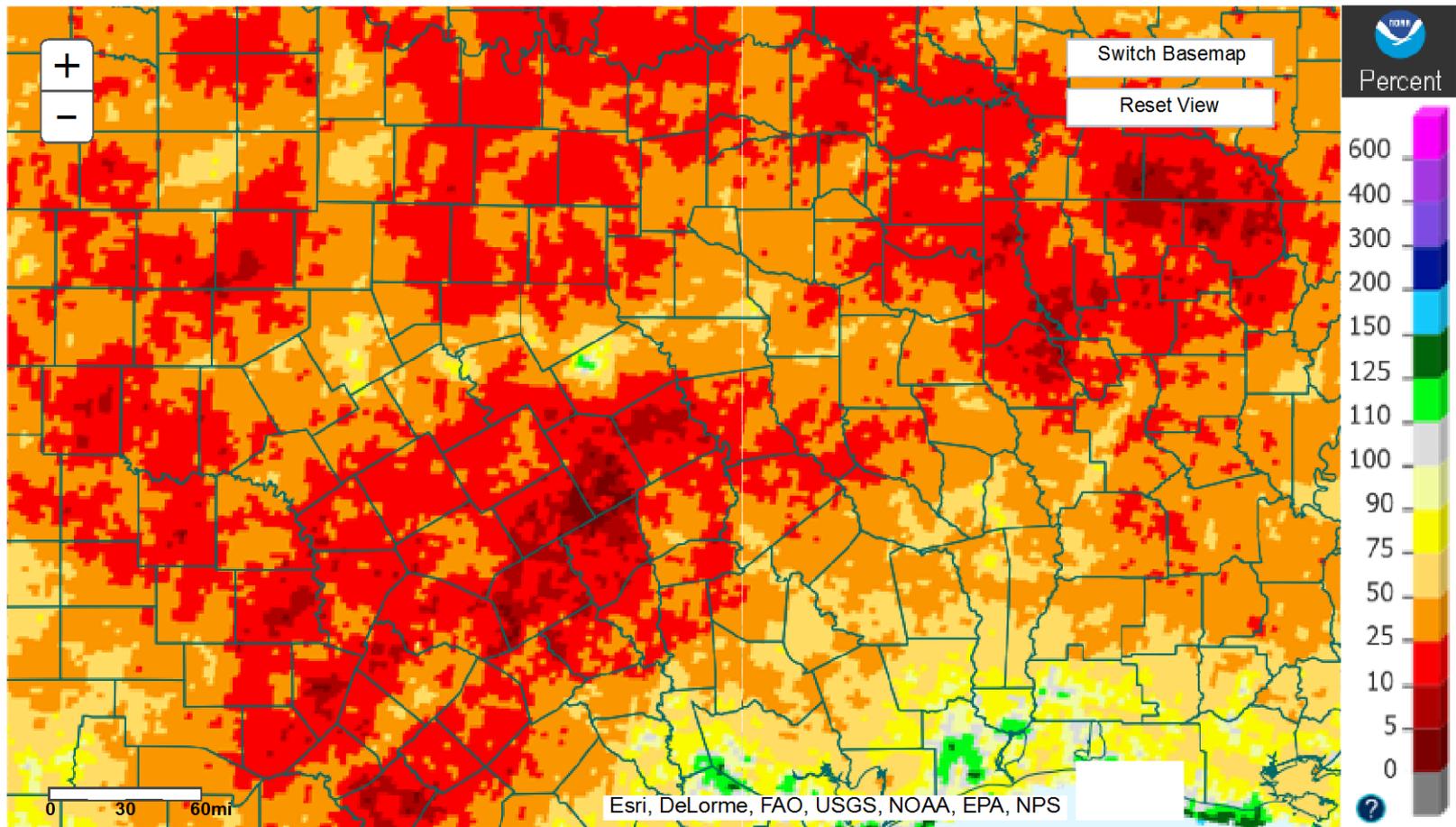
Dead Pool Conservation Pool Flood Pool





Displaying Last 90-Day Normal Precipitation
Valid on: October 21, 2015 12:00 UTC
What is UTC time? Map Help

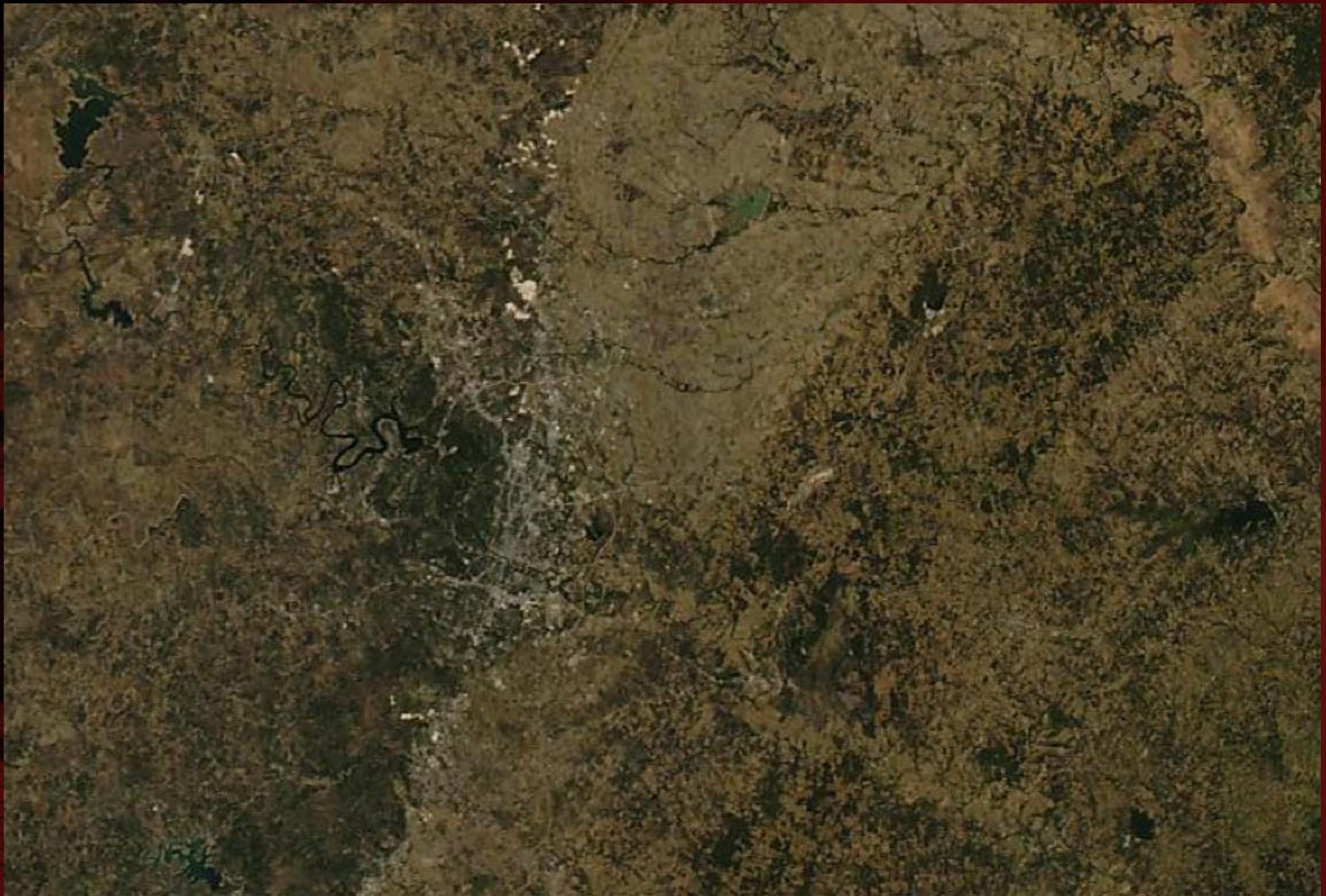




Displaying Last 90-Day Percent of Normal Precipitation
Valid on: October 21, 2015 12:00 UTC
What is UTC time? Map Help







The Faucet

- Climate change's thermodynamic impact: the size of the pipe
- Climate change's dynamic impact: turning the handle



The Faucet

- The size of the pipe matters most when the faucet is wide open
- Where there were times during May 2015 when the faucet was wide open?

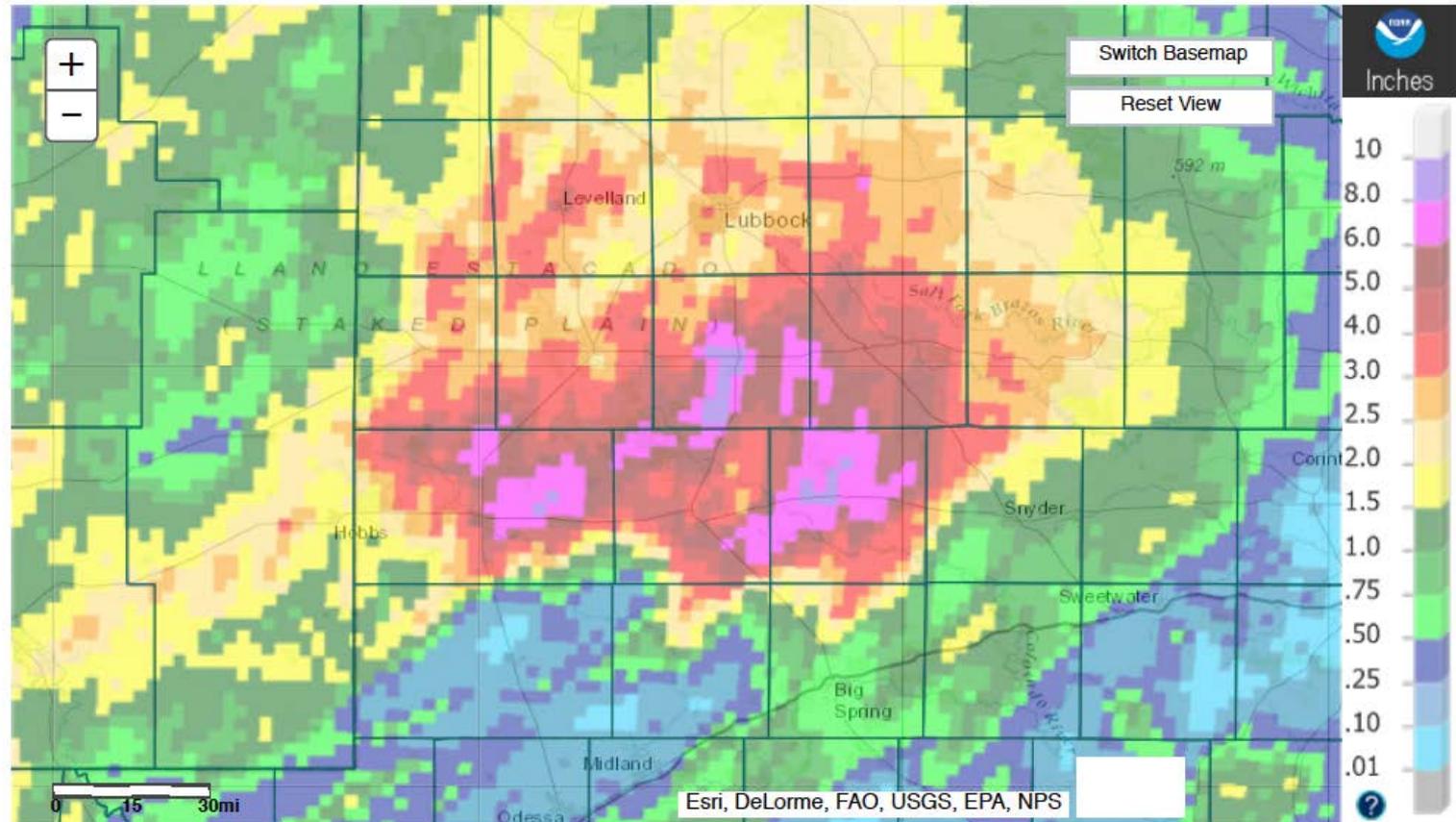
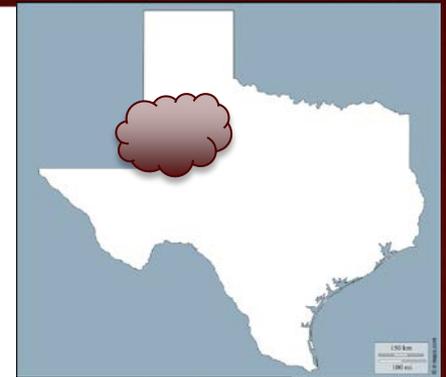


The Faucet

- The size of the pipe matters most when the faucet is wide open
- Where there times during May 2015 when the faucet was wide open?
- Answer: 17 times



