Will La Nina Arrive During the Summer?

Summer 2007 Outlook For Southeast Lower Michigan

By: Bill Deedler, National Weather Service - White Lake Mi

Local Data suggests:

Temperatures:

Overall, look for temperatures to range from near normal to above / 0.0 to +2.0 degrees/ in the final analysis. Local data reveals that our analogue summers generally "warmed up" as the summer evolved. More specifically, out of the three months, June had the best chance to see below normal temperatures, while July and/or August had the best chance of above normal temperatures.

Rainfall:

Overall rainfall will average around normal to locally above.

Broad Scale Discussion

Last summer, a weak La Nina was leaving the Pacific, this summer it is likely to return at some point. Water temperatures west of northern South America continue to cool off from the recent El Nino (warmer waters) which dominated most of the fall and winter of 2006-07. As one can see with Chart-1a (location of Nino 3.4) and 1b below, the forecast sea surface temperatures /SST/ for the summer show many of the model members project a continuation of the cooling of the sea surface temperatures /SSTs/ offshore of northern South America. Latest guidance in May suggests the dynamical models may be cooling the ocean off a bit too quickly (indicative of La Nina forming) while the statistical models show only a subtle hint of a La Nina forming this summer.

Chart 1a

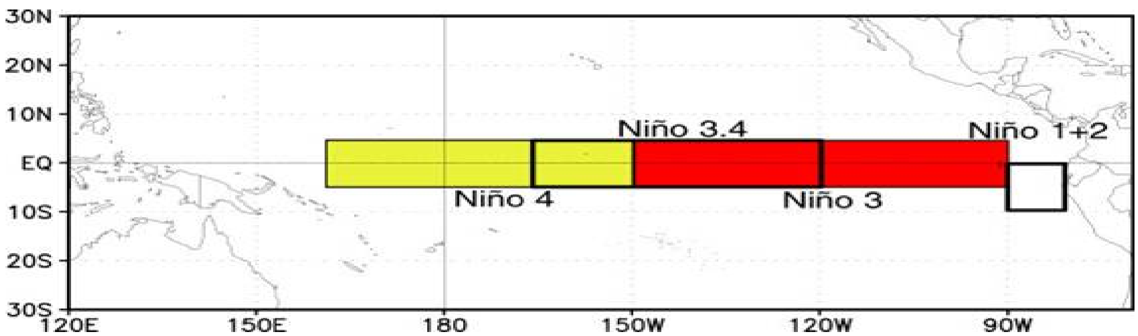
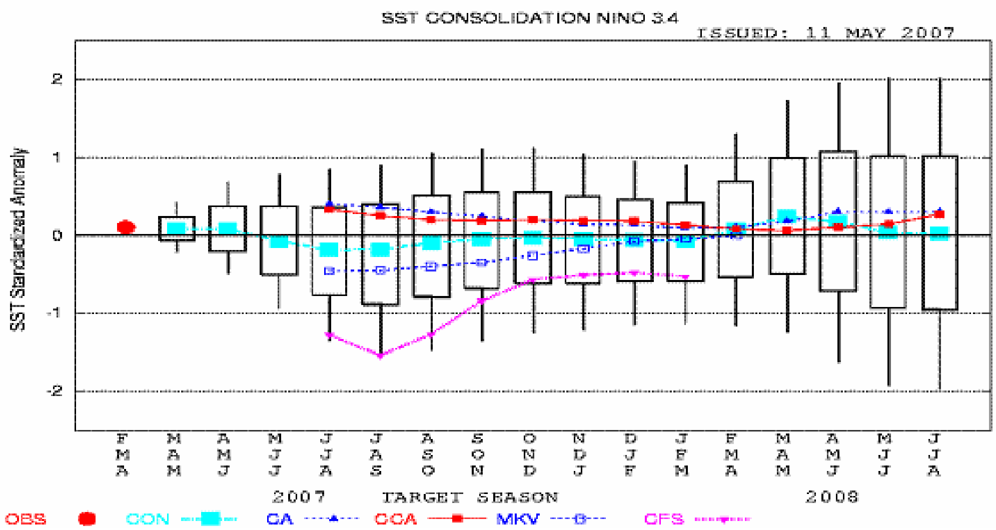
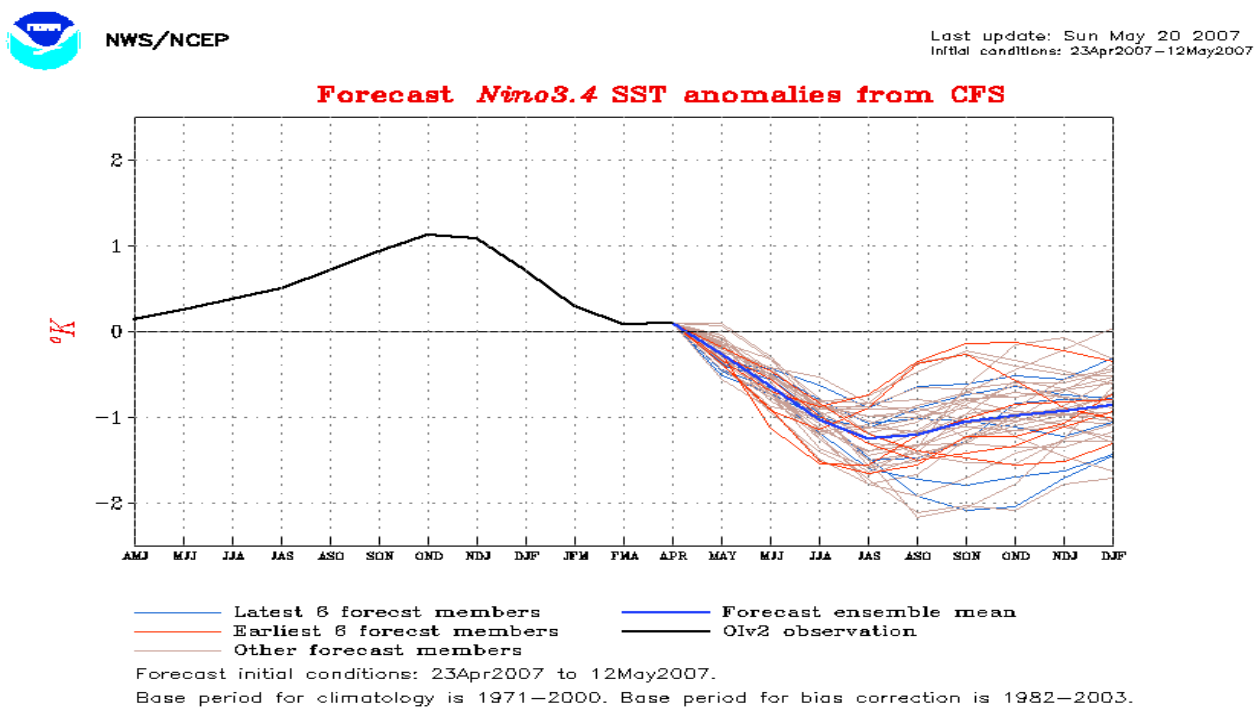


Chart 1b

The official SST projection is as follows:



Note the more dramatic decline seen during the summer in the CFS model:



In any event, summer should start off under generally Neutral Pacific conditions (meaning near normal water temperatures) then progress into weak La Nina later this summer and/or fall. Under these conditions little, if any, significant downwind affects are slated for the Great Lakes. While there are some affects seen across the US during La Ninas (as with El Ninos), they are more likely during stronger La Ninas. The analogue summers were scouted-out on similar broad-scale conditions but it is any resulting local trends and similarities found that will focus on here.

