Preliminary review of 2015 CFS anomaly forecasts of precipitation and severe weather

Greg Carbin, NOAA/NWS/SPC

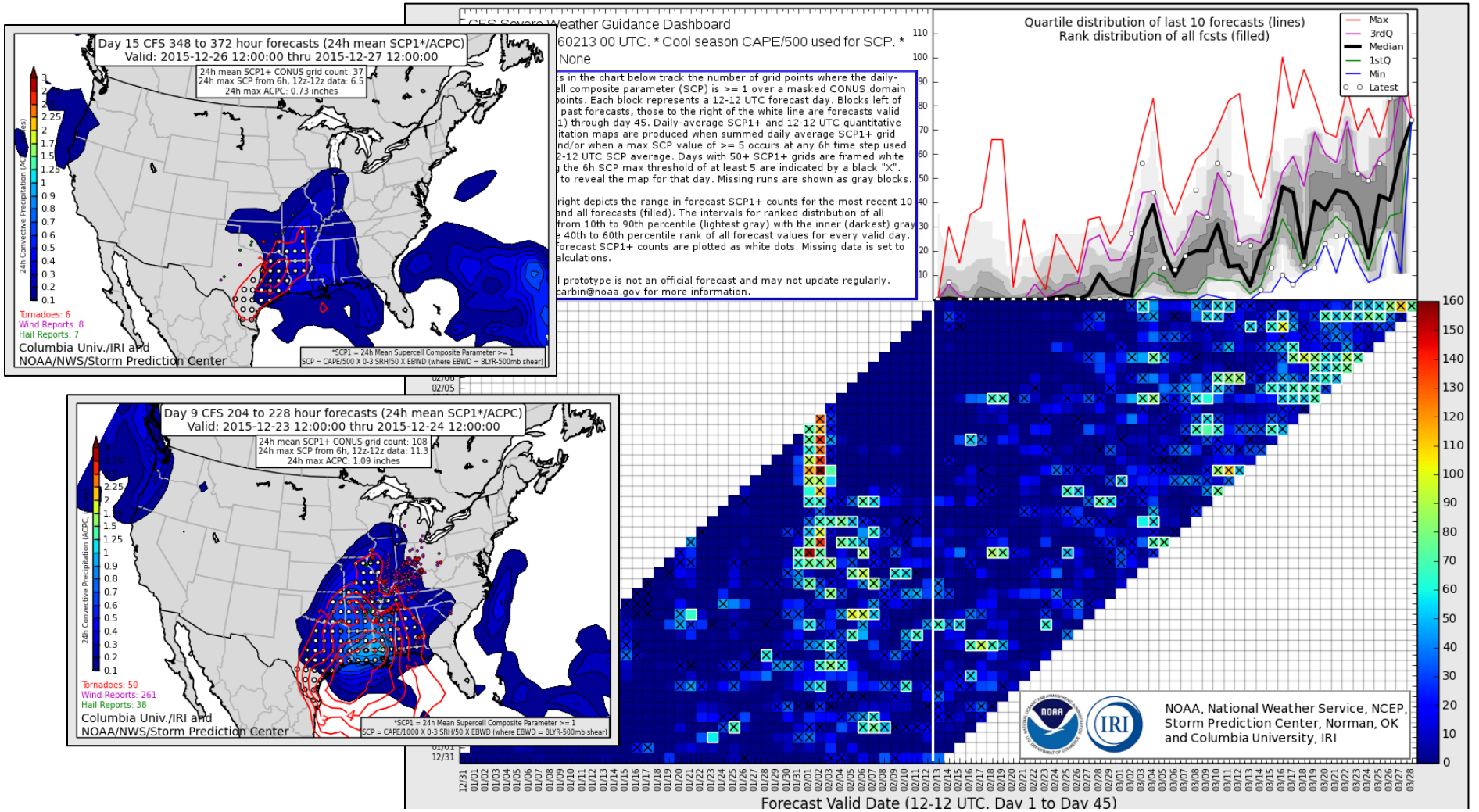
Climate Forecast System (CFS) – Severe

2015-16 Updates

- Dashboard now operational on SPC website (uses SPC grib2)
- Used by forecasters for SPC Day 4-8 forecasts
- **Visualizing Long-range Severe Thunderstorm Environment Guidance from CFSv2**, *Gregory W. Carbin, Michael K. Tippett, Samuel P. Lillo, Harold E. Brooks* (BAMS Online Early Release)

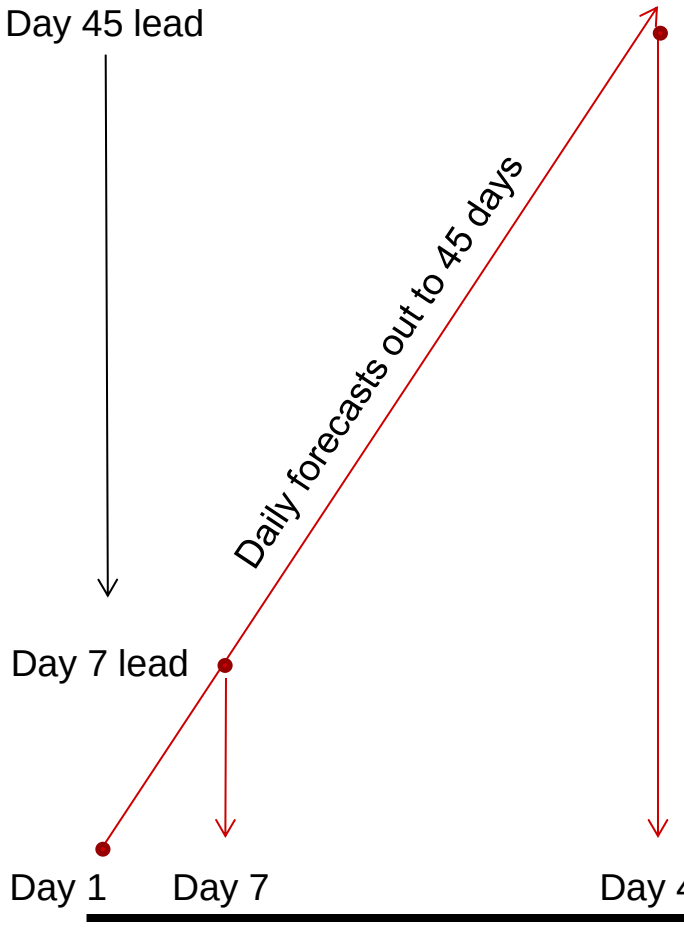
Climate Forecast System (CFS) – Severe

Now operational at www.spc.noaa.gov/exper/CFS_Dashboard



Climate Forecast System (CFS) – Severe

Re-orient your perspective by placing grid count forecasts on parallel diagonals (Day 1 to Day 45 for each 00 UTC CFS run)



Example for initial CFS run on January 1, 2015

As additional forecasts are added along the diagonals, run-to-run consistency in grid count forecasts will appear as vertical stripes with similar color.

Y axis is decreasing lead time with Y=0 being valid date

X axis = dates in calendar year starting Jan. 1, 2015

Climate Forecast System (CFS) – Severe

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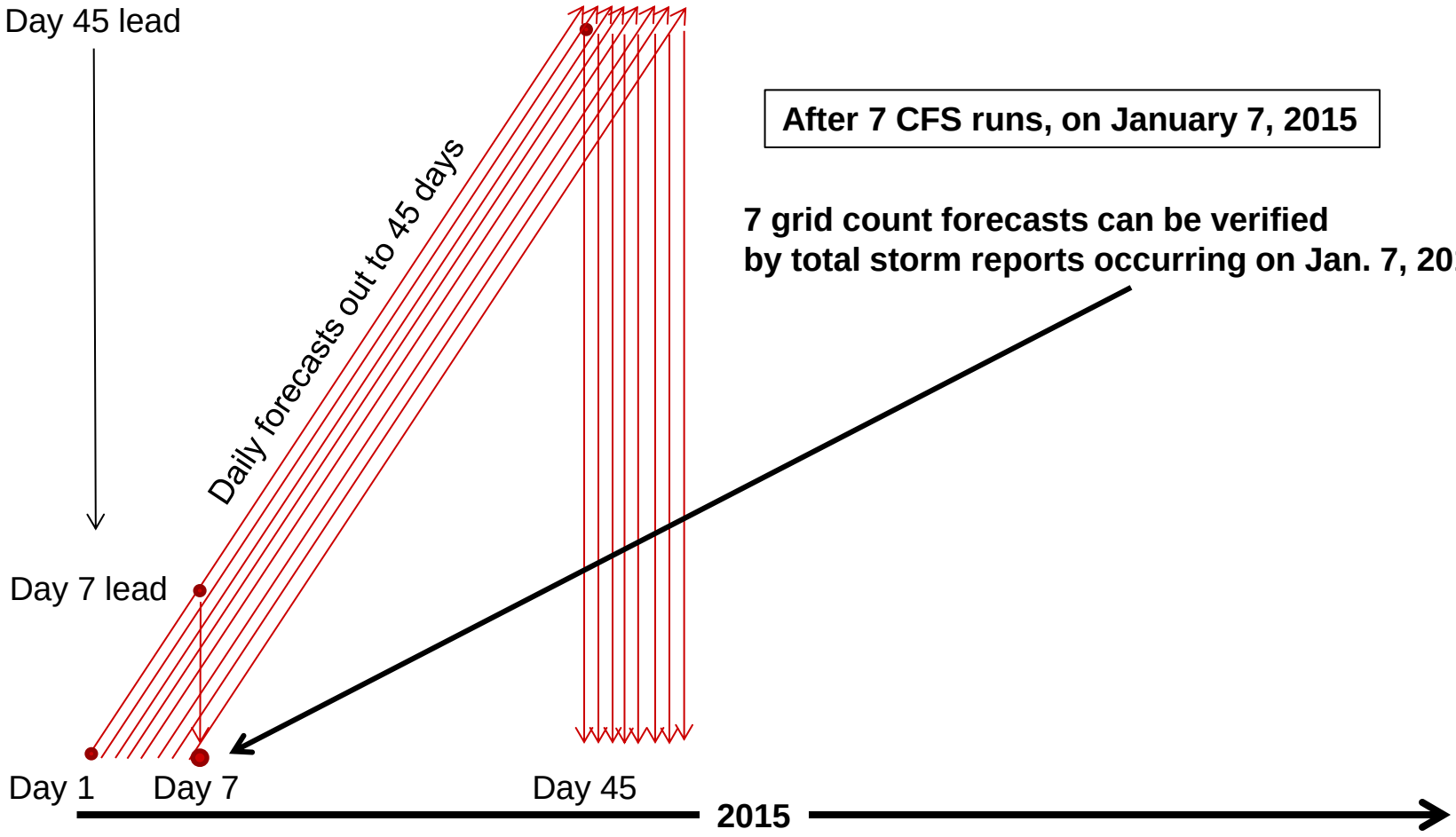

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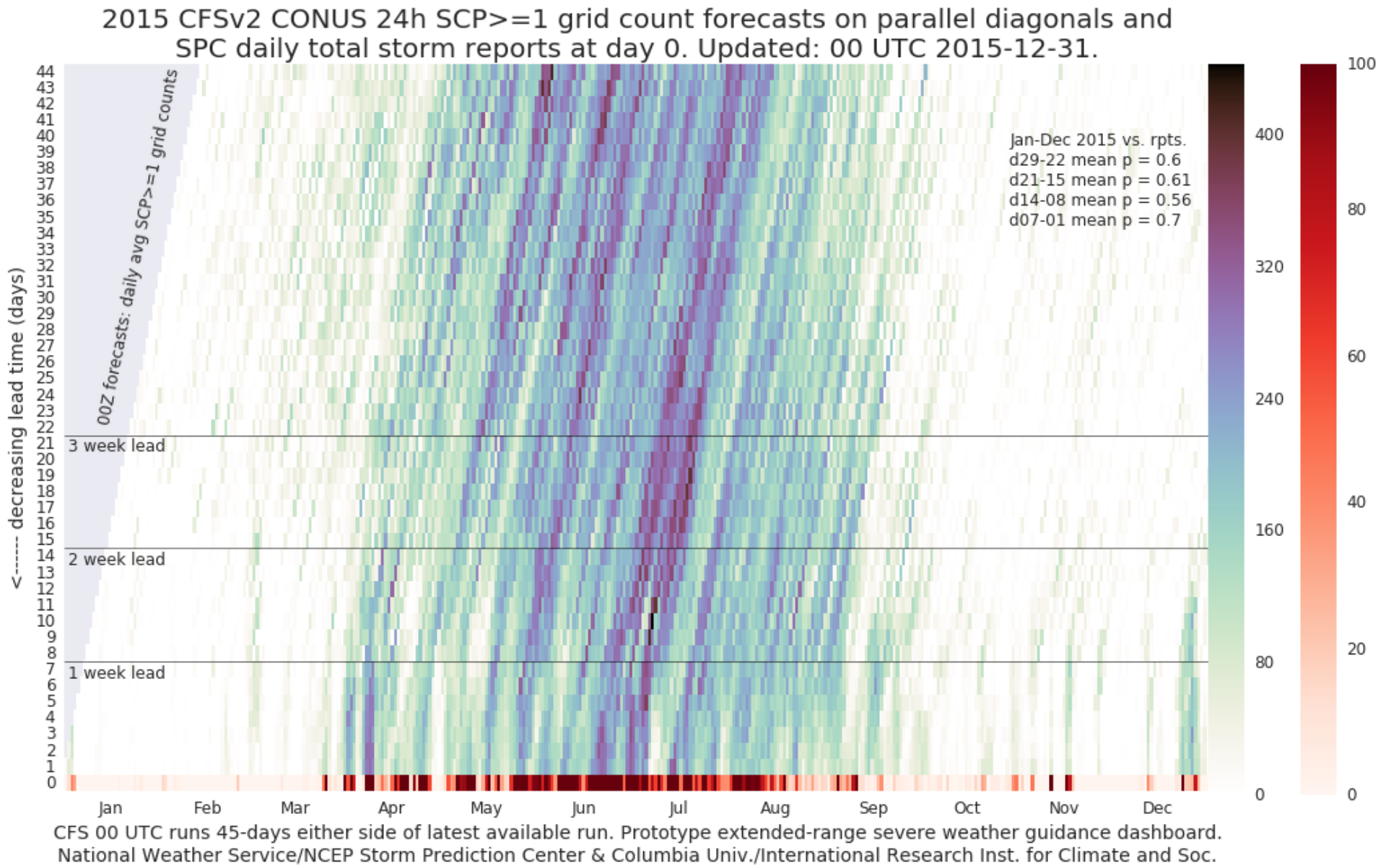