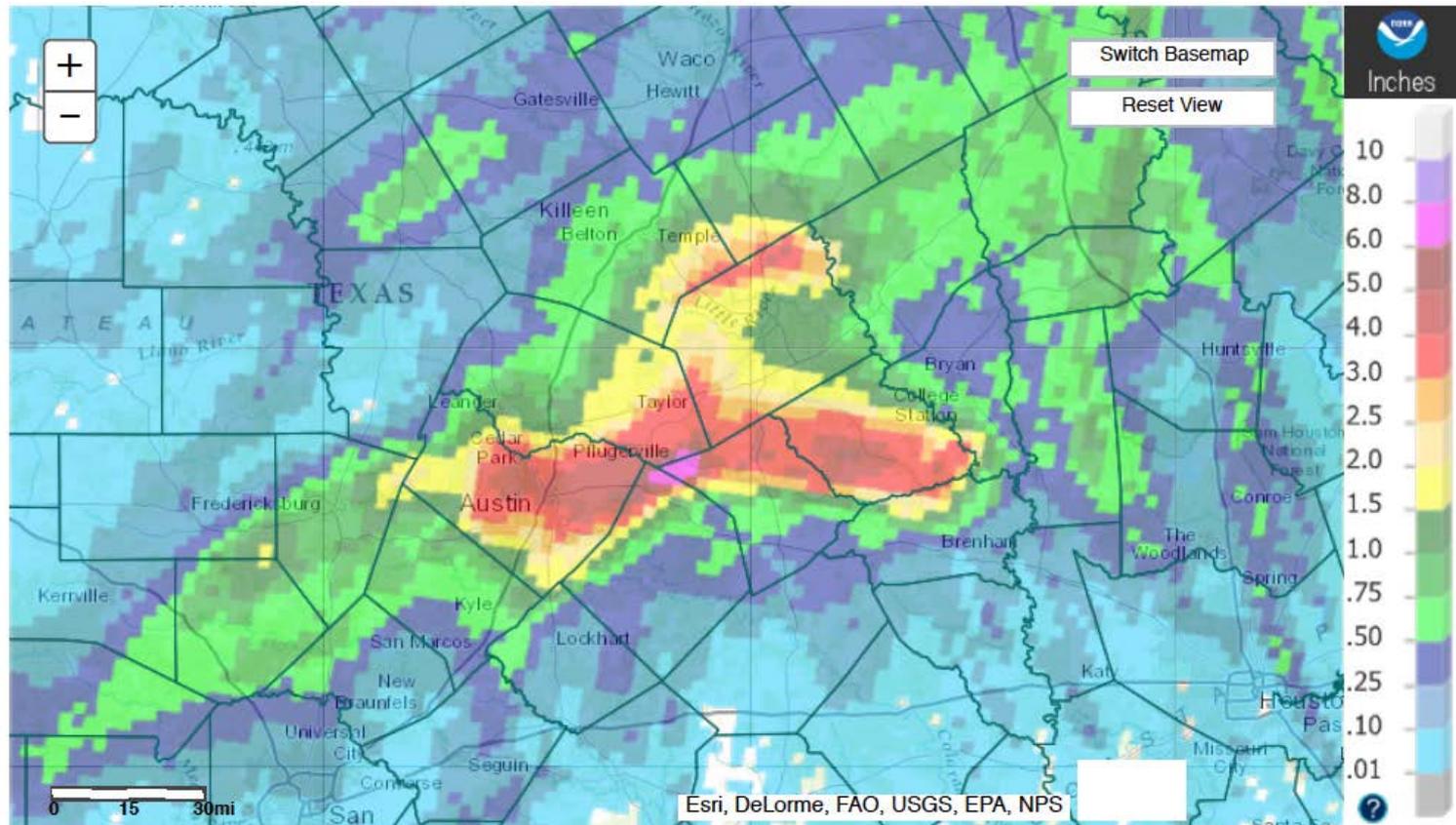
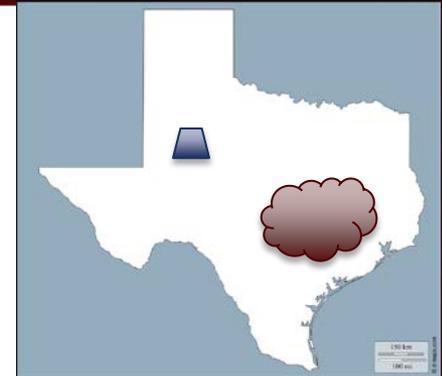
9.10" Tahoka (COOP) [300yr]



Displaying May 05, 2015 1-Day Observed Precipitation
Valid on: May 05, 2015 12:00 UTC



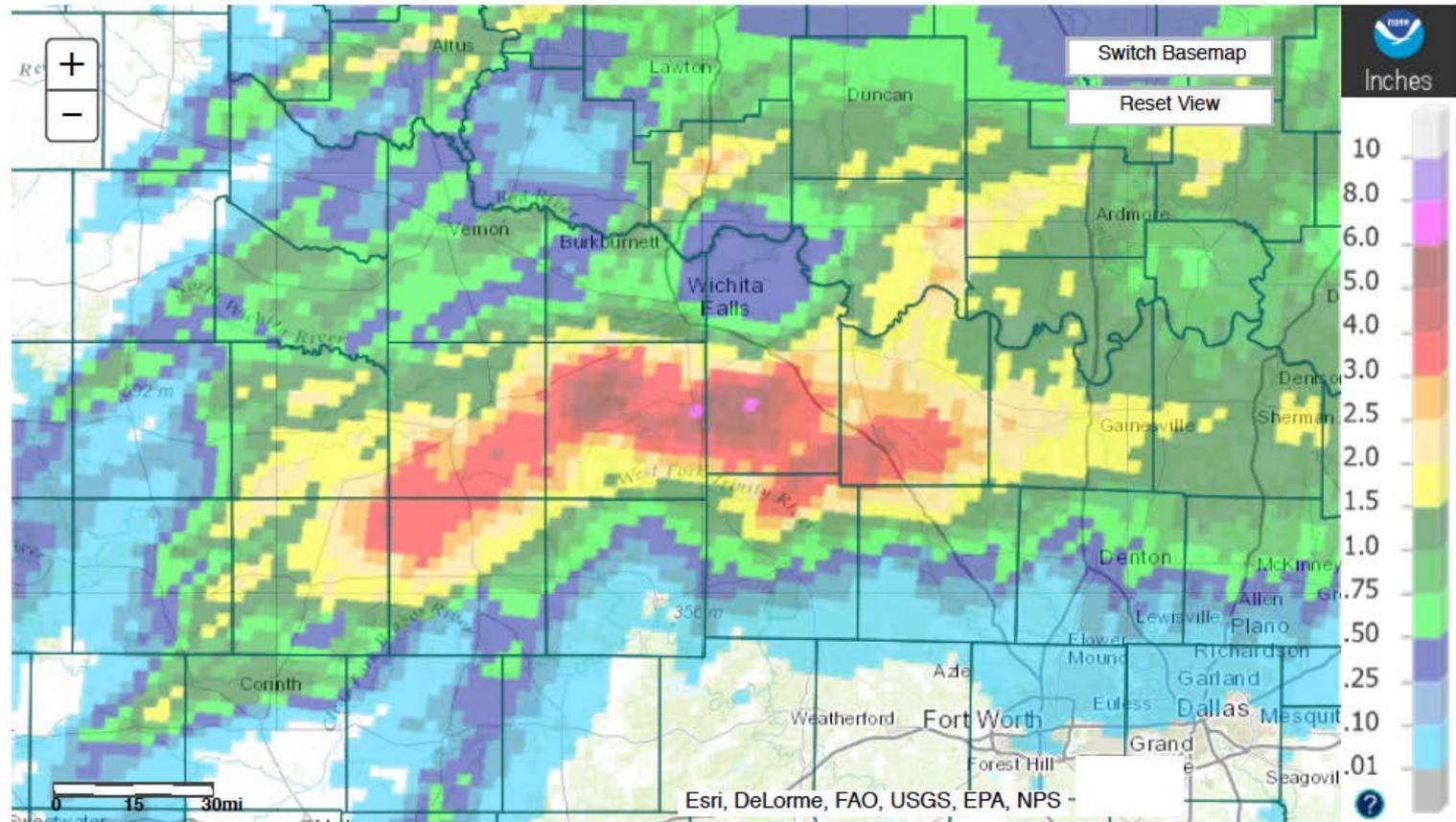
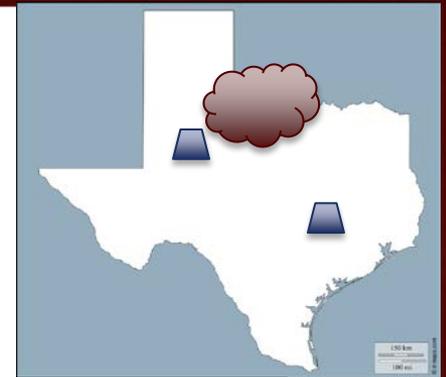
7.93" Coupland 6.5 ESE (CoCoRaHS) [25yr]



Displaying May 06, 2015 1-Day Observed Precipitation
Valid on: May 06, 2015 12:00 UTC



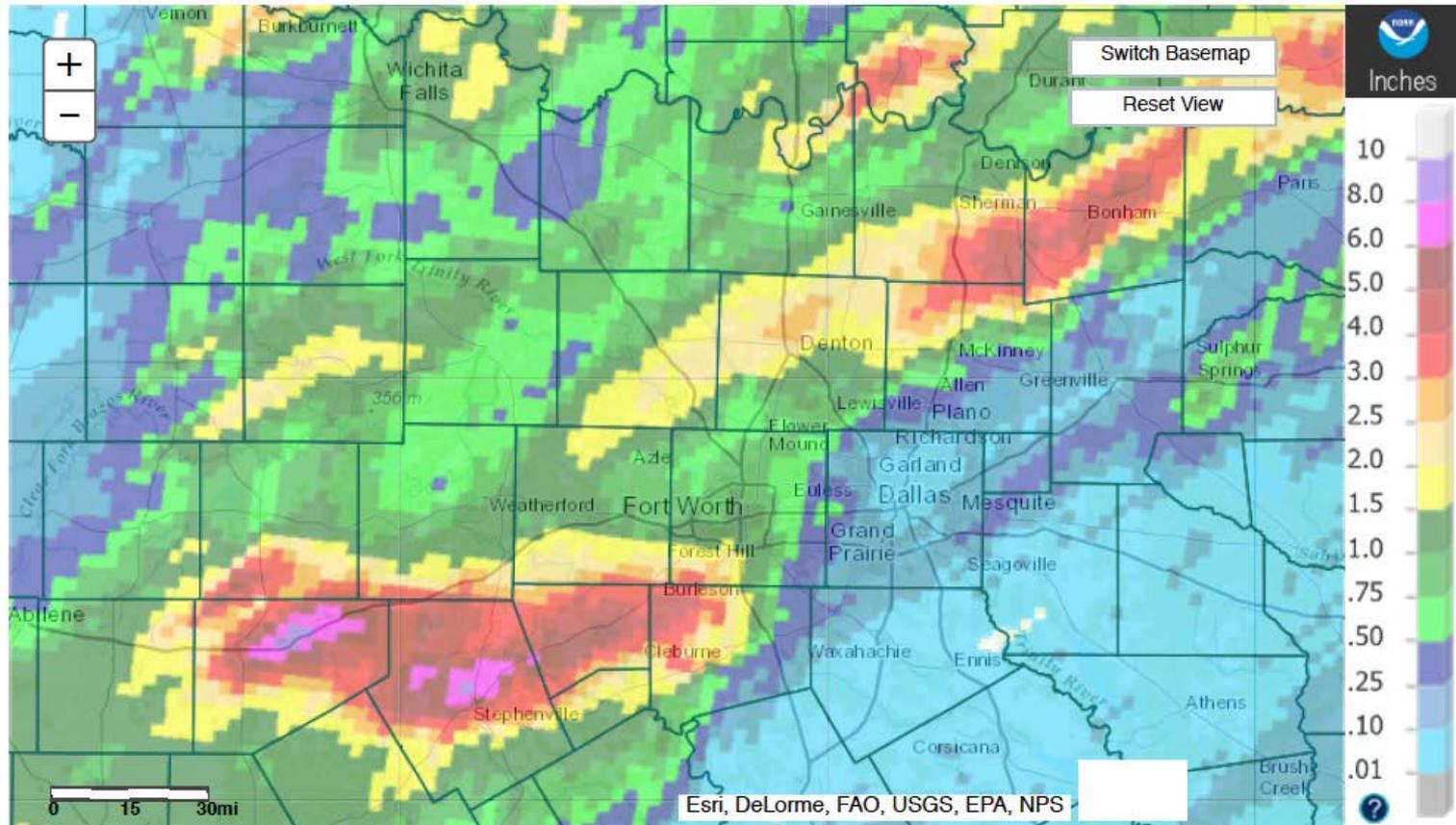
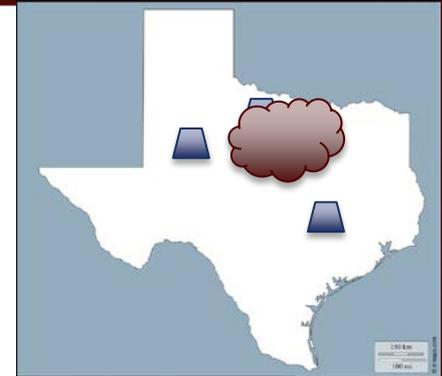
6.32" Scotland (COOP) [15yr]