Analogue Summers

Researching as far back as the late 1800s, 12 summers were chosen for our analogue summers this go around (see Analogue Summers 2007 chart below). All these selected summers followed a similar sequence of events seen recently over the Eastern Pacific the past

few seasons. An El Nino formed for the previous winter, which faded to Neutral conditions in the spring with weak La Nina conditions developing sometime during the summer. All summers were generally Neutral evolving into a weak La Nina's, given the infancy of formation.

<u>Several Trends Surface</u>

Right off, several distinctive trends (especially for a generally, more variable summer period) are seen in several of these summers along with a general time-frame. First off, it is observed that several Junes started the summers out on a cool note, especially before the 1950s. All of the Junes in the Detroit listing (the same being basically true for Flint and Saginaw) averaged below normal from the late 1800s to 1947, with seven out of the 12 Junes averaging below normal in the entire selection. Of the seven below normal Junes, three made Detroit's top coolest Junes list! Interestingly, nearly the the reverse takes place for July and August where four years from both months made Detroit's top warmest July and August (and one July /1924/ still made the top 20 coolest Julys list). After the 1950s, all of the Junes averaged above normal at Detroit (with the 1950s having one below and one above, see below). Expanding on that premise for the later years, our data suggest the chances of having a warmer than normal summer increased notably the second half of the century. This also seems to match up in the trends or "guidance" from La Nina summers maps taken since the 50s (we'll expand on this more later).

Some of the more notable temperature contrasting summers (starting out colder and ending, warmer) were pretty well masked by the "near normal" temperature label for the entire lot.

ANALOGUE SUMMERS 2007

DETROIT	JUN	JUL	AUG	SUM AVE		SUMMERS
1886	67.2	71.6	70.8	69.9	1	
1889	63.8	71.3	69.9	68.3	2	
1900	66.6	72.0	75.5	71.4	1	
1916	63.5	77.9	74.6	72.0	2	
1924	65.6	69.9	70.7	68.7	3	
1947	66.0	70.9	76.5	71.1	3	
1952	72.7	76.5	71.5	73.6	1	
1958	63.9	72.4	71.0	69.1	4	4
1964	69.6	76.0	69.1	71.6	4	
1973	69.9	72.6	72.9	71.8	5	
1988	70.4	77.1	75.1	74.2	2	2
1998	69.1	73.4	73.2	71.9	6	6
				Summer		
Ave	67.4	73.5	72.6	71.1	-0.4	
Norm	69	73.5	71.8	71.4		

FLINT	JUN	JUL	AUG	SUM AVE		SUMMERS
1900	64.5	70.0	73.6	69.4	1	
1916	60.9	75.7	70.6	69.1	2	
1924	66.1	69.3	66.7	67.4	3	
1947	64.4	68.9	76.0	69.8	1	
1952	70.3	73.6	68.7	70.9	2	
1958	61.0	69.5	68.1	66.2	1	1
1964	66.6	71.7	65.3	67.9	4	
1973	67.4	70.4	71.0	69.6	3	
1988	67.7	75.2	72.6	71.8	4	4
1998	66.8	70.4	71.1	69.4	5	5
				Summer		
Ave	65.6	71.5	70.4	69.1	0.7	
Norm	66.2	70.6	68.5	68.4		

SAGINAW	JUN	JUL	AUG	SUM AVE		SUMMERS
1900	66.3	71.3	75.1	70.9	1	
1916	62.2	76.8	71.9	70.3	2	
1924	64.2	67.1	66.4	65.9	1	
1947	63.3	68.7	74.8	68.9	1	
1952	69.1	72.9	68.1	70.0	3	
1958	61.8	70.0	69.3	67.0	2	2
1964	67.8	72.5	65.8	68.7	2	2
1973	69.2	72.4	72.0	71.2	4	
1988	68.0	75.8	72.3	72.0	5	
1998	69.3	73.4	72.4	71.7	6	6
				Summer		
Ave	66.1	72.1	70.8	69.7	0.8	
Norm	66.8	71.2	68.7	68.9		

DETROIT	JUN	JUL	AUG	SUM AVE		SUMMERS
1886	2.07	2.45	2.02	6.54	1	
1889	3.28	1.54	0.19	5.01	2	
1900	3.99	3.71	2.08	9.78		1
1916	3.00	0.99	2.98	6.97	3	
1924	3.15	0.78	1.71	5.64	4	
1947	3.49	2.42	2.85	8.76	5	
1952	1.06	3.14	2.18	6.38	6	
1958	2.98	3.01	2.25	8.24	7	
1964	2.35	2.37	5.87	10.59	1	
1973	4.86	4.66	1.67	11.19	2	
1988	0.97	2.43	3.13	6.53	8	8
1998	2.69	5.72	4.19	12.60		3
				Summer		
Ave	2.82	2.77	2.59	8.19	-1.62	
Norm	3.55	3.16	3.1	9.81		

FLINT	JUN	JUL	AUG	SUM AVE		SUMMERS
1900	4.72	4.30	5.00	14.02	1	
1916	3.10	2.61	4.56	10.27	2	
1924	3.57	4.33	3.15	11.05	3	
1947	3.53	4.75	3.36	11.64	4	
1952	0.90	4.53	2.71	8.14	1	
1958	4.18	2.61	3.46	10.25	5	5
1964	3.98	2.82	2.65	9.45	1	1
1973	3.24	1.78	1.76	6.78	2	4
1988	0.63	3.74	4.00	8.37	3	
1998	1.25	1.13	2.62	5.00	4	
				Summer		
Ave	2.91	3.26	3.33	9.50	-0.17	
Norm	3.07	3.17	3.43	9.67		

SAGINAW	JUN	JUL	AUG	SUM AVE		SUMMERS
1900	2.57	3.89	5.23	11.69	1	
1916	2.68	0.82	1.25	4.75	1	
1924	1.79	5.19	3.18	10.16	2	
1947	3.64	4.46	2.16	10.26	3	
1952	0.64	6.38	3.00	10.02	4	
1958	3.32	3.34	2.63	9.29	1	
1964	1.39	5.33	4.21	10.93	5	5
1973	3.41	1.70	2.86	7.97	2	2
1988	0.61	2.53	2.75	5.89	2	
1998	1.81	1.30	1.51	4.62	3	3
				Summer		
Ave	2.19	3.49	2.88	8.56	-0.38	
Norm	3.06	2.50	3.38	8.94		

Color Legend:

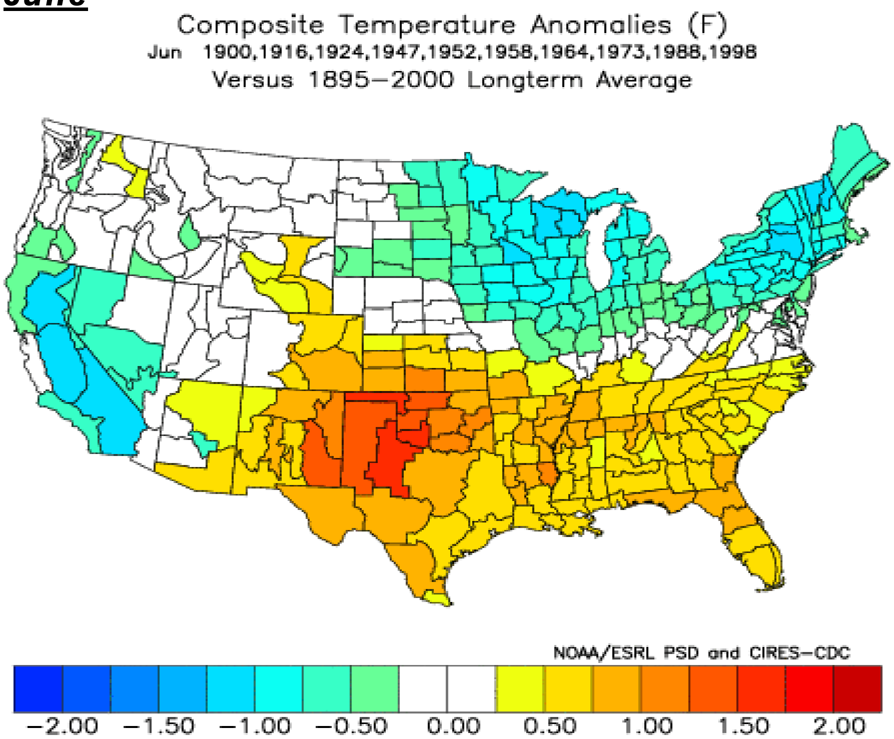
Temps	Degrees
Below	1.0>
Normal	0.0-1.0
Above	1.0>

