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Weather Forecasting For
Traders, Investors, and Businesses



WINTER 2017-18 FORECAST PREVIEW



CONSENSUS FORECAST WINTER 2017-18

**WEAK to MODERATE LA NINA will
dominate the weather patterns over North
America DJFM (Dec Jan Feb Mar)**

**Almost EVERY private meteorologist /
company and CPC entire winter forecast
forecast is based on this premise**

****GROUP THINK ****

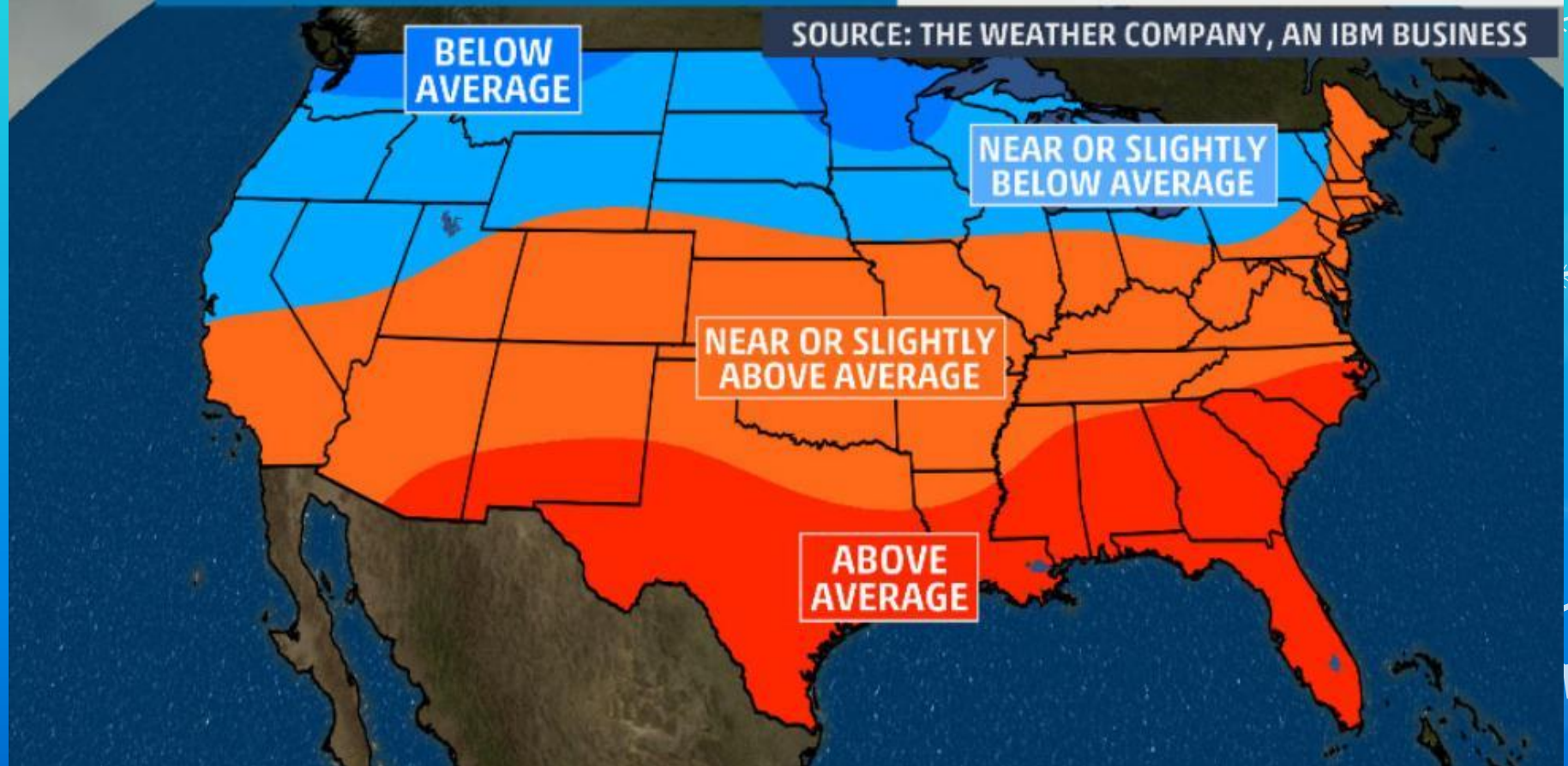
One Meteorologist said " Since last winter featured a weak La Nina, it is reasonable to use it as an analog for this winter's forecast"



TEMPERATURE OUTLOOK

DECEMBER-FEBRUARY

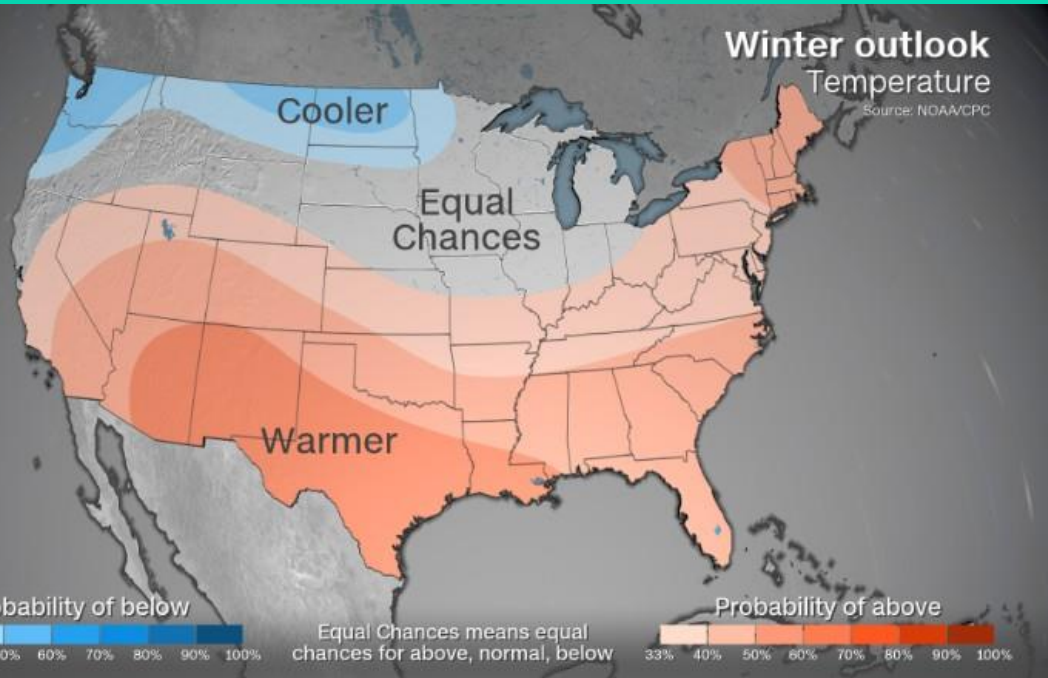
SOURCE: THE WEATHER COMPANY, AN IBM BUSINESS





Winter outlook Temperature

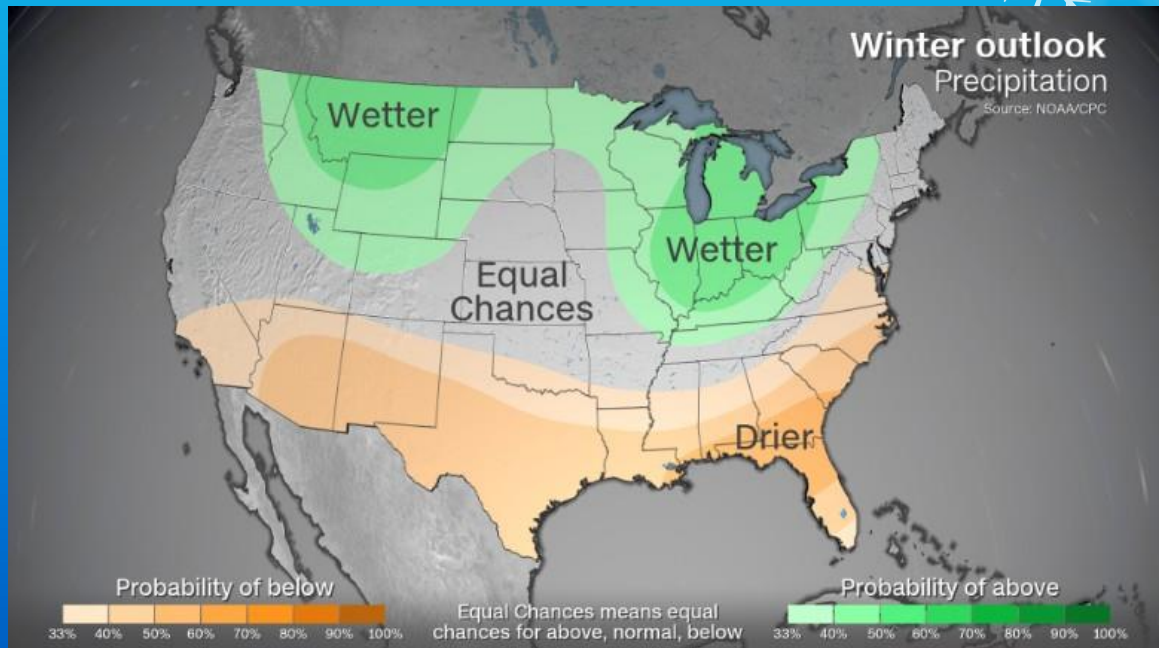
Source: NOAA/CPC



CPC WINTER FORECAST

Winter outlook Precipitation

Source: NOAA/CPC





HIGHLIGHTS


Winter 2017-18



CASE IN POINT CONSENSUS FORECAST SUMMER 2017



**MODERATE EL NINO was coming
Below Normal temps over Plains Midwest
Above Normal Rainfall**



**Below / Much Below Normal
Hurricane season**

**again almost EVERY one had this forecast
in APRIL / MAY 2017**



****GROUP THINK ****



Ski Resort Helmets

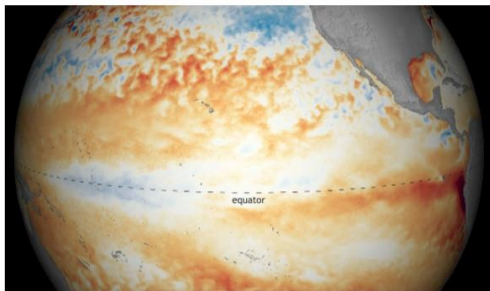
Hurricane Nate Damage Tally

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Full-Fledged El Nino Increasingly Likely in Second Half 2017

By John Kemp | May 5, 2017



March 2017 compared to 1981-2010. Climate.gov/NHIVL. Data: Geo-Polar SST.

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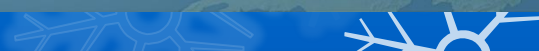
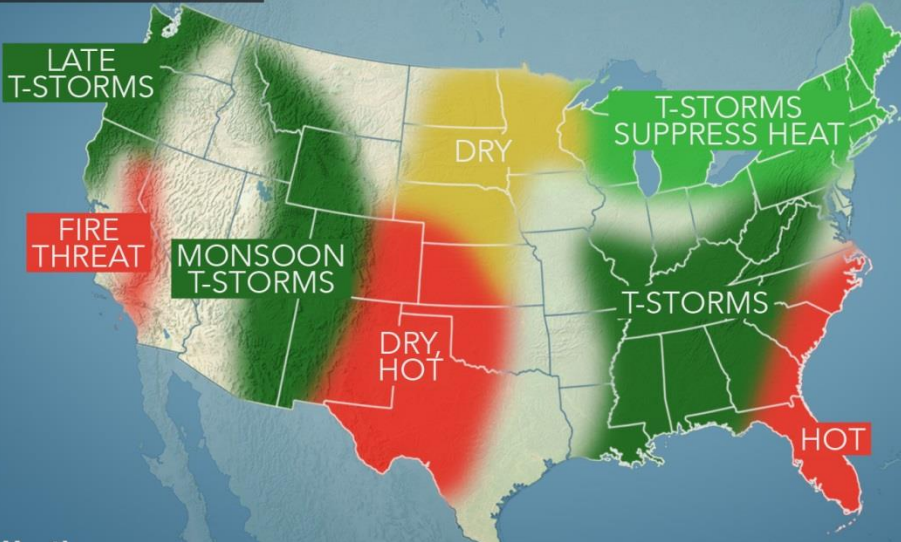
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INDUSTRY INSIGHT



HIGHLIGHTS Summer 2017



2017 Atlantic hurricane forecast: Possible El Niño to limit development of storms

By Jillian MacMath, AccuWeather staff writer
May 31, 2017, 3:06:18 PM EDT

2017 Atlantic Hurricane Forecast: How many named storms will hit th...



Experts are calling for a below-normal hurricane season this year, as a potential El Niño may limit the development of storms.