Displaying May 07, 2015 1-Day Observed Precipitation
Valid on: May 07, 2015 12:00 UTC



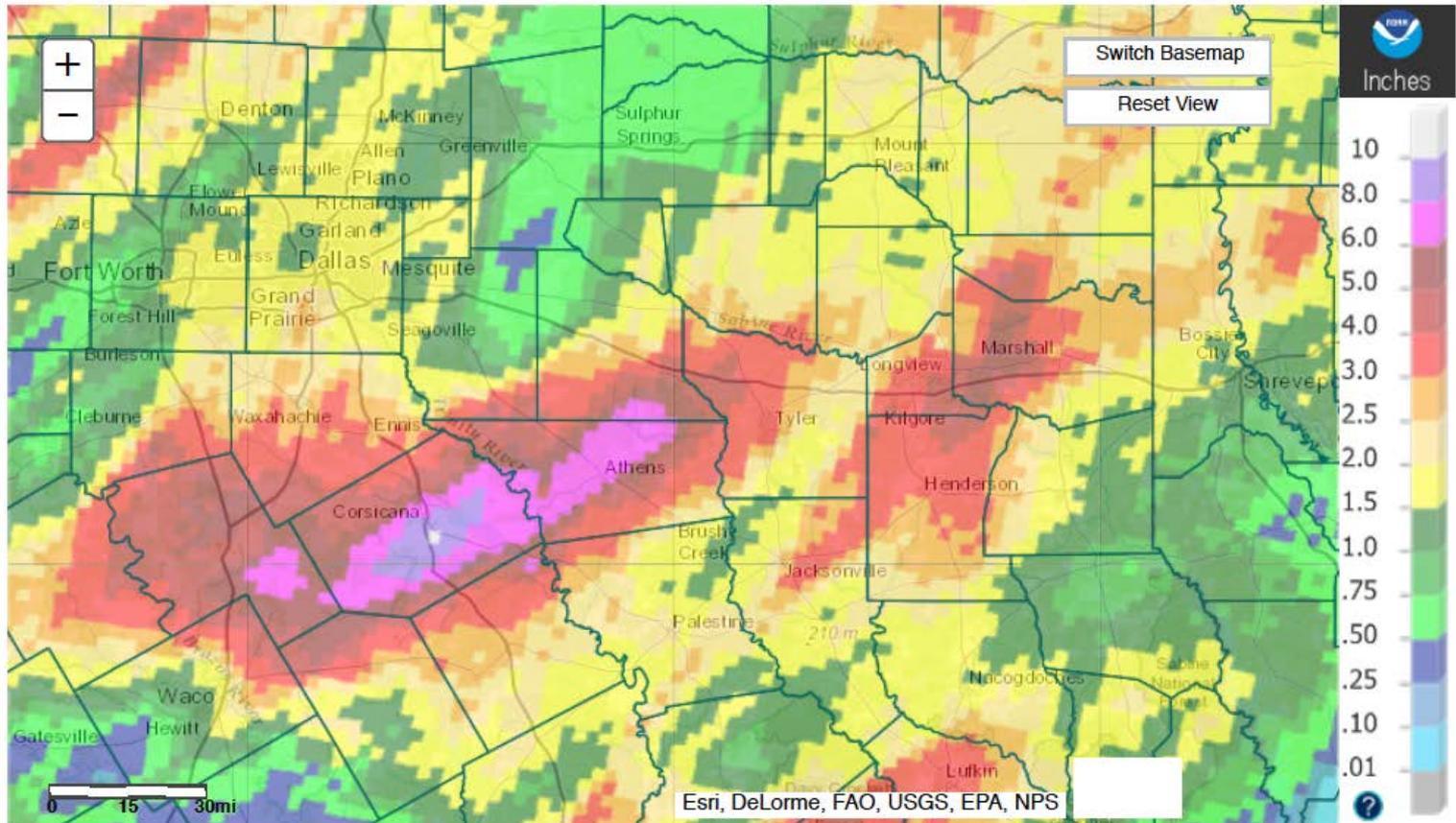
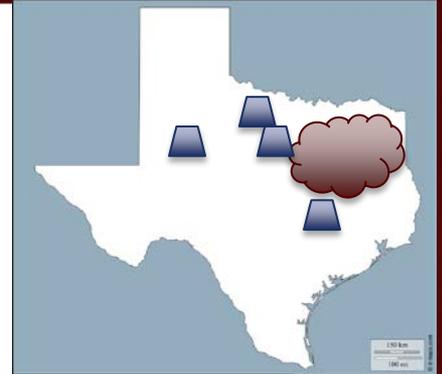
7.14" Stephenville 2.6 NNW (CoCoRaHS) [20yr]



Displaying May 10, 2015 1-Day Observed Precipitation
Valid on: May 10, 2015 12:00 UTC



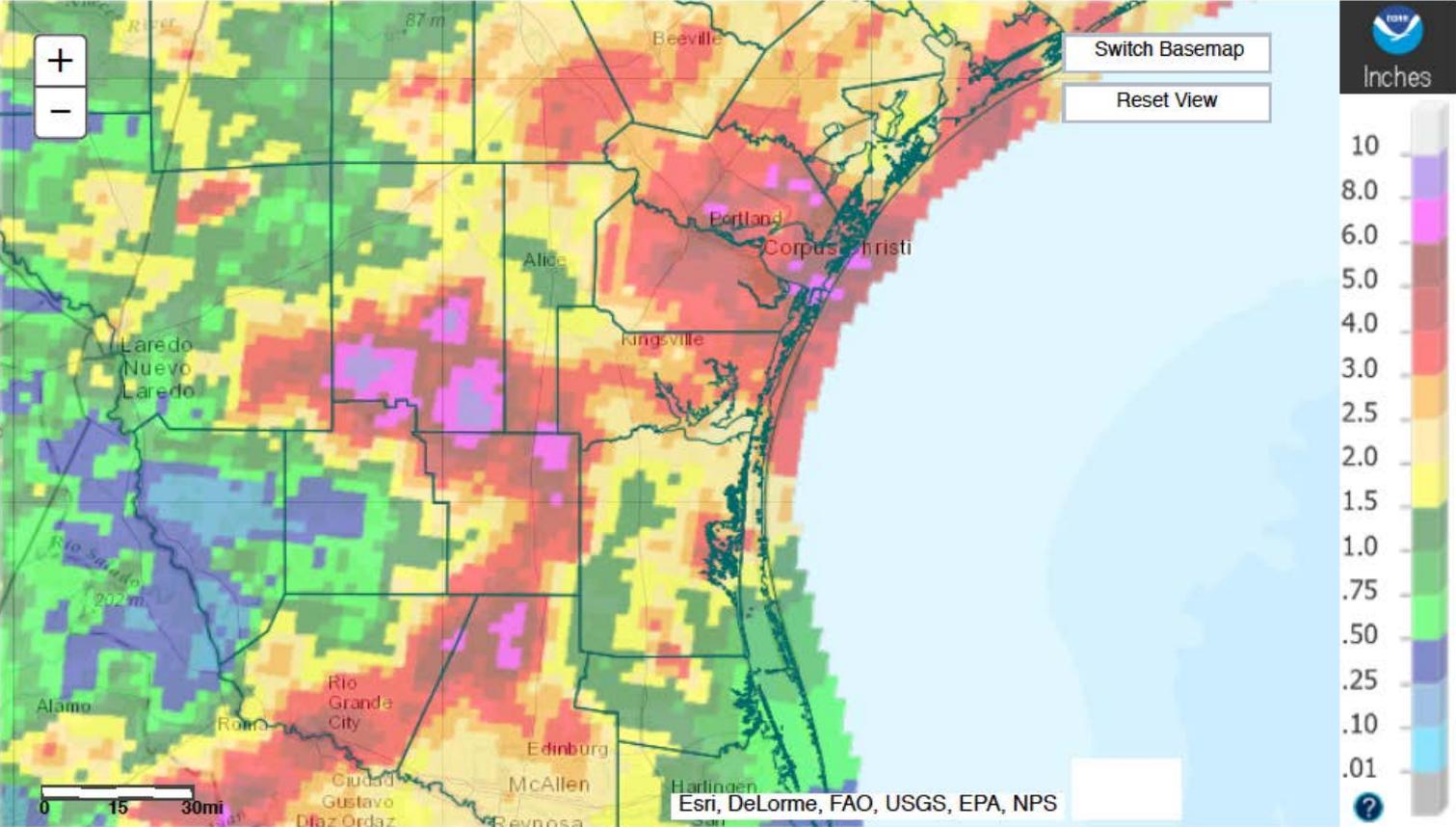
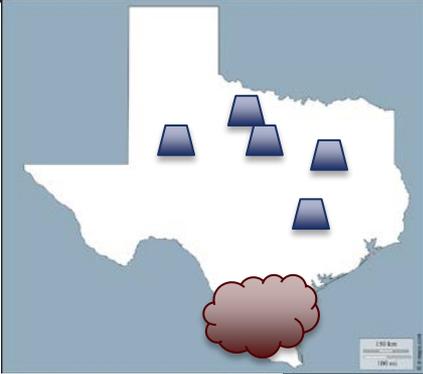
9.91" Corsicana Campbell Field (WBAN) [100yr]



Displaying May 11, 2015 1-Day Observed Precipitation
Valid on: May 11, 2015 12:00 UTC



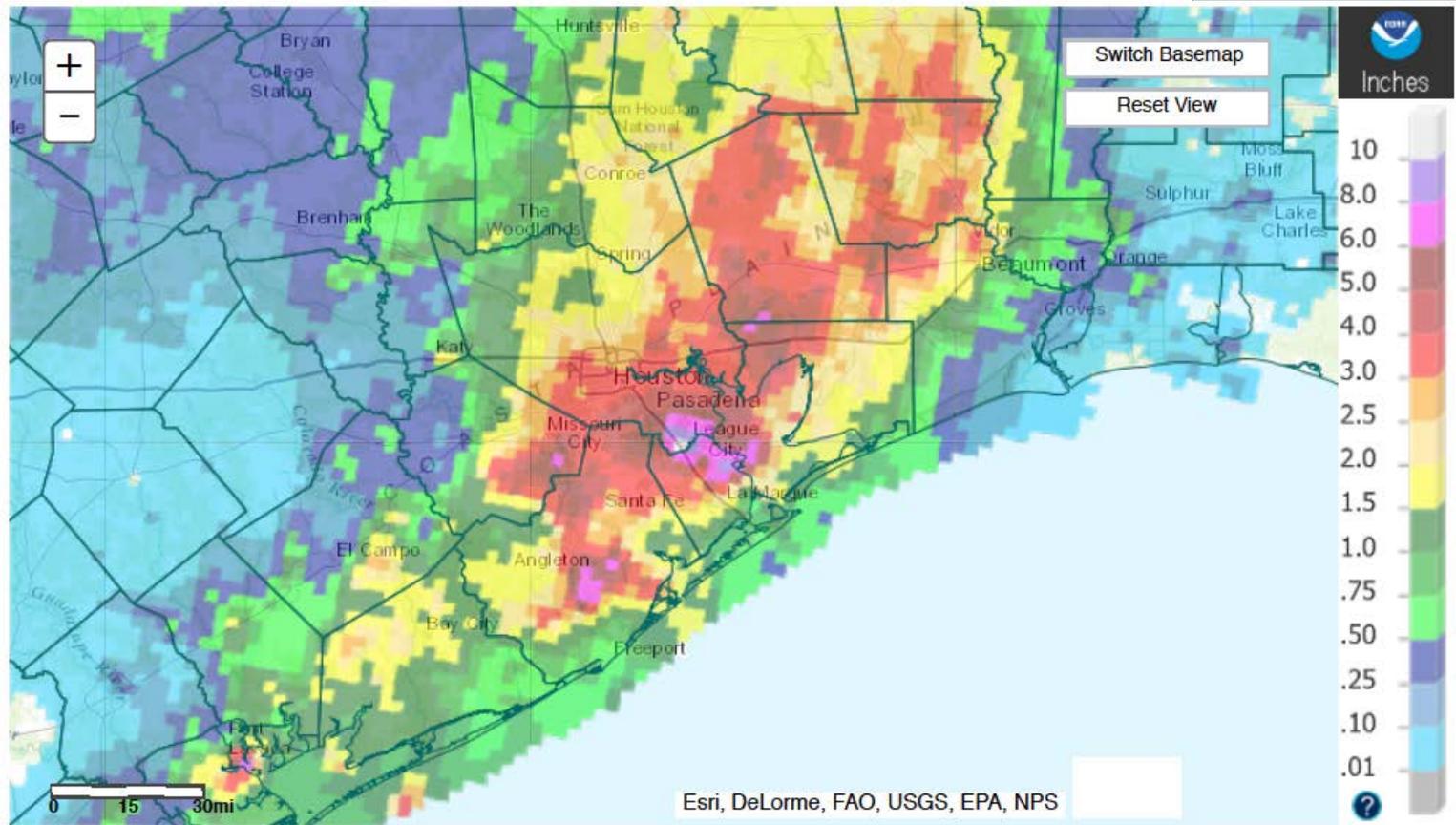
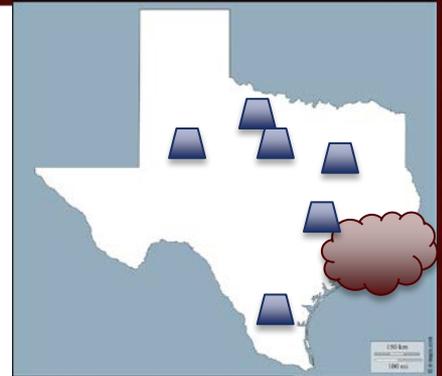
7.32" Corpus Christi 6.9 SE (CoCoRaHS) [10yr]



