



# Dry Thunderstorm Forecasting Using Perfect Prog(nosis)

Forecast results from Summer 2013 and Experimental Web Page for 2014

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**WHERE AMERICA'S CLIMATE AND WEATHER SERVICES BEGIN**

# New for 2014

- New interactive experimental GFS-based Dry Thunderstorm Web page  
( no longer using JAVA applet...works on any PC or SMART PHONE)
- Explicit Dry Thunderstorm Forecasts **DRYTH1** (probability of lightning with less than 0.10 inch of precipitation); also for less than 0.25 inch (**DRYTH2**).
- Using **GFS** input...3 hourly grid forecasts out to **180 hours** (available from 00, 06, 12, 18 UTC runs)...using new equations-derived using 12 years **NARR** and lightning data.
- 40 km (grid) for lower 48 states...10 km (grid) for Alaska.
- Explicit probability forecasts for precipitation amounts (example: precipitation  $\geq 0.10$  inch,  $\geq 0.25$  inch).
- Atmospheric dryness forecasts.
- Experimental web page (for PC or smart phone) @

[www.spc.noaa.gov/exper/dryt](http://www.spc.noaa.gov/exper/dryt)

# Forecasting Dry Thunderstorms

The simple concept of **heavy precipitation**...attributed to veteran forecaster and researcher C.F. (Charlie) Chappell.

***“The heaviest precipitation occurs where the rainfall is the highest for the longest time.”***

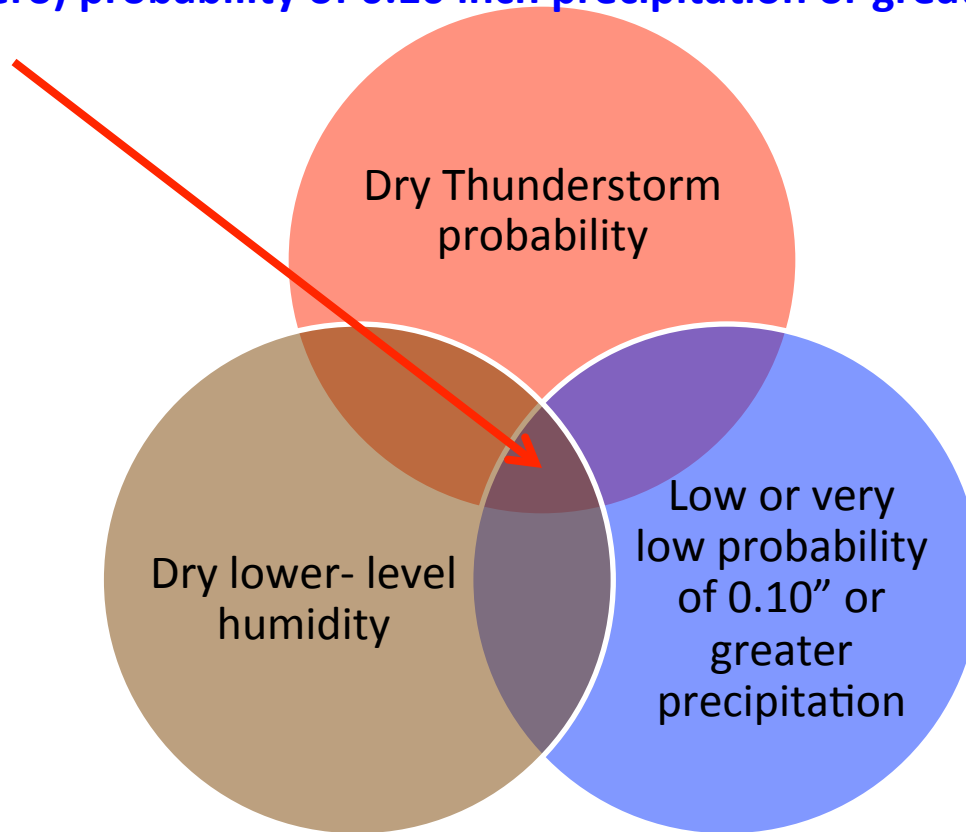
**So: What about the opposite...a dry thunderstorm\*?**

***The least precipitation with lightning (0.10 - or less\*) occurs:***

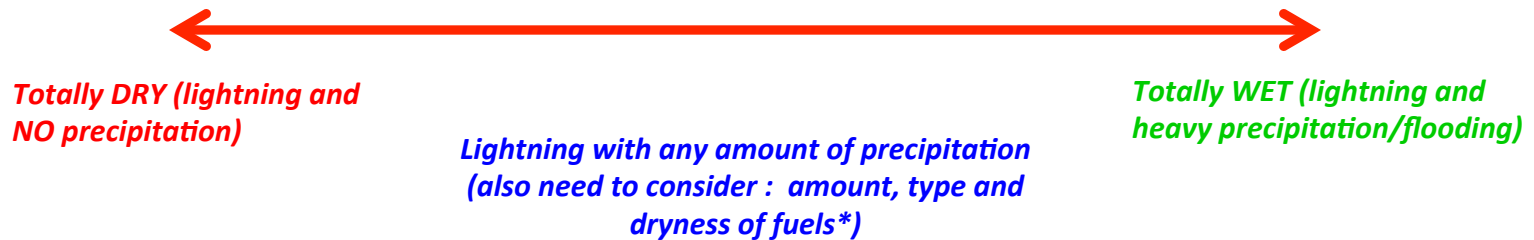
- 1) where the rainfall is the lowest,***
- 2) falling through the driest air,***
- 3) from the highest cloud bases,***
- 4) for the shortest period of time, yet still producing lightning***

Areas that could be most favorable for dry thunderstorms are where the fuels are dry to very dry and the intersection of:

- 1) dry thunderstorm probability
- 2) dry air mass (low relative humidity)
- 3) a low (or zero) probability of 0.10 inch precipitation or greater.



# The “range” of Dry thunderstorms (or...one-size DOES NOT fit all)



- Thunderstorms with no precipitation reaching the ground.
- Thunderstorms with less than 0.10 (or 0.25) inch reaching the ground.
- Could be single flash event or large numbers of flashes.
- Can range in scale from isolated event to large geographical areas.
- \*Also depends amount/type and dryness of fuels.
- Lightning can and does start wildfires virtually anywhere outside the western U.S. from what would not normally be considered a “dry storm”.

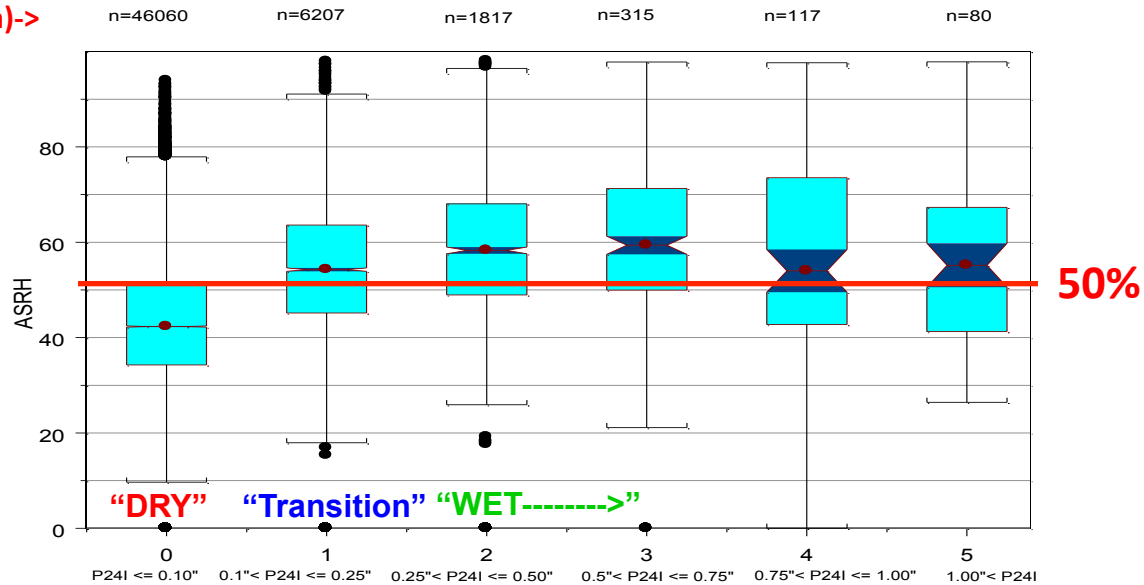
# The “range” of Dry thunderstorms (or...one-size DOES NOT fit all)-continued