AccuWeather meteorologists are predicting 10 named storms, five of which are projected to become hurricanes and three of which may become major hurricanes.

"The big factor is going to be the fact that we now believe El Niño will come on board some time during the summer and will continue all the way through the rest of the hurricane season," AccuWeather Meteorologist Dan Kottlowksi said.



The Weather Channel + US °F

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HURRICANE NEWS

2017 Atlantic Hurricane Season Forecast Calls For a Near-Average Number of Storms, Less Active Than 2016

By Jon Erdman | Apr 26 2017 01:00 PM EDT | weather.com



Above-Average Hurricane Season Expected
Meteorologist Kait Parker takes a look at the updated hurricane outlook for 2017 as above-average numbers are now expected.

Story Highlights

A total of 12 named storms, six hurricanes and two major hurricanes are expected this season.

This is near the 30-year average for the Atlantic basin.

El Niño's potential development is among the factors the forecast takes into account.

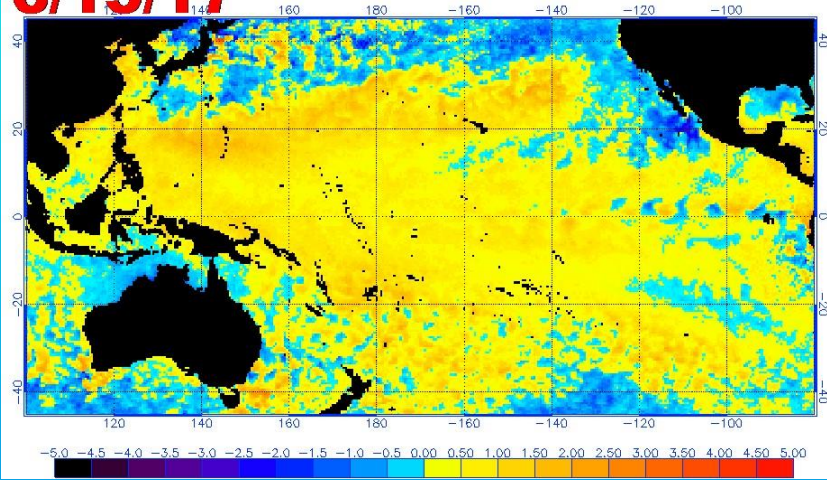
The 2017 Atlantic hurricane season is forecast to be less active than a year ago with the number of named storms and hurricanes near historical averages, according to an outlook released Monday by The Weather Company, an IBM business.

THERE WAS NO EL NINO SUMMER 2017



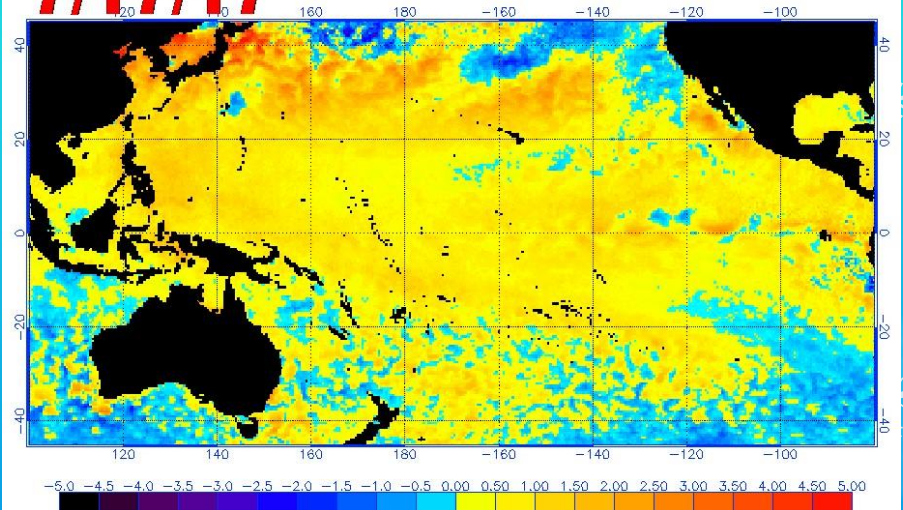
6/15/17

NOAA/NESDIS SST Anomaly (degrees C), 6/15/2017



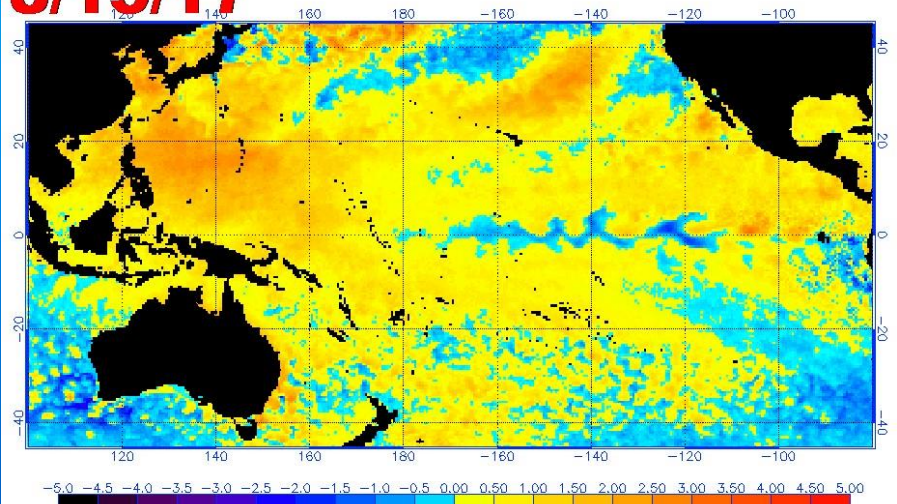
7/17/17

NOAA/NESDIS SST Anomaly (degrees C), 7/17/2017



8/15/17

NOAA/NESDIS SST Anomaly (degrees C), 8/15/2017



CONSENSUS FORECAST WINTER 2016-17



The vast majority of Winter forecasts called for a cold winter with most areas seeing either Average or Above Average snowfall over Midwest and East coast