Displaying May 12, 2015 1-Day Observed Precipitation
Valid on: May 12, 2015 12:00 UTC



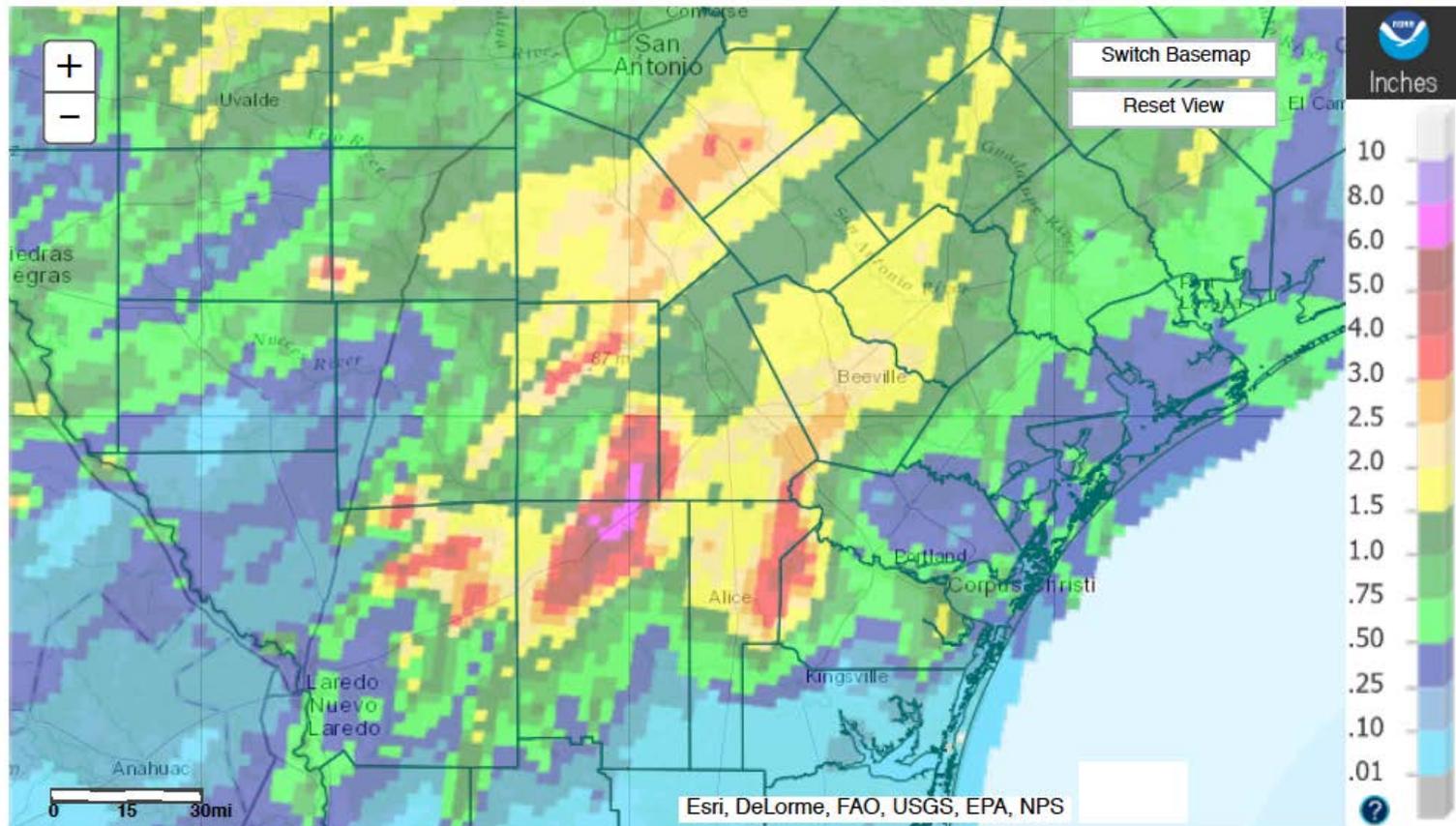
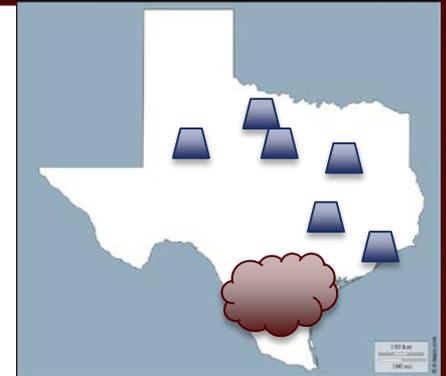
11.00" Webster 1.6 NNW (CoCoRaHS) [25yr]



Displaying May 13, 2015 1-Day Observed Precipitation
Valid on: May 13, 2015 12:00 UTC



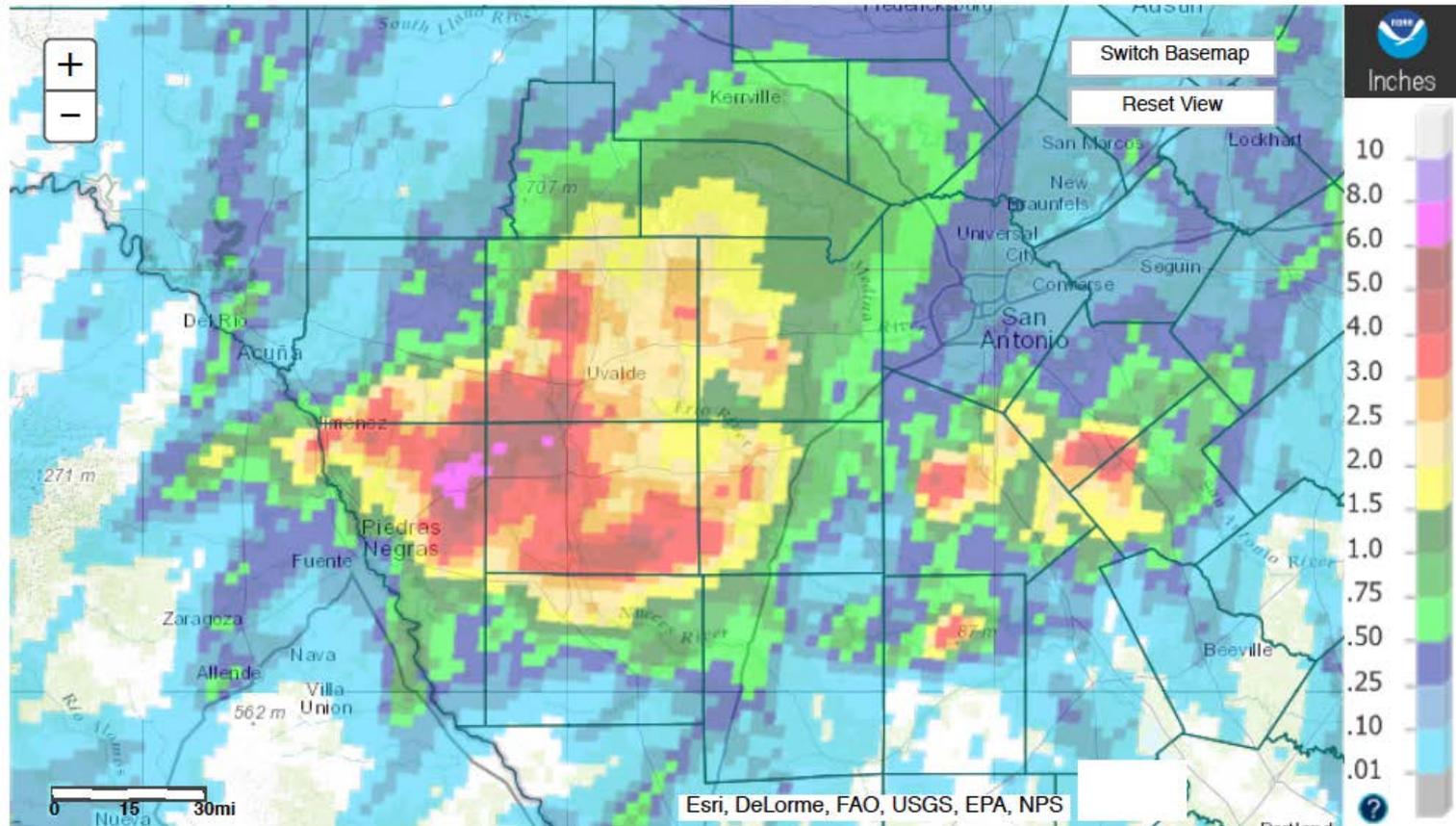
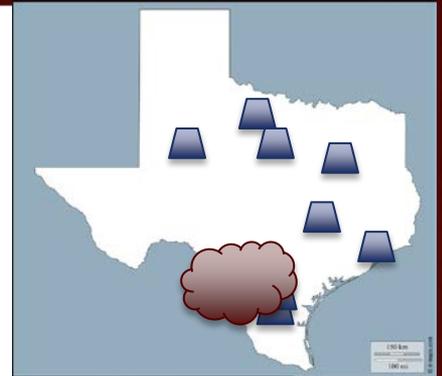
4.24" Orange Grove 2.5 SE (CoCoRaHS) [2yr]



Displaying May 14, 2015 1-Day Observed Precipitation
Valid on: May 14, 2015 12:00 UTC



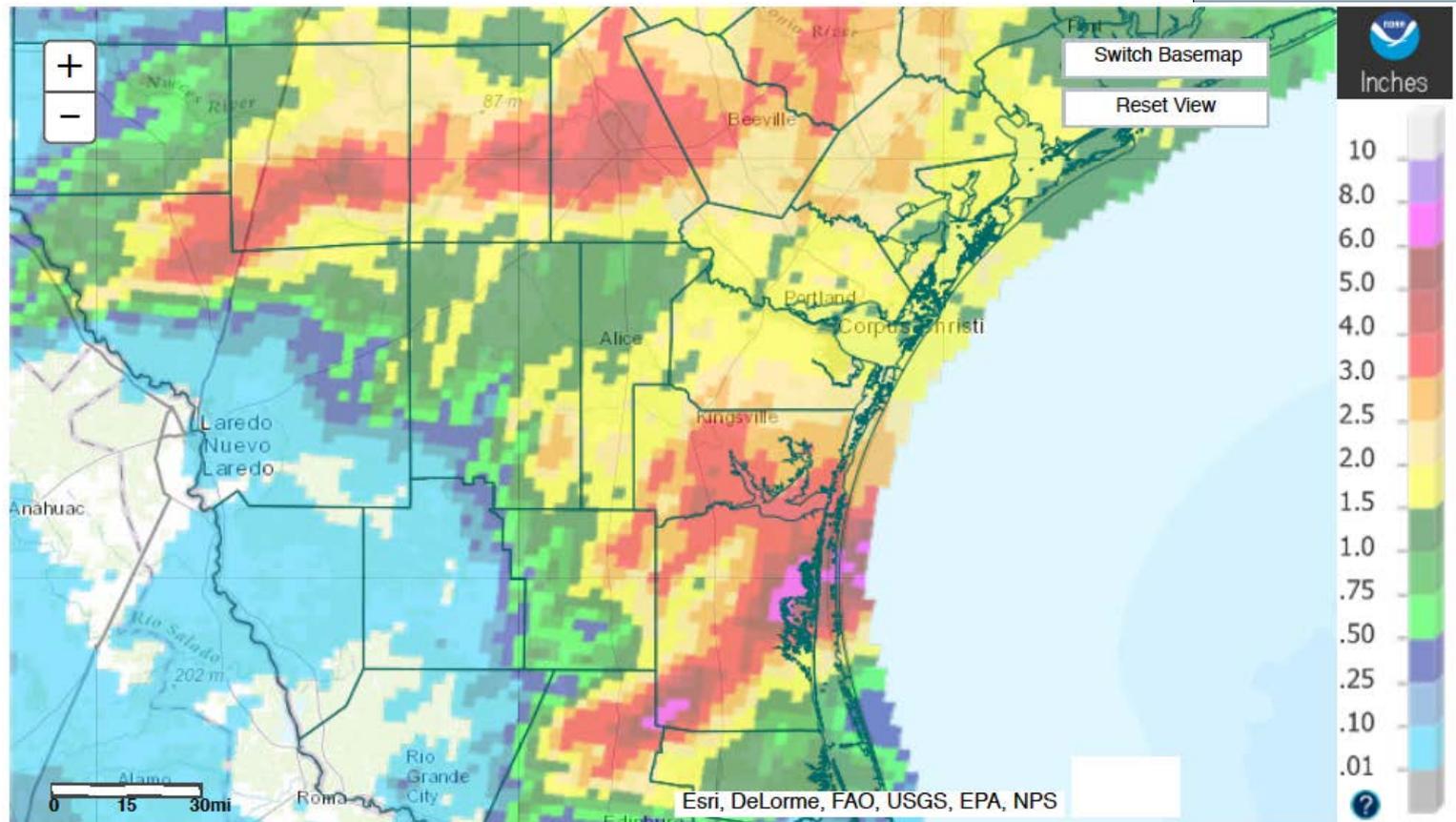
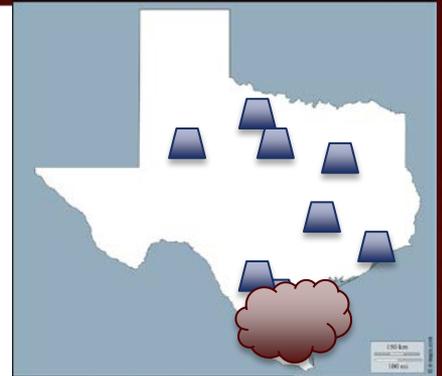
6.28" La Pryor (COOP) [10yr]