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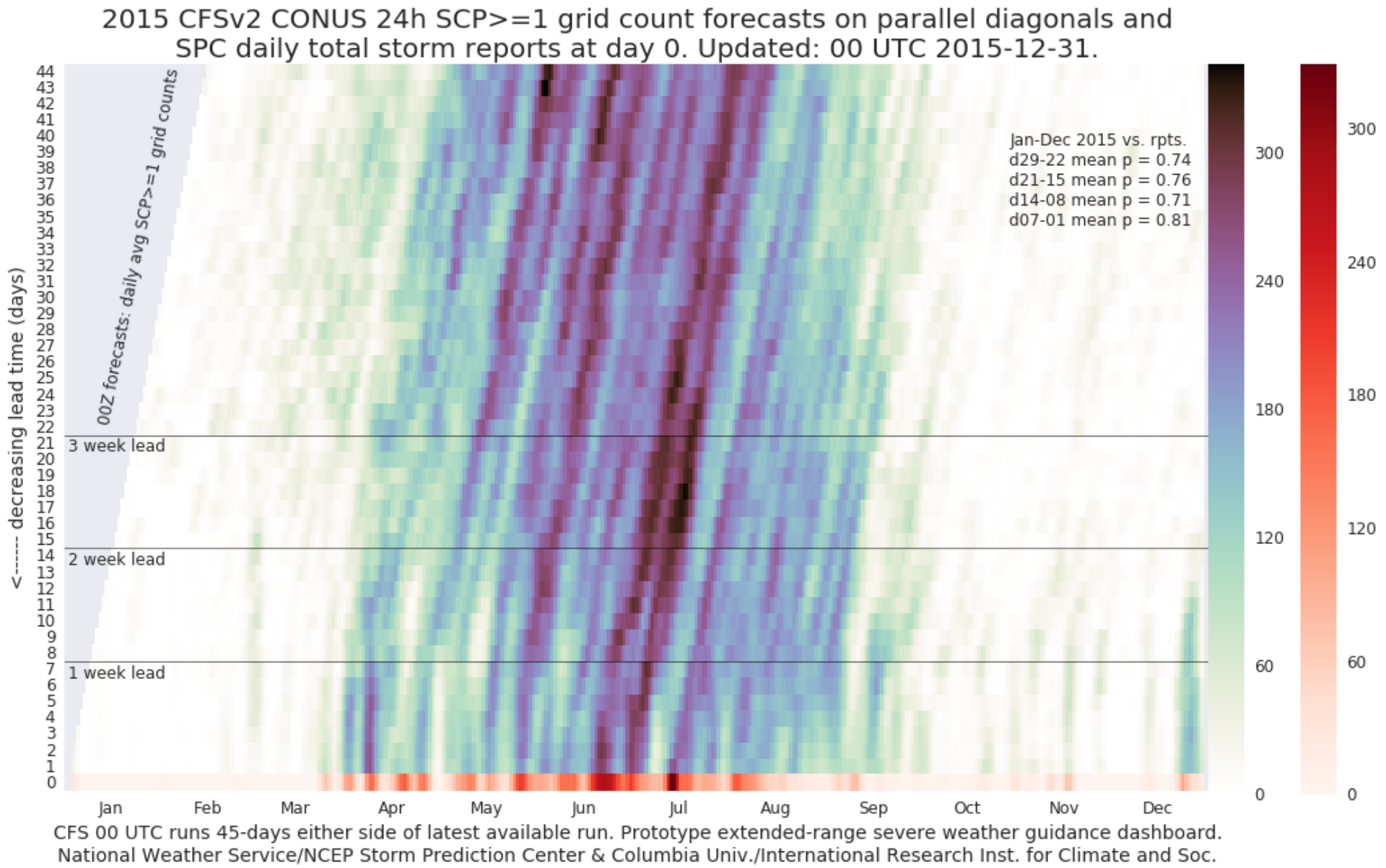

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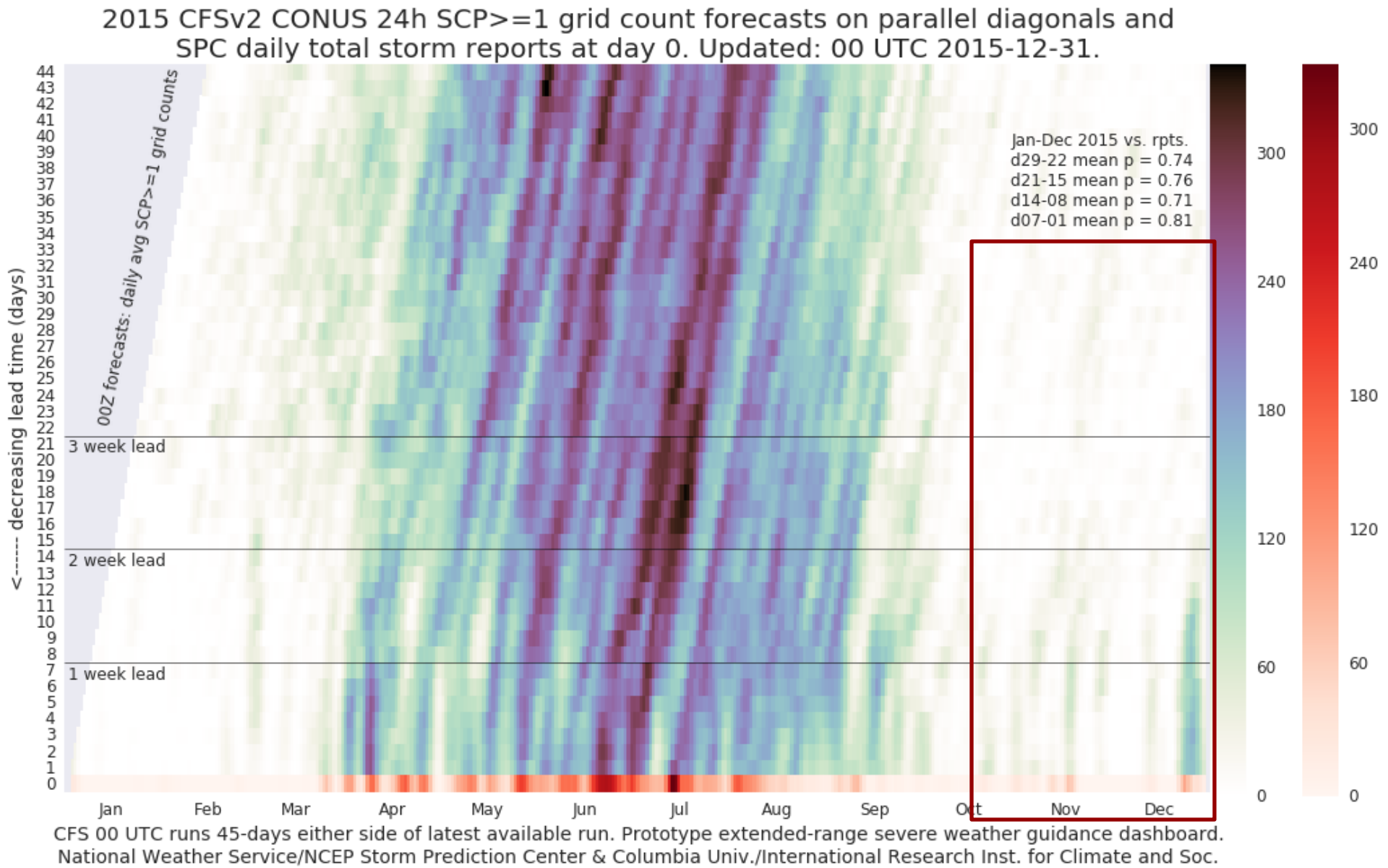