Rain	Inches
Below	1.00>
Normal	0.00-1.00
Above	1.00>

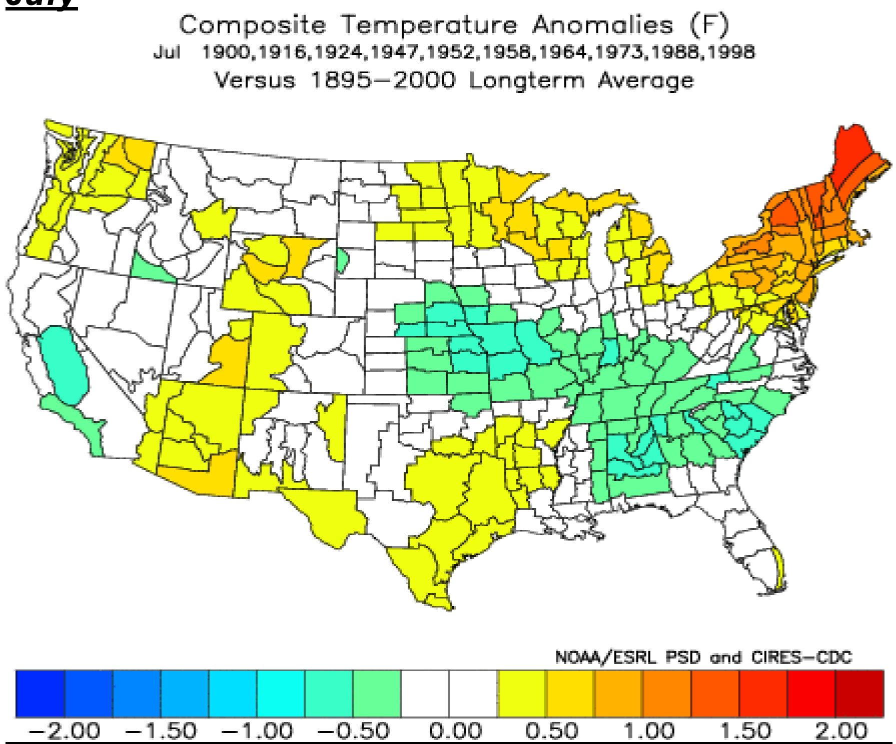
The maps below, constructed from the analogue summers, reveal the monthly temperature and precipitation trends. For our purposes, these monthly trends are used more for general summer trends and are not necessarily, calendar month specific. For example, a cool June preference may suggests a notable cool period was seen at/near this time of the summer. So, for example, a cool period that extended from late May into mid June would suffice (or even mid June to early July) since both occurred early summer. Also, be aware these maps use averages for over a century /1895/ to figure their anomalies, while our standard norms are based just for 30 years/1971-2000/ and thus, the maps have a much longer time-frame of comparison.

And while on the subject of cool periods in June, several of the Junes in our local study (1889, 1900, 1916, 1924, 1947, 1958, 1964, 1998) contained notable cool periods (enough to make some daily averages 10 – 15 degrees below normal) with most occurring early to mid month but not all. And, as mentioned above, three of our Junes made the top 20 coldest Junes list (1889, 1916 and 1958). This doesn't necessarily mean a below normal June as a whole but keeping one eye on our past spring pattern and the other on the analogue June projections, suggests the possibility of some more widely varying and contrasting temperature patterns.

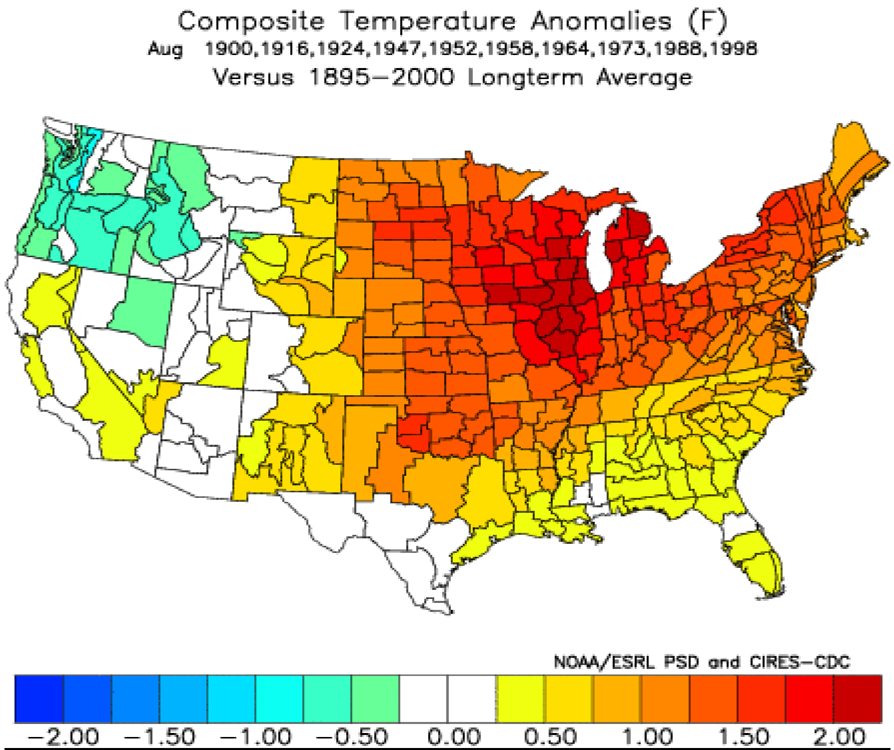
June



July


Composite Temperature Anomalies (F)
Jul 1900,1916,1924,1947,1952,1958,1964,1973,1988,1998
Versus 1895–2000 Longterm Average
NOAA/ESRL PSD and CIRES–CDC
–2.00 –1.50 –1.00 –0.50 0.00 0.50 1.00 1.50 2.00