- Actual precipitation could range from 0 up to generally about 0.25 inch (storms with greater than 0.25 inch tend to producing wetting rains).
- Fire starts also depend on weather before and after the event (prolonged wet/dry before/after) and/or long term drought.
- Lightning outside the main rain shaft can and does start wildfires from both wet and dry storms.

# Importance of a dry sub-cloud layer

Sample Size (n)->

For grid cells with lightning and "binned" by precipitation amounts (X-axis)



Box-and-Wisker plot of Average sub-cloud humidity at 21 UTC (from summer of 2003 study).

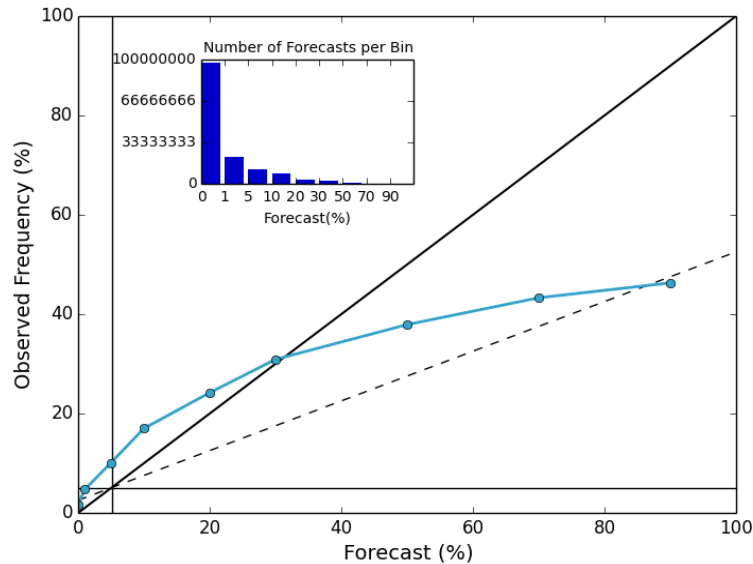
# A measure of sub-cloud humidity

- In the past, the Dry Thunderstorm Potential Index (DTPI) has been used along with the NAM perfect prog forecasts. (DTPI is a combined measure of height of cloud base and sub-cloud humidity).
- At times (especially overnight), depending the parcel and parcel level selected, values were not reflective of how dry the air mass was (also required a significant amount of computer time to calculate correctly).
- Relative humidity value from .94 sigma to .72 sigma level (approximately...uniform 8000 feet...terrain following) now used from GFS to better identify dry lower levels...especially in the overnight hours and across all terrain (readily available from GFS output).

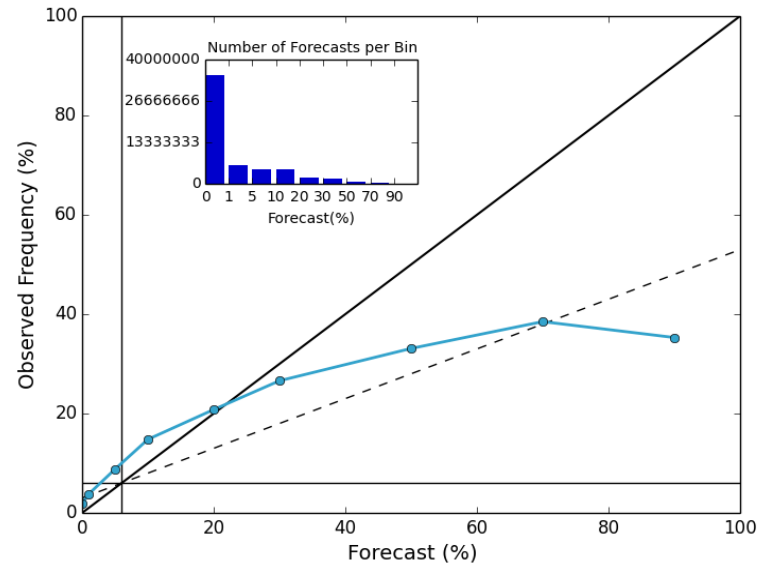


**Reliability diagram for *new* lightning forecast equations using GFS (left) and old equations using NAM (right). Probability of one or more CG flashes for full US 40 km grid.**

**June-July-August (JJA) 2013 results using 2013 equations. Full US -All GFS Cycles (0-180 hours-every 3 hours)**



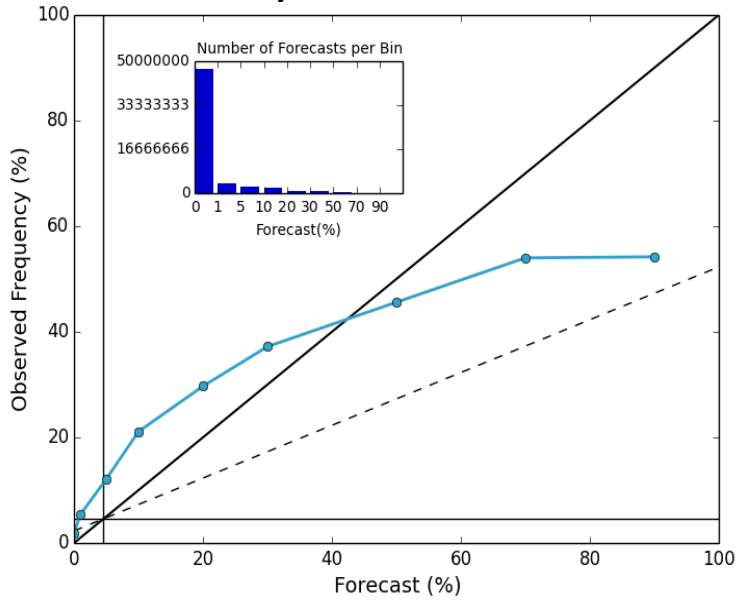
**June-July-August (JJA) 2013 results using 2003 equations. Full US -All NAM Cycles (0-84 hours-every 3 hours)**



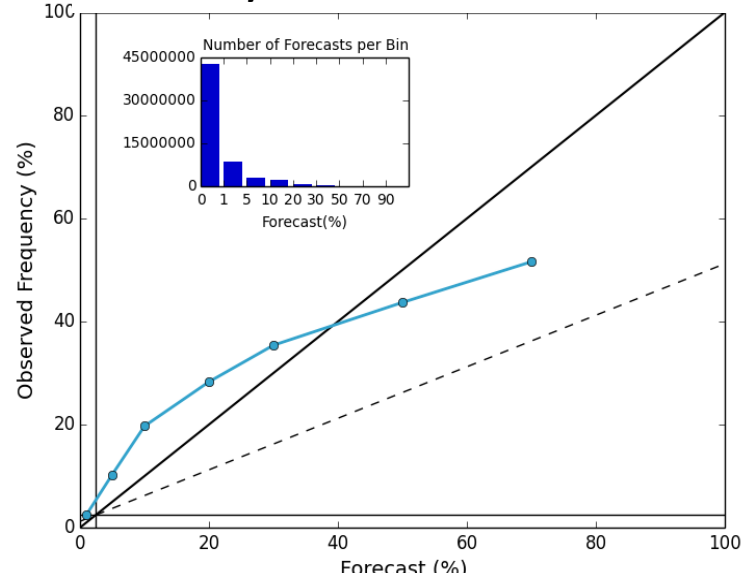
**2013 PPF equations shown an improvement in lightning prediction (1 or more CG flashes) compared to earlier 2003 PPF equations**