Displaying May 15, 2015 1-Day Observed Precipitation
Valid on: May 15, 2015 12:00 UTC



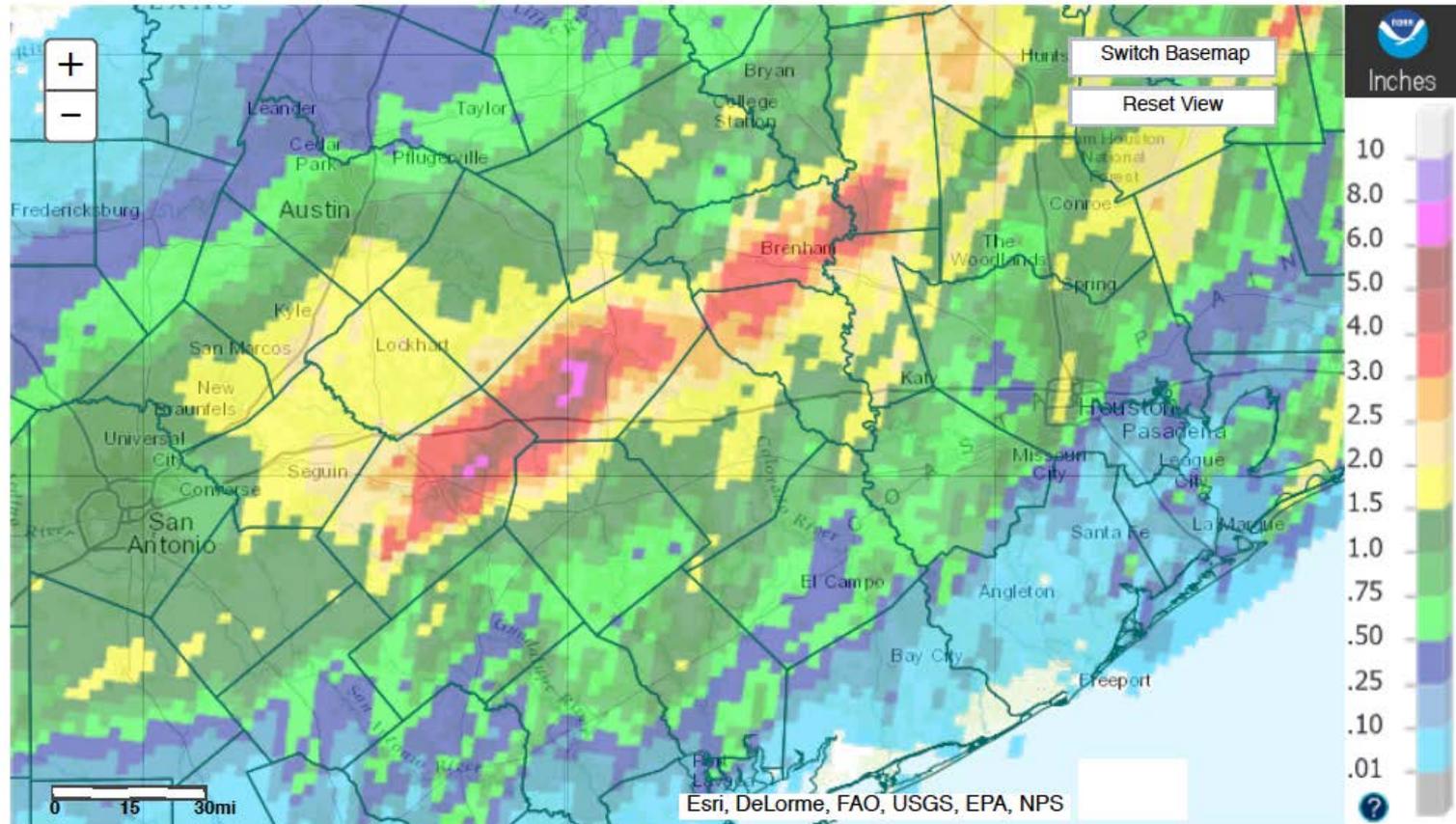
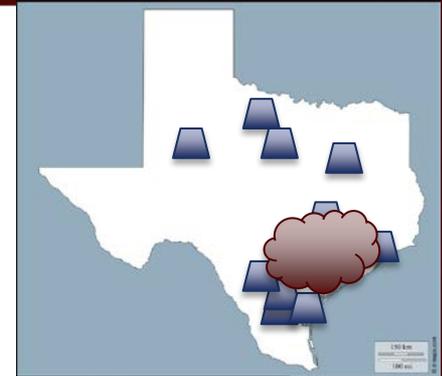
6.34" Artesia Wells 14.0 SE (CoCoRaHS) [15yr]



Displaying May 16, 2015 1-Day Observed Precipitation
Valid on: May 16, 2015 12:00 UTC



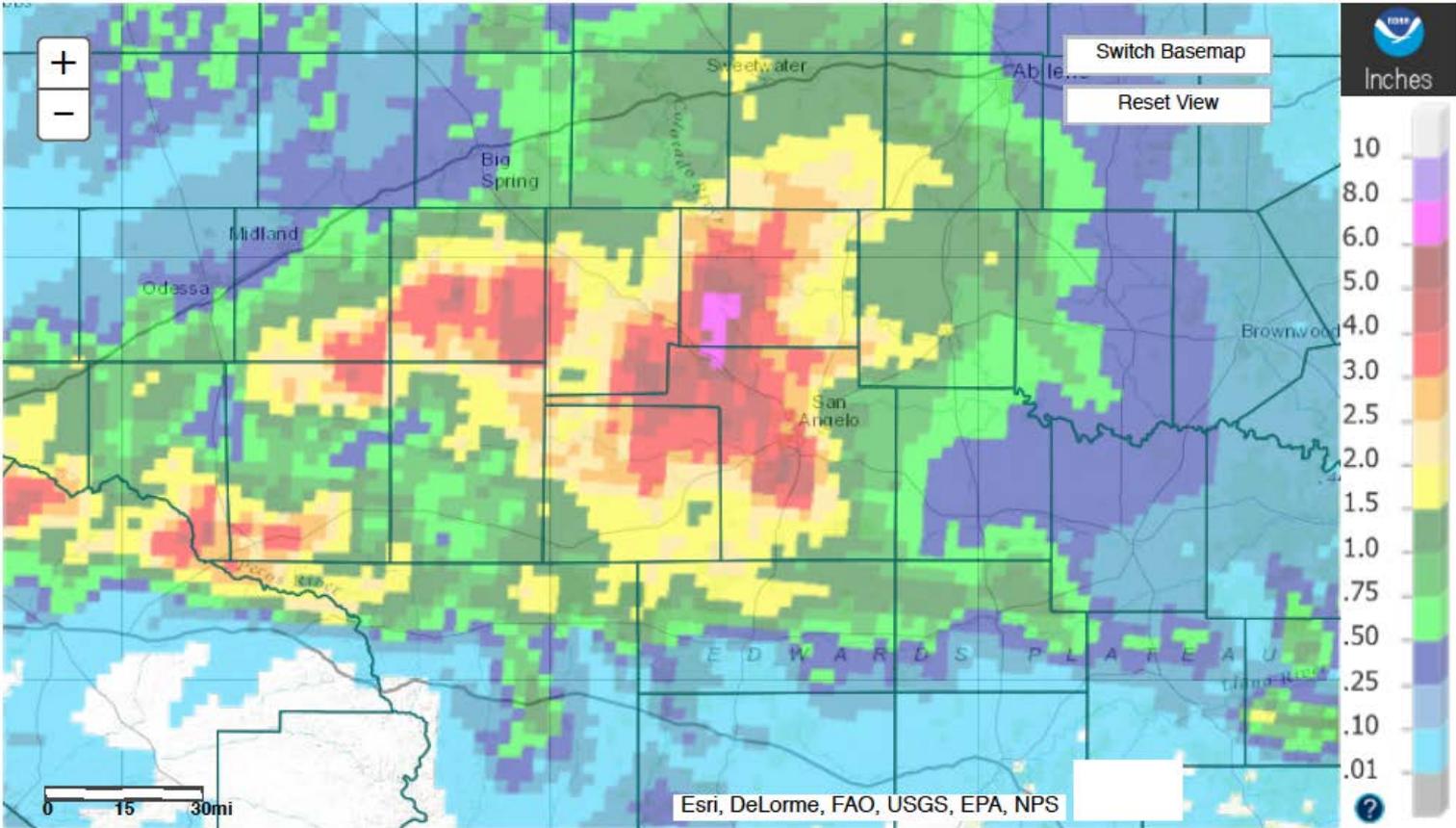
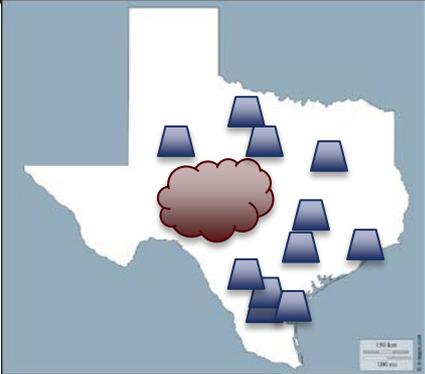
5.75" Flatonia 3.3 NE (CoCoRaHS) [5yr]



Displaying May 18, 2015 1-Day Observed Precipitation
Valid on: May 18, 2015 12:00 UTC