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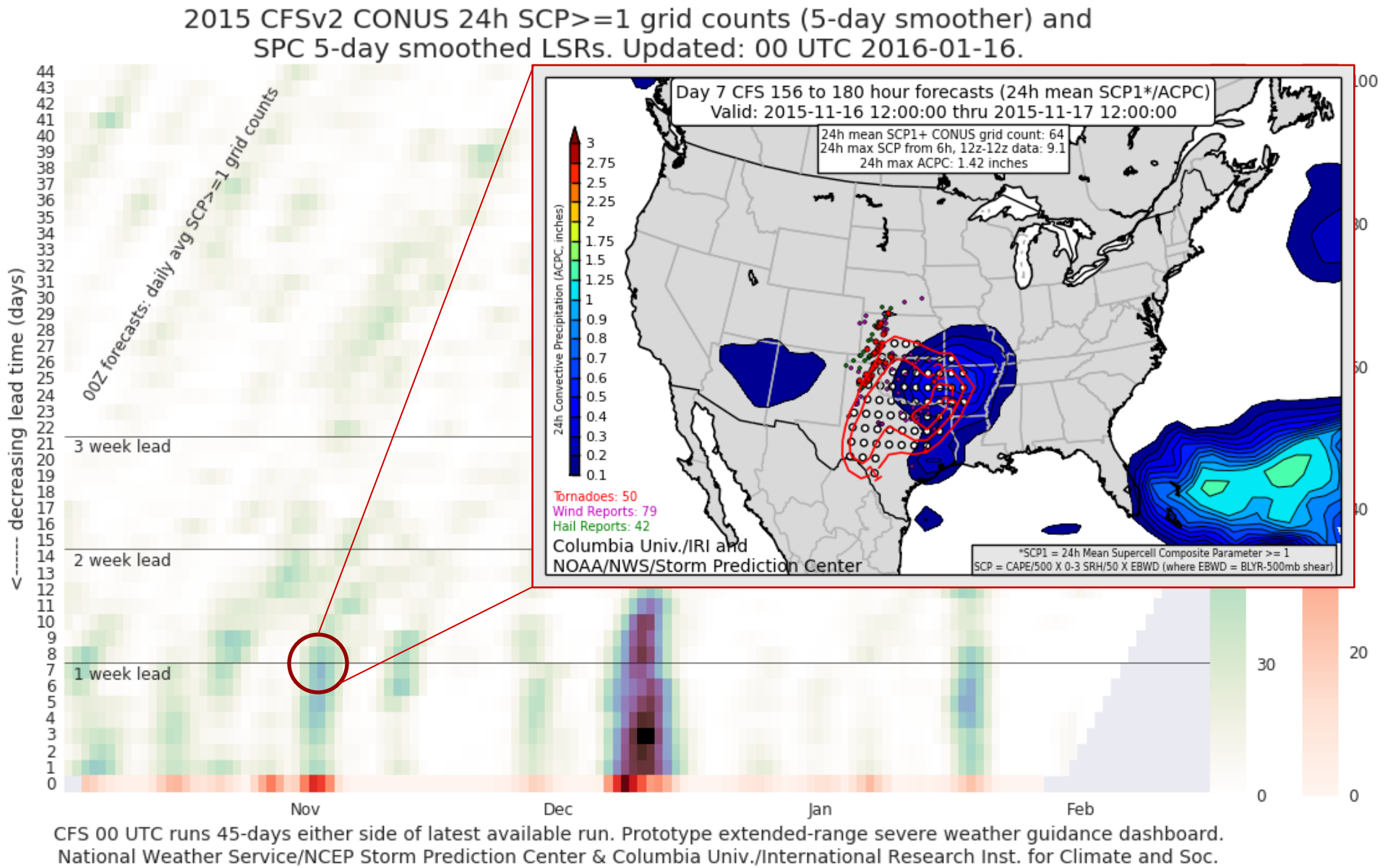
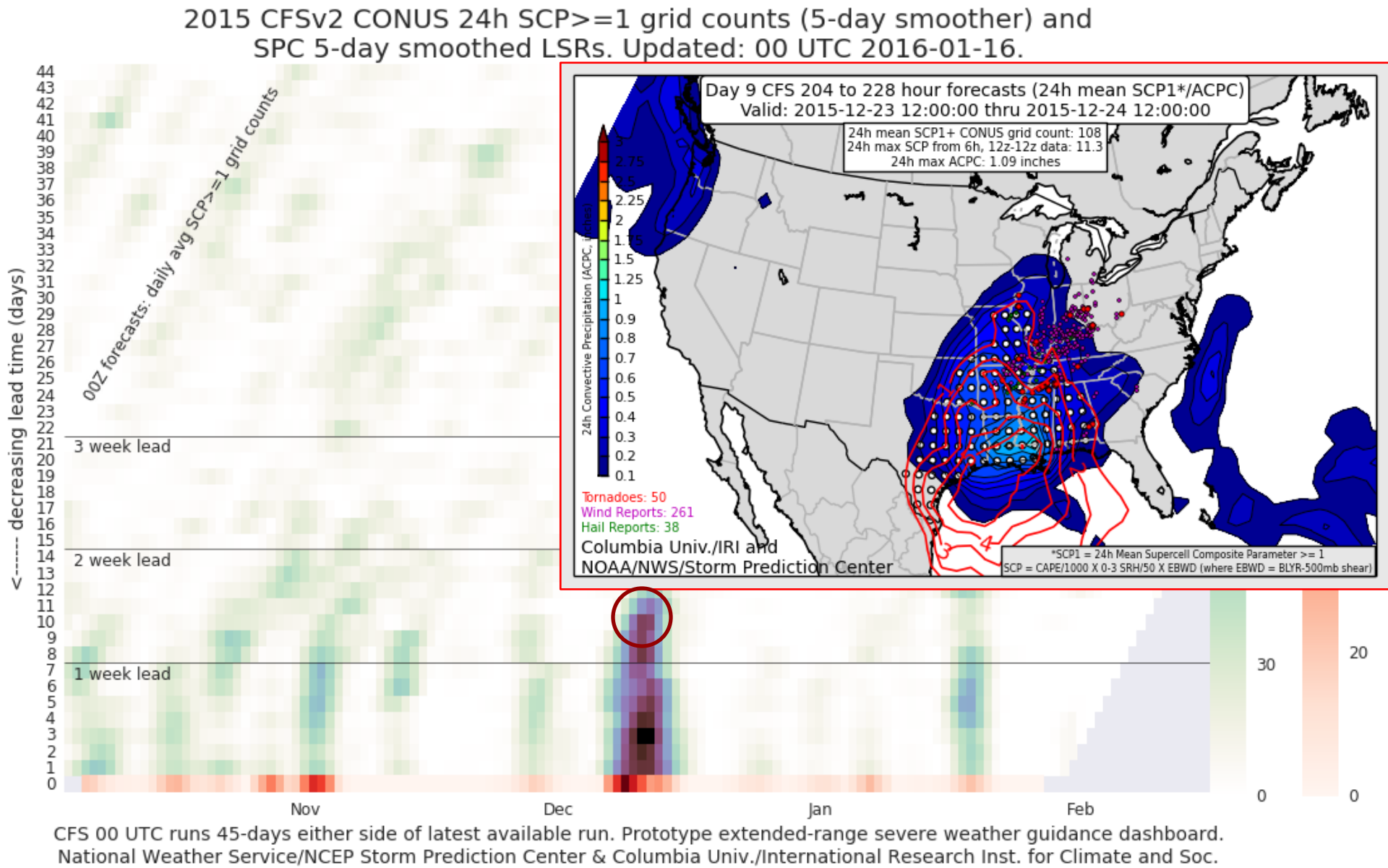


CFS 00 UTC runs 45-days either side of latest available run. Prototype extended-range severe weather guidance dashboard.
National Weather Service/NCEP Storm Prediction Center & Columbia Univ./International Research Inst. for Climate and Soc.

Climate Forecast System (CFS) – Severe



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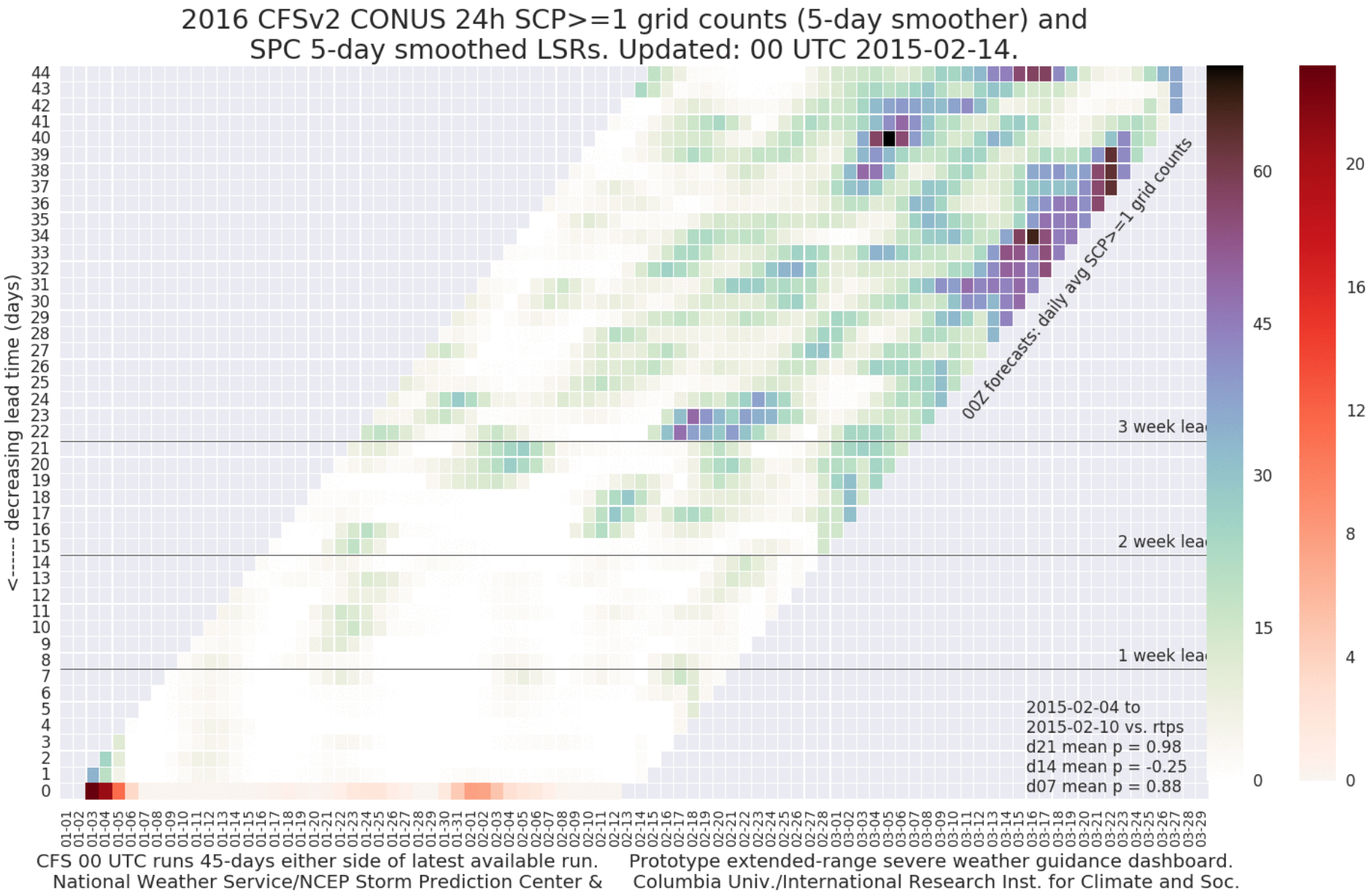

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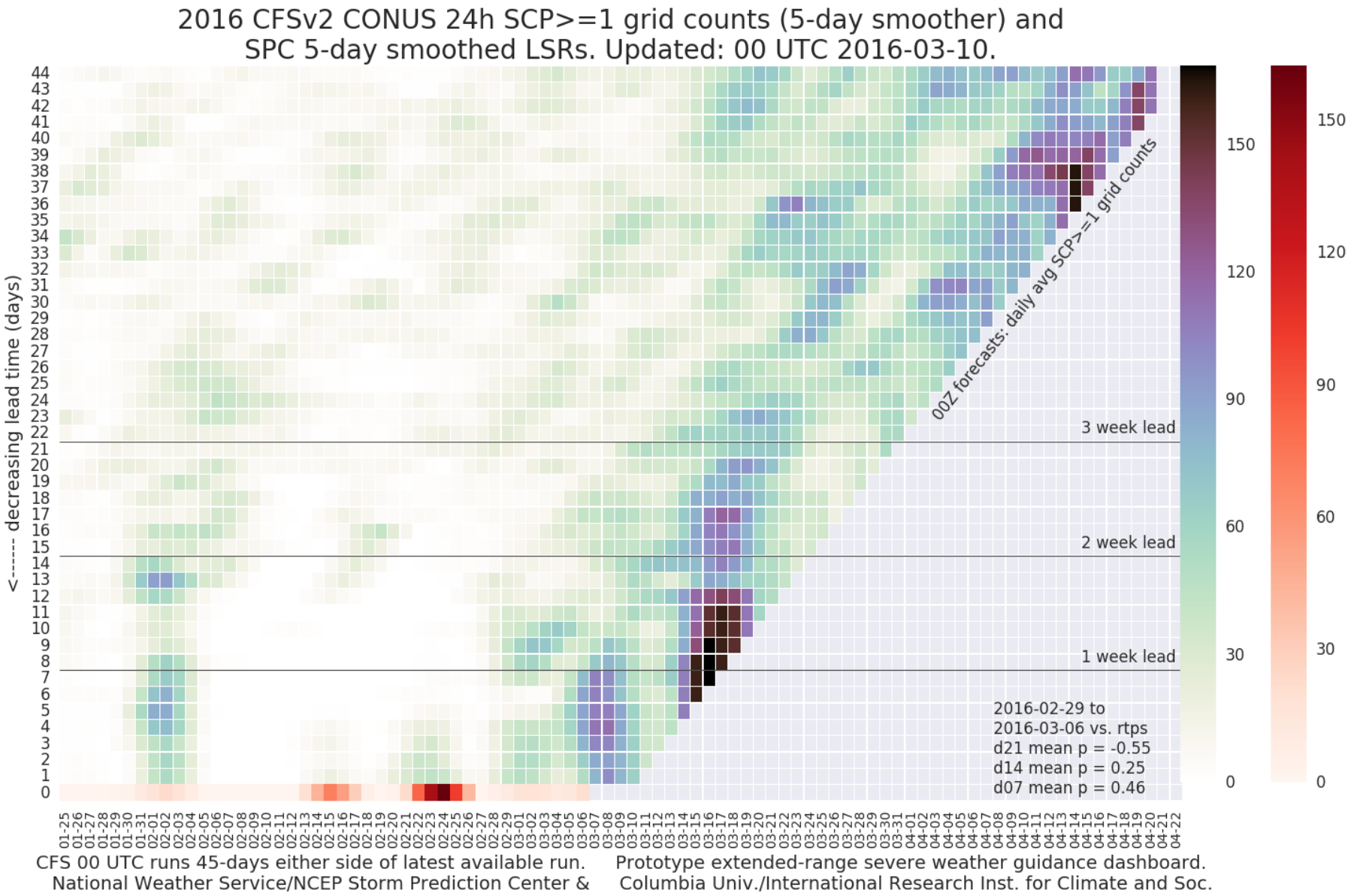
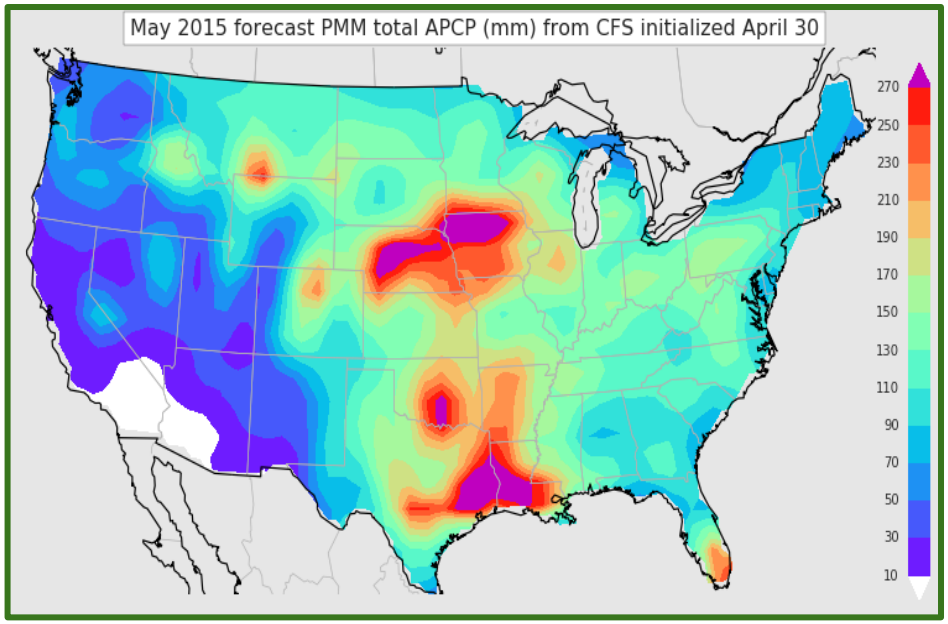
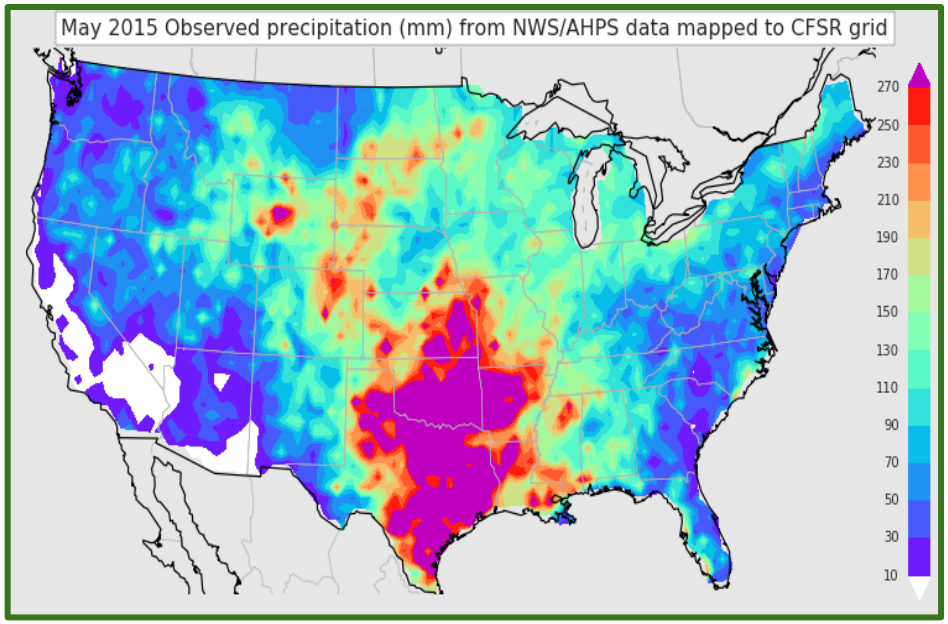