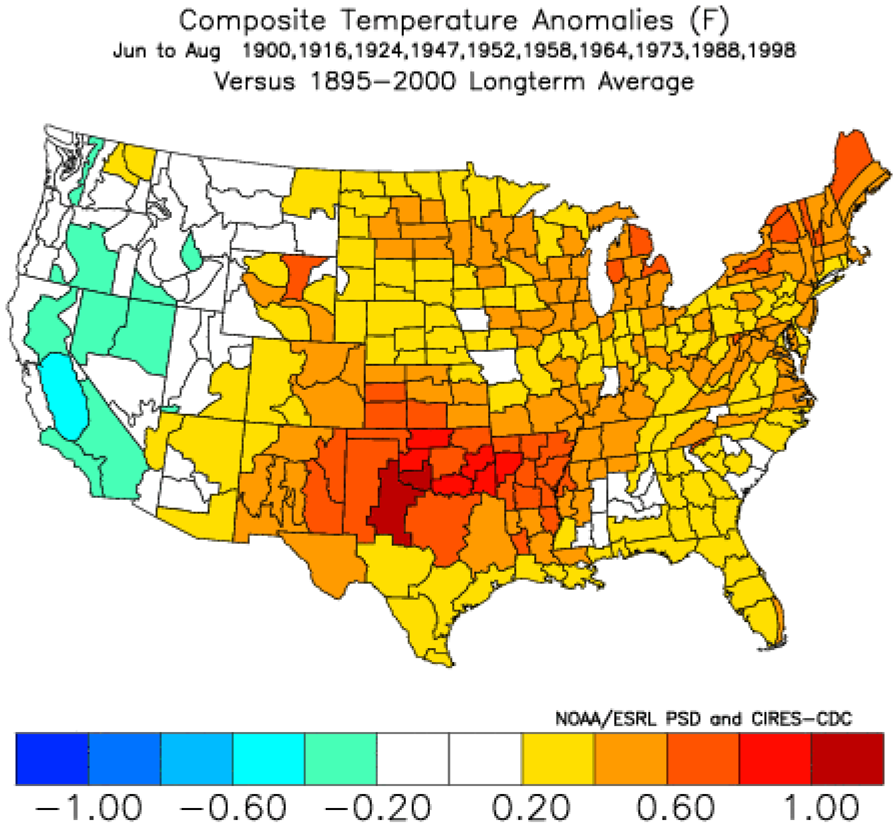
August



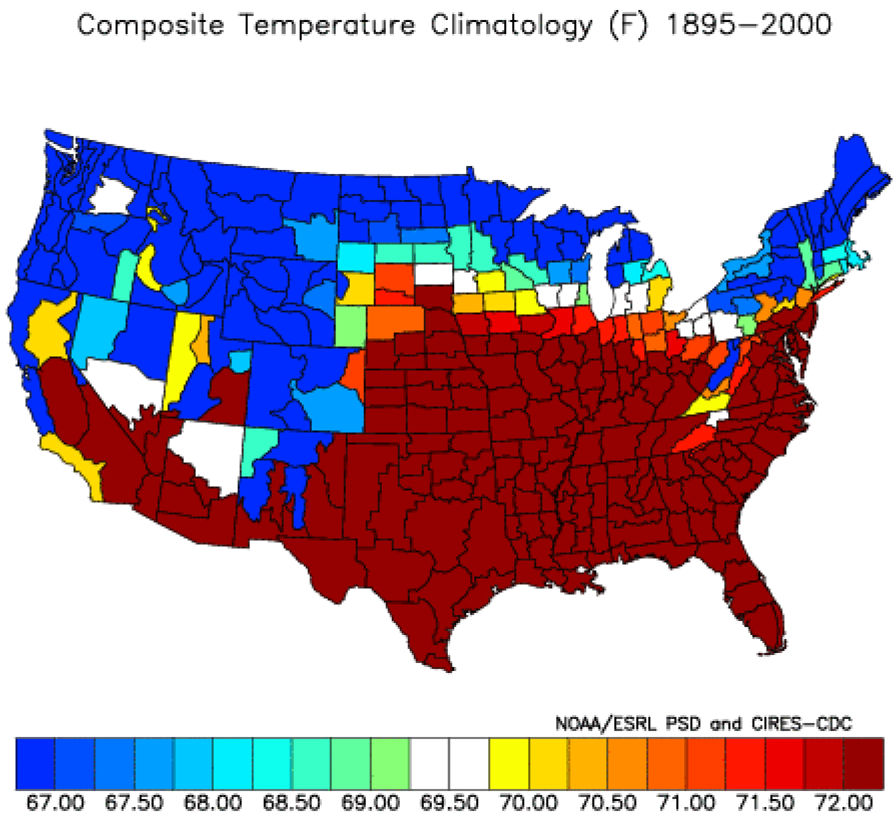
Our data above reveals that our analogue summers generally "warmed up" as the summer evolved. More specifically, out of the three months, June had the best chance to see below normal temperatures, while July and/or August had the best chance of above normal temperatures.

<u>Analogue Summer Map</u>

Strictly speaking, overall, our analogue summers suggest slightly above normal temperatures (based on the 1895-2000 average). For our purposes, <u>normal is within a degree of the summer norm (depending on location) while above or below normal is better than a degree.</u>



Since this average temperature departure is derived from the 1895-2000 average temperature (as opposed to the 30 year norm), it would be nice to know what the summer average (s) are in Southeast Lower Michigan for that century plus period.



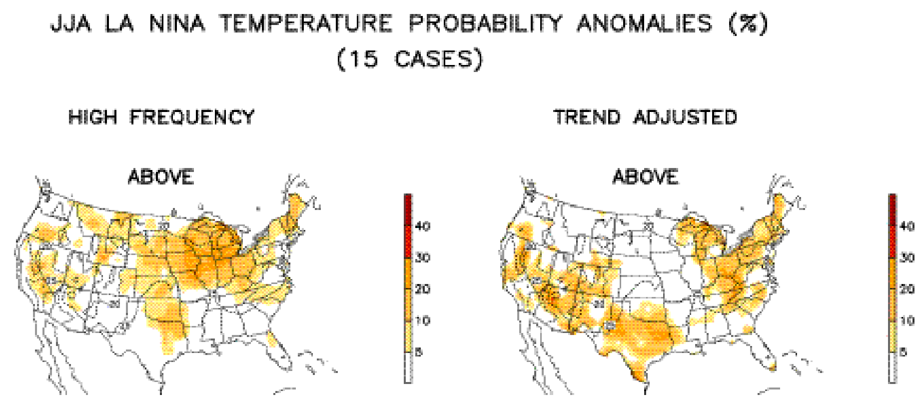
Actually two temperature averages are displayed for Southeast Lower Michigan. Area-1 paints much of Southeast Lower Michigan (roughly from the Flint and Port Huron areas south to the Ohio border), while Area-2 encompasses the Saginaw Valley and Thumb Region. Note history tells us that the Saginaw Valley and Thumb Region summers are a few degrees cooler on average than the remainder of Southeast Lower Michigan.

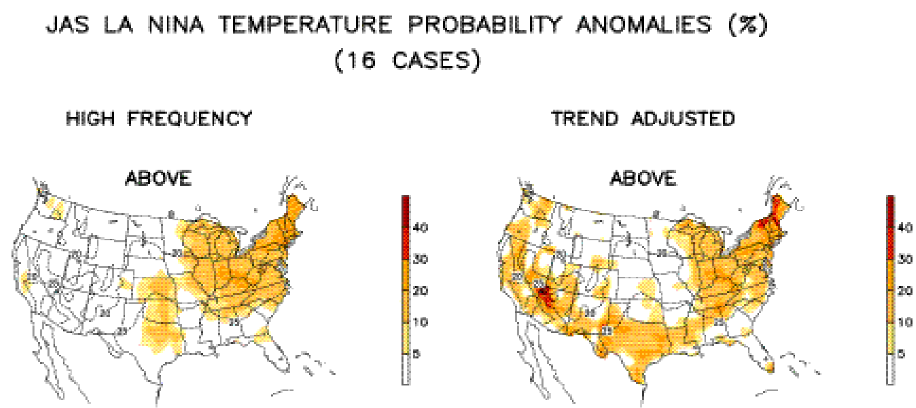
Area-1 displays a summer average of about 70.5
Area-2 displays a summer average of about 68.5