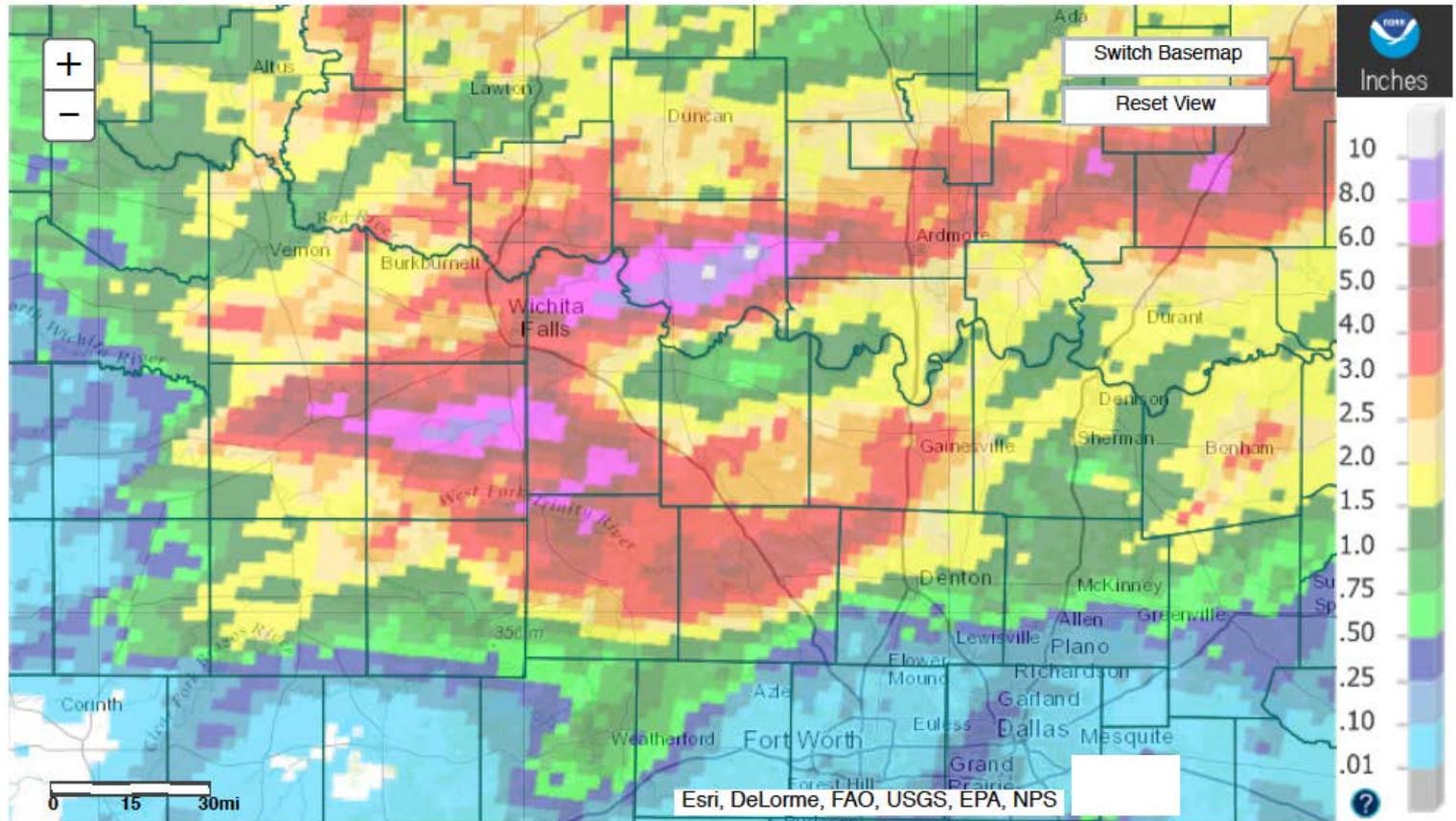
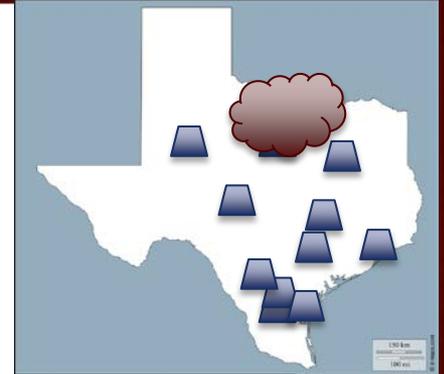
6.87" San Angelo 5.6 SSW (CoCoRaHS) [25yr]



Displaying May 19, 2015 1-Day Observed Precipitation
Valid on: May 19, 2015 12:00 UTC



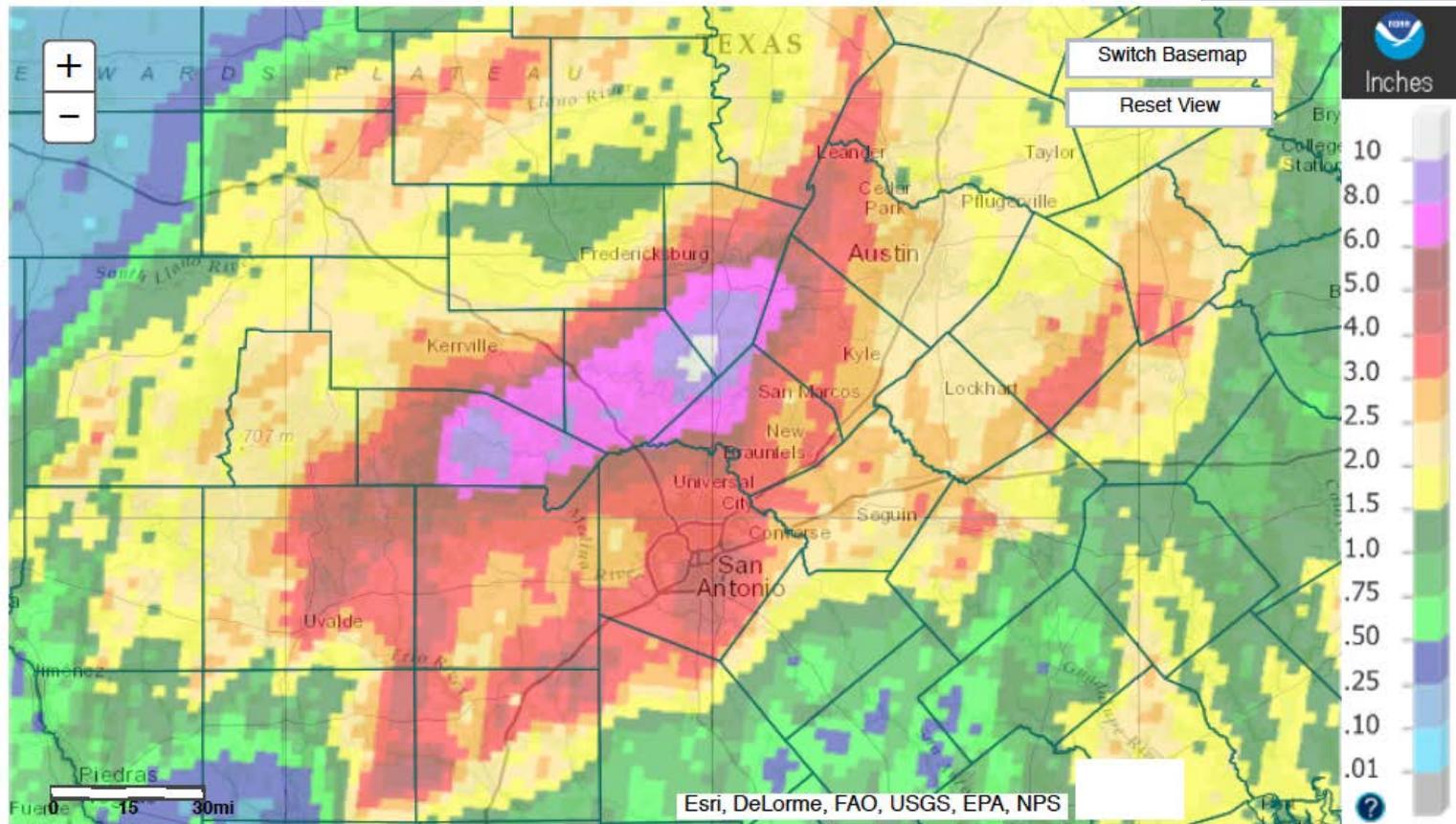
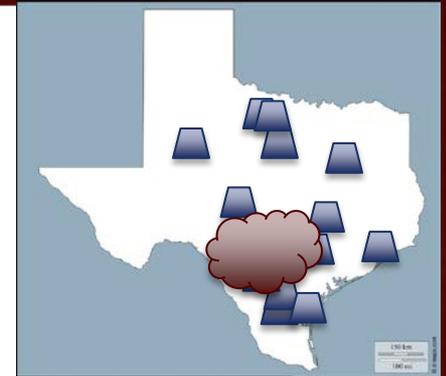
6.92" Scotland (COOP) [25yr]
(less than 2 weeks after 15yr event)



Displaying May 20, 2015 1-Day Observed Precipitation
Valid on: May 20, 2015 12:00 UTC



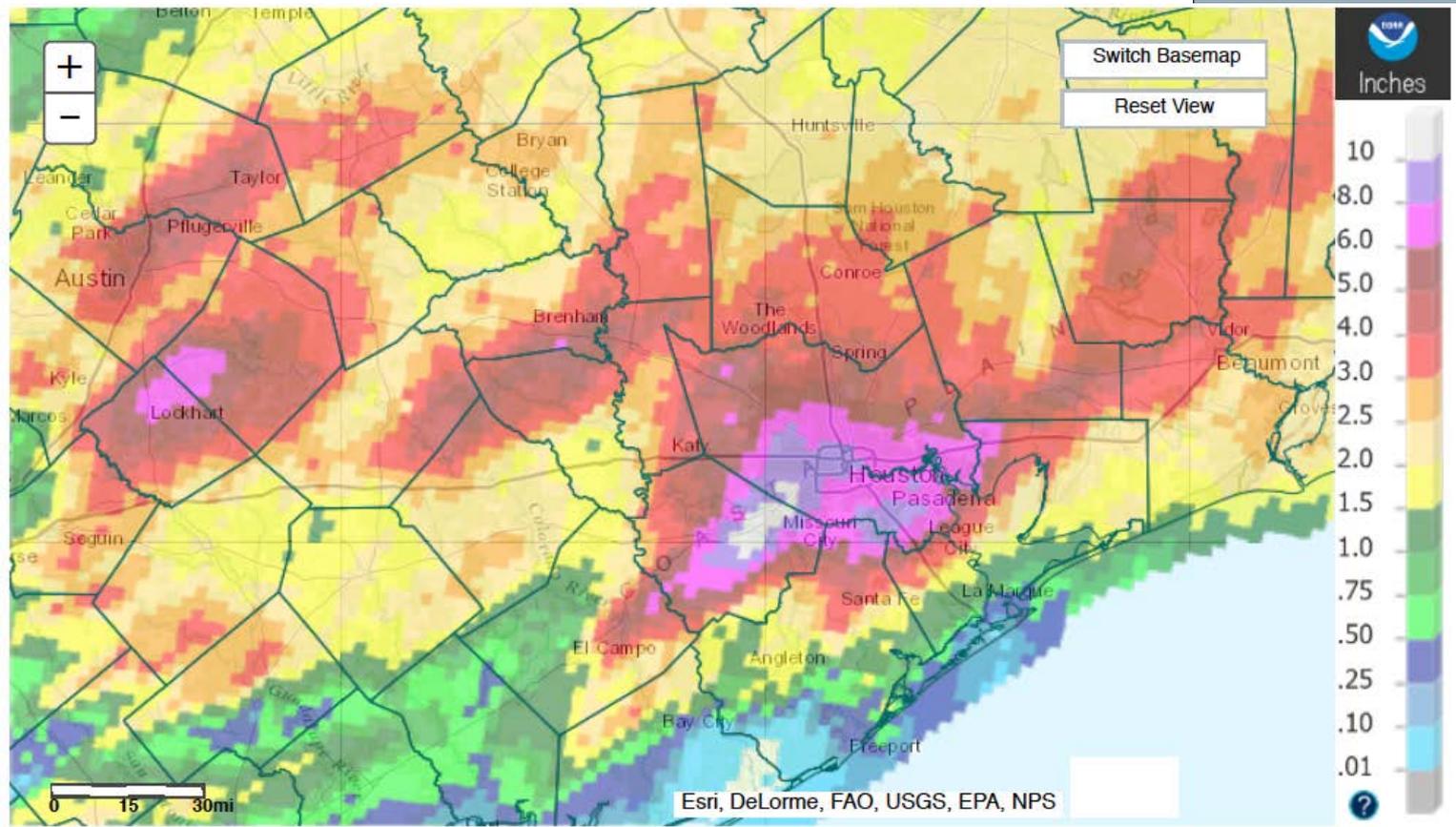
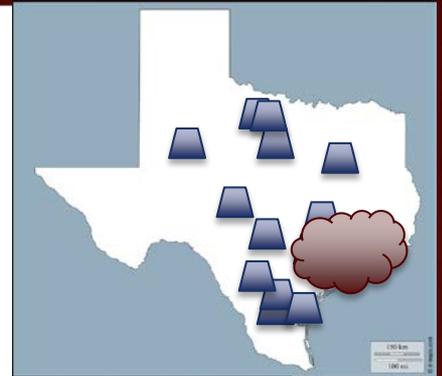
12.32" Kendalia 2.95 NNW (CoCoRaHS) [400yr]



Displaying May 24, 2015 1-Day Observed Precipitation
Valid on: May 24, 2015 12:00 UTC



