Kevin Birk and Ricky Castro
National Weather Service Forecast Office Chicago, IL
Romeoville, IL

WINTER 2018 - 2019 OUTLOOK

WHAT FACTORS WILL PLAY A ROLE THIS WINTER?

Overview

- Bottom Line Up Front
- What are normal winter season conditions in northern IL and NW IN?
- CPC Winter Outlook
- Developing El Niño conditions in the tropical Pacific expected to persist through the winter
  - What is ENSO and El Niño?
  - Current and forecast conditions.
  - What has occurred in past similar winters, including local data.
- Other factors to consider
  - Important Teleconnections
- A Brief Look Ahead into December
- Summary: What we know now and things to consider.
- Conclusion: NWS Chicago Outlook for Winter 2018-19

Bottom Line Up Front

- **ENSO Status:** El Niño favored to form and continue through winter 18-19
  - Likely high end weak or low end moderate peak.
- **Climate Prediction Center (CPC) December-February (DJF) outlook:**
  - Temperatures: Nearly equal chances (above, near, below normal)
    - Very slight lean locally into the above normal probability
    - Low confidence, colder outcome is nearly equally as likely
  - Below normal precipitation favored
- Long range models favor above normal temperatures and normal to below normal precipitation for the DJF Period
- **Past Similar Events:** Since 1950, weak El Niños have produced on average below normal temperatures and near to below normal precipitation locally.
- Below normal precipitation DOES NOT MEAN below normal snowfall.
  - Many weak El Niño winters → > Normal Snow & < Normal Precip.
  - High volatility of seasonal snowfall → little/no skill in long range prediction
  - We have gotten off to a head start this year (3.6" for Chicago-O'Hare and 3.9" for Rockford through 11/21)