All GFS cycles and forecasts (0-180 hours-every 3 hours), June, July, August 2013, but for **Western US\*** (West of 102 longitude) <- main area for dry thunderstorms

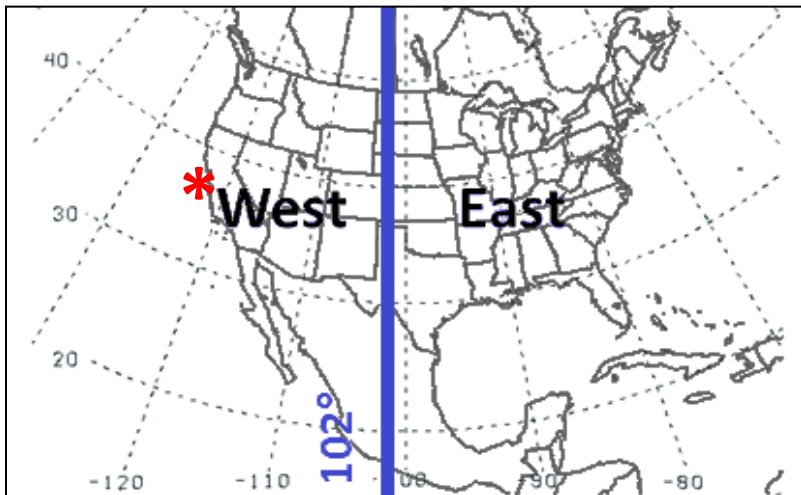
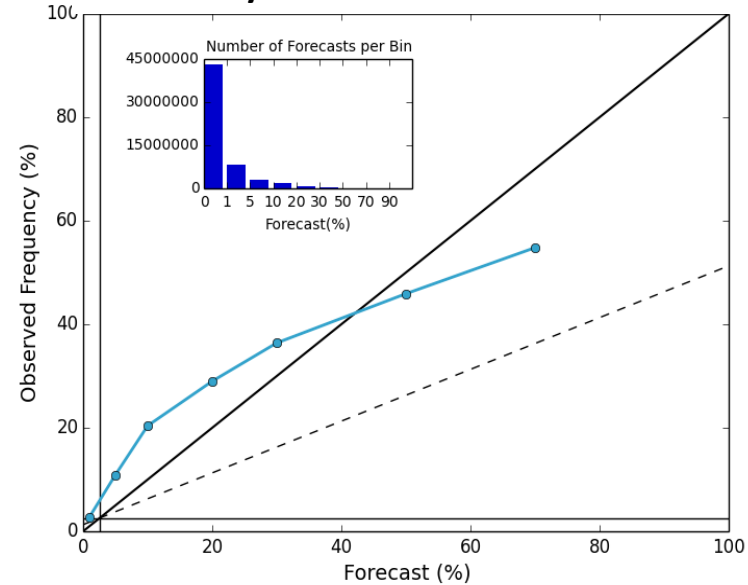
**Probability of 1 or more CG flashes**



**Probability of 1 or more CG flashes and < 0.10 inch**



**Probability of 1 or more CG flashes and < 0.25 inch**



# Example of web page for CONUS

[www.spc.noaa.gov/exper/dryt](http://www.spc.noaa.gov/exper/dryt)

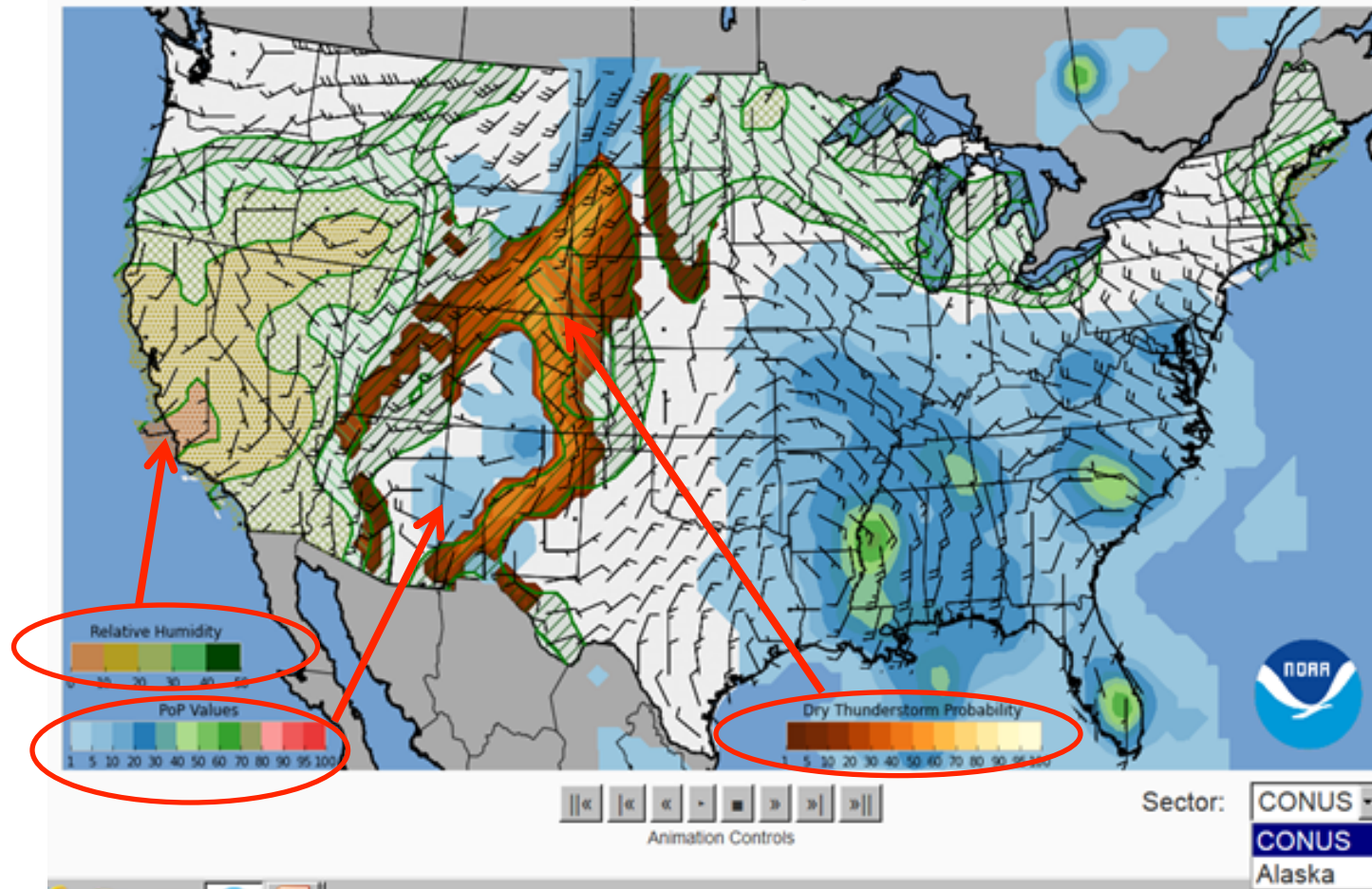
## Experimental Dry Thunderstorm Analysis Page