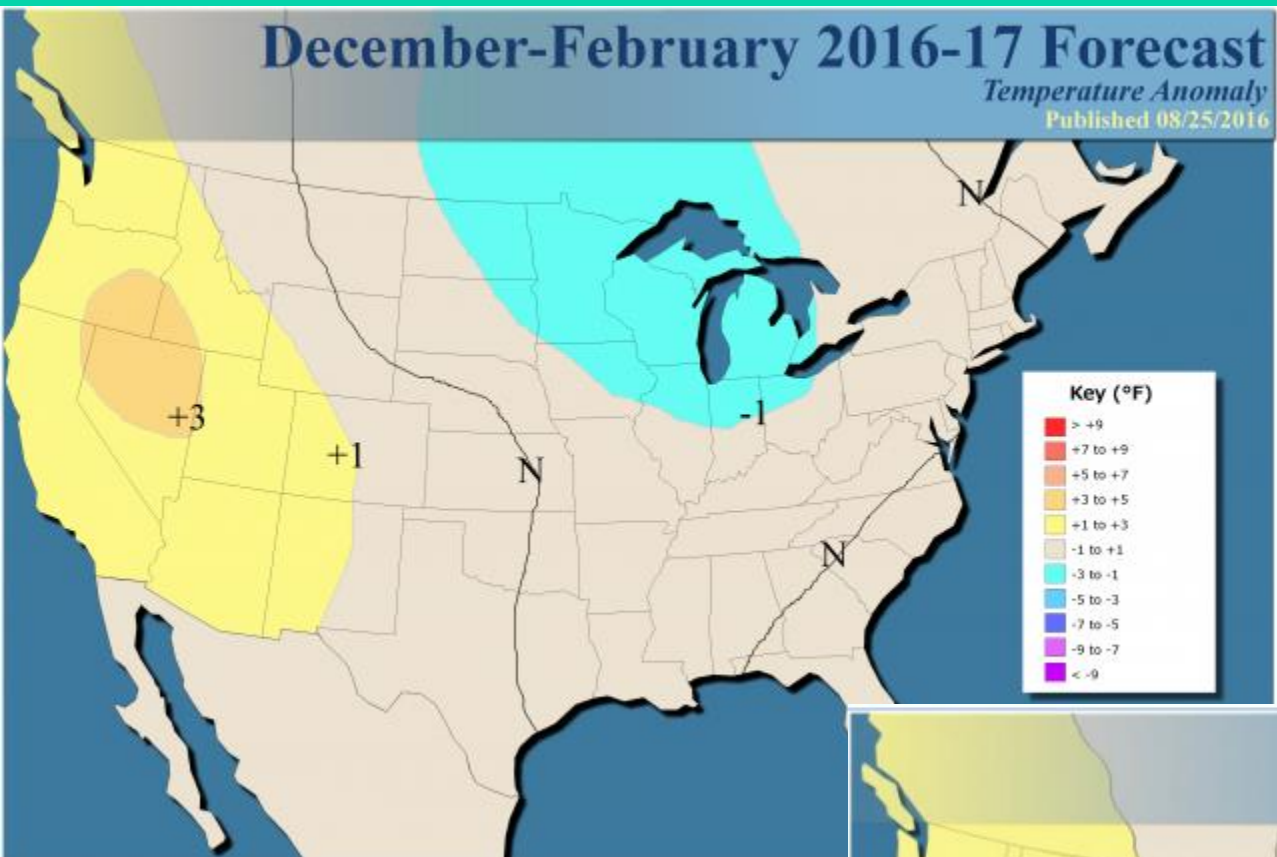
****GROUP THINK ****



December-February 2016-17 Forecast

Temperature Anomaly

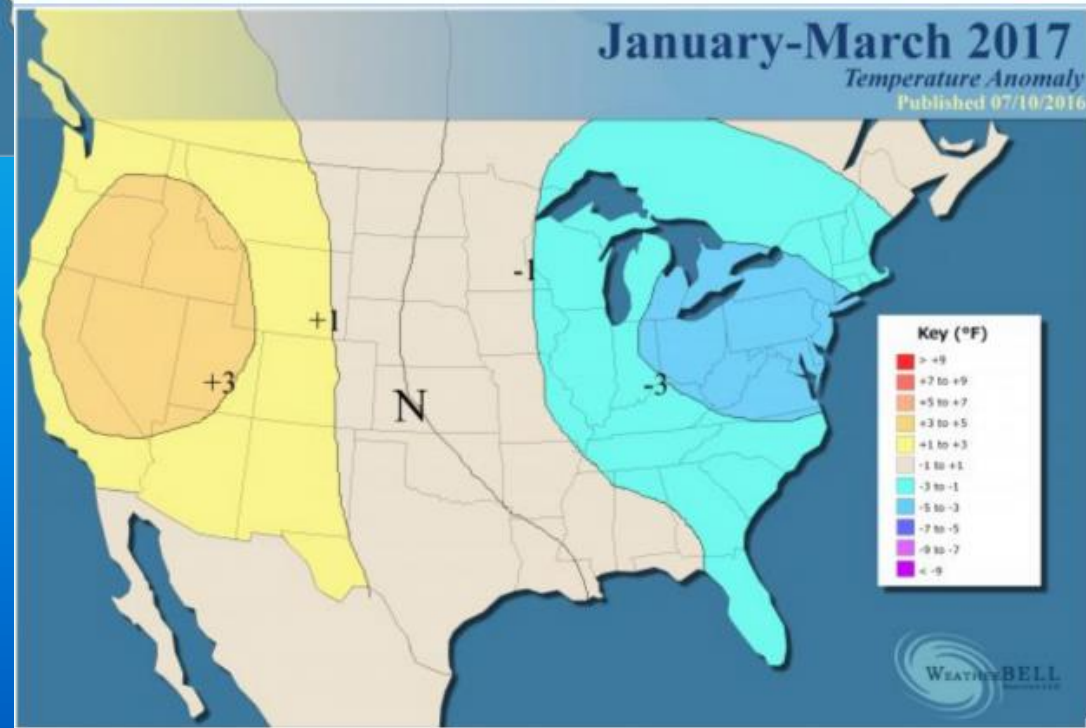
Published 08/25/2016



January-March 2017

Temperature Anomaly

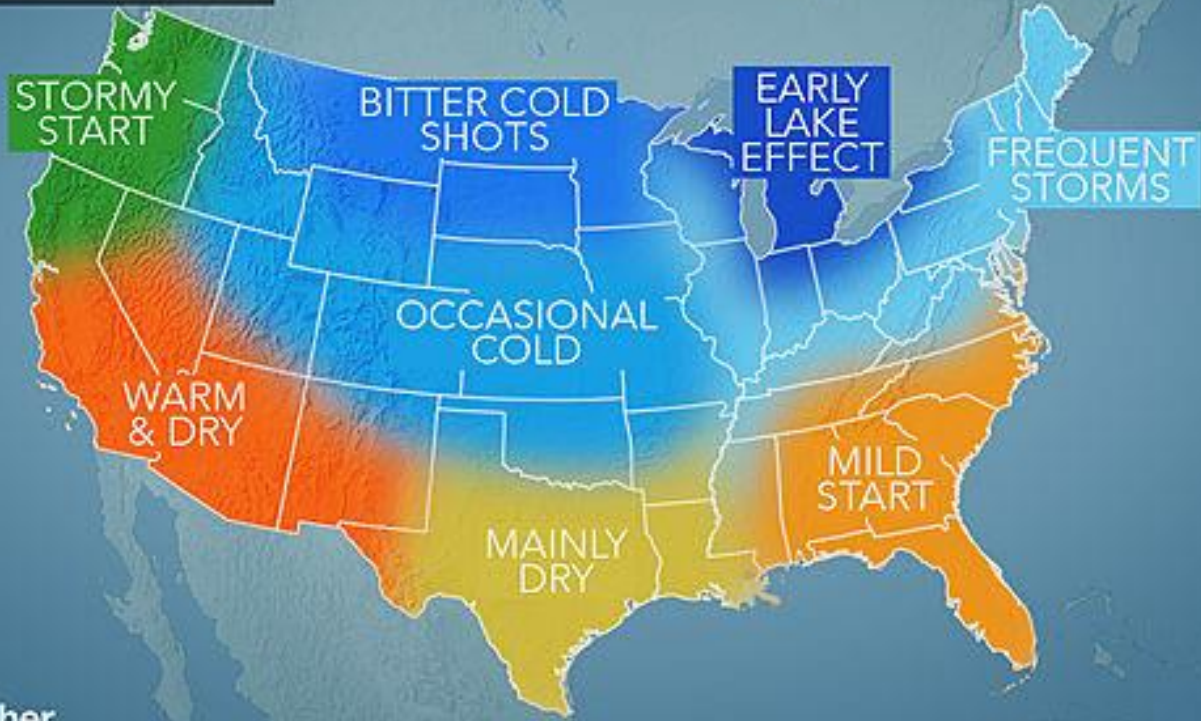
Published 07/10/2016





HIGHLIGHTS

Winter 2016-2017



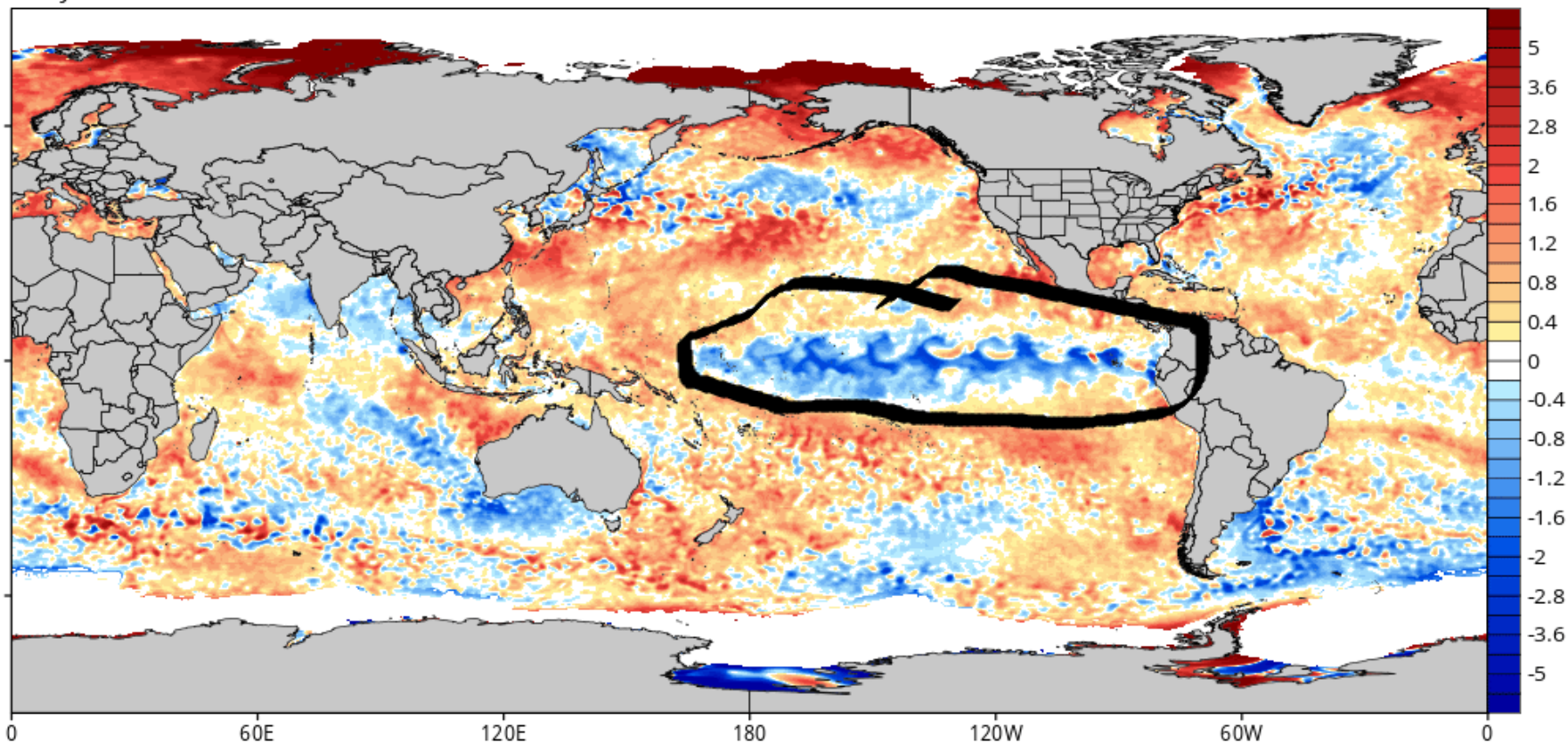
YES There was a weak LA NINA LAST WINTER



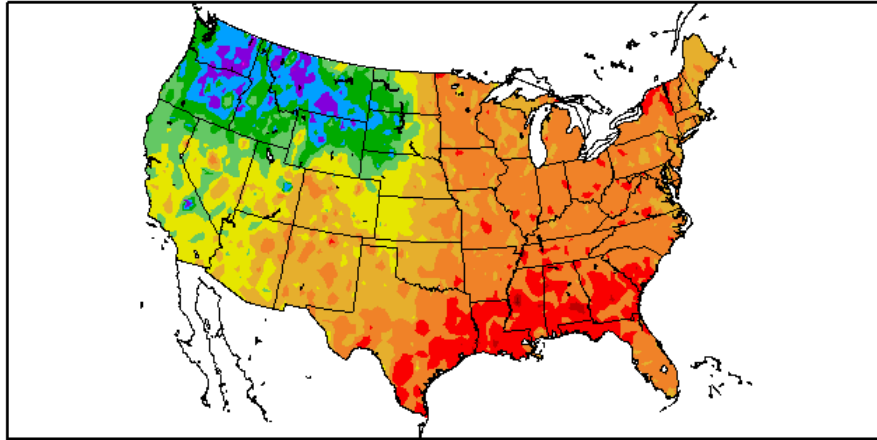
CDAS Sea Surface Temperature Anomaly (°C) (based on CFSR 1981-2010 Climatology)

Analysis Time: 12z Oct 28 2016

TROPICALTIDBITS.COM



Departure from Normal Temperature (F)
12/1/2016 - 2/28/2017

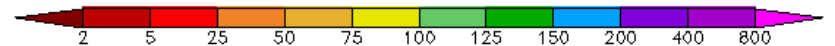
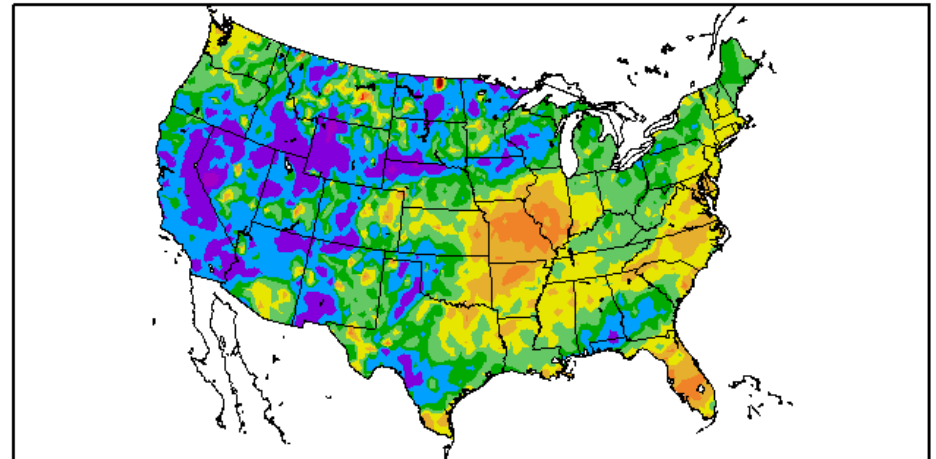


Generated 3/11/2017 at HPRCC using provisional data.

Regional Climate C

LAST WINTER- A REVIEW ..
Yes it was mild all of US
except for Pac NW / North
Rockies -- DRY over central
Plains / portions of Midwest
all of East coast

Percent of Normal Precipitation (%)
12/1/2016 - 2/28/2017



Generated 3/11/2017 at HPRCC using provisional data.

Regional Climate Centers

YET there have been several weak La Nina Winters since 1950 which have featured

- **Either near Normal OR colder than normal temps**
- **Either Normal or Above Normal precipitation**

**WINTERS OF 1964-65 1984-85 1995-96
2000-01 2008-09**

THE QBO

http://en.wikipedia.org/wiki/Quasi-biennial_oscillation

the QBO **quasi-biennial oscillation (QBO)** is high level wind at the very top of the atmosphere (30 mb) that exists over the Equator that oscillates from East (negative QBO) to West (Positive QBO). A full cycle can take anywhere from 18 to 30 months . The strongest Positive values are usually around +15.00 or so while the strongest Negative values will exceed -25.00 or so. The QBO winds work there way down to into the Lower levels and affect weather patterns.

LINK FOR ACTUAL QBO DATA

<http://www.esrl.noaa.gov/psd/data/correlation/qbo.data>

SAMPLE OF THE QBO DATA



1984	-10.65	-11.34	-12.98	-14.58	-15.05	-17.97	-25.39	-27.90	-25.44	-21.59	-13.19	-8.16
1985	-0.37	4.21	6.30	11.11	13.57	14.04	11.10	11.08	11.72	11.84	11.45	9.51
1986	8.74	10.15	11.96	9.11	3.56	-2.15	-5.25	-9.60	-10.21	-9.60	-8.01	-10.51
1987	-9.93	-11.37	-14.23	-16.20	-20.05	-21.47	-13.96	-0.60	5.88	9.35	9.23	8.41
1988	7.81	6.17	5.86	6.59	5.46	0.42	-3.96	-2.58	-2.29	-1.53	-0.84	-2.42
1989	-2.87	-3.56	-1.63	-1.93	-5.46	-9.38	-13.86	-16.98	-18.83	-21.30	-19.01	-13.54
1990	-8.71	-6.74	0.95	5.72	11.46	12.90	12.54	12.63	13.21	12.39	11.55	10.68
1991	8.71	8.44	9.00	10.69	3.82	-3.34	-10.36	-14.69	-13.96	-12.21	-12.27	-11.68
1992	-13.96	-14.33	-16.84	-17.79	-15.96	-15.34	-12.05	-4.75	1.30	3.94	6.33	8.19
1993	9.63	10.81	11.36	12.60	13.56	6.55	0.38	-1.20	-1.14	-4.04	-5.76	-6.00
1994	-7.64	-9.84	-11.29	-14.71	-18.03	-23.09	-28.65	-27.82	-19.07	-10.29	-0.30	5.93
1995	8.38	8.01	8.79	11.79	14.92	15.62	11.74	9.53	6.98	3.43	-0.77	-4.57
1996	-5.79	-6.90	-9.92	-11.08	-14.88	-17.03	-23.93	-25.85	-26.02	-23.40	-18.08	-9.86
1997	-3.57	1.94	4.77	9.74	12.37	14.50	14.85	11.69	11.64	9.91	5.74	0.78
1998	-0.85	-2.96	-4.92	-7.82	-14.08	-18.57	-22.97	-24.70	-22.12	-18.77	-12.22	-3.96
1999	3.09	5.84	8.59	13.51	15.56	15.23	14.11	11.91	11.18	10.62	6.01	6.43
2000	4.85	4.20	5.51	3.98	-0.99	-7.83	-13.13	-15.31	-15.52	-14.04	-15.07	-14.56
2001	-15.69	-15.53	-15.99	-17.73	-20.99	-23.31	-24.45	-21.57	-14.29	-10.81	-3.88	1.48
2002	4.64	8.00	9.32	14.03	14.26	13.26	10.05	10.60	8.90	7.66	4.46	-0.50
2003	-1.39	-1.43	-3.30	-8.56	-13.63	-17.71	-22.99	-24.64	-22.51	-20.34	-17.86	-11.38
2004	-4.84	2.61	5.45	10.46	12.97	11.75	9.96	8.74	7.29	8.00	4.35	2.45
2005	-0.69	-0.96	-0.33	-6.64	-15.09	-20.59	-24.20	-25.87	-27.80	-28.76	-29.55	-25.04
2006	-18.83	-11.24	-0.38	5.00	10.36	11.47	10.75	9.10	10.20	10.86	10.10	6.21
2007	2.61	2.43	1.24	-5.18	-14.06	-21.33	-24.92	-27.41	-28.13	-29.05	-27.61	-19.48
2008	-12.42	-4.70	2.19	6.43	11.53	13.45	13.27	11.63	11.60	11.05	9.13	10.46
2009	10.71	12.33	11.44	9.11	1.56	-5.47	-12.21	-14.45	-13.81	-11.60	-13.83	-15.57
2010	-16.02	-16.98	-19.68	-23.57	-26.28	-25.05	-9.84	1.45	6.58	10.83	12.16	10.97
2011	9.18	10.05	10.44	10.71	10.02	3.90	0.44	-0.49	-2.30	-3.05	-9.09	-16.25
2012	-16.07	-15.25	-16.74	-17.82	-22.04	-25.89	-27.82	-27.93	-26.60	-24.51	-18.95	-10.02
2013	-6.07	-1.23	2.85	8.30	12.64	13.38	14.27	14.66	13.12	11.60	12.45	11.55
2014	13.13	12.68	11.72	7.15	-2.81	-13.98	-19.29	-21.64	-23.24	-23.86	-23.65	-25.38
2015	-26.70	-28.62	-28.15	-24.38	-12.33	2.18	7.45	10.97	12.07	13.38	12.79	11.39
2016	9.34	6.77	3.16	0.64	2.37	3.86	6.25	10.07	10.48	12.83	14.16	15.09
2017	14.92	14.78	14.35	13.88	8.01	-3.18	-10.48	-14.42	-999.00	-999.00	-999.00	-999.00