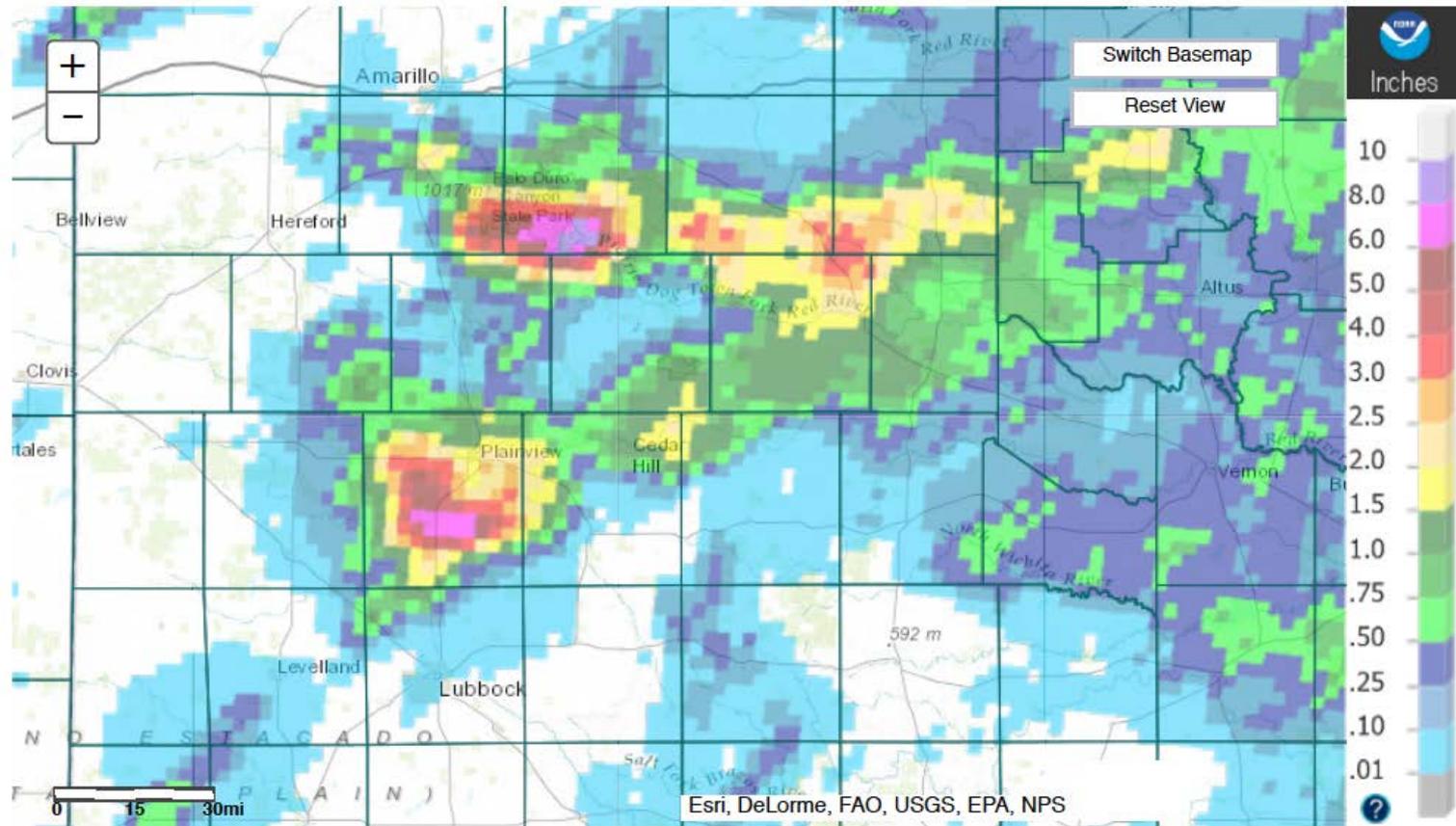
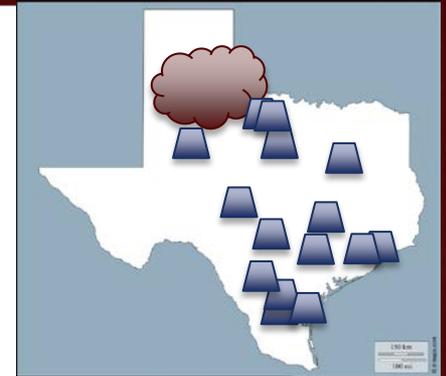
11.88" Richmond 3.4 NNE (CoCoRaHS) [50yr]



Displaying May 26, 2015 1-Day Observed Precipitation
Valid on: May 26, 2015 12:00 UTC



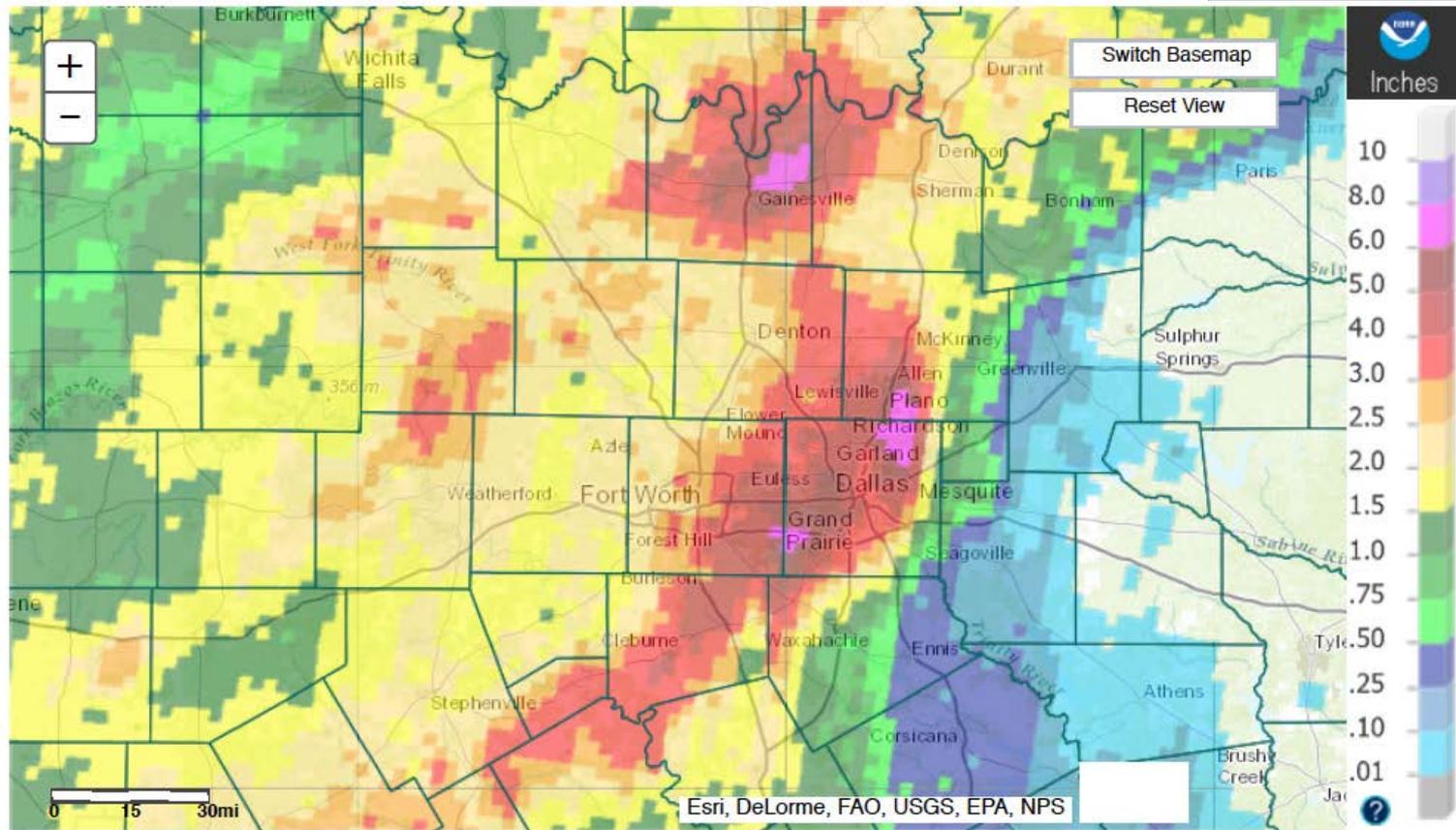
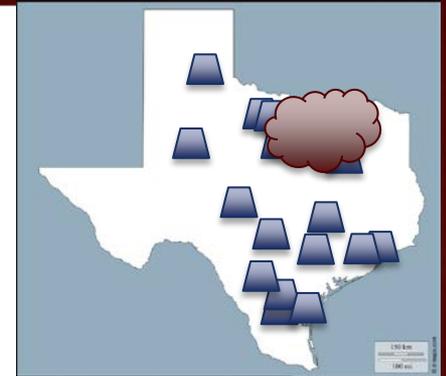
4.85" Memphis 1.4 NNW (CoCoRaHS) [15yr]



Displaying May 28, 2015 1-Day Observed Precipitation
Valid on: May 28, 2015 12:00 UTC

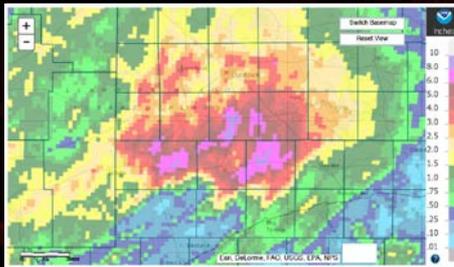


7.18" Garland 3.6 NNW (CoCoRaHS) [25yr]

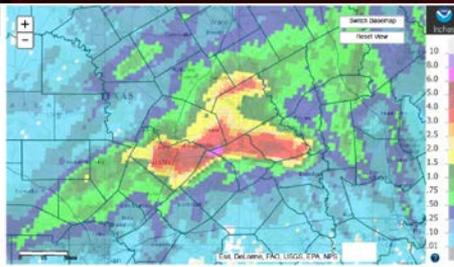


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Valid on: May 29, 2015 12:00 UTC

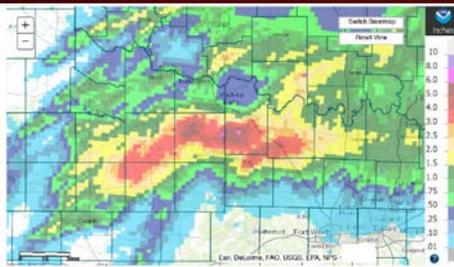




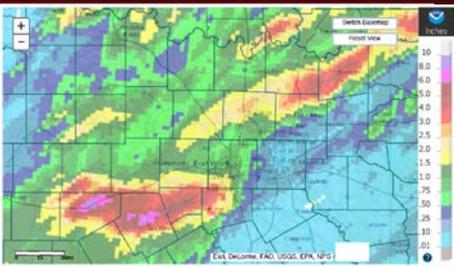
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Valid on: May 05, 2015 19:00 UTC



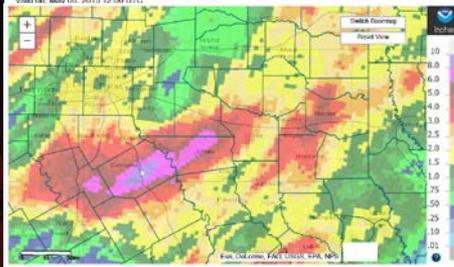
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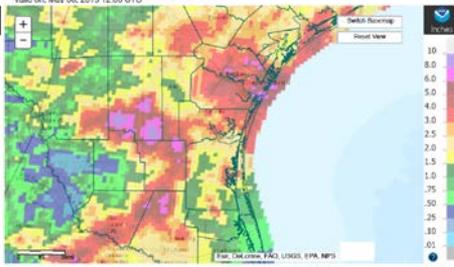
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Valid on: May 07, 2015 19:00 UTC



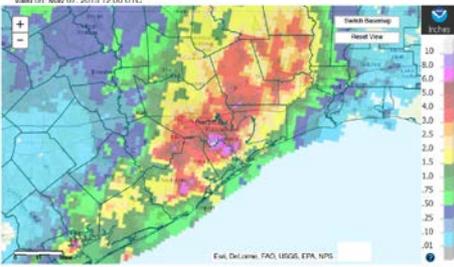
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Valid on: May 10, 2015 19:00 UTC



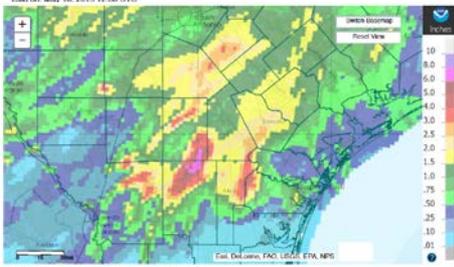
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Valid on: May 11, 2015 19:00 UTC



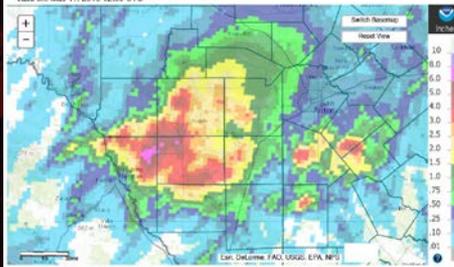
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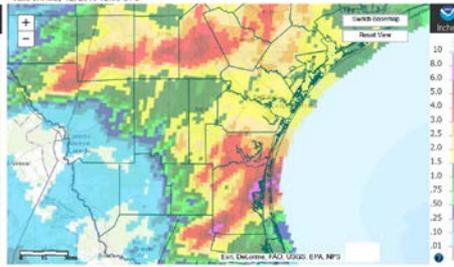
Displaying May 13, 2015 1-Day Observed Precipitation
Valid on: May 13, 2015 19:00 UTC