Monthly CFS Precipitation Forecasts with Probability Matched Mean QPF

May 2015



Forecast made April 30, 2015



From NWS AHPS analysis

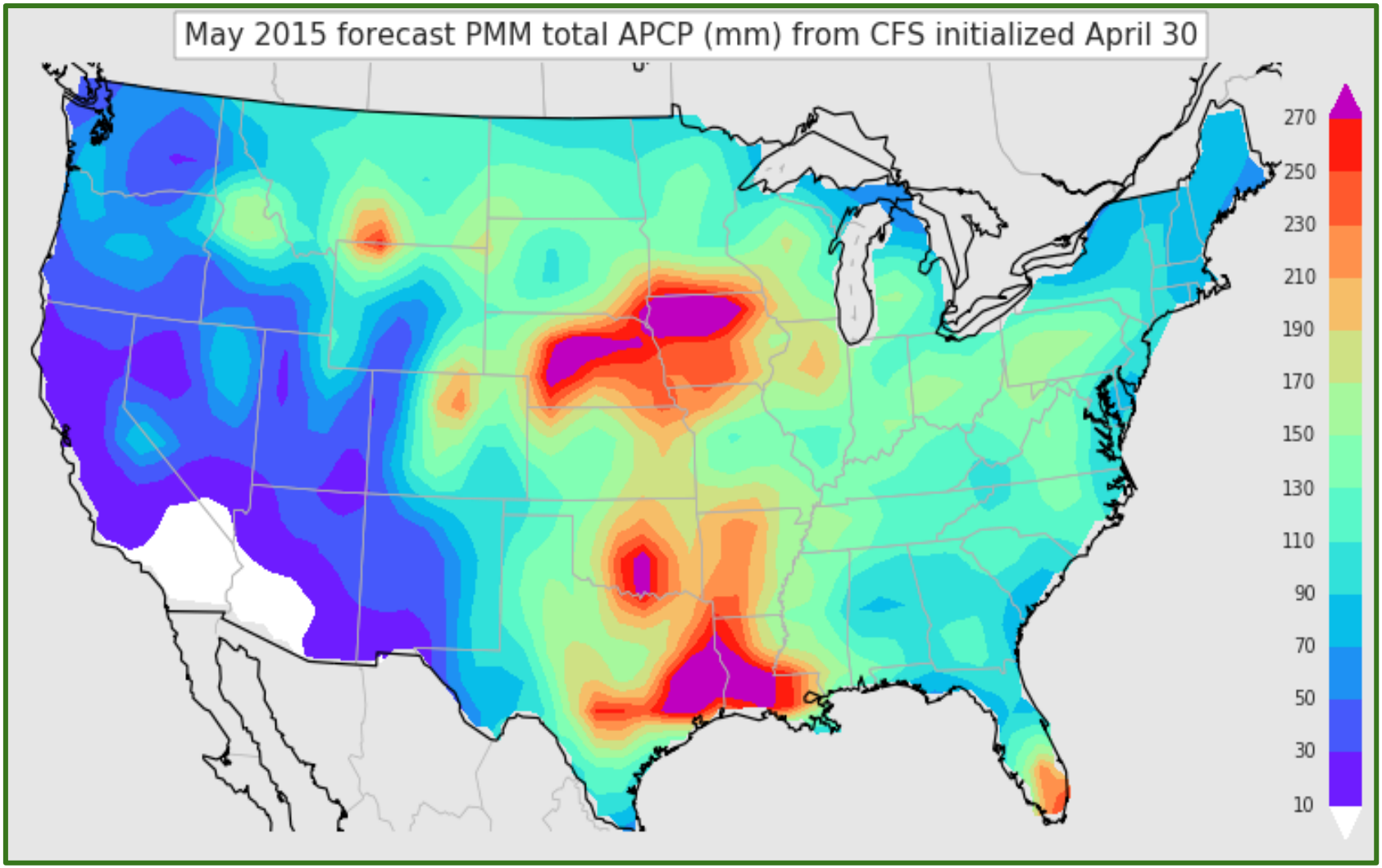
Why probability matched mean (PMM)?

Ability of a Poor Man's Ensemble to Predict the Probability and Distribution of Precipitation

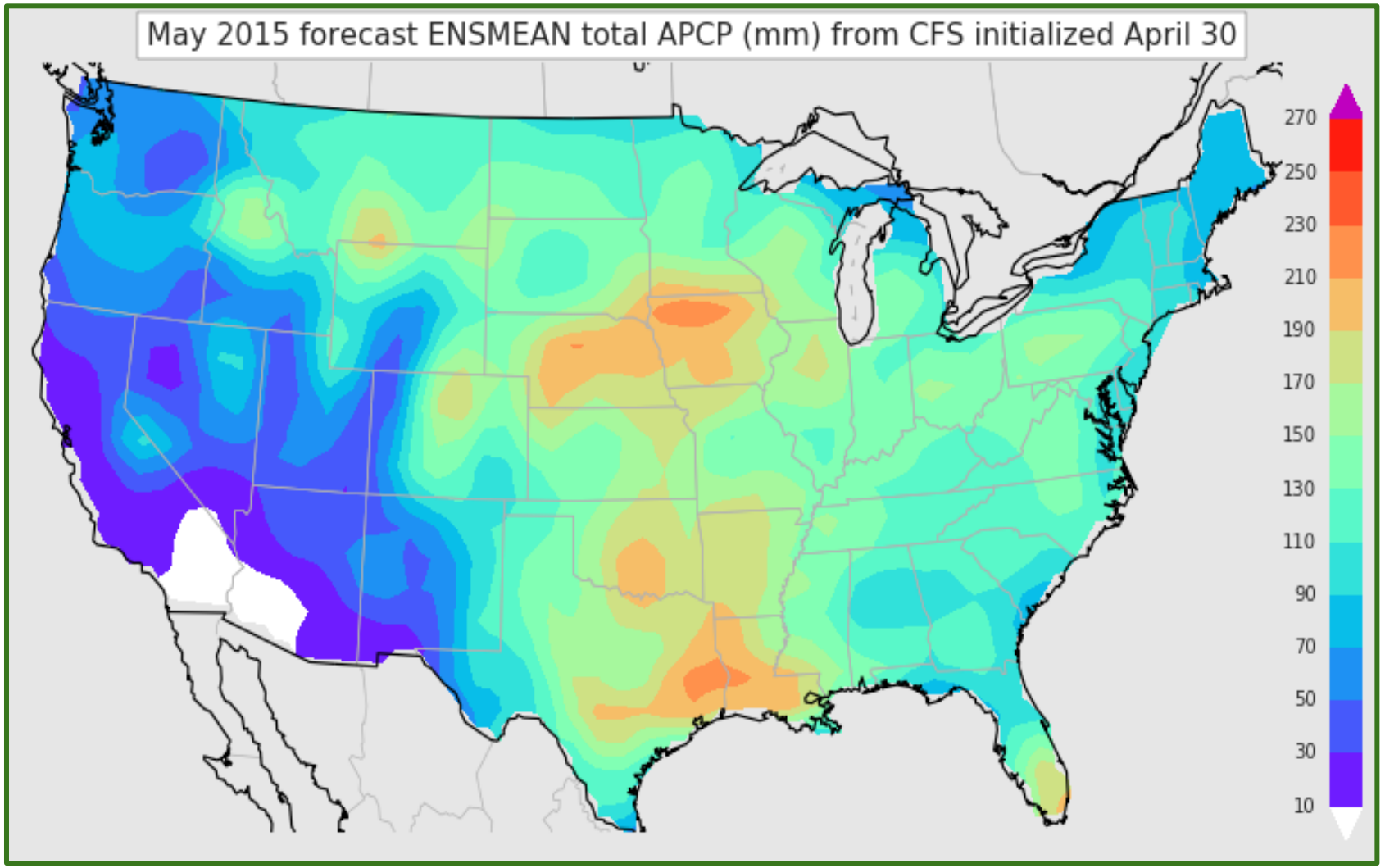
Elizabeth E. Ebert
Monthly Weather Review
Volume 129, Issue 10 (October 2001) pp. 2461-2480

"The most successful strategy used probability matching (PM) to reassign the rain rates in the ensemble mean using the rain rate distribution of the component QPFs. The PM forecast benefited from the improved rain location given by the ensemble mean, with more realistic rain rates taken directly from the model QPFs."

May 2015 Total CONUS Precipitation PMM of 8 CFS members on April 30



May 2015 Total CONUS Precipitation
Ens Mean of 8 CFS members on April 30



Methods

Take latest 1-month lead CFS forecasts → Compute ensemble mean and PMM → Use CFSR and compare areal extent of extremes

Use last n CFS runs

For 1-month ahead, forecast precipitation is computed by summing valid CFS 6h APCP grids for all available runs on the last day of current month. For example, forecasts for May 2015 use CFS runs initialized April 30, 2015.