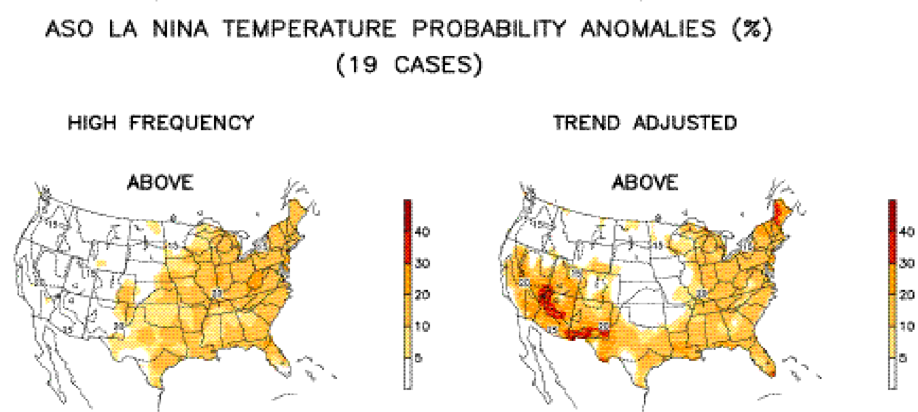
Below are maps of 15 La Nina summer periods and associated temperature trends over the country. All three panels reflect the high frequency and trend adjusted La Nina summer periods (we'll look at the Neutral Summer, after). The top two maps denote the standard June-Aug summer period, the middle map the Jul-Sep period and the bottom map, the Aug-Oct period. The trend adjustment maps here are nearly a duplicate of what our analogue summers suggest; the chances of warmer than normal temperatures rise as the summer progresses (and in fact, continues into early fall). The Climate Prediction Center /CPC/

explains these two categories (high frequency and trend adjustment) this way:

> There have been significant trends in precipitation and surface air temperature at many locations in **recent decades,** so it is worthwhile to examine the **influence of trends on ENSO composites**. For this purpose, two basic types of composites are examined:
>
> - High-frequency (denoted HF) composites
> - Trend adjusted (denoted TA) composites

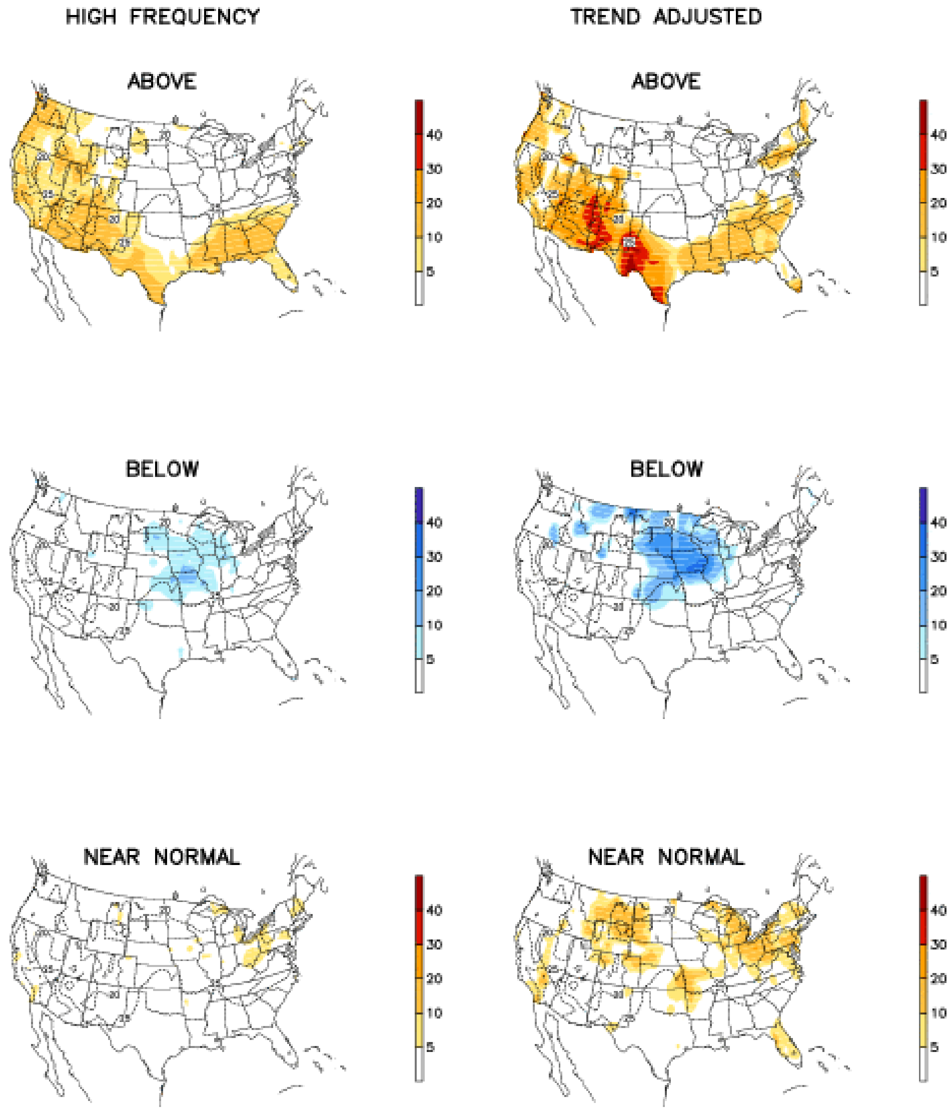






When a Neutral summer prevailed or lasted longer into summer, note the temperature trend across the Great Lakes (below) - the data was more mixed with several closer to normal and notably cooler than normal just to our west. <u>This will have to be watched as the La Nina timing and strength unfolds more assuredly</u>. This does leave the door open for updates if needed.

JJA ENSO–NEUTRAL TEMPERATURE PROBABILITY ANOMALIES (%)
(25 CASES)

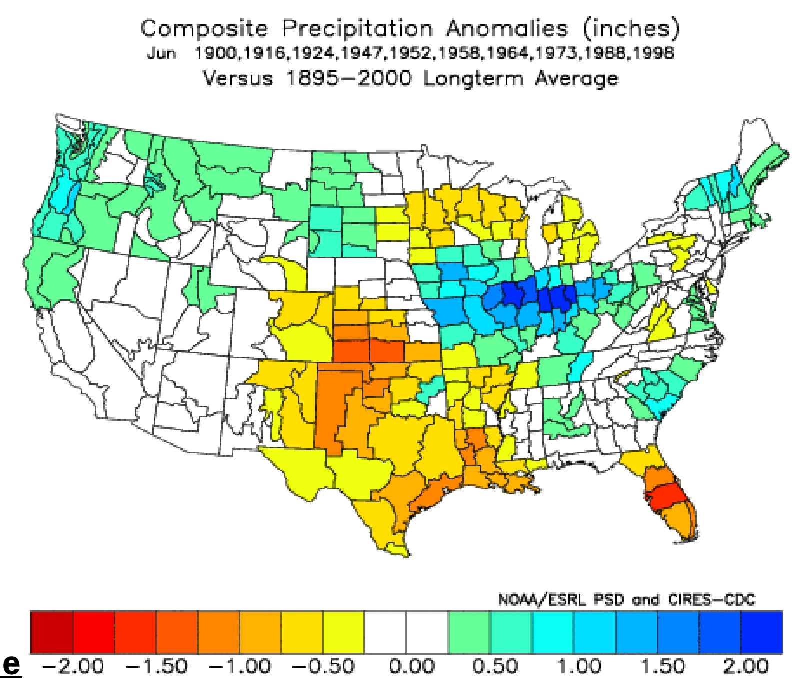


* Shading indicates departures from random chance (33.3%) of the indicated category.
* Dashed lines are the 1971–2000 climatology (°C).