Current Forecast Cycle: 20140529 1800 UTC

Previous Forecast Cycle:  
20140529 1200 UTC

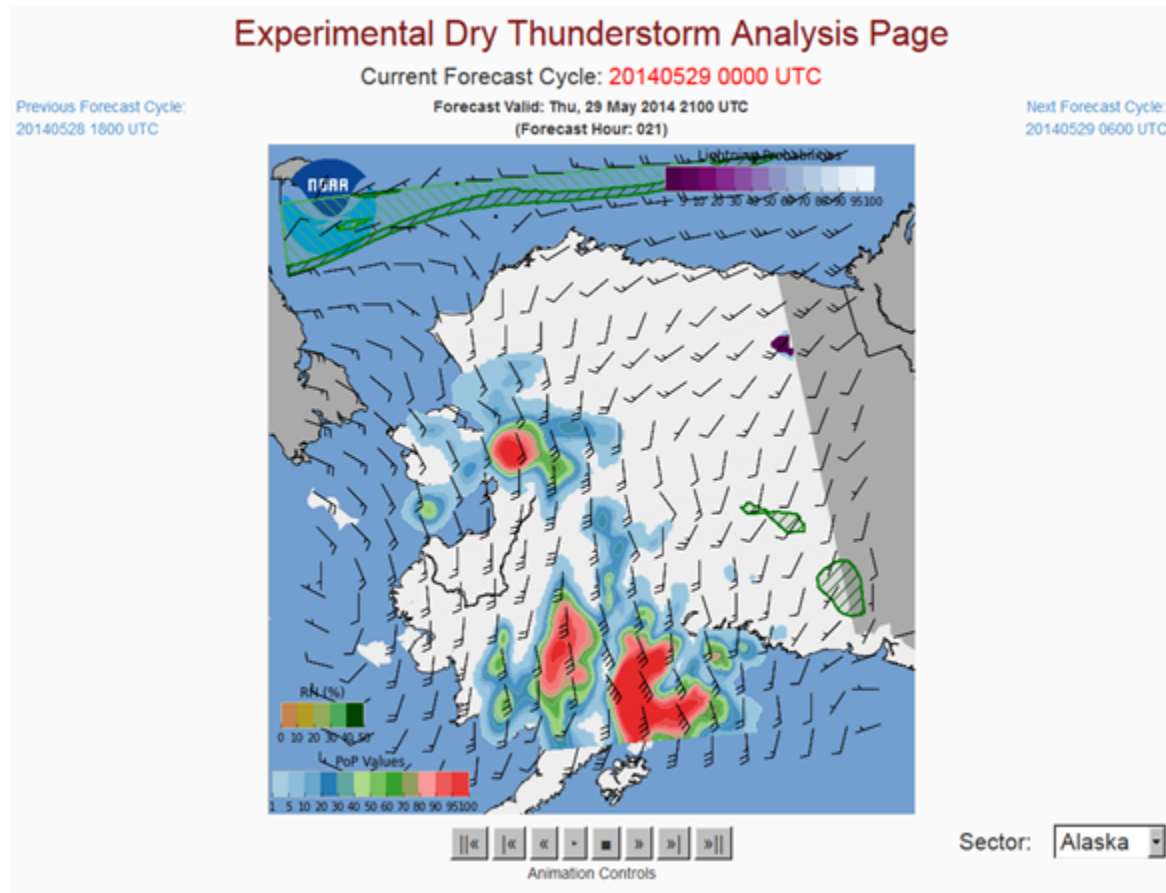
Forecast Valid: Thu, 29 May 2014 2100 UTC  
(Forecast Hour: 003)

Next Forecast Cycle:  
20140530 0000 UTC

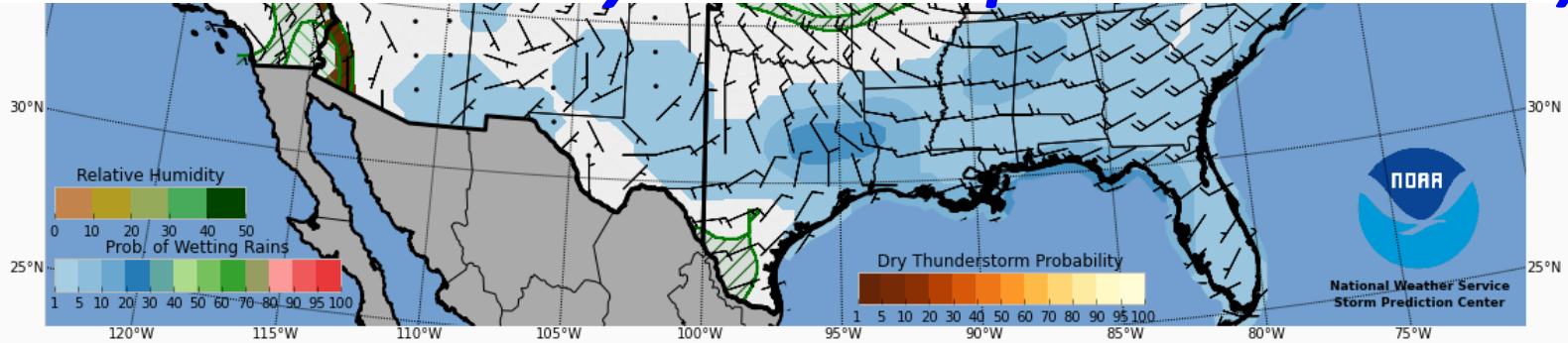


# Example of web page for Alaska

[www.spc.noaa.gov/exper/dryt](http://www.spc.noaa.gov/exper/dryt)



# Web page (continued with animation controls, Parameter Overlays and Geopolitical Borders)



Animation control buttons ->



Sector -> Sector:

NEW order for overlays

Parameter Overlays

- Dry Thunder Parameter 1 (Lightning with < 0.10" Precipitation)
- Dry Thunder Parameter 2 (Lightning with < 0.25" Precipitation)
- Probability of Wetting Rains  $\geq$  0.10"
- Probability of Wetting Rains  $\geq$  0.25"
- Lower Troposphere RH
- 700mb Wind Barbs
- Probability of 1 or more Lightning Flashes

Loads by default

NWS Forecasts

*SPC Fire Forecasts*

*GACC Fuel Dryness*

Climatologies

*Dry Thunder Parameter 1 Climatology*

*Dry Thunder Parameter 2 Climatology*

Geopolitical Borders

State Borders

County Borders

Lats and Lons

NWS County Warning Areas

NWS Fire Weather Zones

Predictive Service Areas

GACC Regions

<-Overlay control (selecting a higher number than the other images will place image as top overlay).