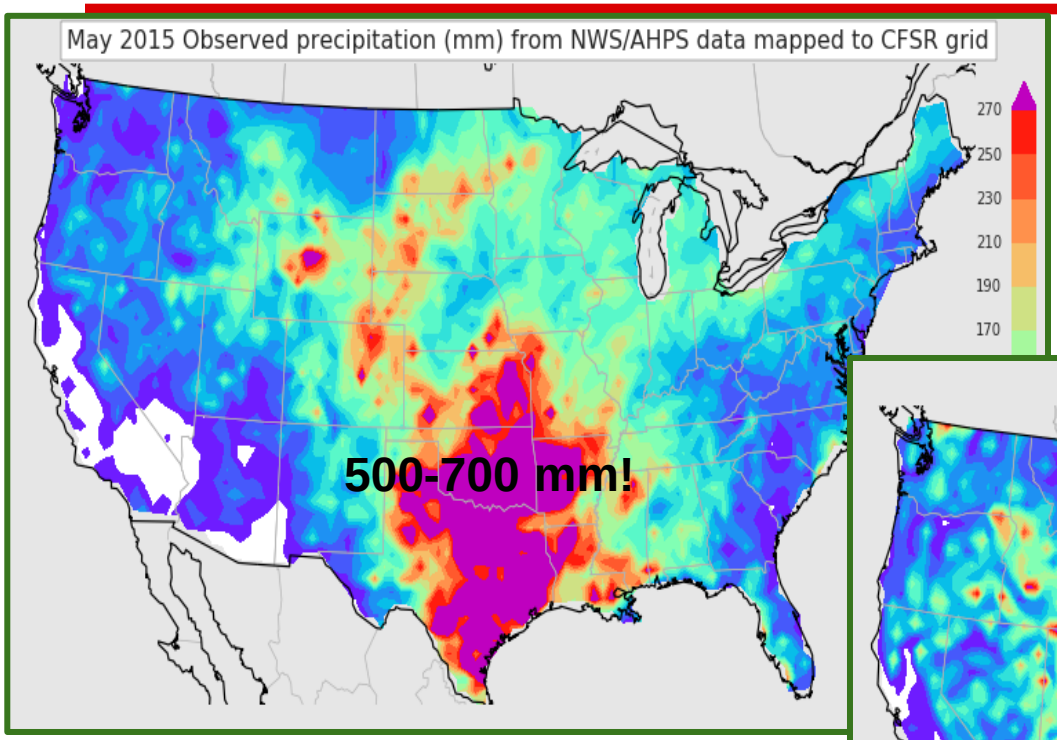
PMM QPF

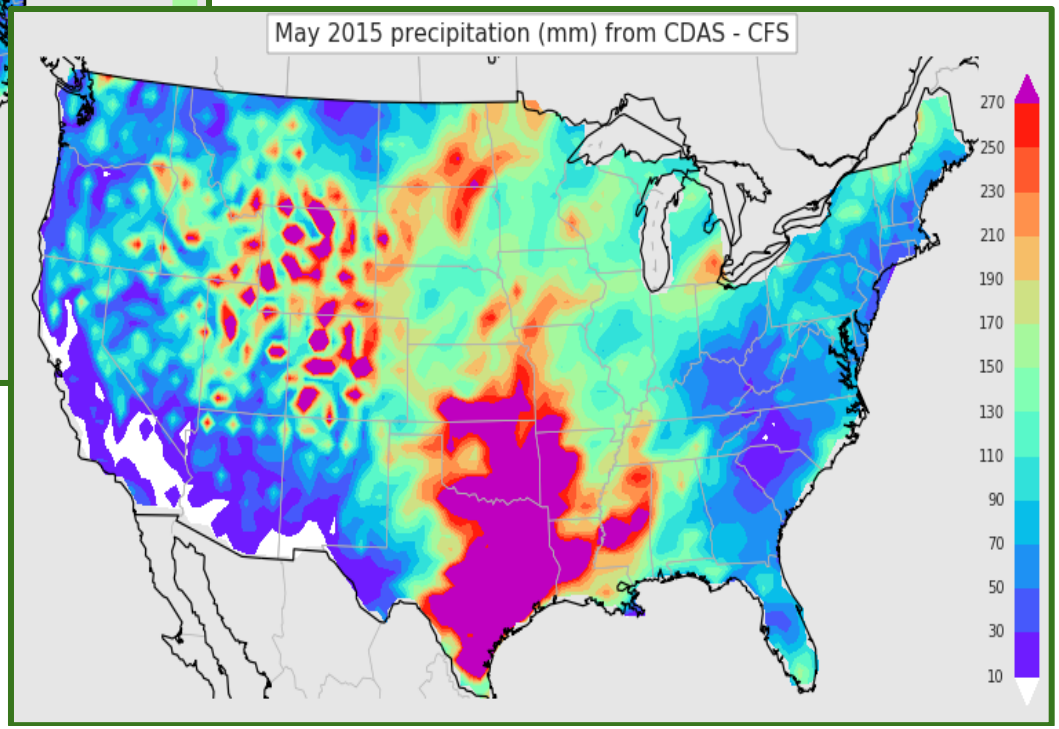
For ensemble of n-size, entire ensemble distribution is ranked. The ensemble mean values are similarly ranked. Ensemble mean ranked values are replaced with every nth value from total ensemble ranking.

Observed v. Forecast

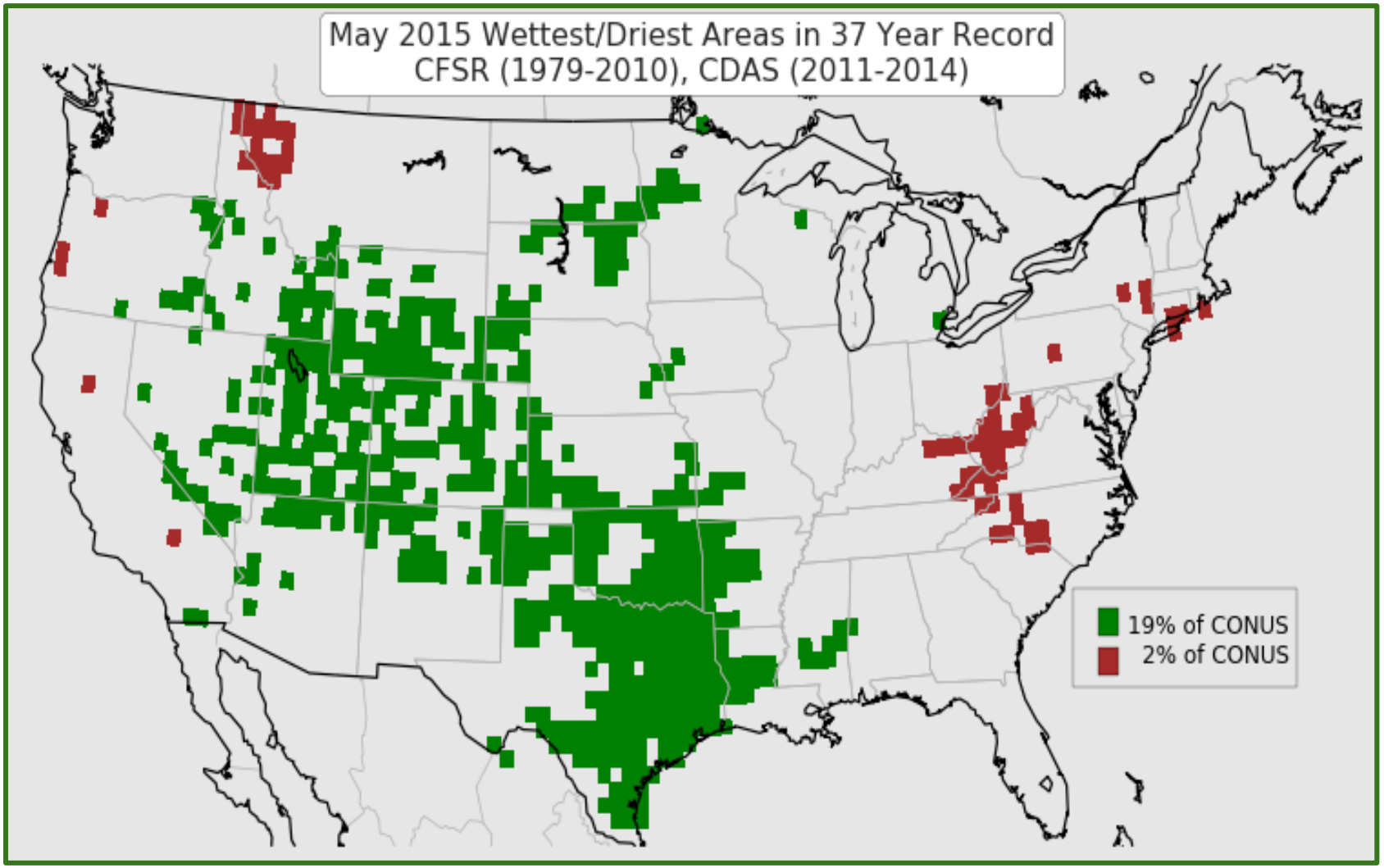
Using 1979-2015 CFSR/CDAS, calculate 37-year climatology of monthly precipitation. Compare areal coverage of extreme wet/dry areas (based on percentile rank) with CFS PMM monthly forecasts.