Summer Precipitation

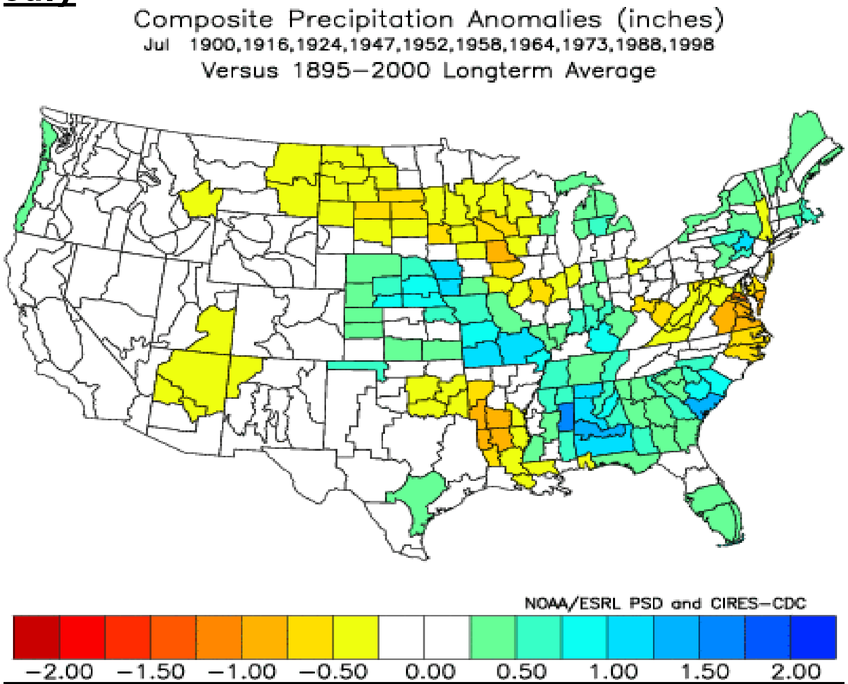
Other distinctive trends in these particular summers surfaces under the precipitation mode as well. Paying close attention to just the Detroit figures first, shows numerous "dry" summers mainly in the first half of the data set extending from the late1800s to the 1950s. Looking at the 1960s on, wetter summers materialized around metro Detroit in these developing La Nina summers. Another equally interesting trend reveals itself in the location of the dry and wet areas. If we now examine all three cities (and subsequent location differences), several times when it was dry in Detroit; chances were that it was wet at Flint and/or Saginaw (and visa-versa). The heavier convective rains tended to follow climate norms and lifted north during several of the earlier summers (1900, 1916, 1924, 1947 and 1958) which allowed Flint and Saginaw (minus 1916) to turn out wetter than Detroit. This was not always the case but prevalent nonetheless. In 1964, for example, all three cities had normal to above rainfall. The later years (minus 1988) , however, do show the wetter areas from metro Detroit south into northern Ohio Valley.

These variable rainfall patterns just signify the common feast or famine scenarios seen so often in a typical summer with convective rains. Our monthly rainfall maps paint variable (below to above normal) rainfalls across into the southern Great Lakes Region.