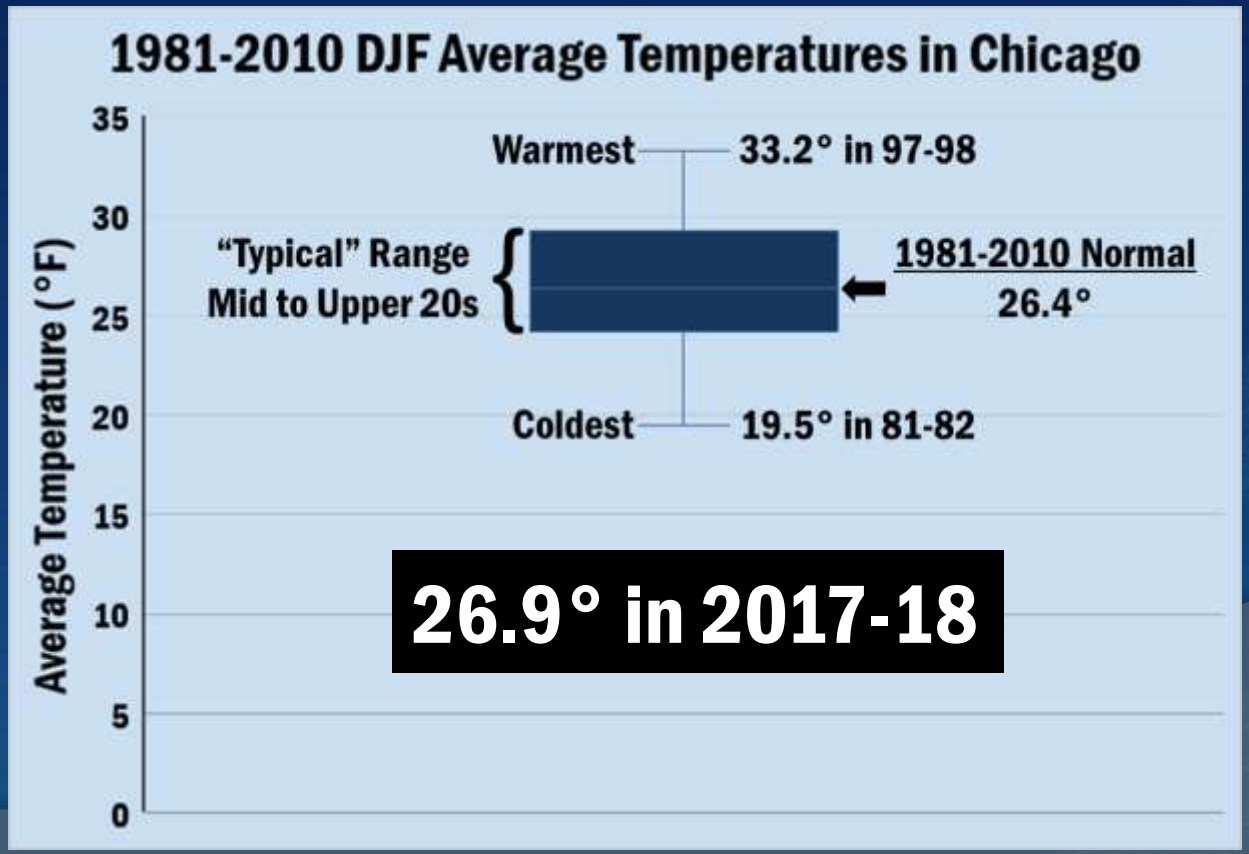
Normal Winter Temperatures in Chicago

1981-2010 Normal Daily High Temps

	Chicago
December	34.8°
January	31°
February	35.3°

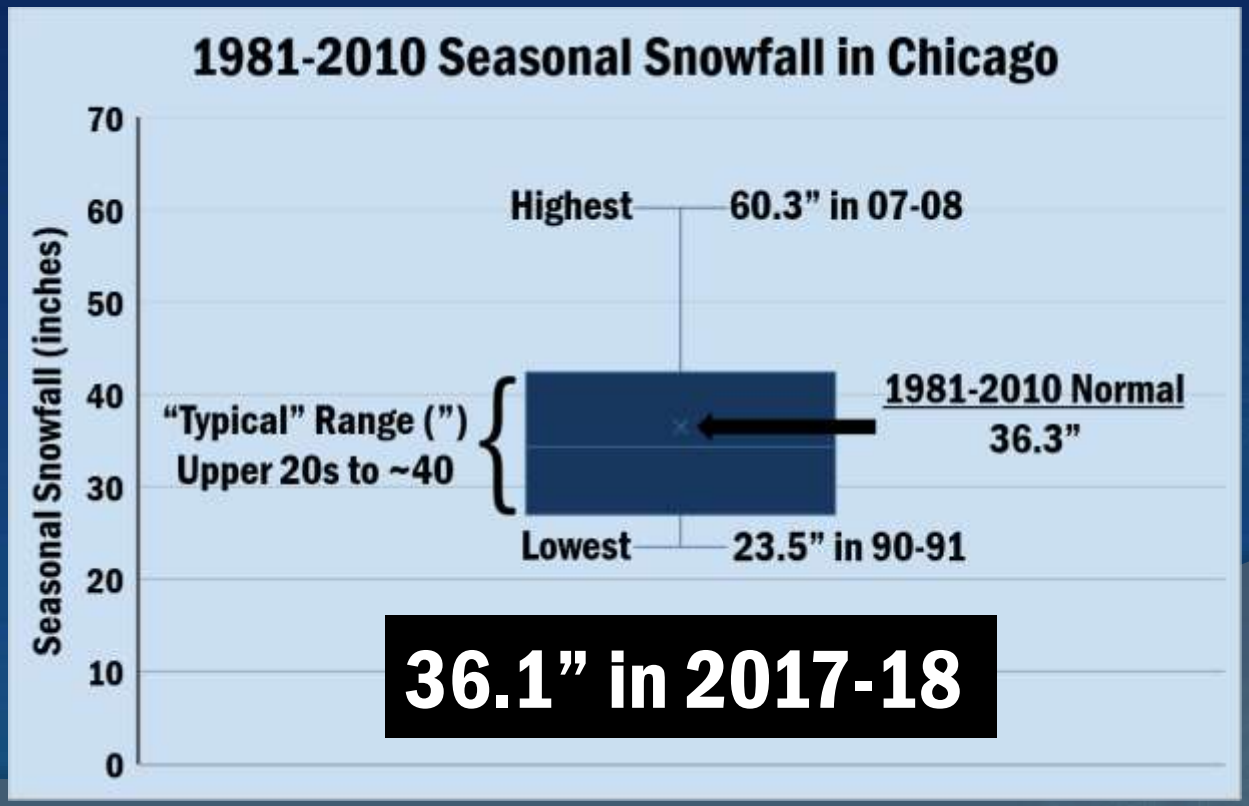
1981-2010 Normal Daily Low Temps

	Chicago
December	20.7°
January	16.5°
February	20.1°



Normal Winter Snowfall in Chicago

1981-2010 Average Snowfall	
	Chicago
December	8.2”
January	10.8"
February	9.1"
Seasonal (October through May)	36.3”