Observed vs. CDAS/CFS, May 2015

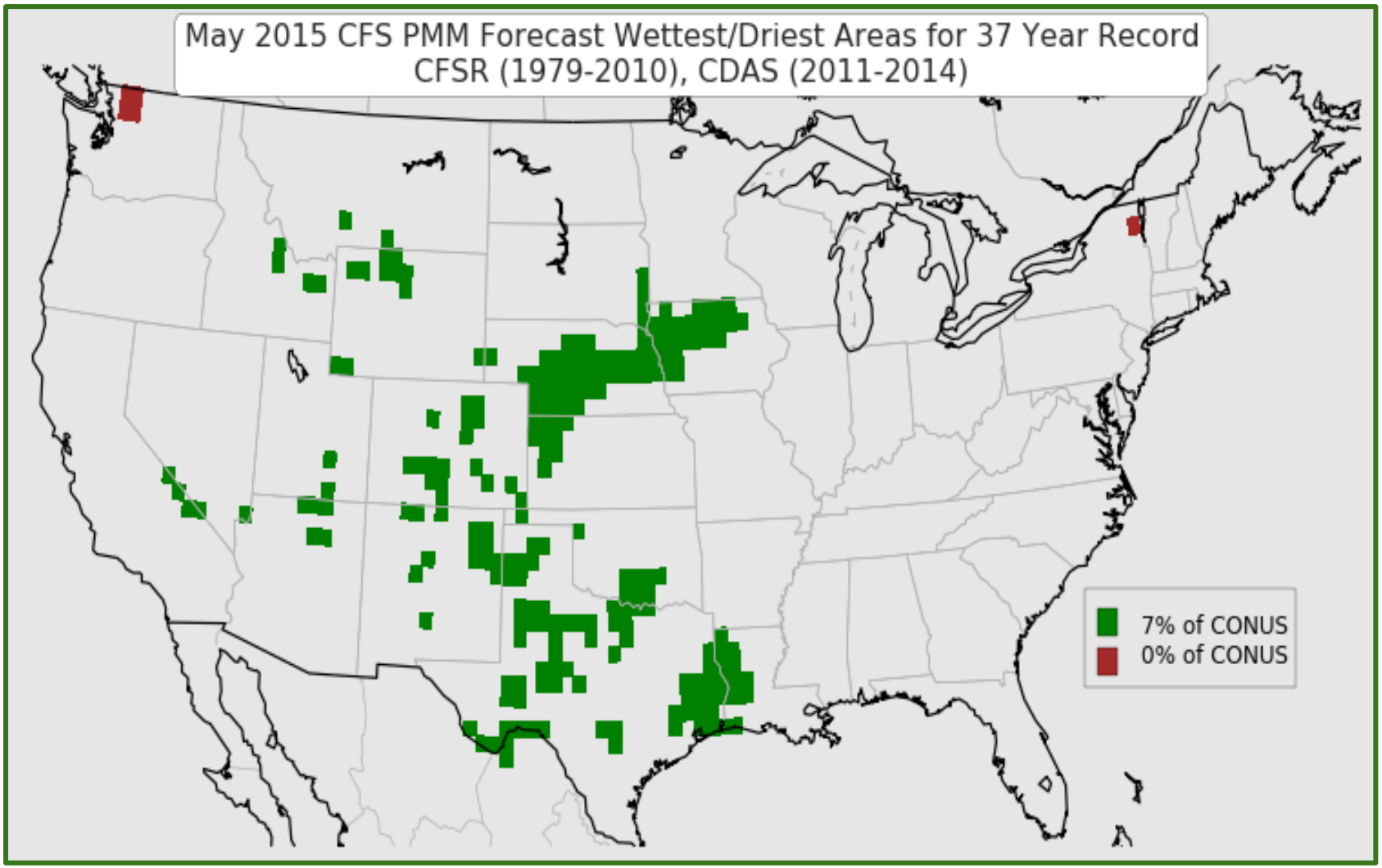




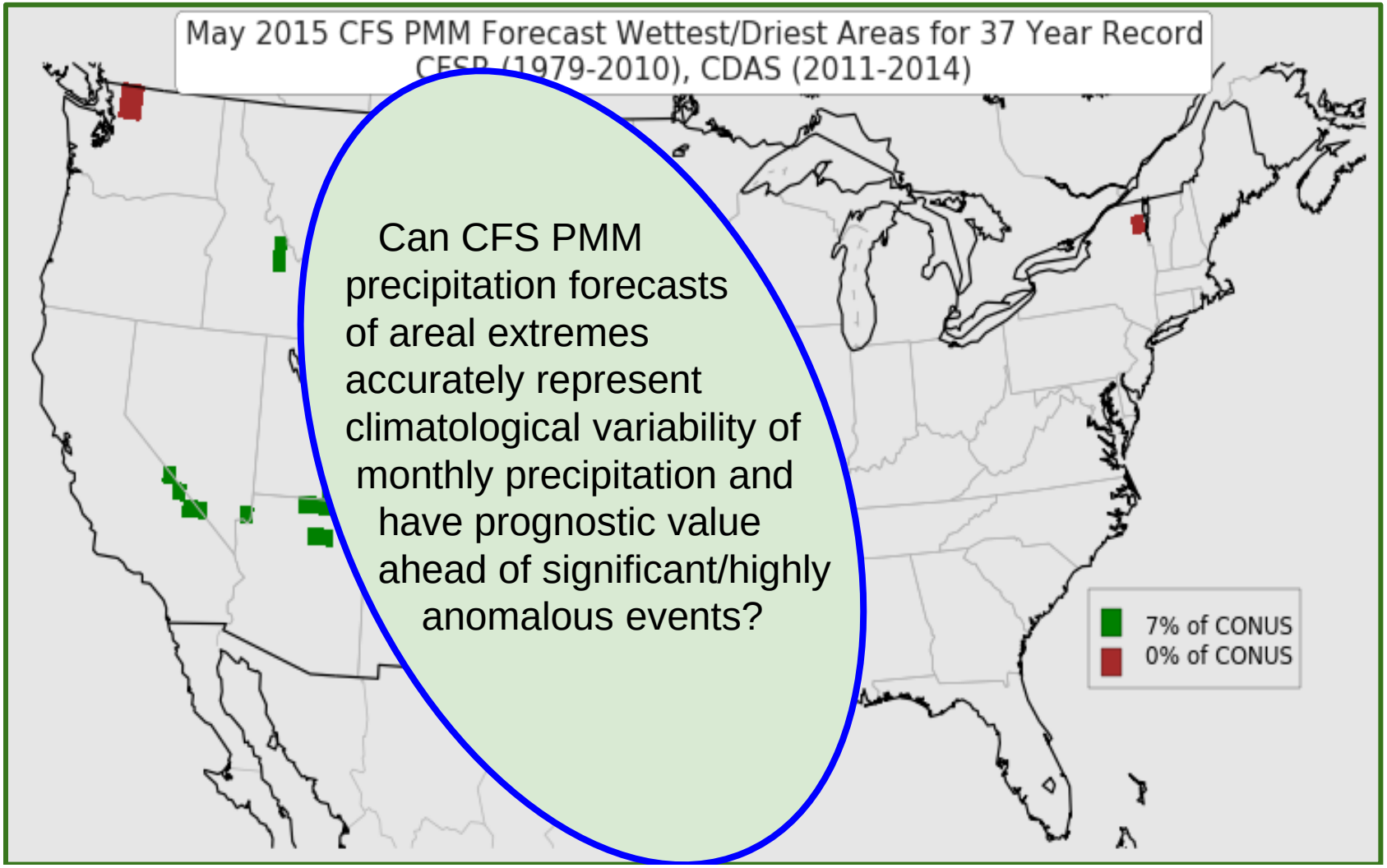
May 2015 Total CONUS Precipitation
Areal coverage of extreme values



May 2015 Total CONUS Precipitation CFS PMM forecast of extreme values

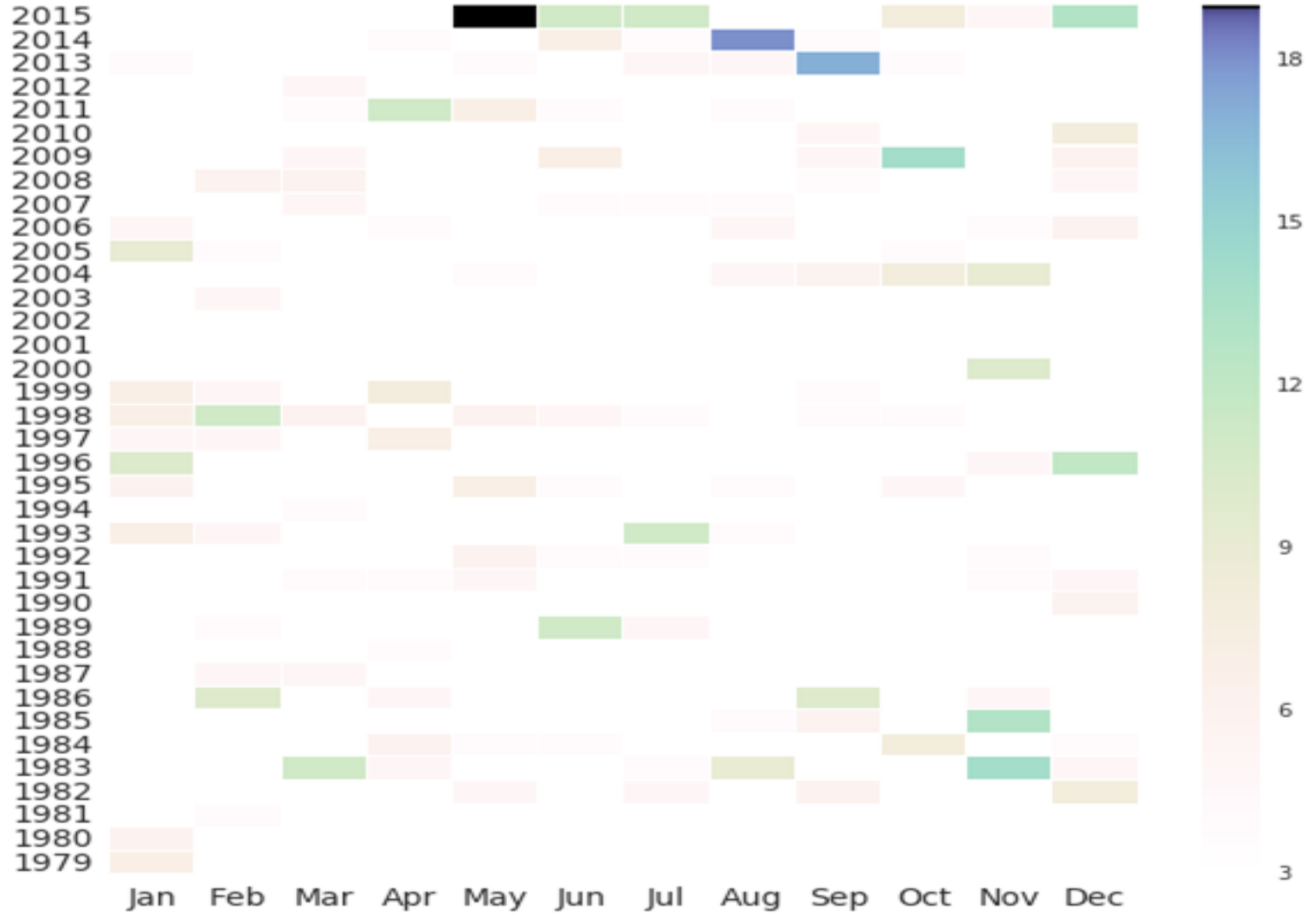


Despite limited areal extent of extremes in CFS forecast… is this still a signal?



CFS/CDAS CONUS Monthly Precipitation
Areal coverage of extreme values

Monthly extent of wettest / areas in 37 year reanalysis



CFS/CDAS CONUS Monthly Precipitation
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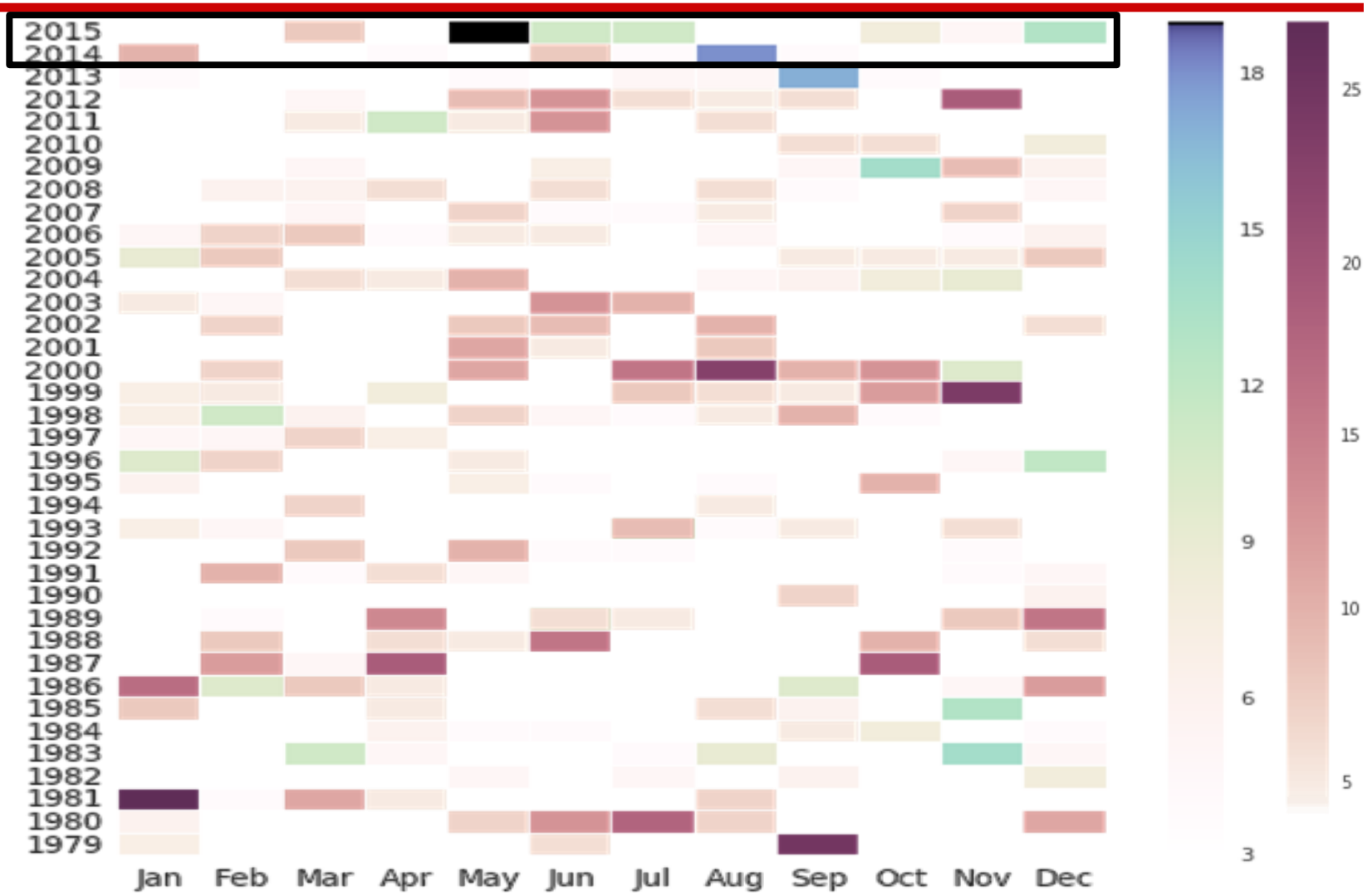
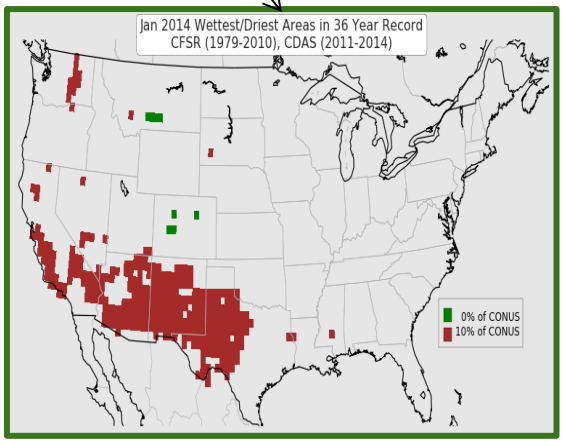


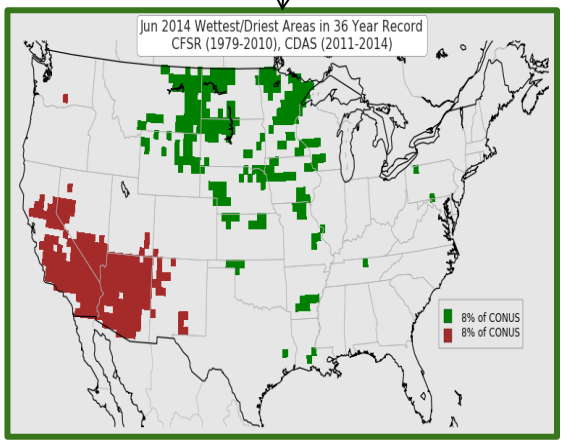
Monthly CONUS Precipitation Areal Coverage (%) Observed Extremes