NEW-GACC boundaries

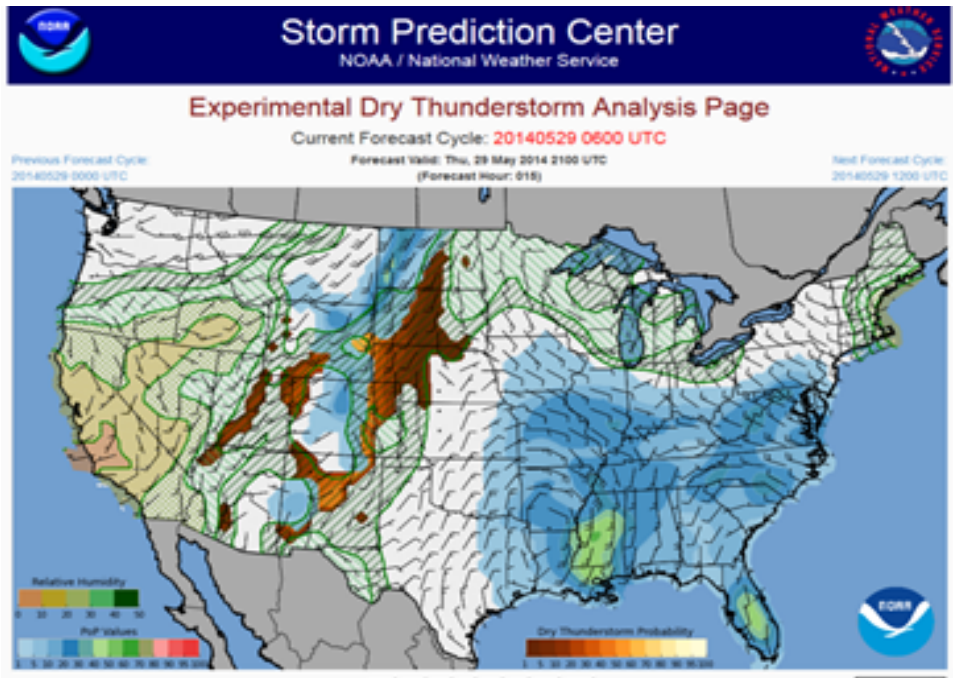
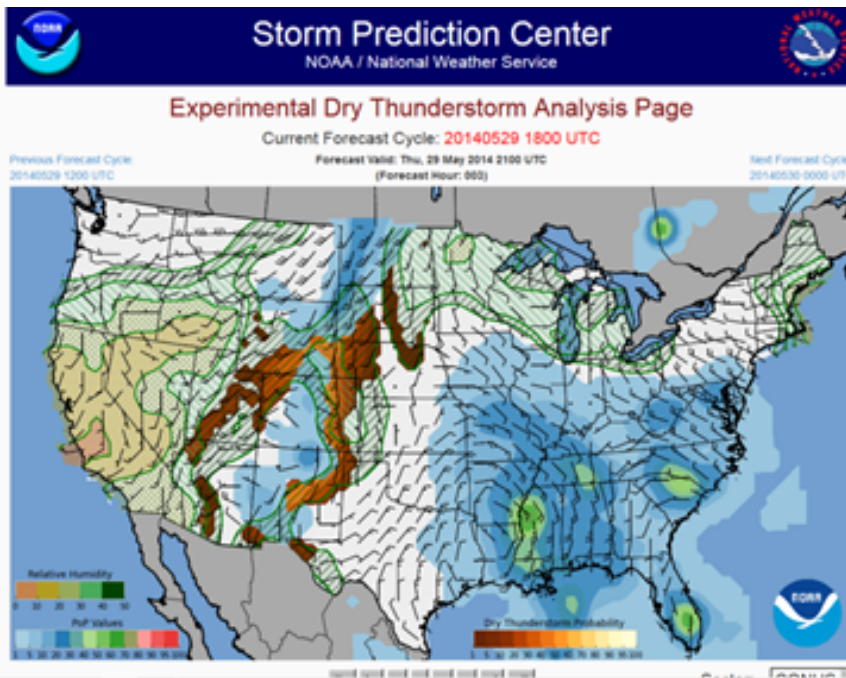


# Example of **dProg/dT** for May 29 2100 UTC

Forecast for **0.10 inch or greater** is dominant overlay

**3 hr fcst** from 18 UTC GFS cycle

**15 hr fcst** from 06 UTC GFS cycle

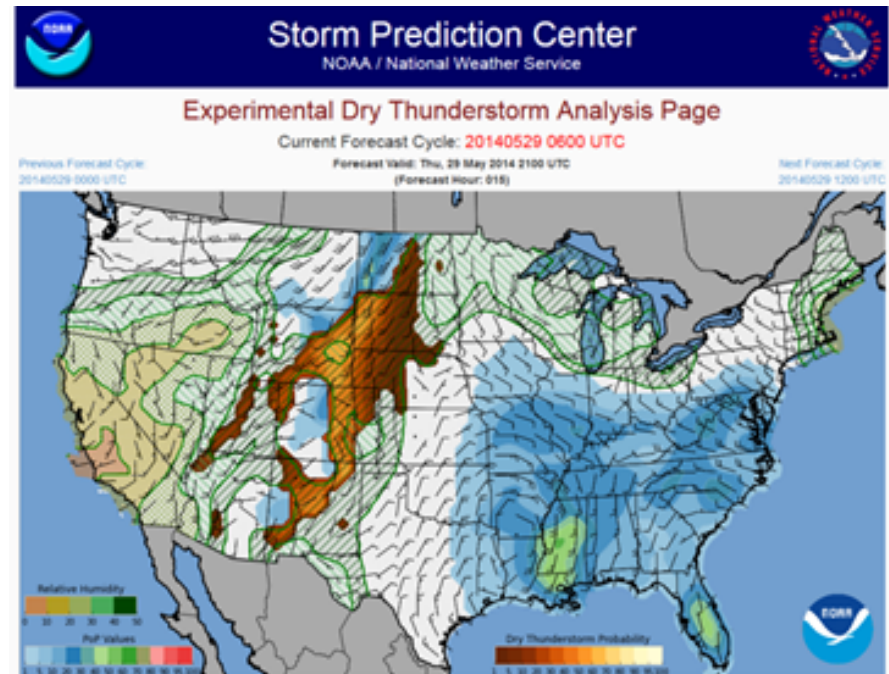
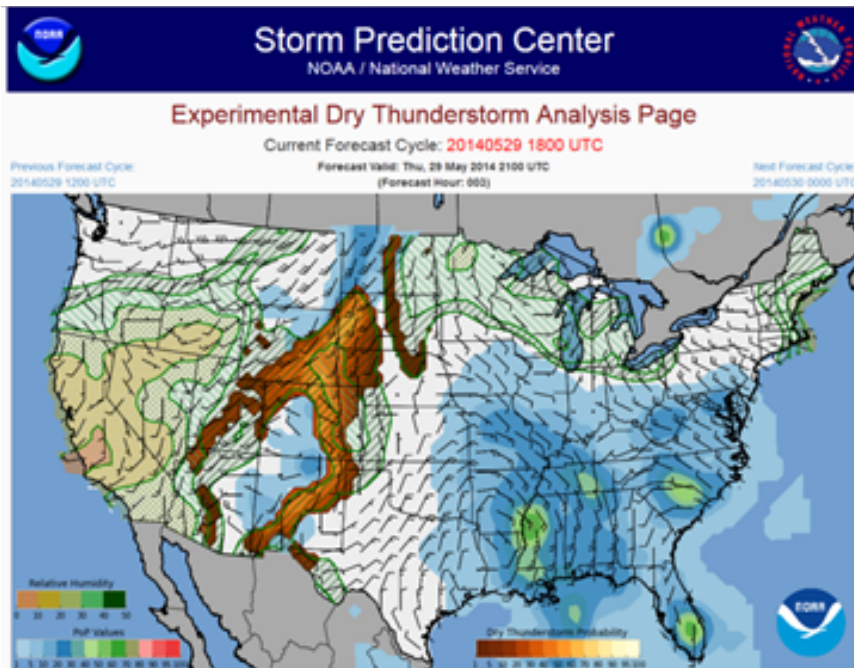


# Example of dProg/dT for May 29 2100 UTC

## Forecast for DRYTH1 is dominant overlay

**3 hr fcst** from 18 UTC GFS cycle

**15 hr fcst** from 06 UTC GFS cycle



# **Use of the SPC Experimental Dry Thunderstorm Web page**

**[www.spc.noaa.gov/exper/dryt](http://www.spc.noaa.gov/exper/dryt)**

**June 2014 cases (CONUS and Alaska)**

Each forecast is valid for a 3 hour time period and  
the times are the start times