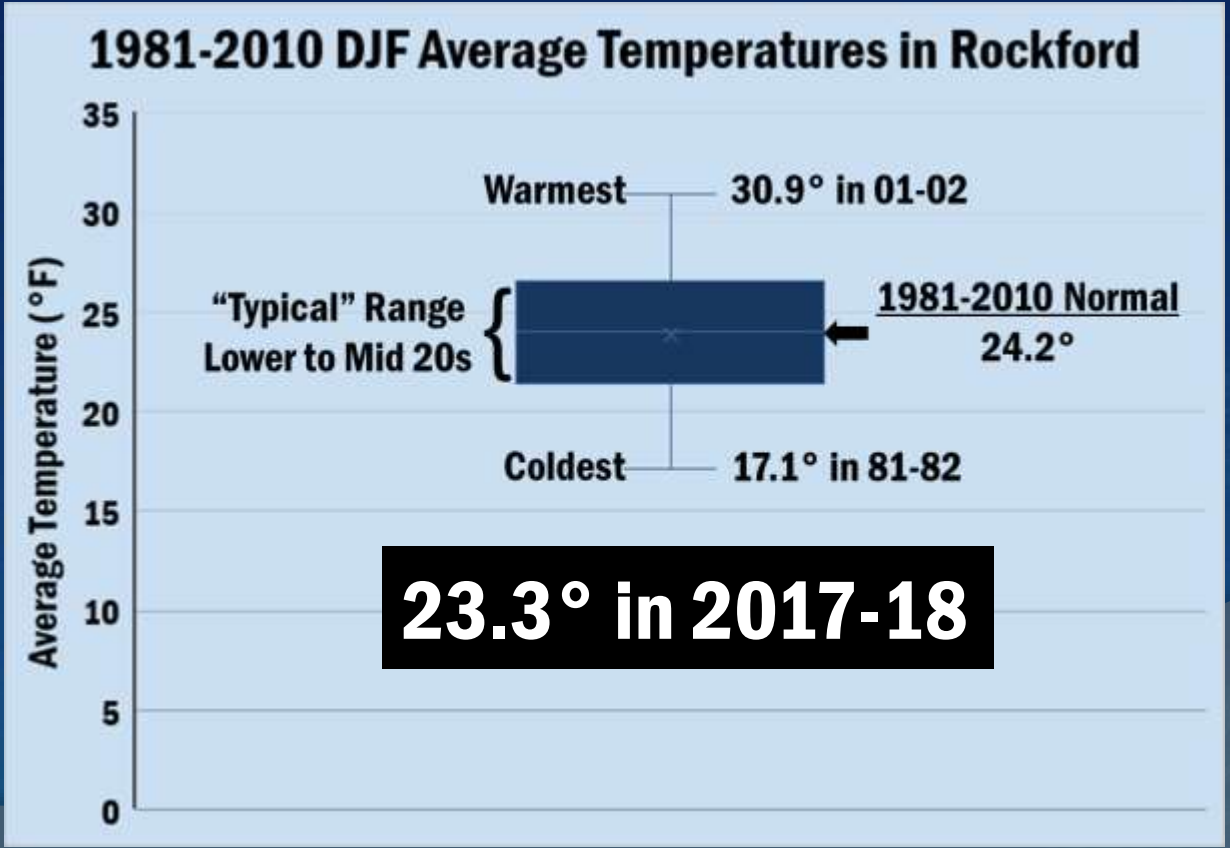
Normal Winter Temperatures in Rockford

1981-2010 Normal Daily High Temps

	Rockford
December	33.2°
January	29.5°
February	34.2°

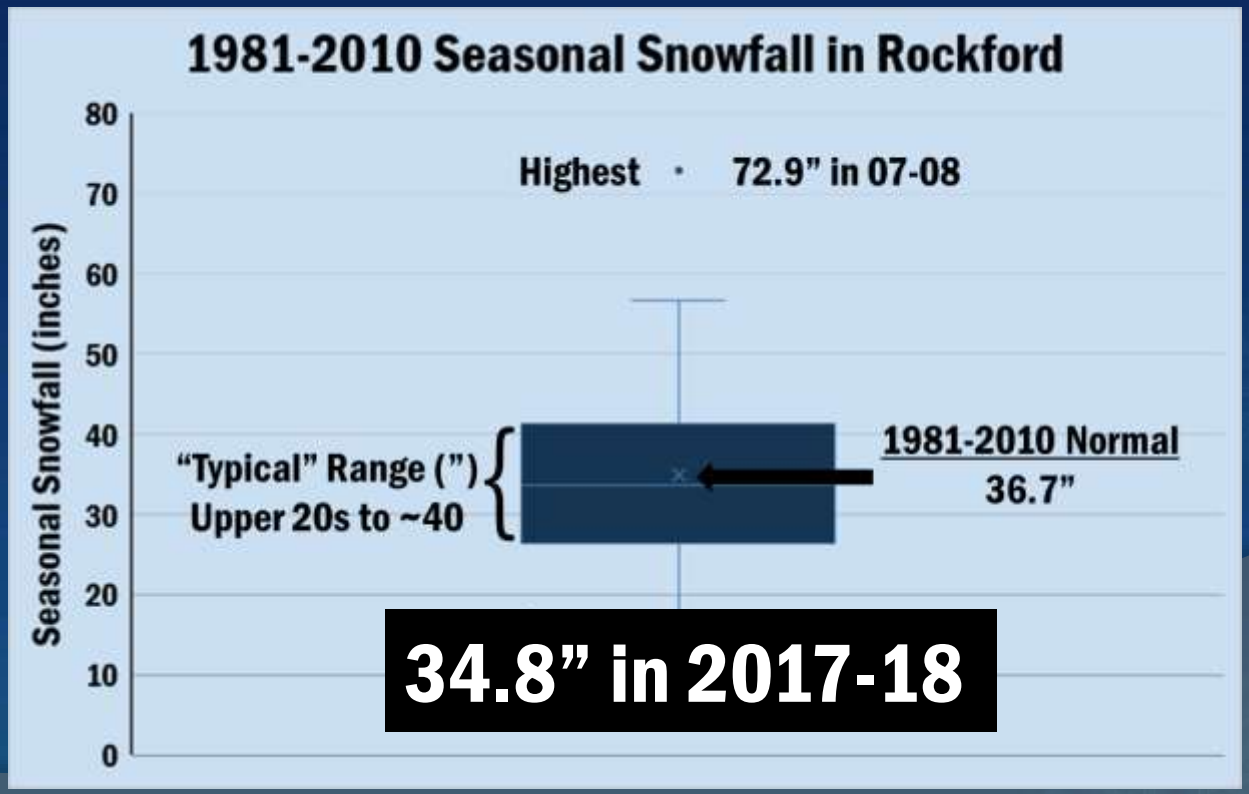
1981-2010 Normal Daily Low Temps

	Rockford
December	17.7°
January	13.5°
February	17.7°

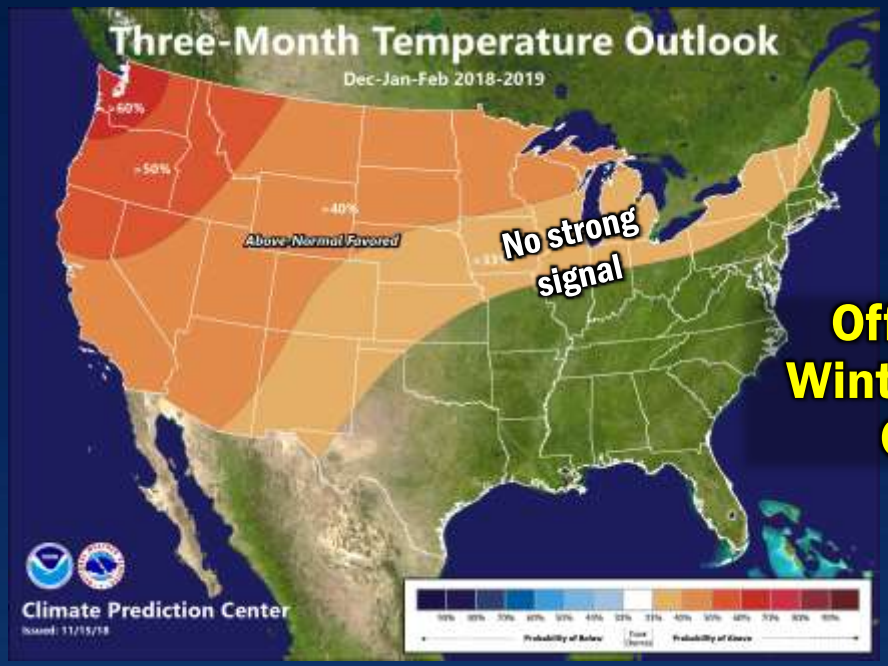


Normal Winter Snowfall in Rockford

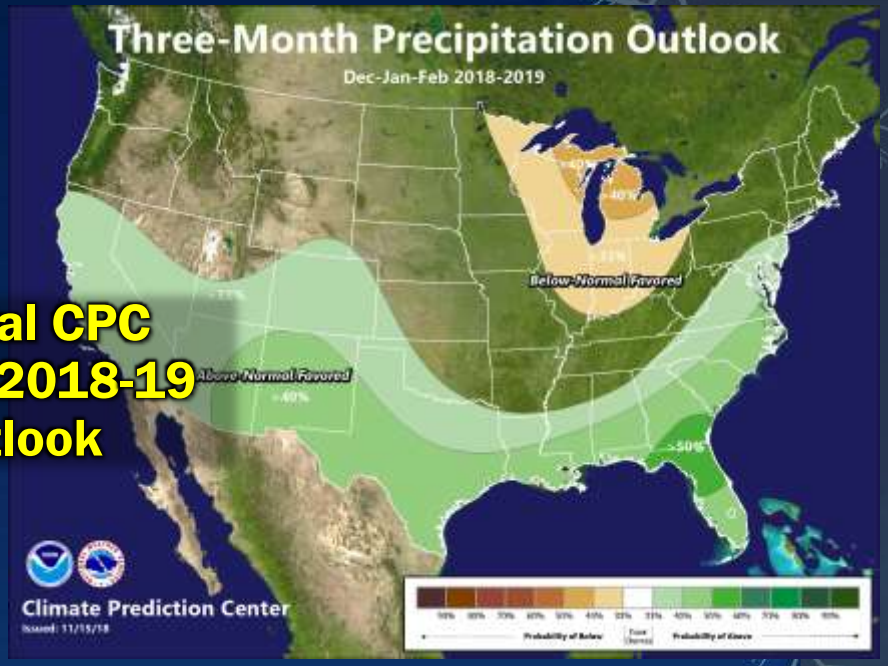
1981-2010 Average Snowfall	
	Rockford