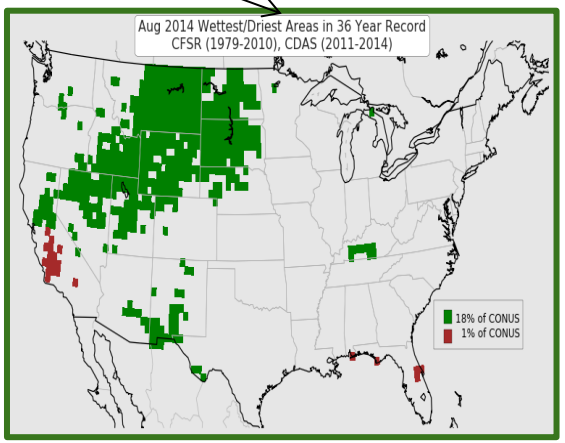
2014

OBS

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	2	2	4	2	8	6	18	5	2	1	1
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10	1	0	0	1	8	0	1	0	4	1	1



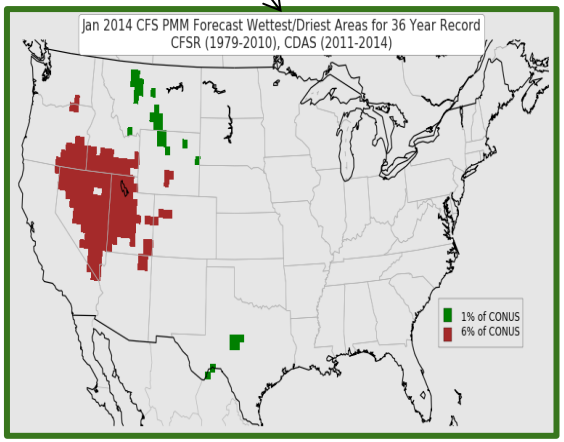


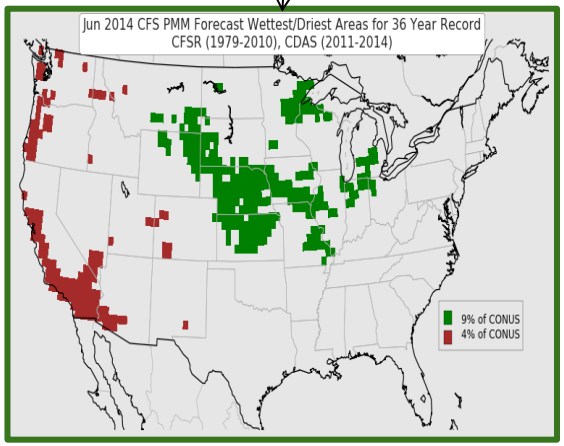


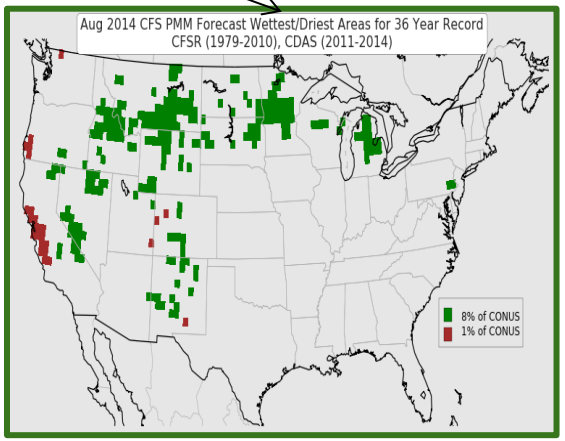
Monthly CONUS Precipitation Areal Coverage (%) Forecast Extremes

2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1	1	2	3	1	9	3	8	7	1	0	1
FCST	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	6	0	0	1	1	4	1	1	1	0	0	1

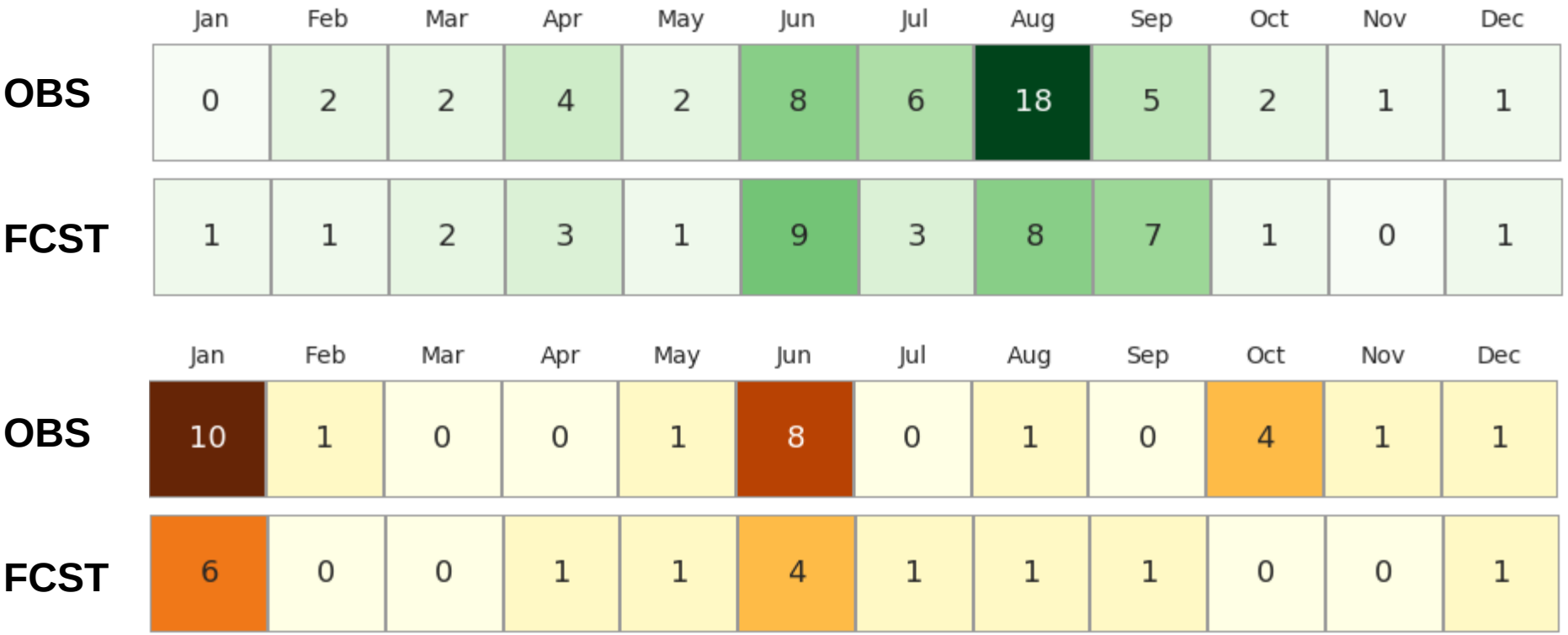






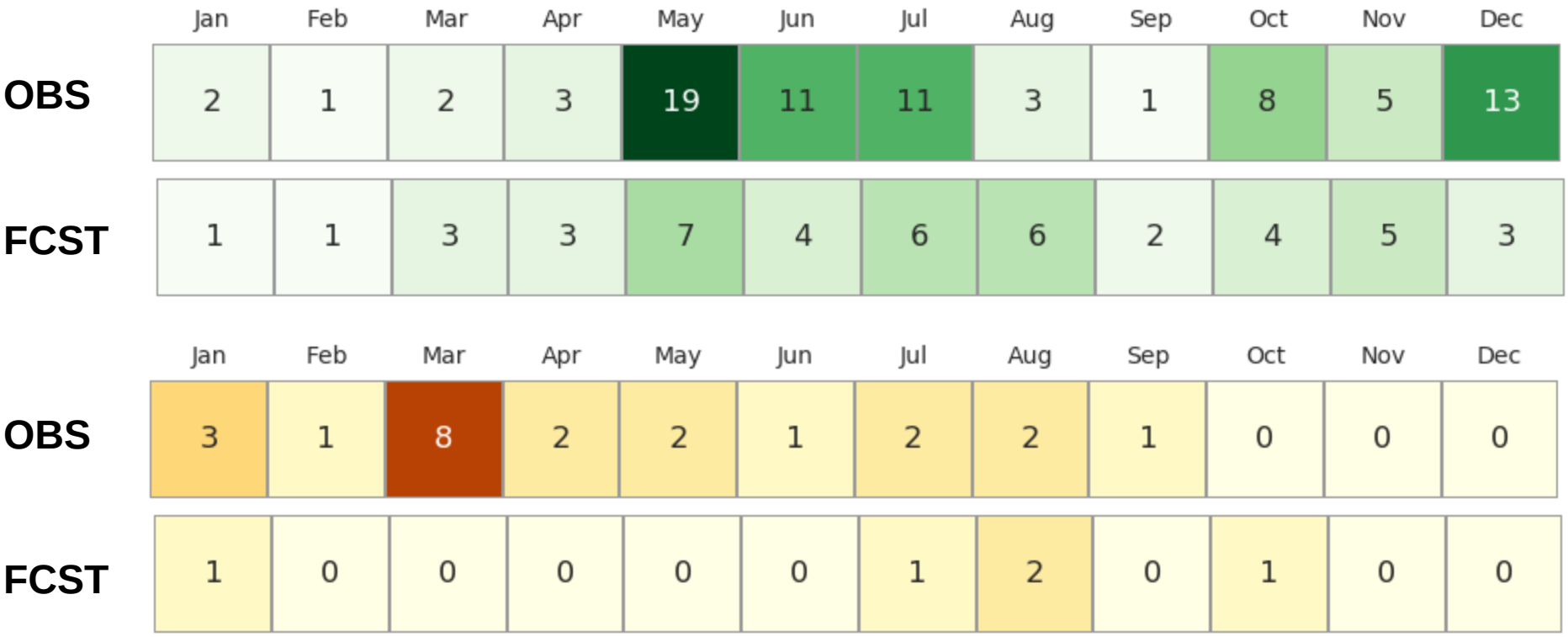
Monthly CONUS Precipitation Observed vs. Forecast Extremes (%Cvg)

2014



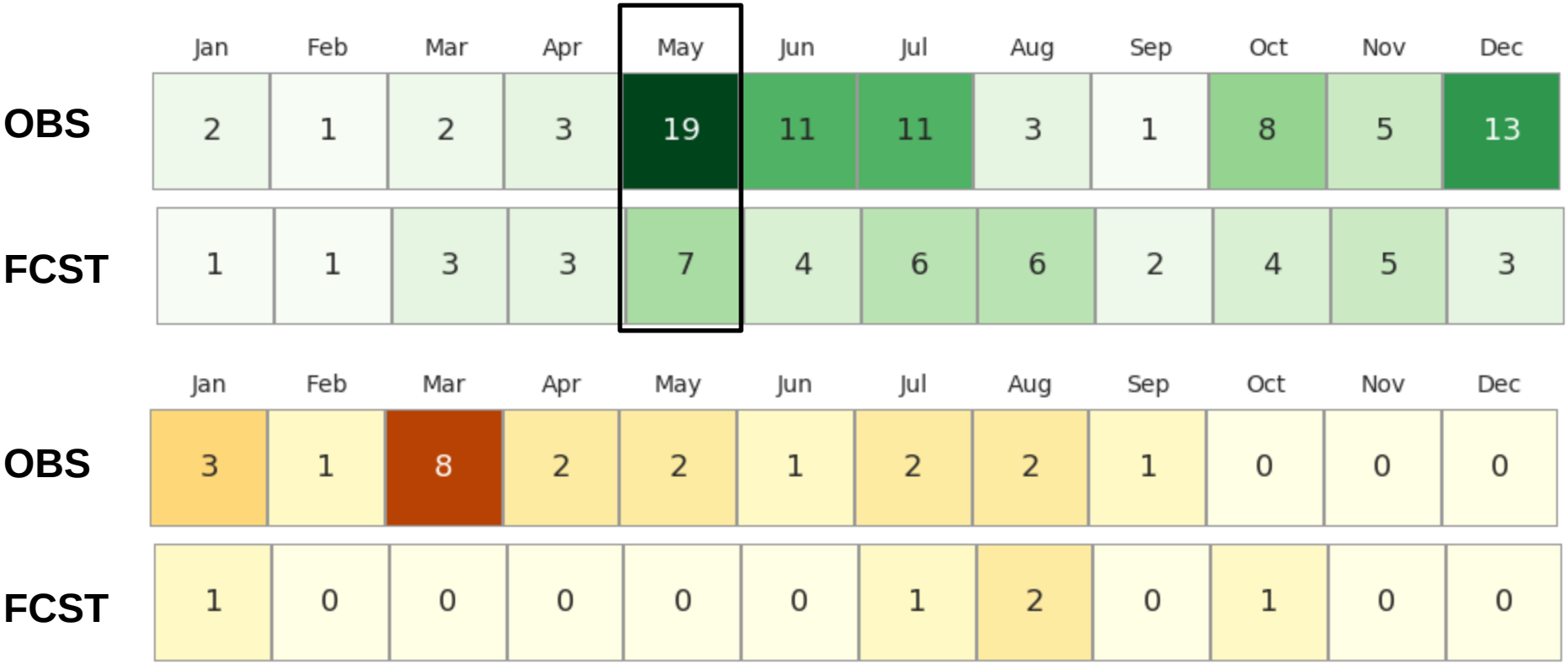
Monthly CONUS Precipitation Observed vs. Forecast Extremes (%Cvg)