so? WHY is this QBO thing important?

Strongly POSITIVE QBO values correlate to Non Blocking weather patterns in the Jet stream. The result is west to east ZONAL jet stream pattern...mild temps WET over western US DRY eastern US in WINTER

STRONGLY Negative QBO (-21 to -26) values in the cold season Months also mean NO blocking patterns in the Jet stream strong Pacific Jet.. Stormy cold western US Mild dry eastern US

BUT... QBO values that are “moderately negative” (-11 to -20) favor STRONG Blocking patterns over N Hemisphere in the cold season months (NDJFM)

THE QBO the last 2 years

The QBO in the SPRING of 2016 was dropping towards negatives values APRIL / MAY 2016.. When suddenly the QBO did a total reversal and rapidly rose to STRONGLY Positive values in Autumn and Winter 2016-17.

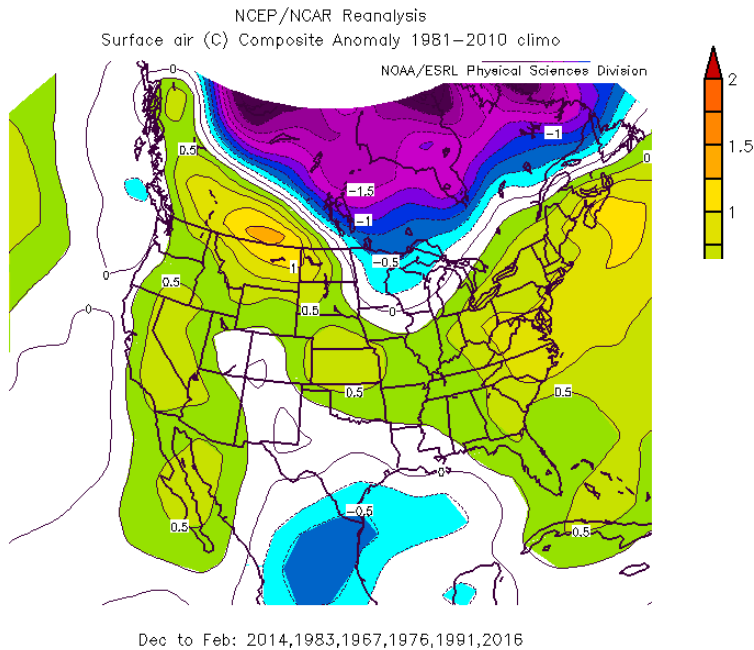
WHY did this happen? I have no idea

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
2015	-26.70	-28.62	-28.15	-24.38	-12.34	2.18	7.45	10.96	12.07	<u>13.38</u>	12.79	11.39	
2016	<u>9.34</u>	<u>6.77</u>	<u>3.16</u>	<u>0.64</u>	2.37	3.86	<u>6.25</u>	<u>10.07</u>	<u>10.48</u>	<u>12.83</u>	<u>14.16</u>	<u>15.09</u>	
2017	<u>14.92</u>	<u>14.78</u>	<u>14.35</u>	<u>13.88</u>	8.01	-3.18	-10.48	-14.42					

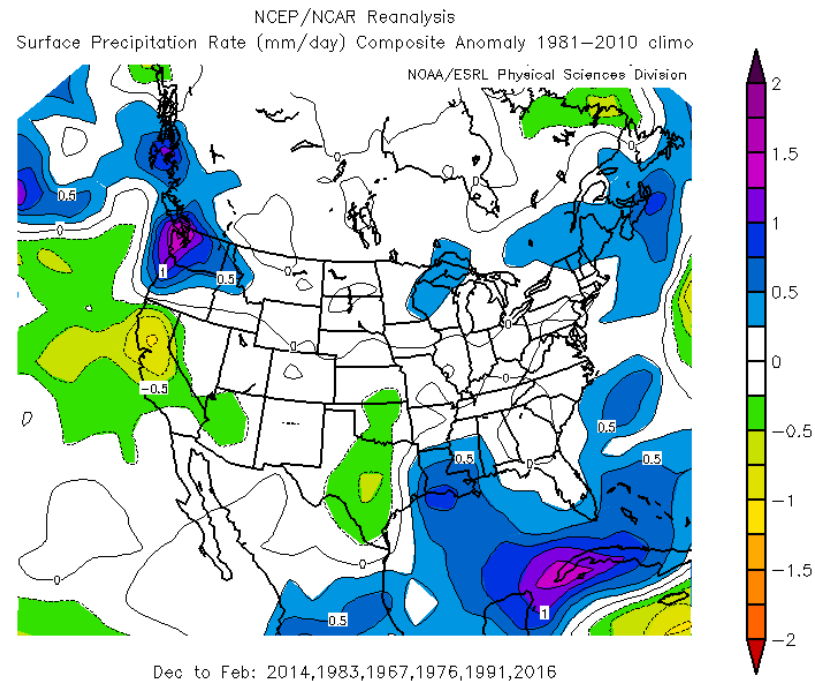
Even more unusual the QBO from OCT 2016 to MARCH 2017 reach the HIGHEST Positive values ever! (QBO data goes back to 1945)

SEPT 2017 -15.00

DEC JAN FEB TEMPS when the QBO is +10 or higher all winter long . This is a MILD/ warm Winter



DEC JAN FEB PRECIP - close to Normal when the QBO is +10 or higher all winter long .



For the Winter of 2017-18.. We can EXPECT QBO values of -10 to -20
SEPT 2017 -15.00

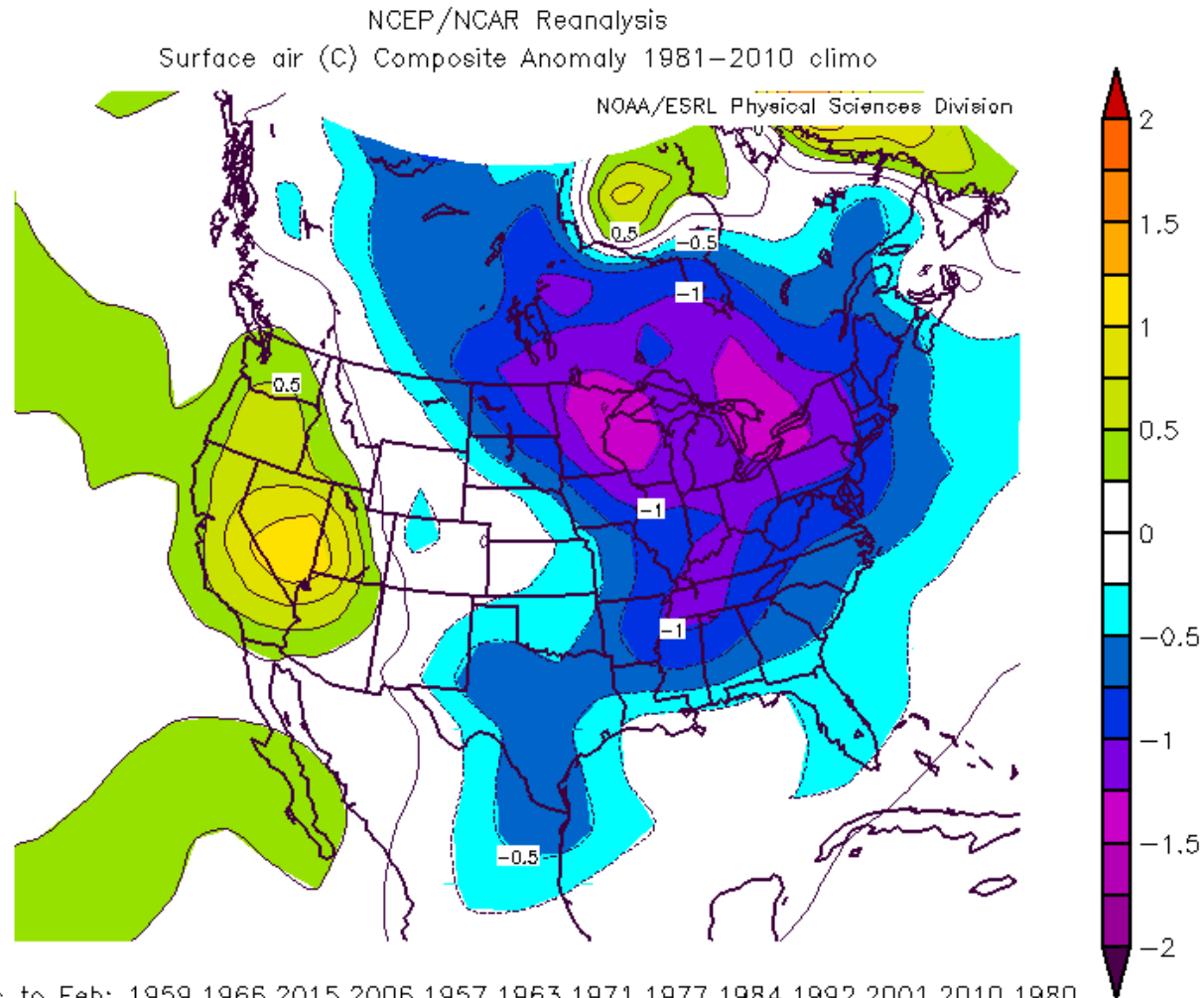


Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
2015	-26.70	-28.62	-28.15	-24.38	-12.34	2.18	7.45	10.96	12.07	<u>13.38</u>	12.79	11.39
2016	<u>9.34</u>	<u>6.77</u>	<u>3.16</u>	<u>0.64</u>	2.37	3.86	<u>6.25</u>	<u>10.07</u>	<u>10.48</u>	<u>12.83</u>	<u>14.16</u>	<u>15.09</u>
2017	<u>14.92</u>	<u>14.78</u>	<u>14.35</u>	<u>13.88</u>	8.01	-3.18	-10.48	-14.42	-	-	-	-