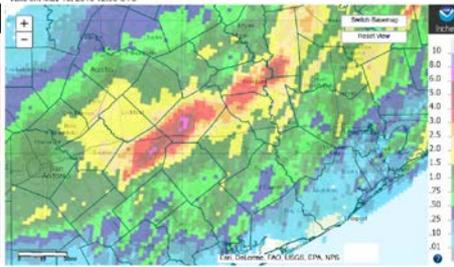
Displaying May 14, 2015 1-Day Observed Precipitation
Valid on: May 14, 2015 19:00 UTC



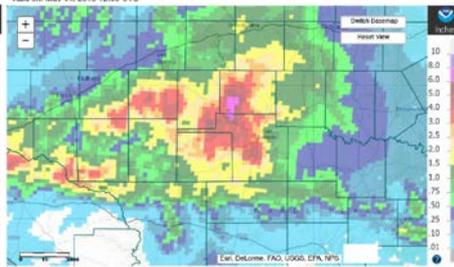
Displaying May 15, 2015 1-Day Observed Precipitation
Valid on: May 15, 2015 19:00 UTC



Displaying May 16, 2015 1-Day Observed Precipitation
Valid on: May 16, 2015 12:00 UTC



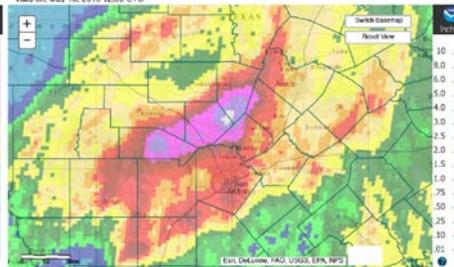
Displaying May 18, 2015 1-Day Observed Precipitation
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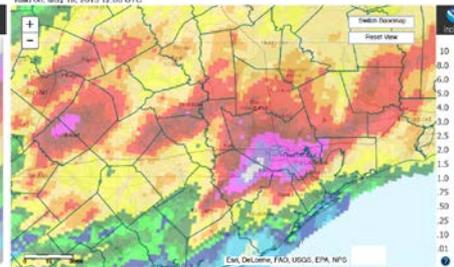
Displaying May 19, 2015 1-Day Observed Precipitation
Valid on: May 19, 2015 19:00 UTC



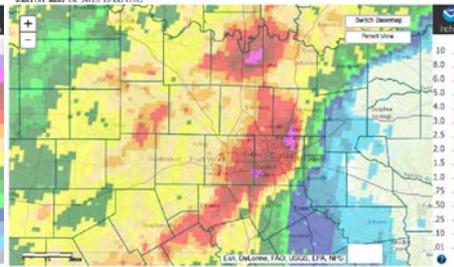
Displaying May 20, 2015 1-Day Observed Precipitation
Valid on: May 20, 2015 19:00 UTC



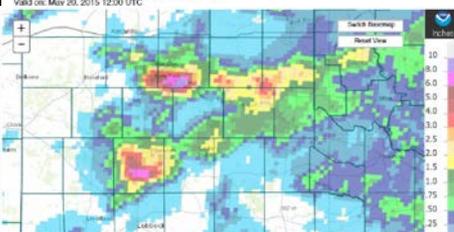
Displaying May 24, 2015 1-Day Observed Precipitation
Valid on: May 24, 2015 12:00 UTC



Displaying May 26, 2015 1-Day Observed Precipitation
Valid on: May 26, 2015 19:00 UTC



Displaying May 29, 2015 1-Day Observed Precipitation
Valid on: May 29, 2015 12:00 UTC



Displaying May 20, 2015 1-Day Observed Precipitation
Valid on: May 20, 2015 19:00 UTC



Maximum Daily Rainfall

- 50th %ile: 2.70"
- 75th %ile: 3.78"
- 90th %ile: 5.25"



The Three-Legged Stool

- Peak 1-day and 2-day rainfall is increasing (thermodynamics beats dynamics)
- Models say it should be increasing
- Physics says it ought to be increasing



Earth's Future

RESEARCH ARTICLE

10.1002/2013EF000185

Key Points:

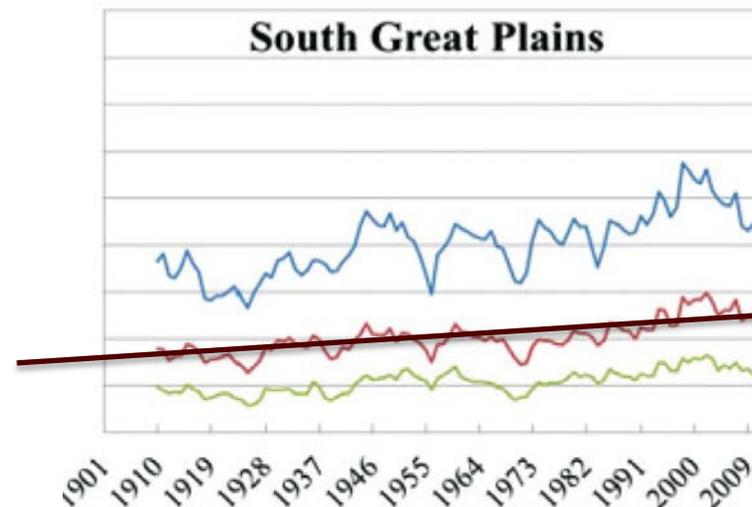
- The United States has seen increases in extreme precipitation event frequency
- Simulations show increasing trends of smaller magnitude than observations
- Projections show a further increase in frequency of extreme precipitation

Observational- and model-based trends and projections of extreme precipitation over the contiguous United States

Emily Janssen¹, Donald J. Wuebbles¹, Kenneth E. Kunkel², Seth C. Olsen¹, and Alex Goodman¹

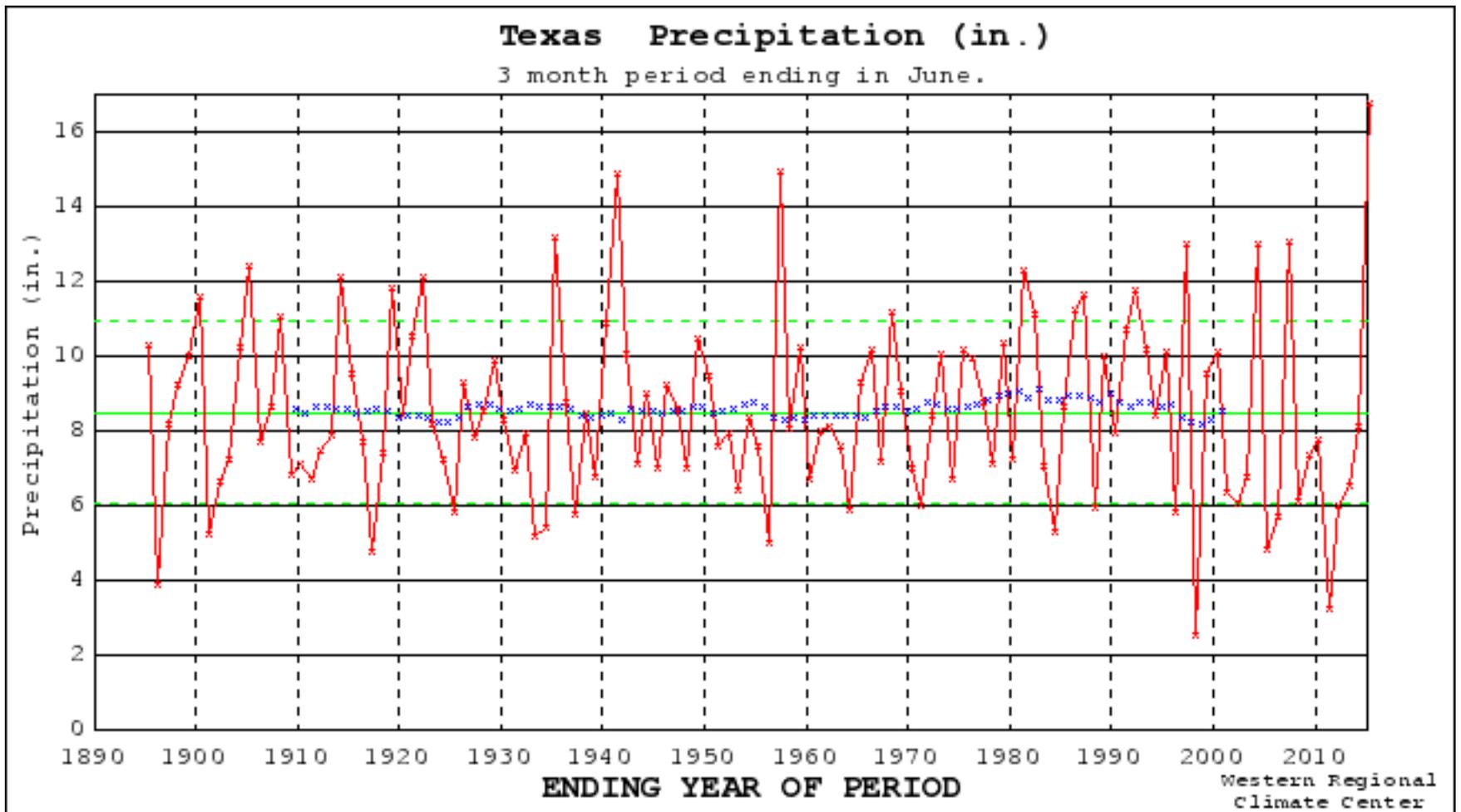
¹Department of Atmospheric Sciences, University of Illinois at Urbana-Champaign, Urbana, Illinois, USA, ²NOAA Cooperative Institute for Climate and Satellites, North Carolina State University and National Climatic Data Center, Asheville, North Carolina, USA

Abstract Historical and projected trends in extreme precipitation events are examined in Coupled Model Intercomparison Project 5 (CMIP5) models and observations, over the contiguous United States



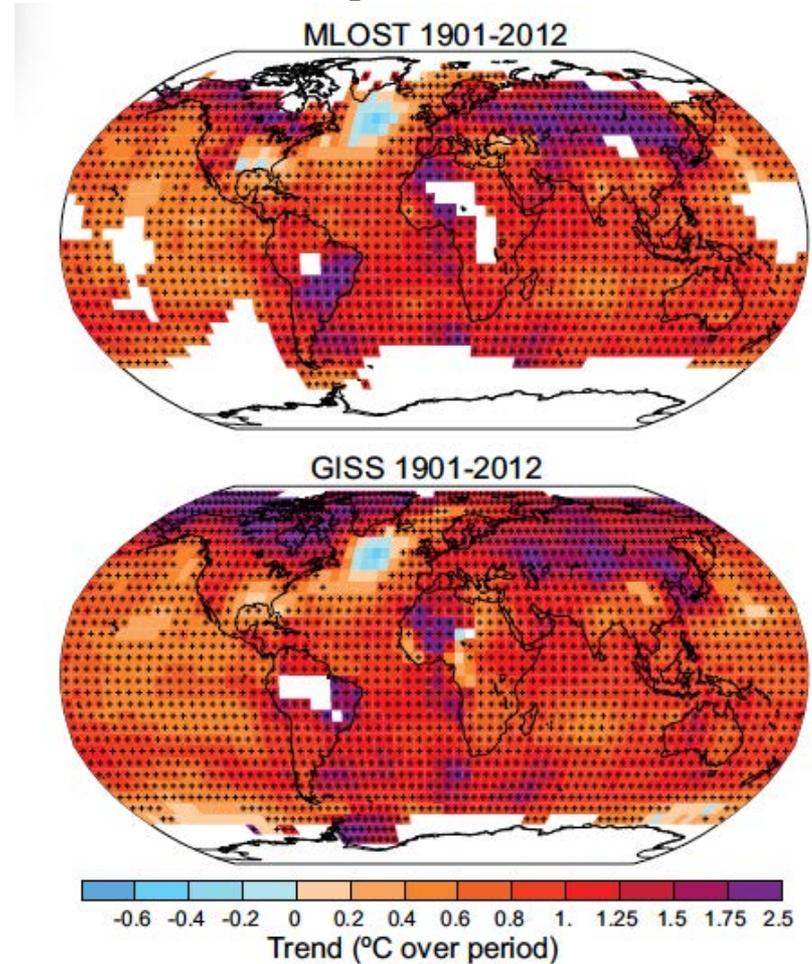
Frequency of 10-year return period 2-day events

Monthly Total Rainfall: Flat



Nonlinear Climate Responses

- Enhanced El Niño? (Cai et al. 2014)
 - Extreme El Niños expected to become more common
 - Caused by reduced climatological east-west temperature gradient
 - Hasn't happened yet
- Enhanced response to El Niño?
 - See next talk (Simon Wang)
 - Magnitude of enhancement small



Informal Attribution: The Faucet

- SST warmer than it would have been, so
 - Peak water vapor content larger
 - When faucet was wide open, rainfall was heavier
- Was the knob being turned?
 - Long term precipitation trend zero
 - Long term trend of precipitation variability undetected
 - Enhanced El Niño response possible