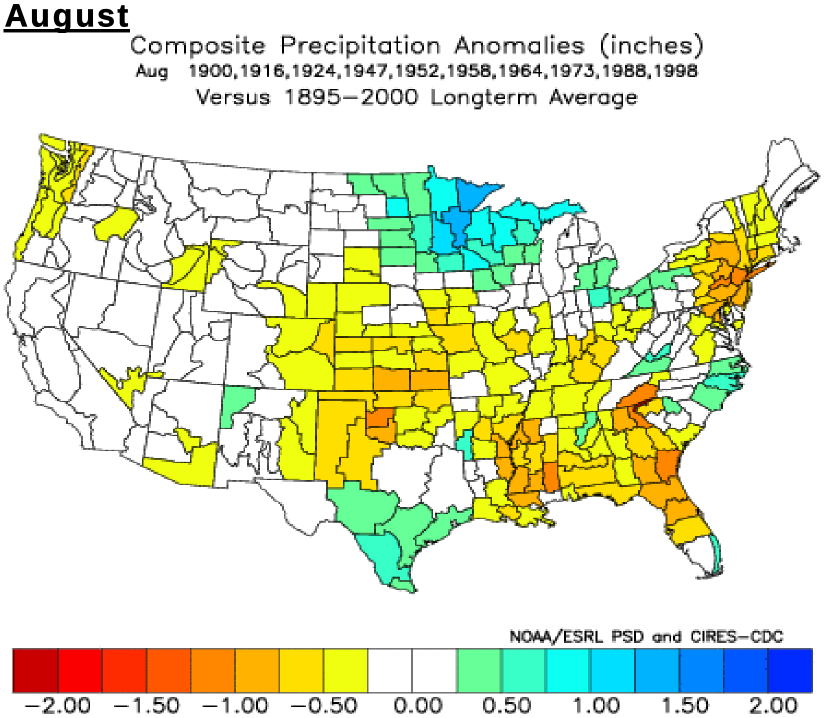


June

July



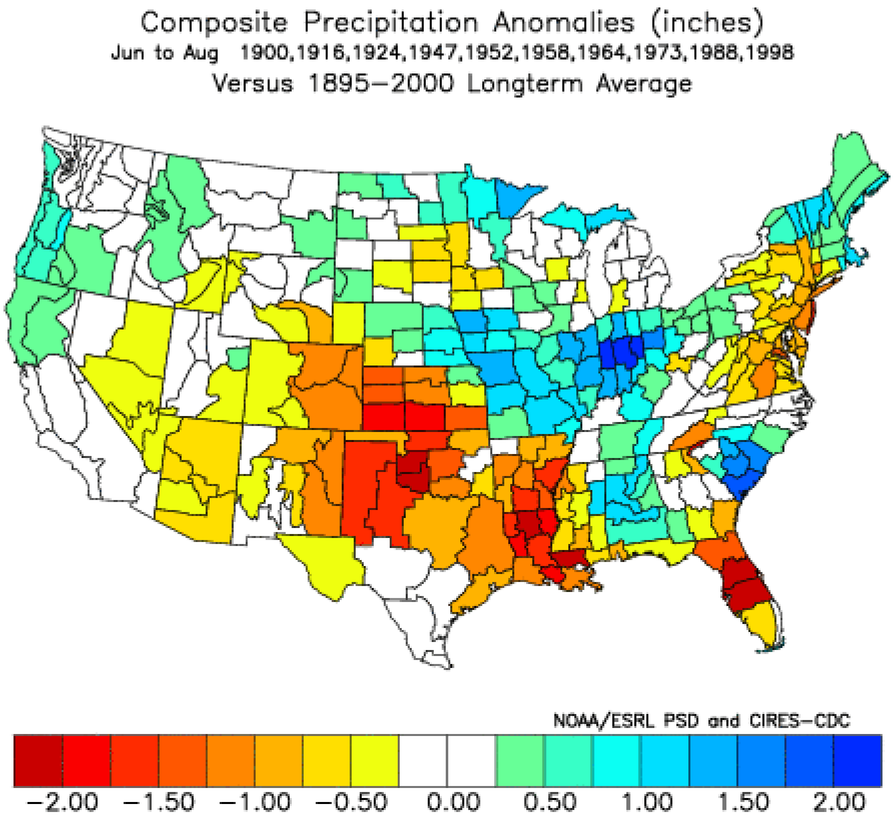
August



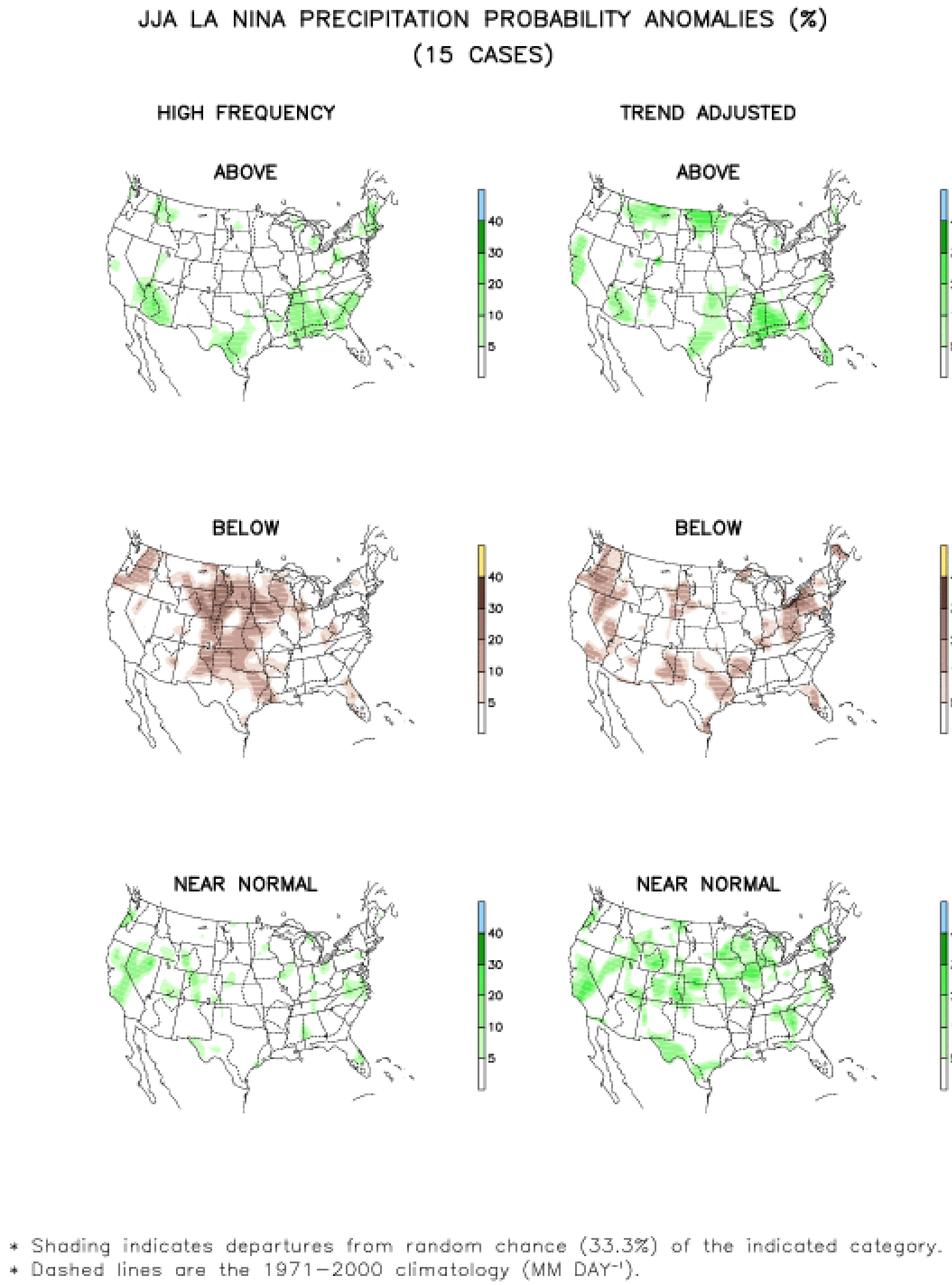
The trend lately has been for wetter than normal conditions mainly from the Flint to Port Huron areas south to Ann Arbor

and Metro Detroit. This trend may very well point in the direction where the summer rains will be the most productive.

Analogue Summer Rainfall Map



The normal to above normal rainfall is also suggested by the CPC La Nina study cases below



If conditions warrant, an updated Summer Outlook will be sent.

Have a good summer, enjoy any time off and may good weather be your traveling companion.

SUMMER BEGINS: JUNE 21st at 206 PM EDT

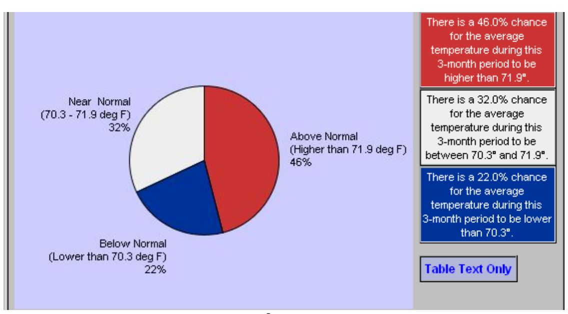
Local 3 Month Outlook
June-July-August 2007
By Karen Kahl

A new long range forecast tool, the Local 3 Month Outlook, became operational on January 17, 2007. This tool was developed in an effort to provide detailed statistical data and probabilistic forecasts to enhance the seasonal categorical forecasts. The Local 3 Month Outlook is available for 10 sites across southeast Michigan and 43 sites across the state. This forecast is produced by down-scaling the national outlook and performing a regression analysis based on the climate record for each site. This forecast is issued for 13 consecutive overlapping three-month periods (e.g. January-February-March, February-March-April). The Local 3 Month Outlook is presented in several graphical formats with pie charts being the most simplistic option, while more complex diagrams show temperature range graphs and probability of exceedance curves. This data can be found on each local Weather Service Page by going to Climate›Local›Climate Prediction.

"The local three-month temperature outlook products are valuable tools to aid decision-makers in managing risks and opportunities at the regional and local level," said Dr. Robert E. Livezey, chief of climate services for NOAA's National Weather Service. This forecast product is not intended to provide temperature information about any particular day or smaller periods within the larger 3 month cycle, but will be most useful in comparing the upcoming season to the longer 30 year mean. A summary of the latest Local 3 Month Outlook will be appended to each of the local seasonal outlooks to provide a numerical accompaniment of data.

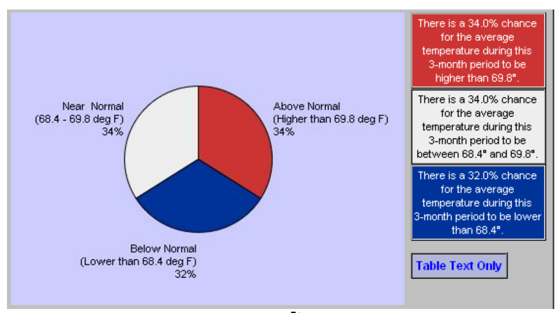
<u>Pie Charts</u>

The first set of images below illustrates chances for above normal, near normal, and below normal conditions as a percentage of a pie chart. In the past, the national outlook has given the probability of falling in the highest category, but the pie charts now give the chances of falling in each category. These charts also provide temperature data so the above normal, near normal, and below normal ranges are explicitly defined.



Detroit

There is a 46% chance of the average temperature being above 71.9 degrees while the 30 year average summer temperature is only 71.4 degrees.



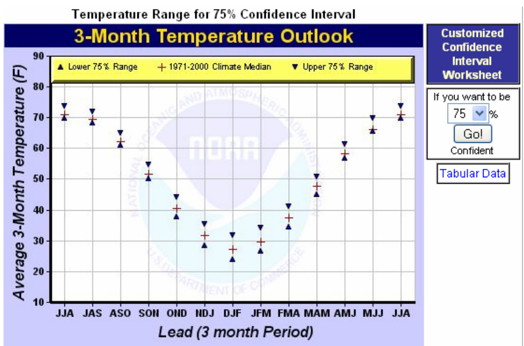
Flint

There is a 34% chance of the average temperatures being above 69.8 degrees while the 30 year average summer temperature is only 68.4 degrees.

The data obtained from these pie charts should be interpreted very carefully and evaluated on an individual site by site basis to make correct use of the information. Data at each site is highly dependent on both the climatology and spread of the observed data from the 1971-2000 period. For example, a quick glance shows that the chance of an above normal summer at Detroit is higher than at Flint. However when the temperature ranges are examined more carefully, one can see that the category for above normal at Detroit begins at only a half degree above the seasonal normal, while the range for Flint begins at one and four tenths of a degree above the seasonal normal. If interpreted incorrectly and without attention to detail, this data could yield misleading results.