December	11.3"
January	10.2"
February	7.7"
Seasonal (October through May)	36.7"



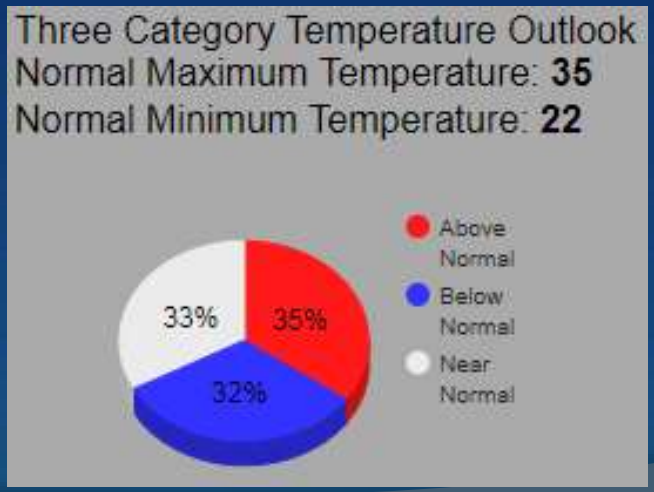
Official CPC Winter 2018-19 Outlook

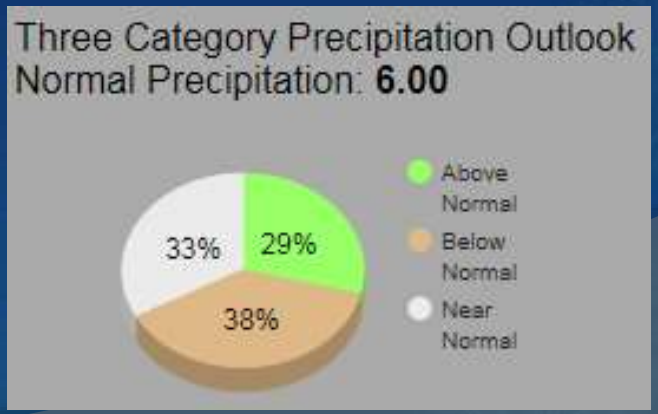


Official CPC Winter 2018-19 Outlook



Downscaled Outlook For Chicago





El Niño (warmer than average water temperatures) in the Tropical Pacific Ocean

Operational Definitions for El Niño, La Niña and ENSO Neutral (El Niño Southern Oscillation Neutral)