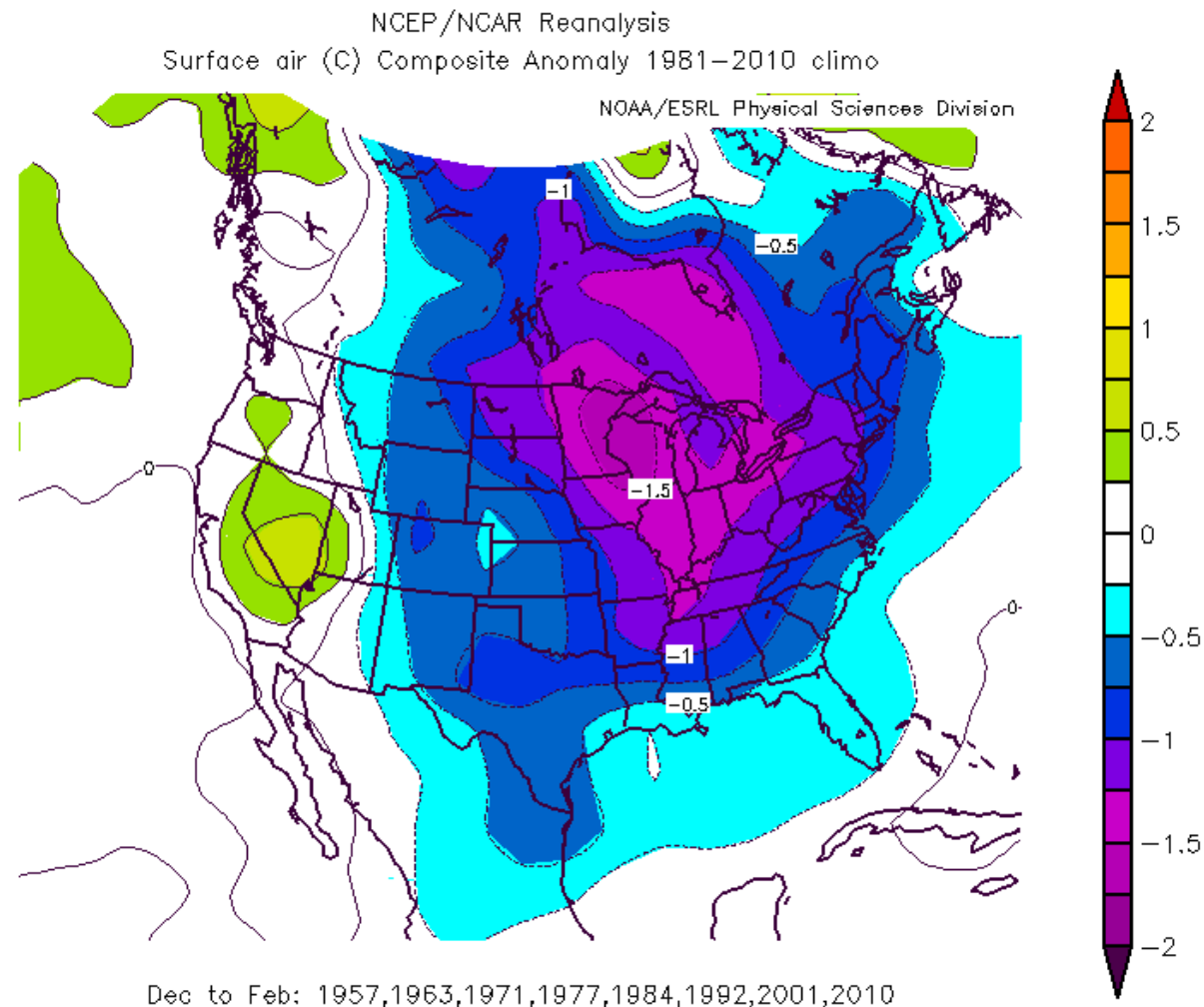
It should be OBVIOUS that is the exact OPPOSITE of what we saw last Winter



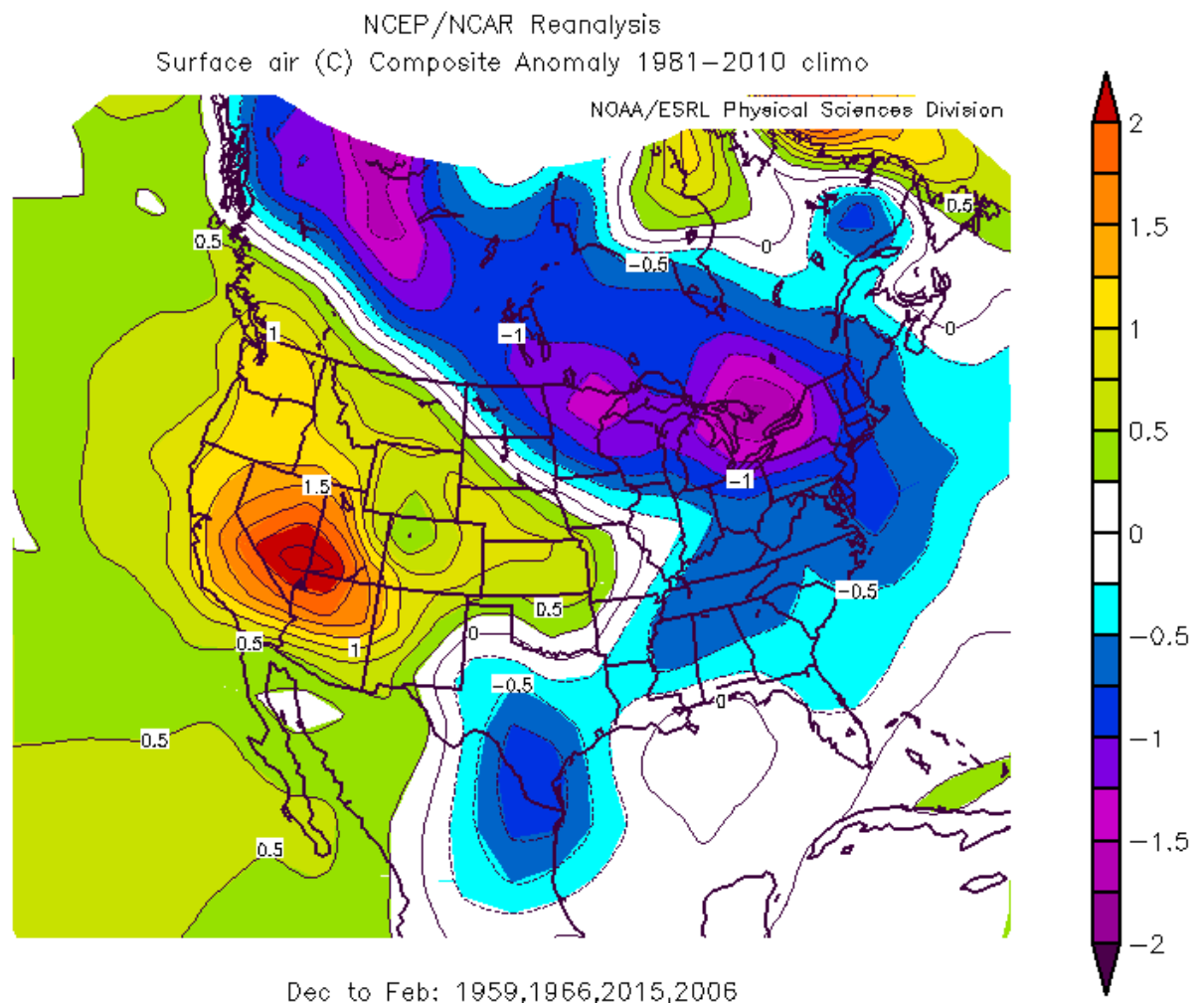
Winters where QBO for DJF was -10 to -15



Winters where QBO for DJF was -15 to -20



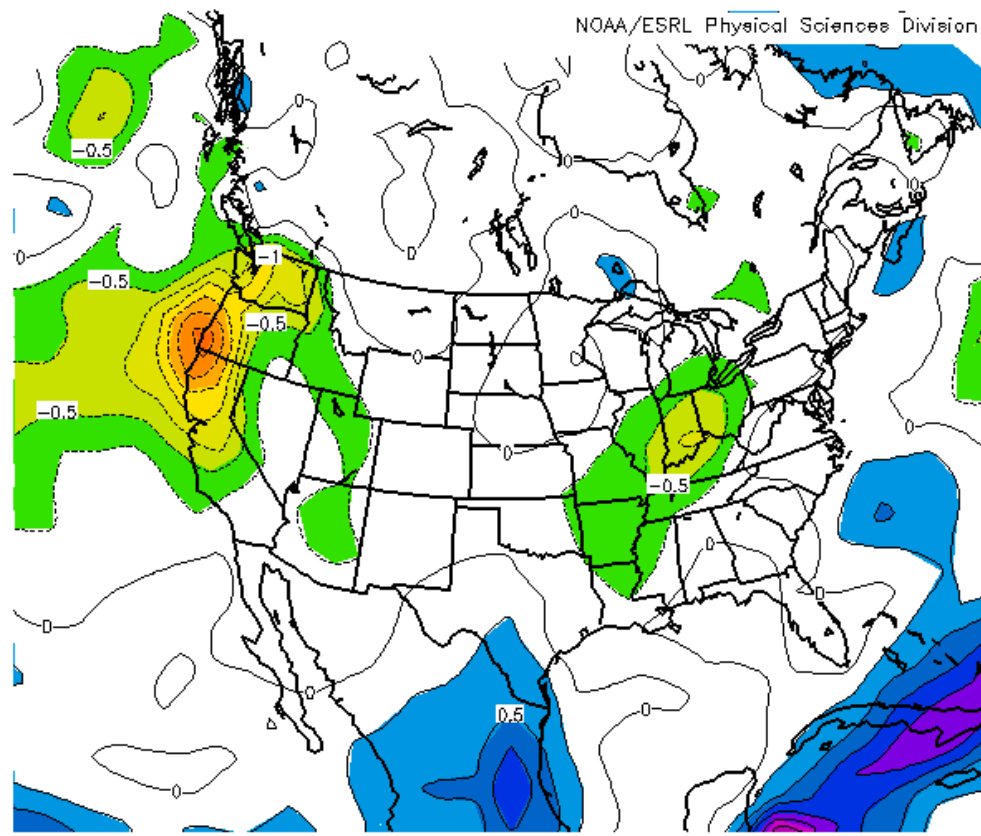
Winters where QBO for DJF was -20 or lower



PRECIP anomalies in Winters where QBO for DJF was -15 to -20



NCEP/NCAR Reanalysis
Surface Precipitation Rate (mm/day) Composite Anomaly 1981–2010 climo
NOAA/ESRL Physical Sciences Division