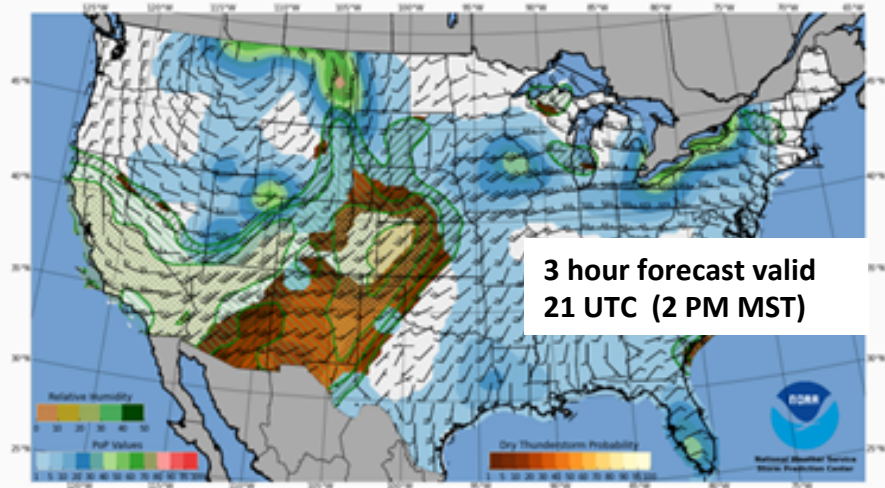
Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140617 1800 UTC

Forecast Valid: Tue, 17 Jun 2014 2100 UTC  
(Forecast Hour: 003)

Next Forecast Cycle: 20140618 0000 UTC

Previous Forecast Cycle: 20140617 1200 UTC



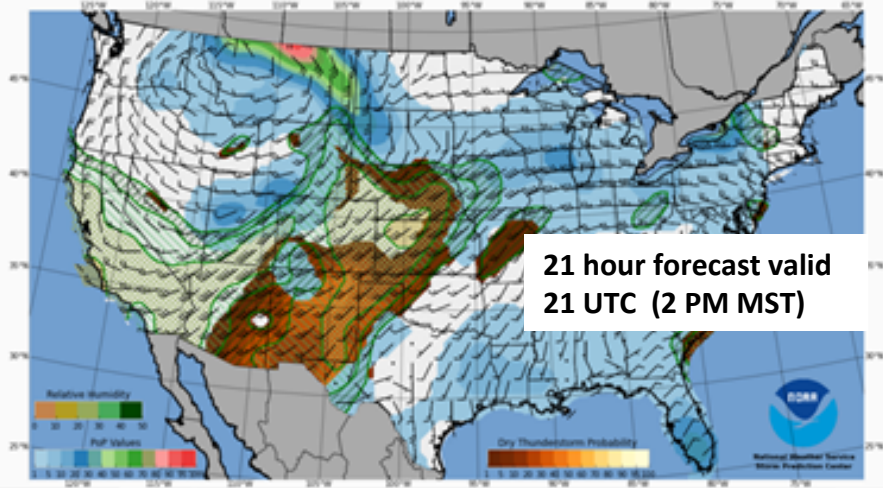
Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140617 0000 UTC

Forecast Valid: Tue, 17 Jun 2014 2100 UTC  
(Forecast Hour: 021)

Next Forecast Cycle: 20140617 0600 UTC

Previous Forecast Cycle: 20140616 1800 UTC



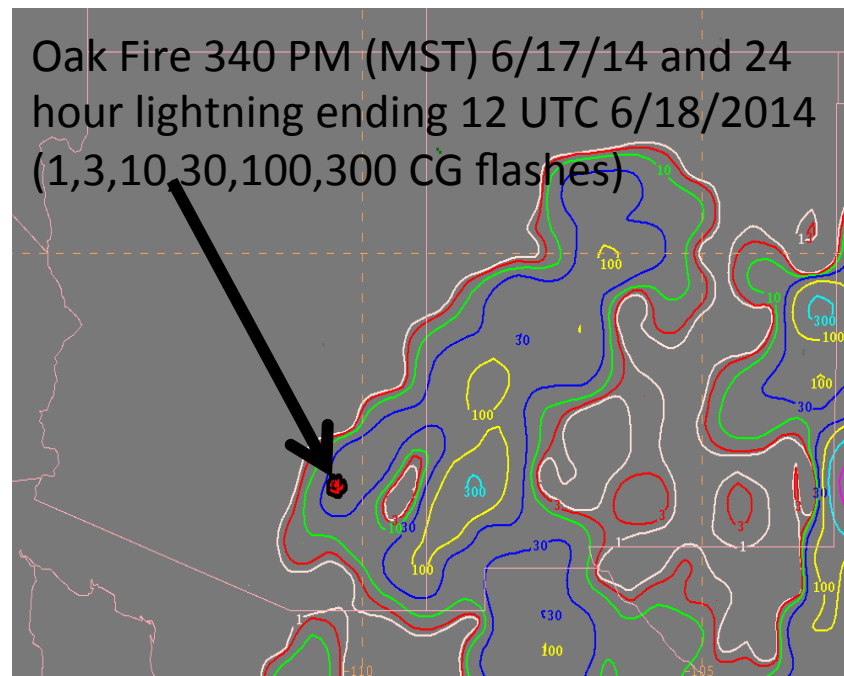
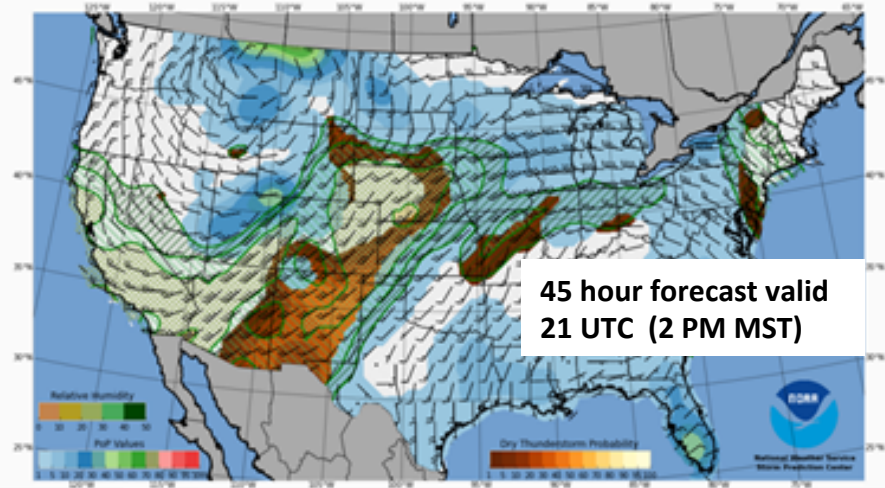
Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140616 0000 UTC

Forecast Valid: Tue, 17 Jun 2014 2100 UTC  
(Forecast Hour: 045)