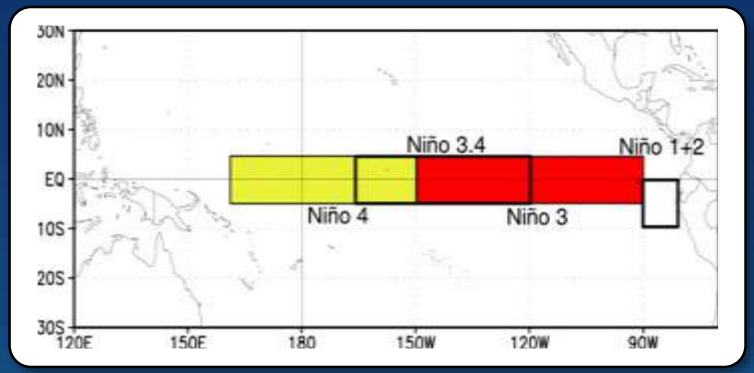
- El Niño: characterized by a positive ONI (SST departures in defined Niño 3.4 region of tropical Pacific) greater than or equal to +0.5ºC.
- La Niña: characterized by a negative ONI less than or equal to -0.5ºC.
- By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.
- CPC considers El Niño or La Niña conditions to occur when the monthly Niño 3.4 OISST departures meet or exceed +/- 0.5ºC along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months.
- ENSO Neutral: characterized by an average ONI between -0.4°C and + 0.4°C
- Most recent ONI value (Aug – Oct 2018): +0.4°C

Niño Region SST Departures (ºC)
Recent Evolution

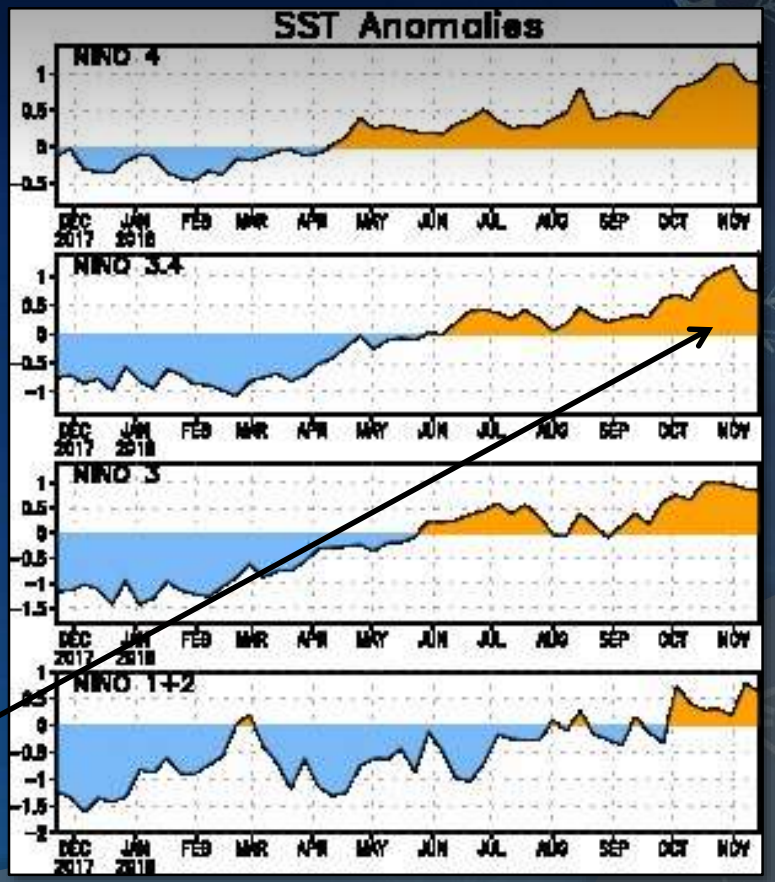
The latest weekly SST departures as of 11/19:

Niño 4	0.9ºC
Niño 3.4	**0.7ºC**
Niño 3	0.8ºC
Niño 1+2	0.6ºC

The latest (Oct. '17) monthly Niño 3.4 index: 0.83ºC



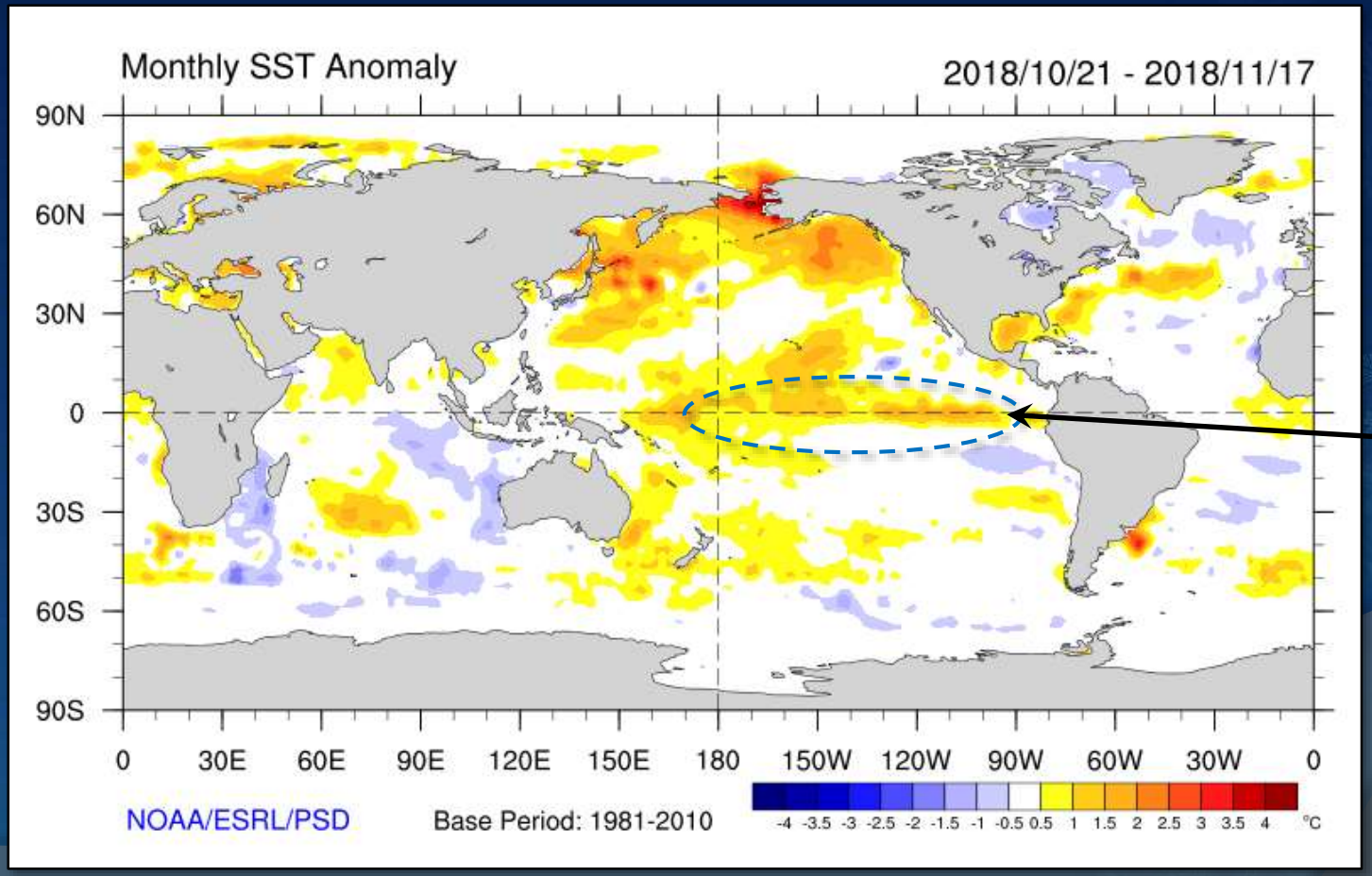
Niño 3.4



ENSO status is determined by SST departures in this region.

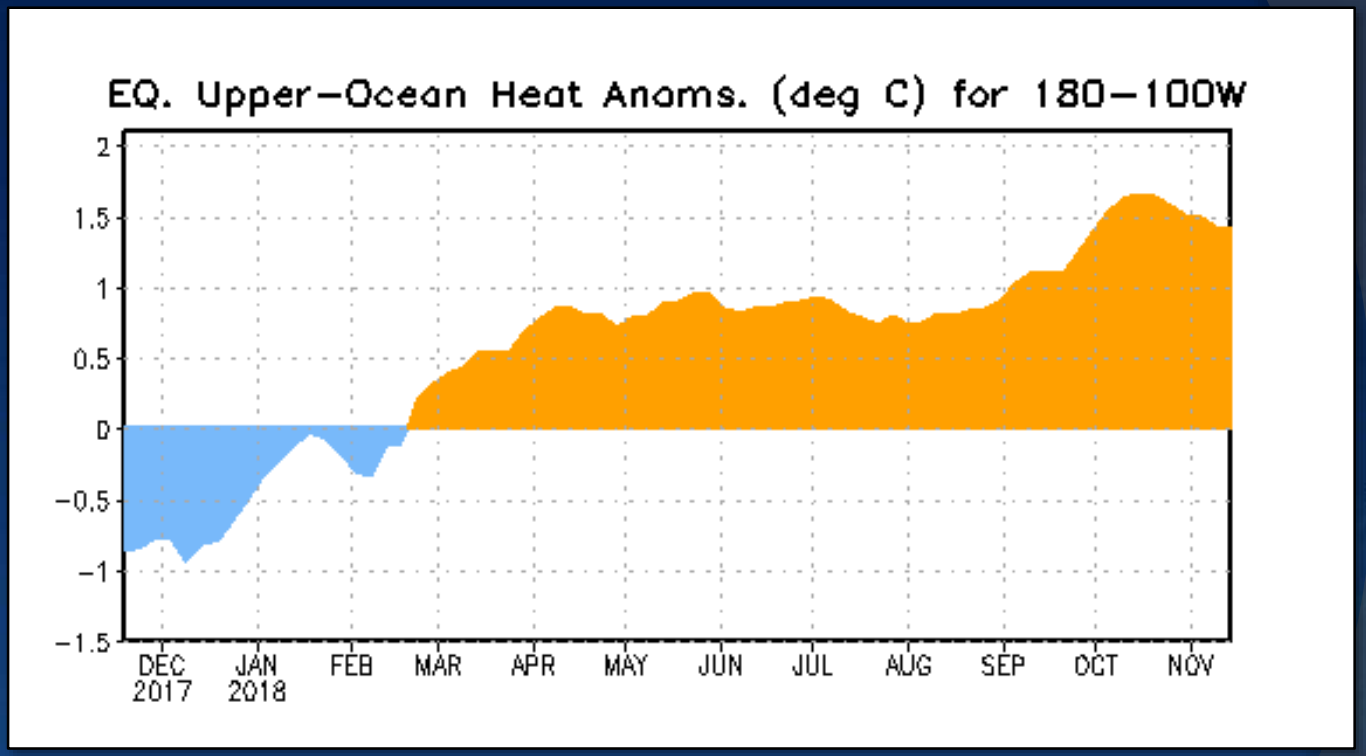
Global SST Departures (ºC) During the Last Four Weeks

- During the last four weeks, equatorial SSTs were above average in the central and eastern Pacific Ocean.