Temperature Range Graphs

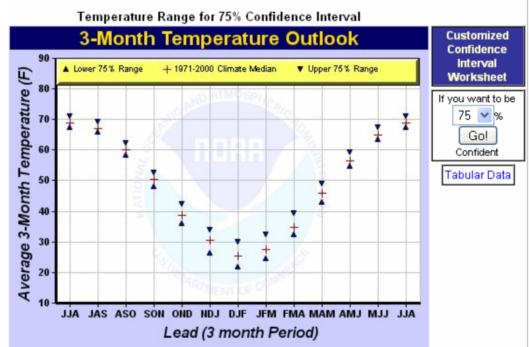
The next set of images are temperature range graphs extending through the upcoming year. These graphs show an expected range for the 3 month average temperature based on a degree of confidence. The user may select from five different confidence intervals ranging from 50% to 99%. Selecting a lower confidence level will yield a smaller range of values, while selecting a higher confidence level will yield a larger range of values. In addition, the median for the 1971-2000 period is plotted as a crosshair on each three month range. The graphs below depict a 75% confidence level for the upcoming year.



Current % Confidence Interval Table													
	JJA	JAS	ASO	SON	OND	NDJ	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA
Median	71.7	70.2	62.9	52.5	41.0	31.8	27.8	30.4	37.8	47.9	59.0	67.5	71.7
75%	73.7 69.7	71.9 68.4	64.9 61.0	54.7 50.3	44.1 37.9	35.4 28.3	31.7 23.9	34.1 26.7	41.2 34.5	50.8 45.0	61.2 56.8	69.7 65.4	73.7 69.7

Detroit

The 75% confidence interval shows that the average temperature at Detroit will fall between 69.7 and 73.7 degrees. The median temperature of 71.7 degrees is higher than the climatological median of 70.6 degrees.



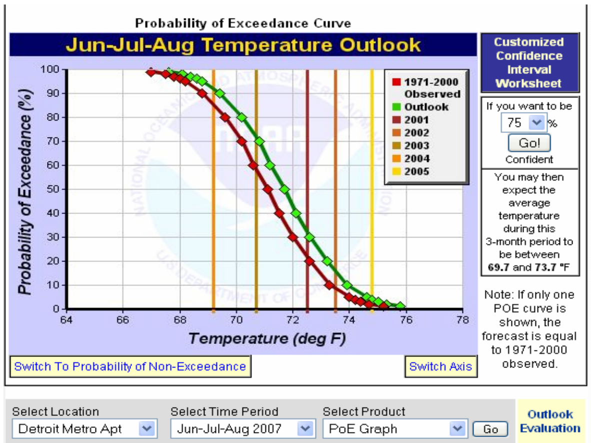
Current % Confidence Interval Table													
	JJA	JAS	ASO	SON	OND	NDJ	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA
Median	69.2	67.6	60.4	50.3	39.1	30.1	25.9	28.3	35.8	46.0	56.9	65.3	69.2
75%	71.0 67.3	69.2 65.9	62.3 58.4	52.7 47.9	42.2 35.9	33.7 26.4	30.0 21.7	32.2 24.5	39.2 32.3	49.0 43.0	59.1 54.8	67.4 63.3	71.0 67.3

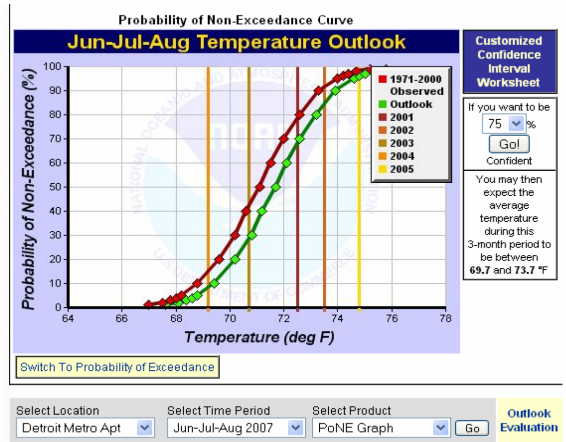
Flint

The 75% confidence interval shows that the average temperature at Flint will fall between 67.3 and 71.0 degrees. The median temperature of 69.2 degrees is higher than the climatological median of 68.6 degrees.

Probability of Exceedance and Non-Exceedance Graphs

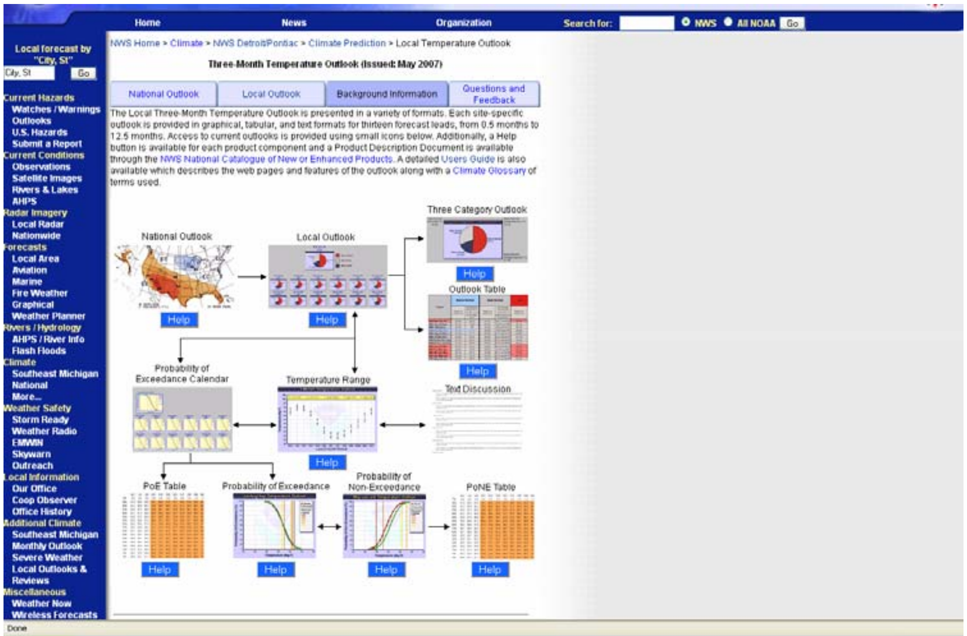
Another useful way to gain information about the Local 3 Month Outlook is by viewing the Probability of Exceedance or Probability of Non-Exceedance Curves. The Probability of Exceedance graphs show the chance that the average seasonal temperature will exceed any particular value. Users may again select a confidence interval between 50%-99% and may also choose to inversely display the data as the Probability of Non-Exceedance. The Probability of Exceedance and Probability of Non-Exceedance graphs for Detroit are shown below.





In these graphs, the green line represents the outlook for this season, while the red line represents climatology. Using the Probability of Exceedance for Detroit(above left), you can infer that based on a 75% confidence interval, there is approximately a 56% chance that the average temperature for this summer will exceed the 30 year average temperature of 71.4 degrees. In comparison, the inverse value can be inferred by using the Probability of Non-Exceedance graph for Detroit(above right). This chart shows that based on a 75% confidence interval, the probability of not exceeding the 30 year average temperature of 71.4 degrees is approximately 44%. The vertical lines plotted on the chart represent the last five available summers to be used as a comparison.

The examples shown above are only a few of the ways that the Local 3 Month Outlook can be displayed. By clicking on the tab titled Background Information, the flow chart below shows how all of the various products and tables are inter-related.



To learn more about using and interpreting the Local 3 Month Outlook, please view the following brochure.

http://www.nws.noaa.gov/om/brochures/climate/L3MTO_PFS1.pdf

Please direct any questions regarding this product to Karen.Kahl@noaa.gov .