Next Forecast Cycle: 20140616 0600 UTC

Previous Forecast Cycle: 20140615 1800 UTC



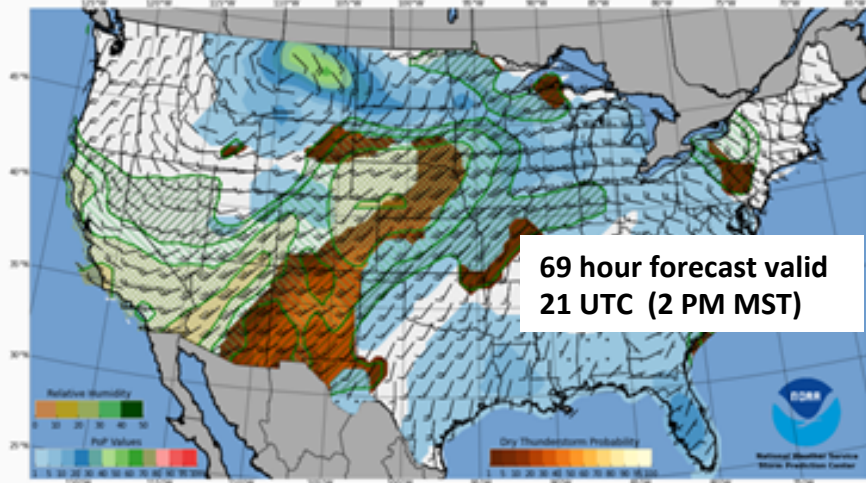
Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140615 0000 UTC

Forecast Valid: Tue, 17 Jun 2014 2100 UTC  
(Forecast Hour: 069)

Next Forecast Cycle:  
20140615 0600 UTC

Previous Forecast Cycle:  
20140614 1800 UTC



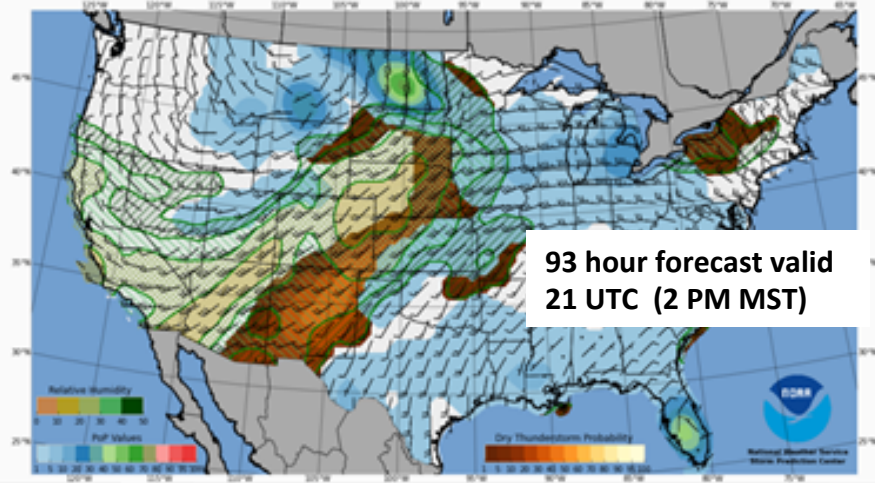
Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140614 0000 UTC

Forecast Valid: Tue, 17 Jun 2014 2100 UTC  
(Forecast Hour: 093)

Next Forecast Cycle:  
20140614 0600 UTC

Previous Forecast Cycle:  
20140613 1800 UTC



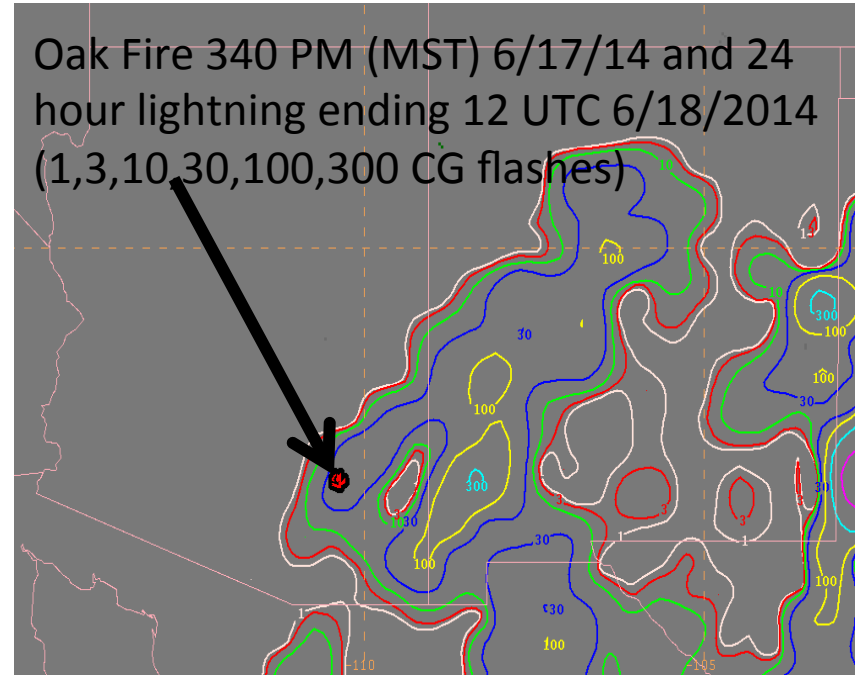
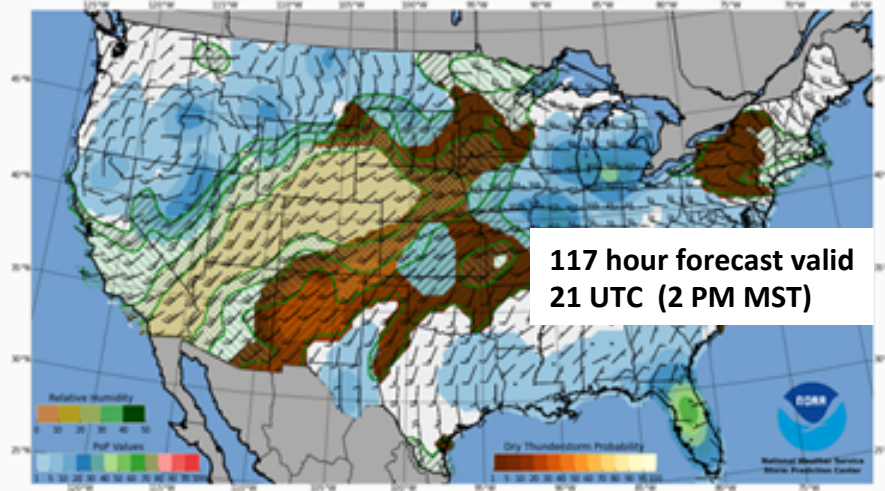
Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140613 0000 UTC

Forecast Valid: Tue, 17 Jun 2014 2100 UTC  
(Forecast Hour: 117)

Next Forecast Cycle:  
20140613 0600 UTC

Previous Forecast Cycle:  
20140612 1800 UTC





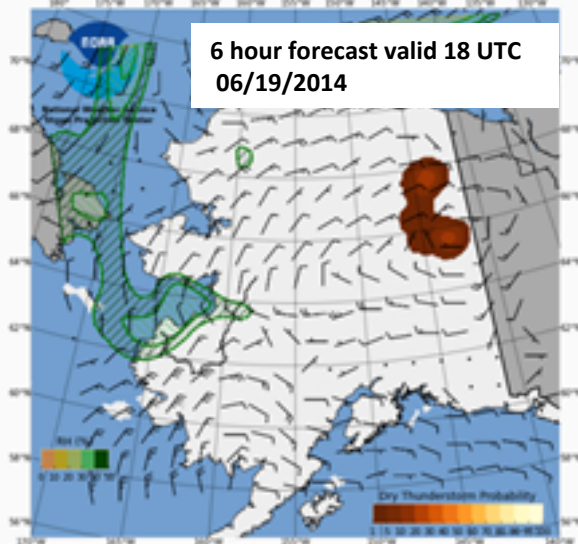
### Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140619 1200 UTC