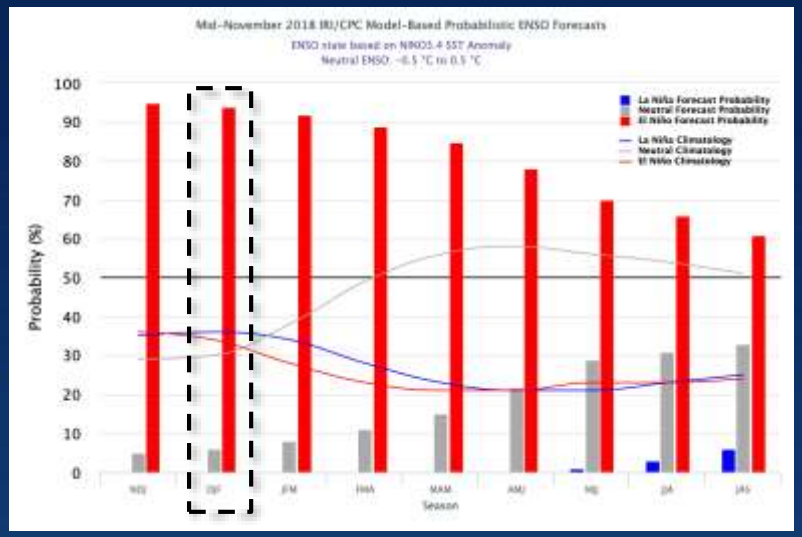
Weak El Niño Conditions Likely in the Tropical Pacific

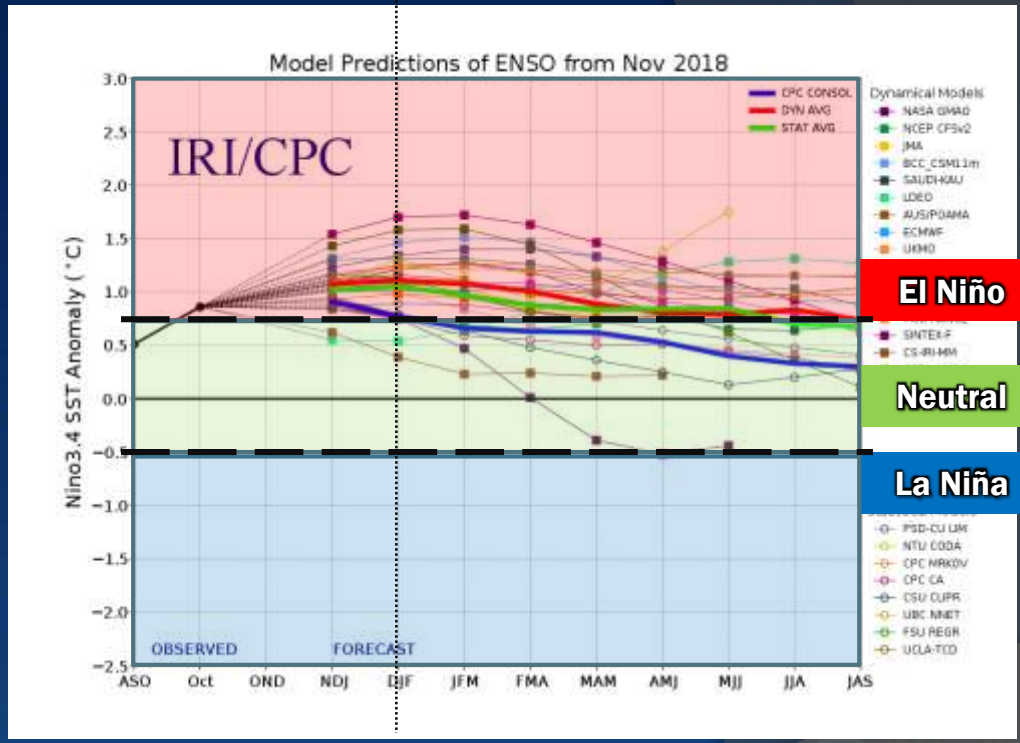
Sub-surface anomalies favor El Niño maintenance at the surface in Niño 3.4 Region



El Niño Conditions Expected in the Tropical Pacific

Atmospheric response (coupling) to El Niño SST signal has not yet occurred.
Weak to possibly low end moderate El Niño conditions are favored through winter 2018-19.
With late start to full El Niño conditions, most likely that atmospheric response will be that of a weak event.





Time periods in figures are for three month periods.
SON = September, October and November
OND = October, November and December
NDJ = November, December and January
DJF = December, January and February
JFM = January, February and March