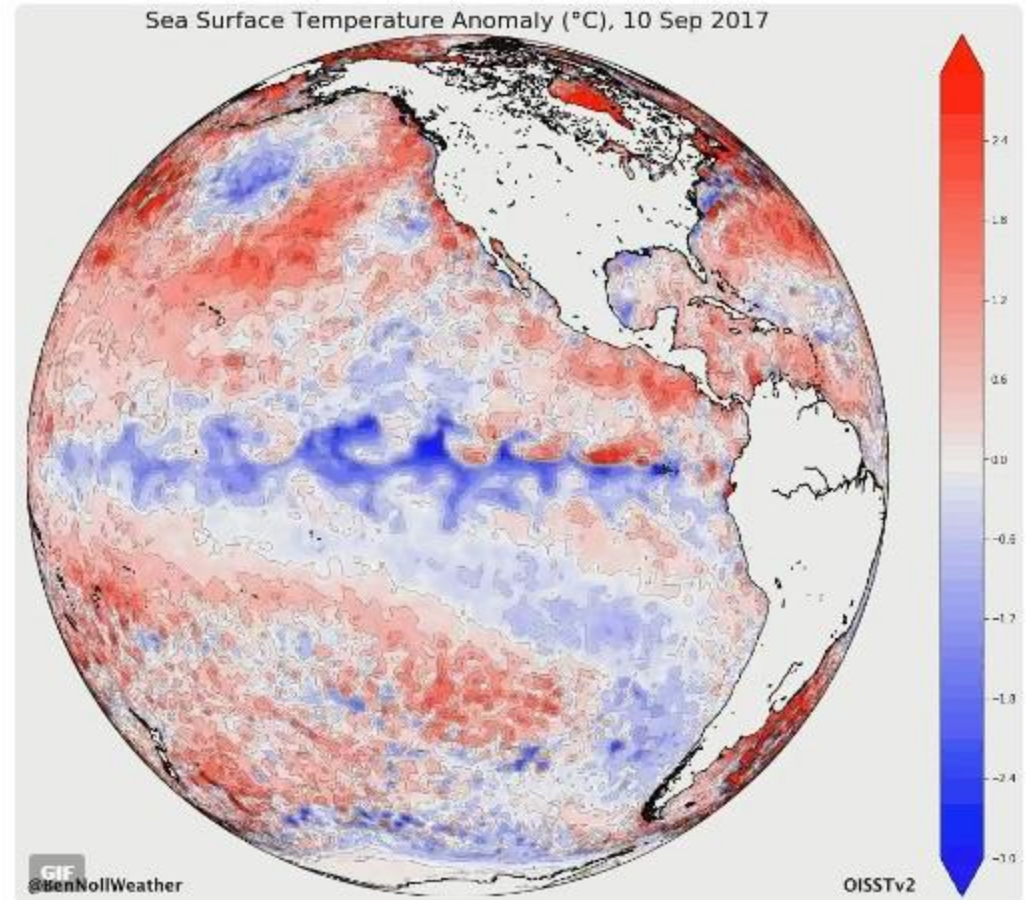


Dec to Feb: 1957,1963,1971,1977,1984,1992,2001,2010



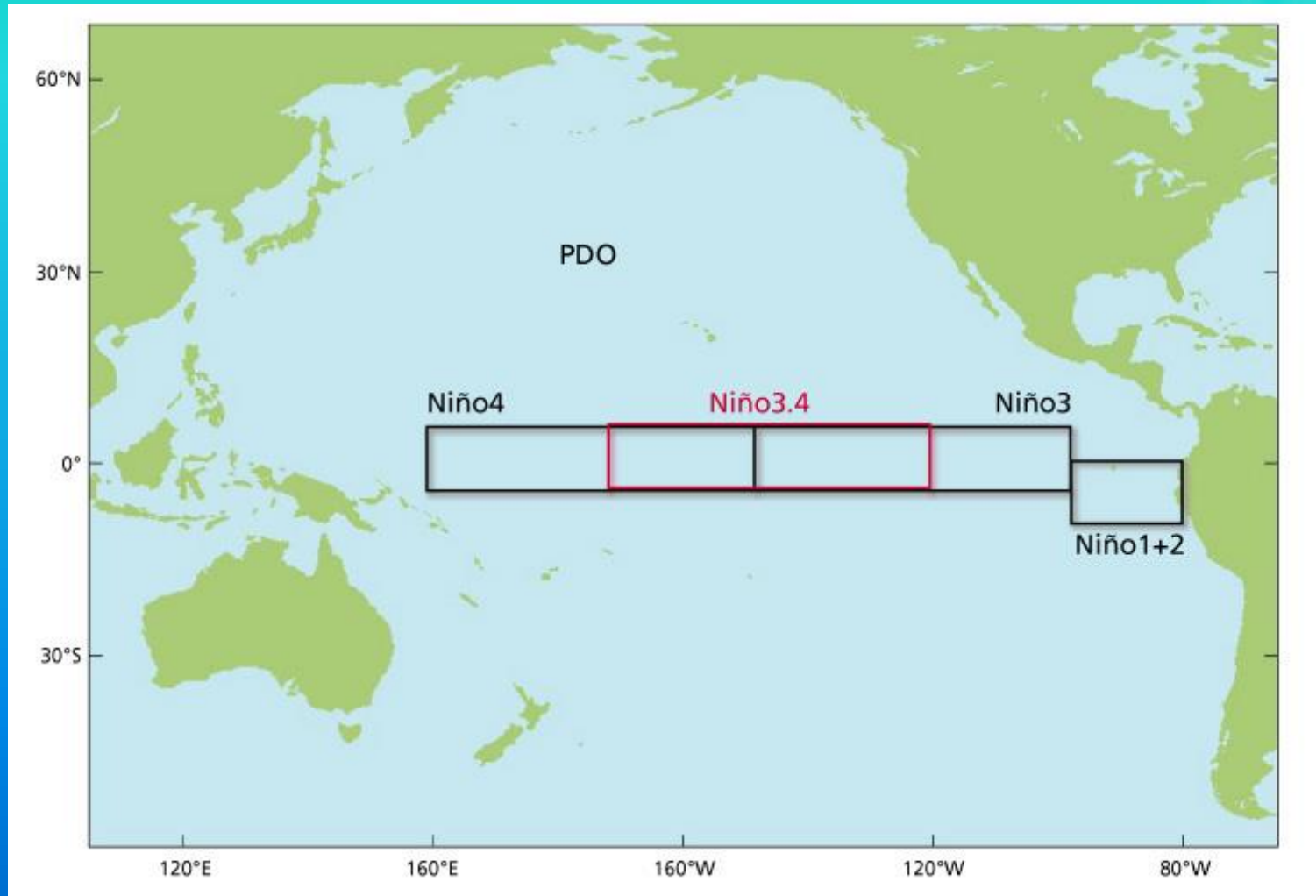
WHAT ABOUT THE LA NINA?

Striking #LaNiña-like SST trend in the tropical Pacific over the last 3 months- if trends continue, we'll have 'official' event by Nov-Dec.

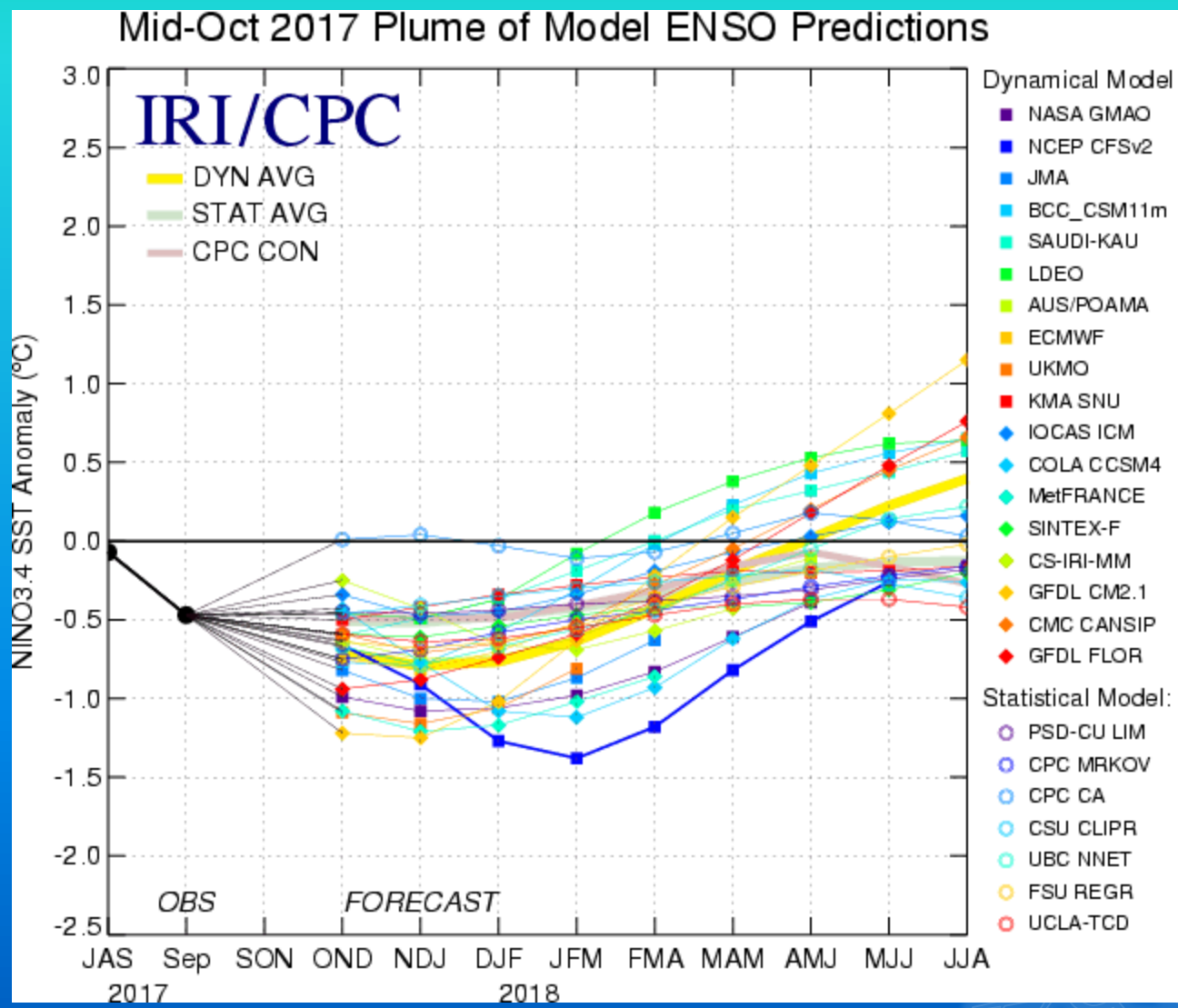


6:29 AM - 13 Sep 2017

THE 4 REGIONS OF ENSO where El Nino / La Nina form

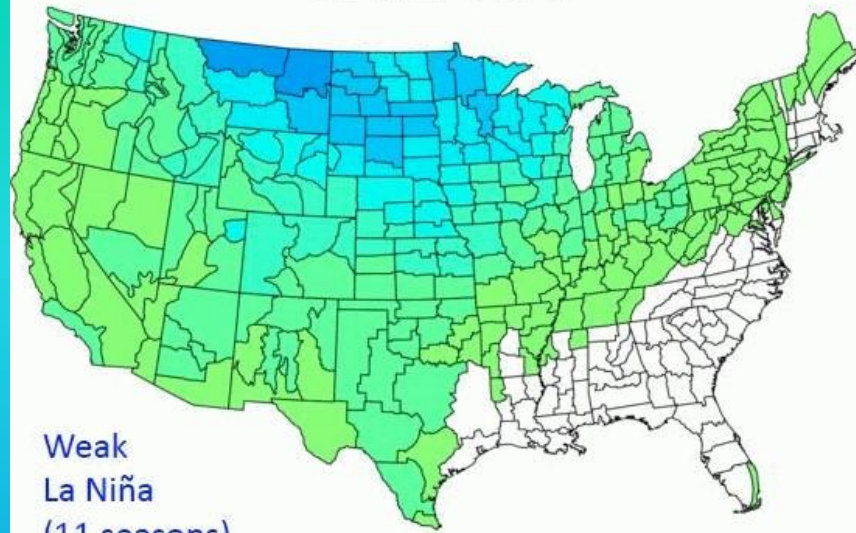


ALL CLIMATE MODELS -- again CFS MODEL PROJECTION (dark BLUE line) COLDER STRONGER LA NINA THAN ANY OTHER MODEL

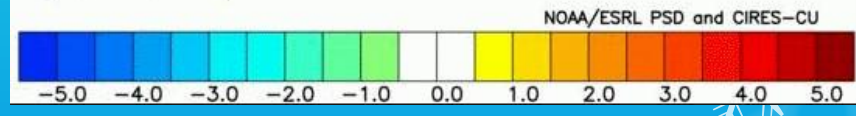


WEAK La Nina temp anomalies DJF

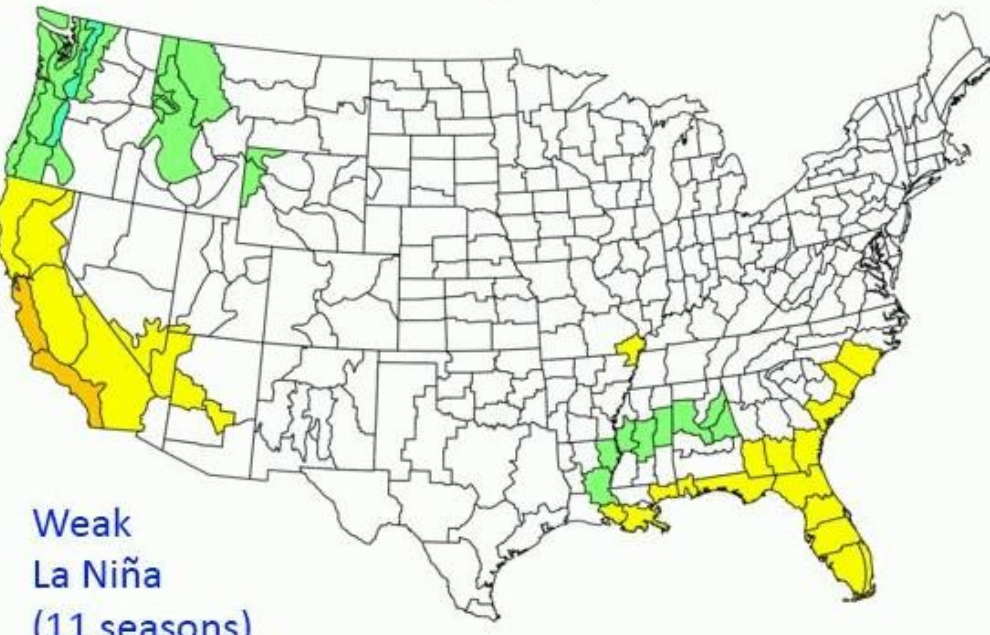
NOAA/NCDC Climate Division Composite Temperature Anomalies (F)
Versus 1981-2010 Longterm Average
Dec to Feb 1950-51,1954-55,1964-65,1967-68,1971-72,1974-75,1983-84,1984-85
1995-96,2000-01,2011-12,



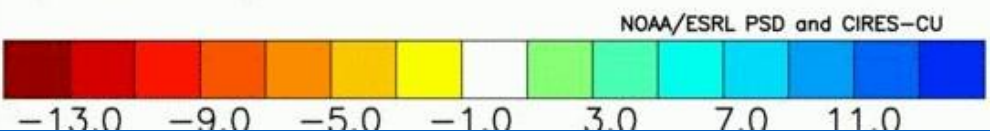
Weak
La Niña
(11 seasons)



NOAA/NCDC Climate Division Composite Precipitation Anomalies (in)
Versus 1981-2010 Longterm Average
Dec to Feb 1950-51,1954-55,1964-65,1967-68,1971-72,1974-75,1983-84,1995-96
2000-01,2011-12,