2015



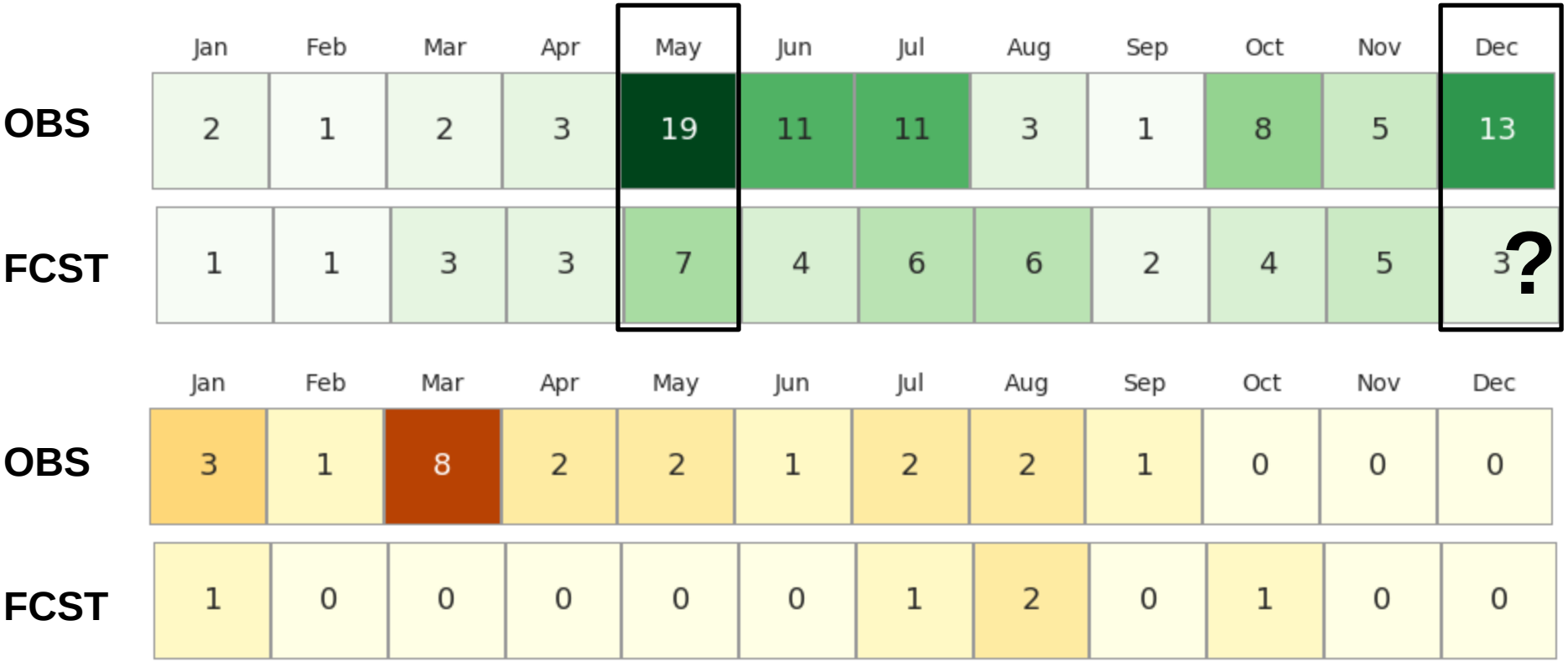
Monthly CONUS Precipitation Observed vs. Forecast Extremes (%Cvg)

2015

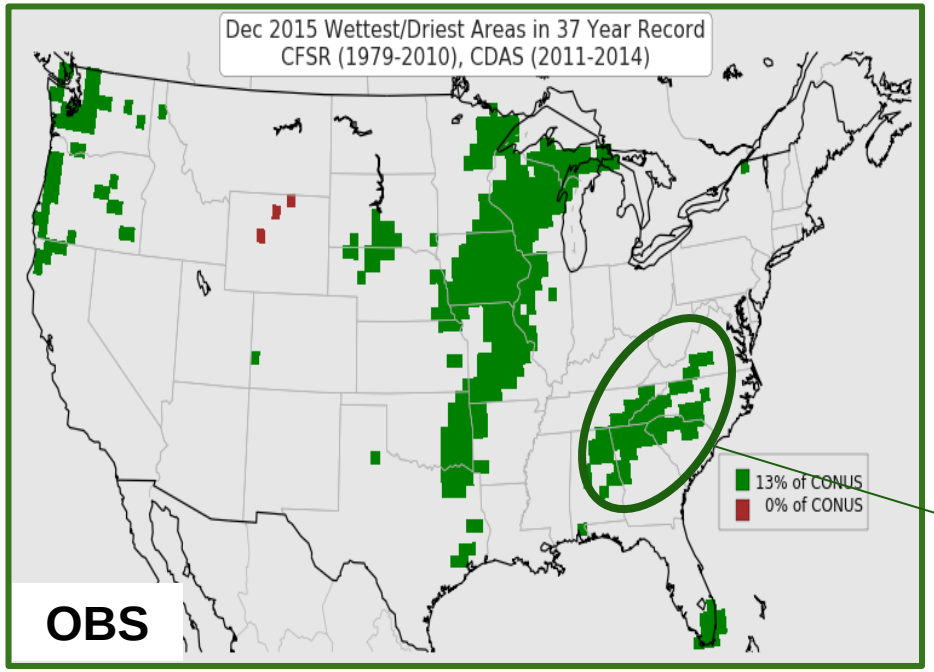


Monthly CONUS Precipitation Observed vs. Forecast Extremes (%Cvg)

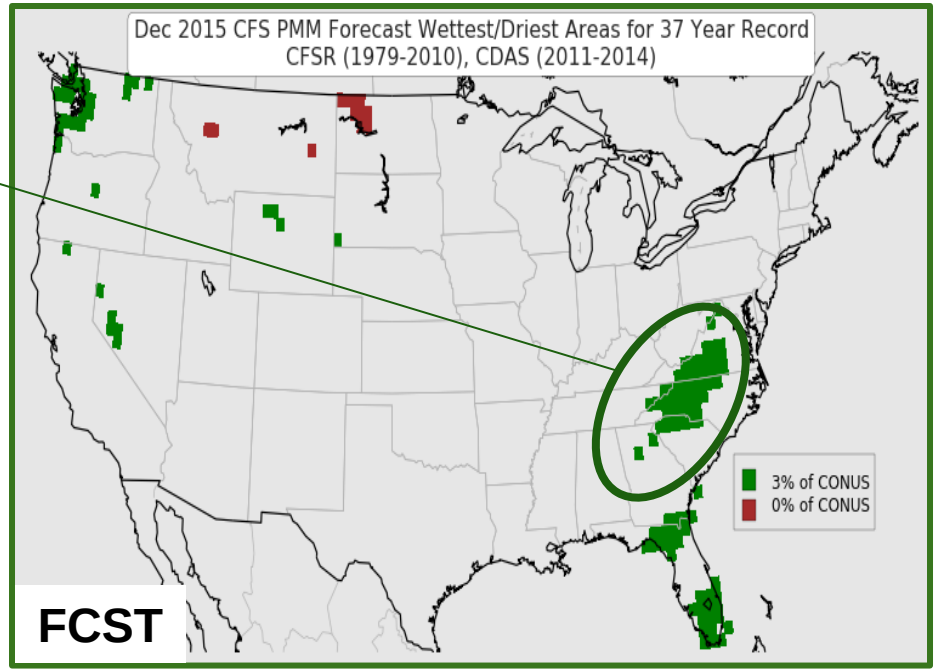
2015



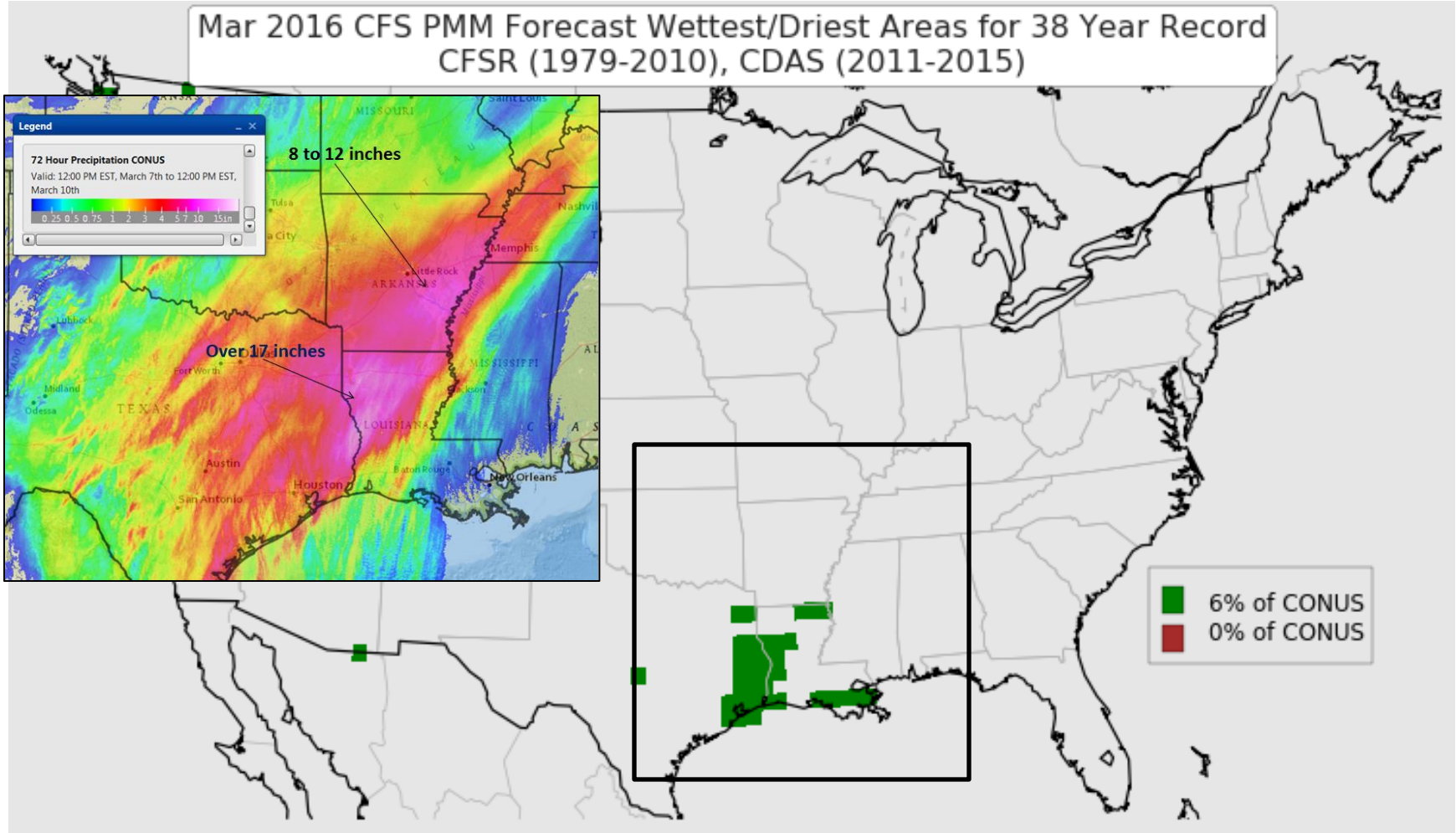
December 2015 CONUS Precipitation Observed vs. Forecast Extremes (%Cvg)



Despite missing the highly anomalous heavy December precipitation across the middle of the CONUS, CFS accurately forecast extreme December precipitation over inland southeast, southern Florida, and Pacific Northwest.



March 2016 Forecast Extremes (%Cvg) from Feb. 29, 2016 CFS runs (8)



CFS Probability Match Mean QPF to Forecast Monthly Precipitation Extremes

Using PMM to maintain extreme values within ensemble output shows promise for one month-lead forecasts of extreme precipitation (wet and dry areas in lowest/highest %-tile ranks) based on a review of 2014-2015 forecasts.

Further refinement of this method could be used to generate shorter-term (two-week) extreme precipitation forecasts.

CDAS as analysis may have issues in the warm season across high terrain of the west.

Additional ensemble and re-forecast methods should improve extreme precipitation predictability.

Thank you!

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www.wpc.noaa.gov
www.nssl.noaa.gov