Previous Forecast Cycle:  
20140619 0600 UTC

Forecast Valid: Thu, 19 Jun 2014 1800 UTC  
(Forecast Hour: 006)

Next Forecast Cycle:  
20140619 1800 UTC



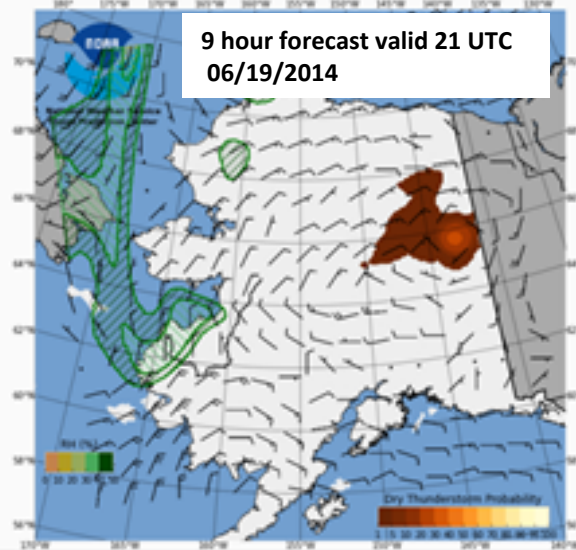
### Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140619 1200 UTC

Previous Forecast Cycle:  
20140619 0600 UTC

Forecast Valid: Thu, 19 Jun 2014 2100 UTC  
(Forecast Hour: 009)

Next Forecast Cycle:  
20140619 1800 UTC



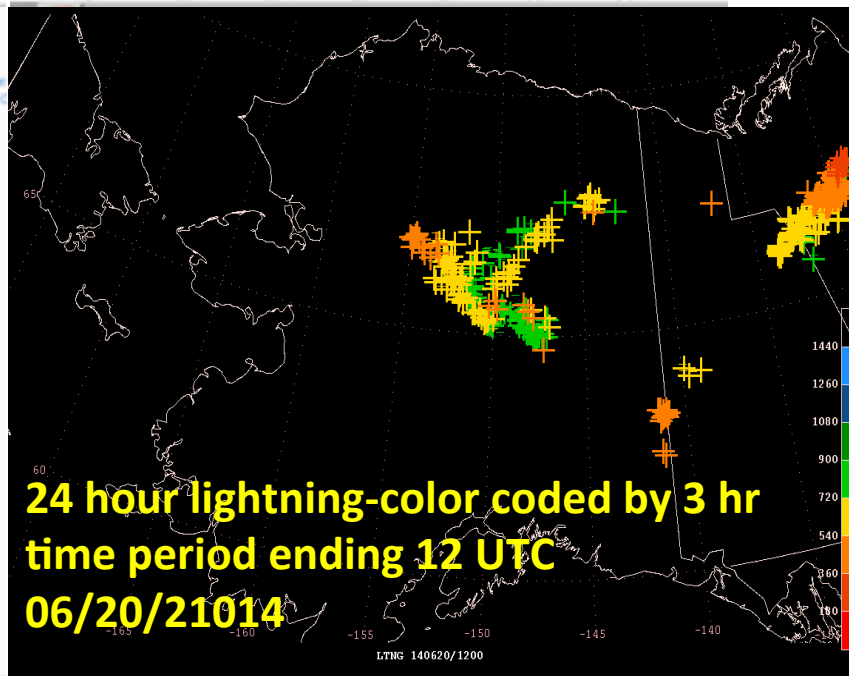
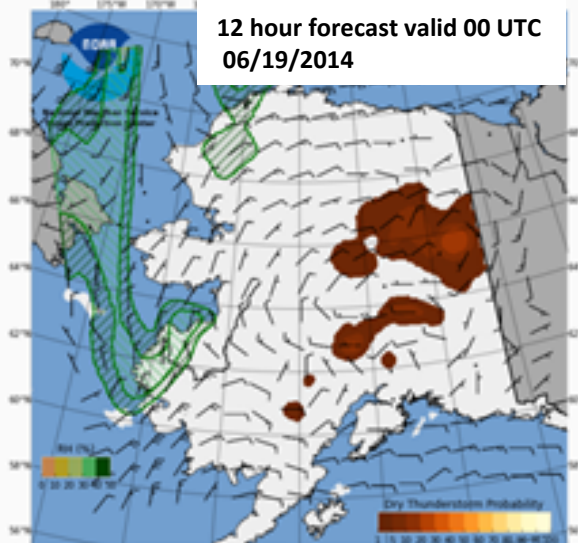
### Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140619 1200 UTC

Previous Forecast Cycle:  
20140619 0600 UTC

Forecast Valid: Fri, 20 Jun 2014 0000 UTC  
(Forecast Hour: 012)

Next Forecast Cycle:  
20140619 1800 UTC



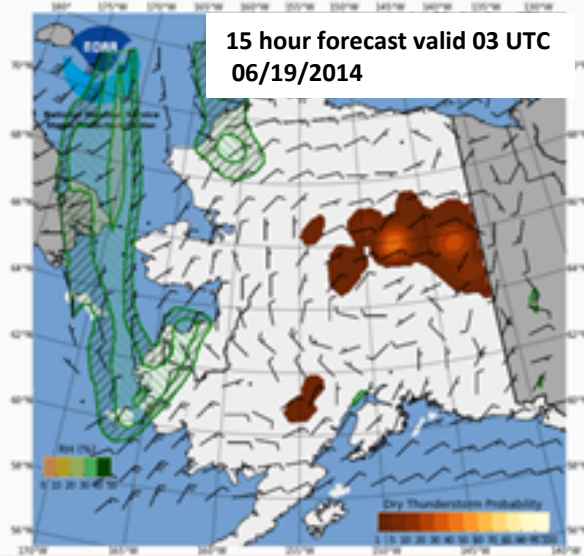
### Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140619 1200 UTC

Previous Forecast Cycle:  
20140619 0600 UTC

Forecast Valid: Fri, 20 Jun 2014 0300 UTC  
(Forecast Hour: 015)

Next Forecast Cycle:  
20140619 1800 UTC



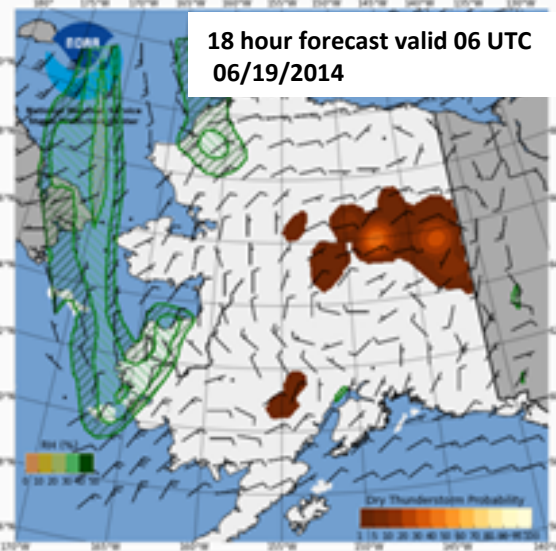
### Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140619 1200 UTC

Previous Forecast Cycle:  
20140619 0600 UTC

Forecast Valid: Fri, 20 Jun 2014 0600 UTC  
(Forecast Hour: 015)

Next Forecast Cycle:  
20140619 1800 UTC



### Experimental Dry Thunderstorm Forecast Page

Current Forecast Cycle: 20140619 1200 UTC

Previous Forecast Cycle:  
20140619 0600 UTC

Forecast Valid: Fri, 20 Jun 2014 0900 UTC  
(Forecast Hour: 021)

Next Forecast Cycle:  
20140619 1800 UTC