Weak
La Niña
(11 seasons)

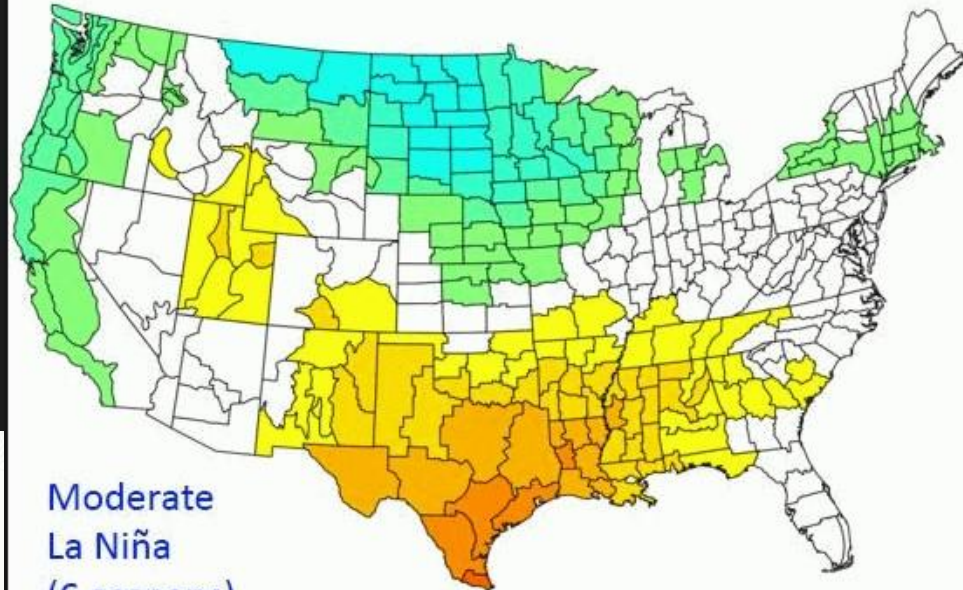


WEAK La Nina precip anomalies DJF



MODERATE La Nina temp anomalies DJF

NOAA/NCDC Climate Division Composite Temperature Anomalies (F)
Dec to Feb 1955-56,1970-71,1998-99,1999-00,2007-08,2010-11
Versus 1981-2010 Longterm Average



Moderate
La Niña
(6 seasons)

NOAA/ESRL PSD and CIRES-CU



NOAA/NCDC Climate Division Composite Precipitation Anomalies (in)
Dec to Feb 1955-56,1970-71,1998-99,1999-00,2007-08,2010-11
Versus 1981-2010 Longterm Average

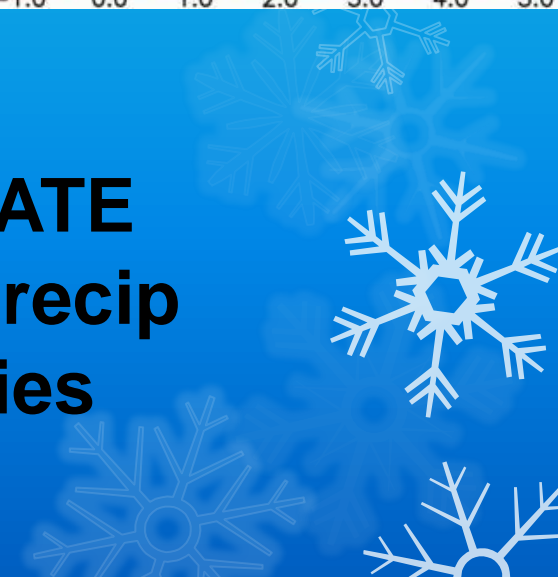


Moderate
La Niña
(6 seasons)

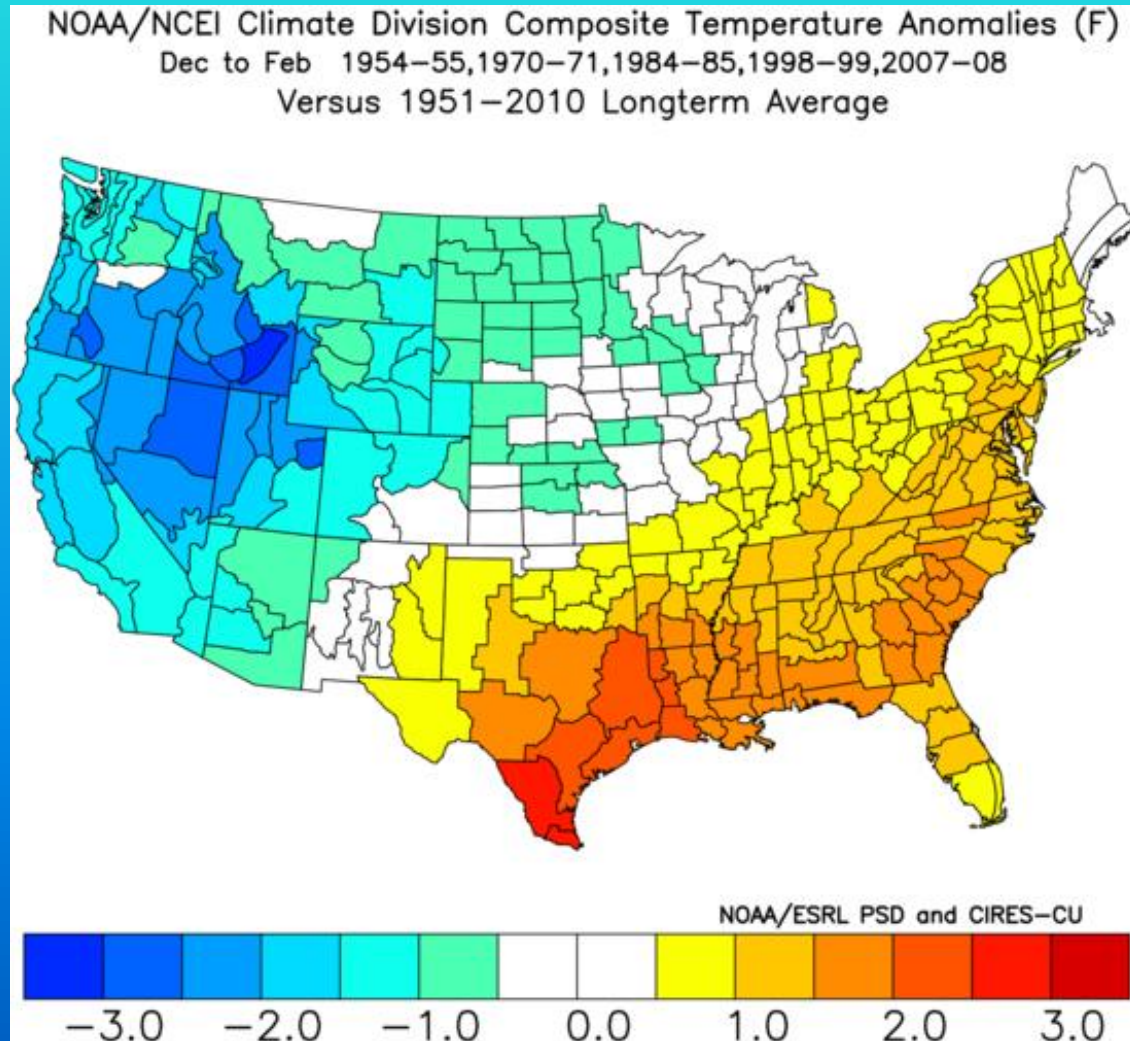
NOAA/ESRL PSD and CIRES-CU



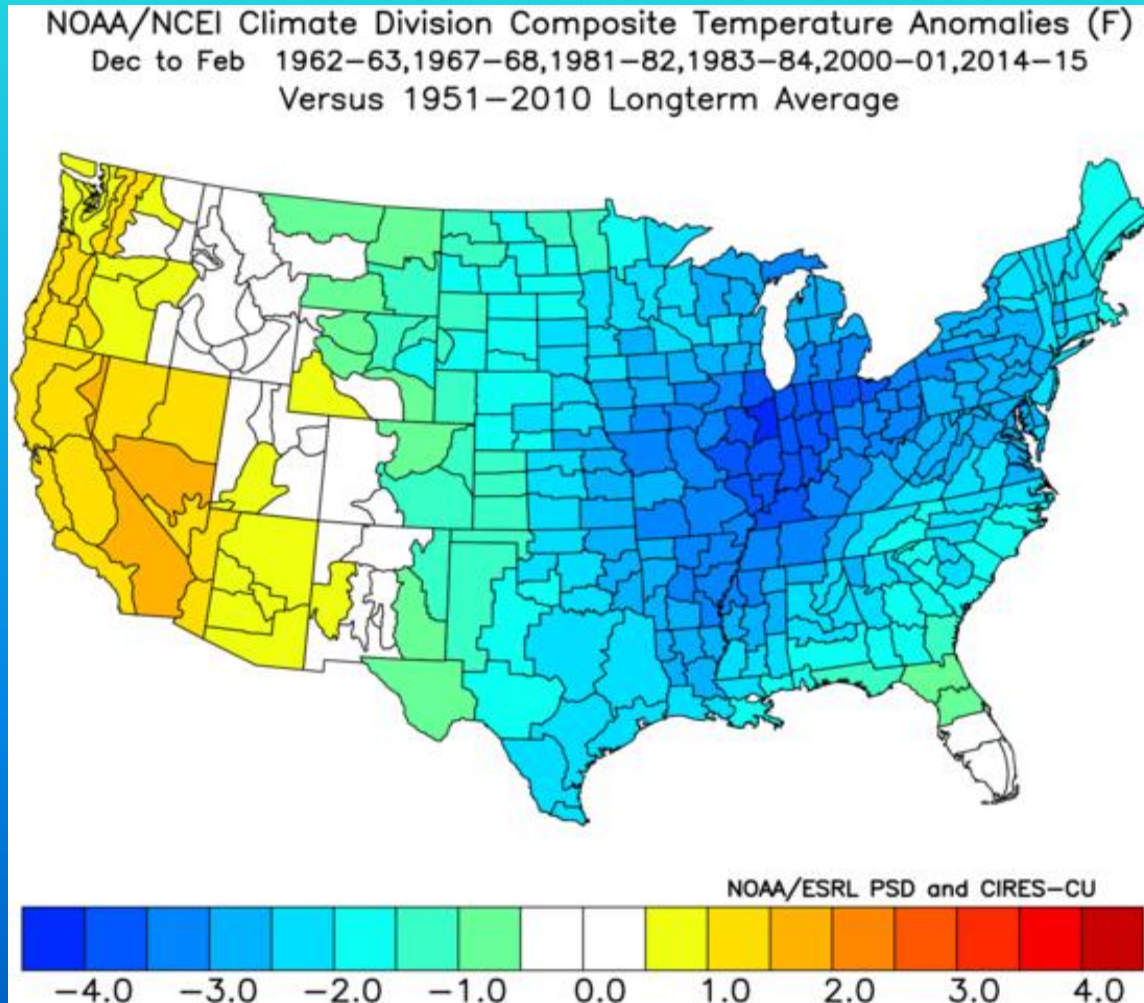
MODERATE La Nina precip anomalies DJF



Winters with WEAK La Nina & QBO was negative in NOV rose to Neutral by FEB



Winters with WEAK La Nina & QBO was negative in NOV and STAYED Negative all winter into March



SIBERIAN SNOW COVER IN OCTOBERand NORTH AMERICAN / US WINTERS



SIBERIAN SNOW COVER BUILD UP IN OCTOBER



--- it is strongly connected to SUPPLY of Arctic air that cross over in northern Canada / USA (hence the term “Siberian express”)



It is Measured in 2 ways

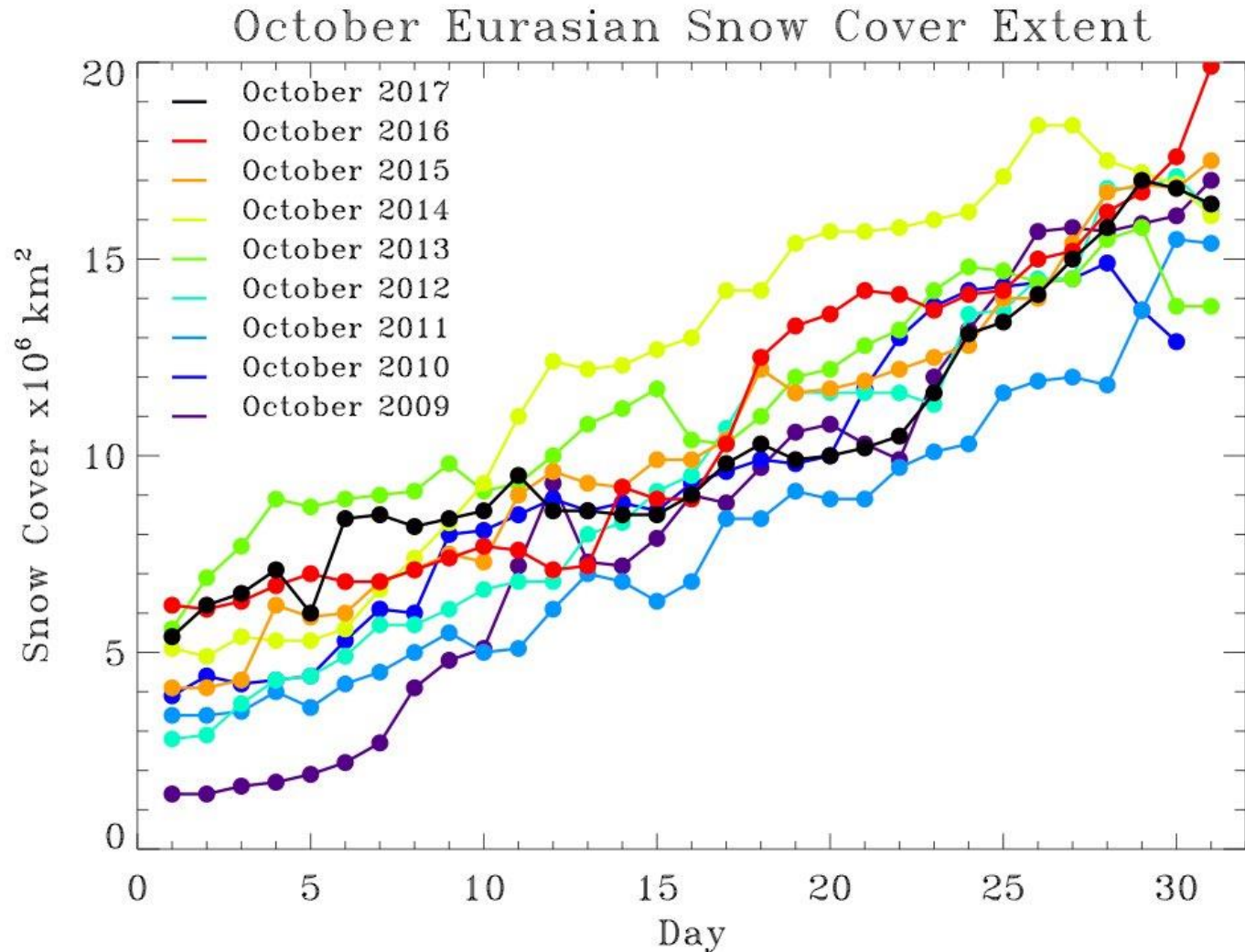
- SCE - Siberian coverage event How much of Siberia actually covered in snow by 10/31) Positive SCE = lots of cold air available for Winter. Negative SCE= Below Normal cold air build up
 - SAI - Snow Advance Index how fast does the snow advance toward north China by 10/31. Positive SAI= Winter weather patterns favor Strong Blocking JAN-MARCH. Negative SAI = Blocking patterns much less likely
- 
- 
- 
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SIBERIAN SNOW COVER BUILD UP IN OCTOBER part 2

SCE / SAI doesn't always work... Build up DEEP heavy snow in OCTOBER in SIBERIA does NOT guarantee a cold winter central/eastern US

BUT without Good build up of hvy deep snow in Siberia ARCTIC / SIBERIAN express outbreaks are non existent

SCE SIBERIAN SNOW COVER BUILD UP IN OCTOBER - Much Above Normal)



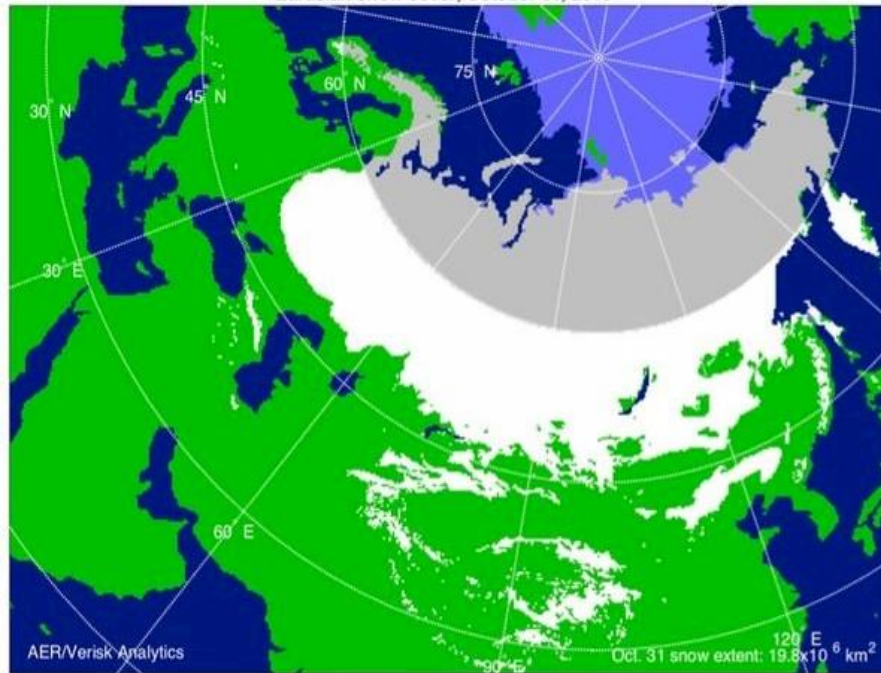
This compares SNOW cover 10/31/16 (LEFT) with SNOW cover 10/31/17



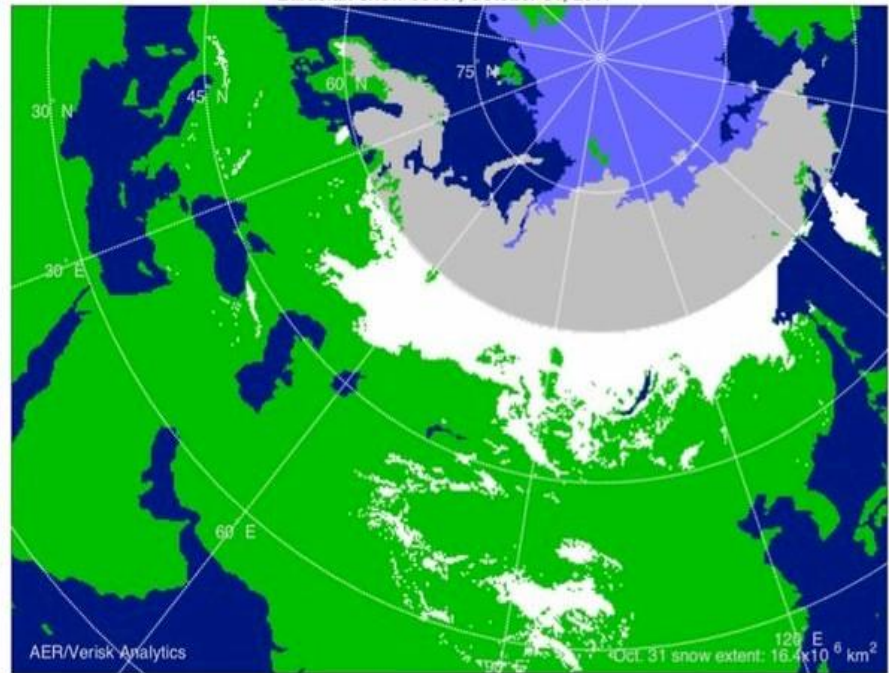
This is show we measure the SAI ! The SAI value is down from last Winter.



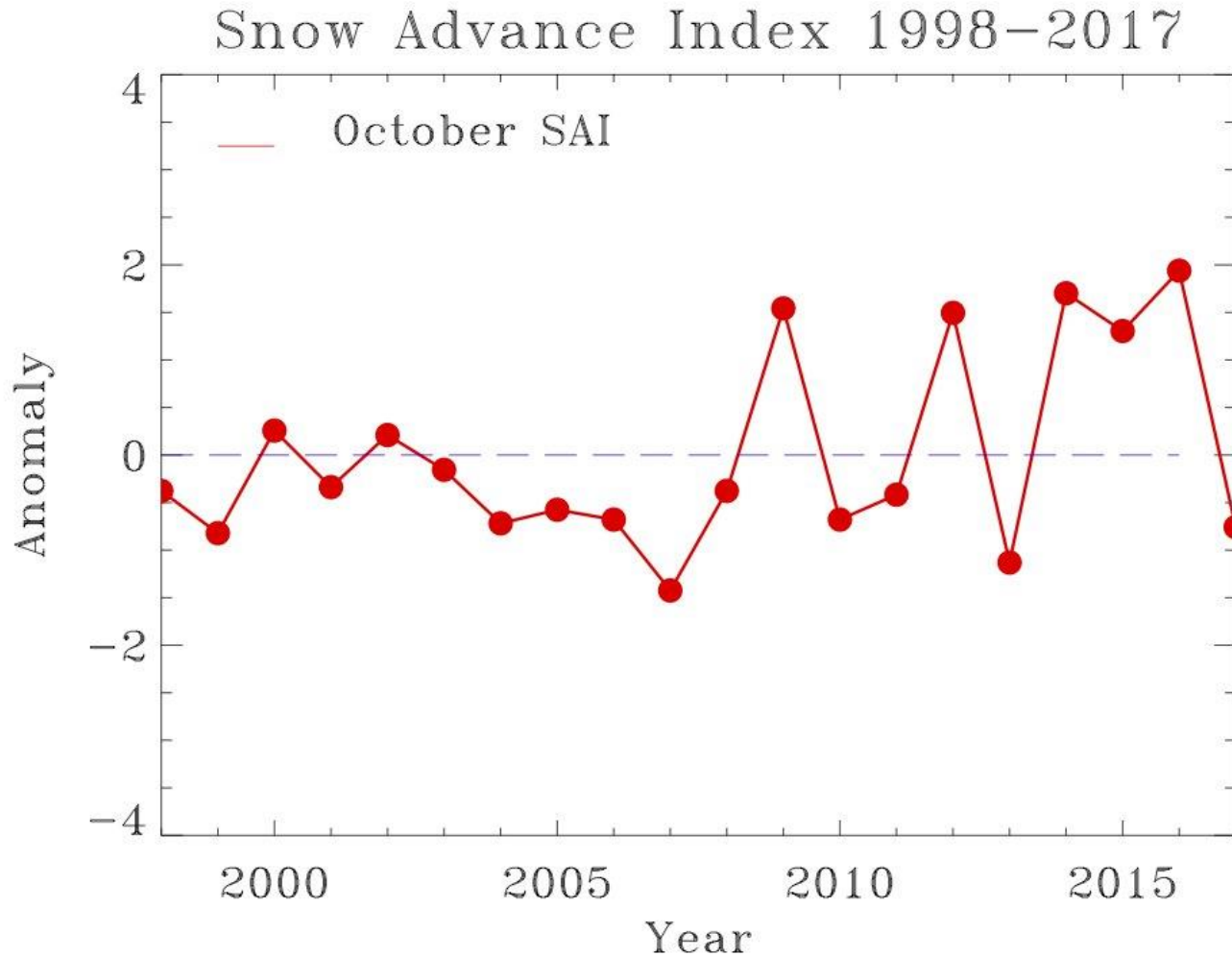
Eurasian snow cover, October 31, 2016



Eurasian snow cover, October 31, 2017



SAI plotted on a chart – OCT 2017 was slightly below Normal



SUMMARY FOR WINTER 2017-18

- WEAK LA NINA-- may end by Mid Jan 2018
- **LAST TIME SAI was negative BUT SCE was positive was OCT 2013.**
- DECEMBER warmest of WINTER months
- 2nd of winter colder snowier than 1st half like 2013-14
- QBO negative/ East - favors negative AO... blocking pattern
- **1ST HALF of winter DEC 1-JAN 15** will feature a bias for Above Normal snowfall & Below Normal temps for Pacific NW North/ Central Rockies Upper Plains Great Lakes North New England

SUMMARY FOR WINTER 2017-18

- MILD Temps bias and Below Normal snowfall Middle Atlantic Tenn valley central/ Lower Plains
- **2nd HALF of winter JAN 15 – MARCH 15** will feature a bias for Normal or Above Normal snowfall over all of the Plains Midwest Middle Atlantic New England
- Below or Much Below Normal temps Plains and entire eastern half of the country
- MILD Temps bias and Below Normal Precip West coast Great Basin Rockies
- **KEY will be keeping the QBO -11 to -20 DJF**
- **If QBO drops to -21 or lower the forecast will Bust**

FINAL UPDATE NOVEMBER 15

- **Temp & Precip forecasts for DEC JAN FEB**
- **Additional forecast information**
- **Winter outlooks for the EPO AO PNA NAO**