El Niño Categorization

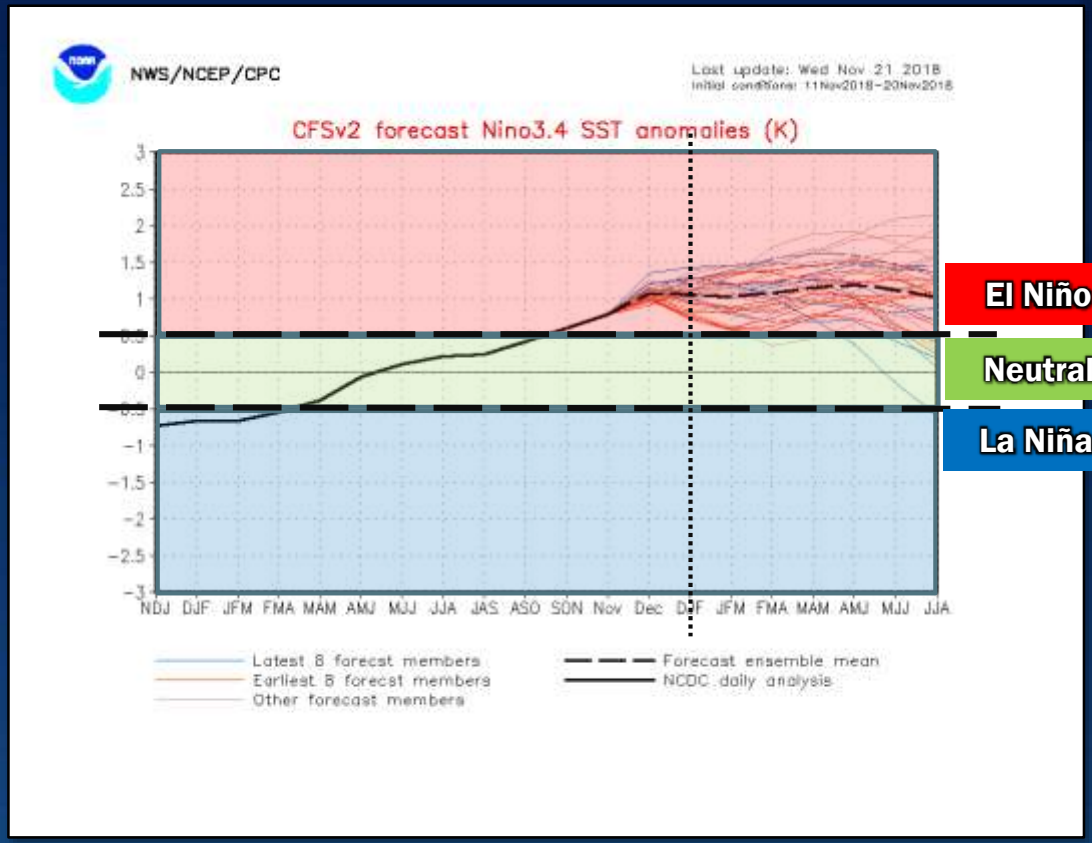
0.5°C to 0.9°C: Weak
1.0°C to 1.4°C: Moderate
1.5°C & warmer: Strong

ENSO Neutral

-0.1°C to -0.4°C: Cold Neutral
+0.1°C to +0.4°C: Warm Neutral

Weak El Niño Conditions Likely in the Tropical Pacific

CFSv2 Niño 3.4 SST Anomaly Ensemble Forecast



Time periods in figure are for 3-mo. periods.
SON = September, October and November
OND = October, November and December
NDJ = November, December and January
DJF = December, January and February
JFM = January, February and March

El Niño Categorization

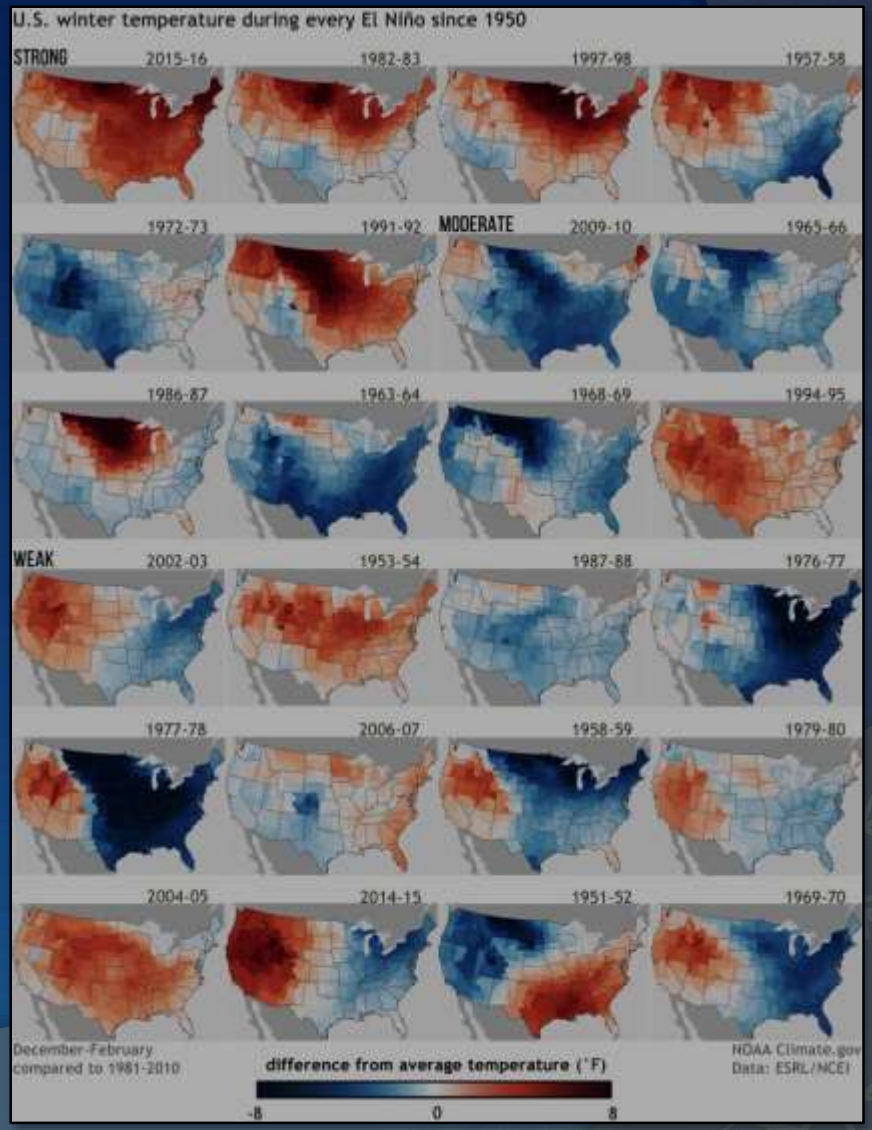
0.5°C to 0.9°C: Weak
1.0°C to 1.4°C: Moderate
1.5°C & warmer: Strong

ENSO Neutral

-0.1°C to -0.4°C: Cold Neutral
+0.1°C to +0.4°C: Warm Neutral

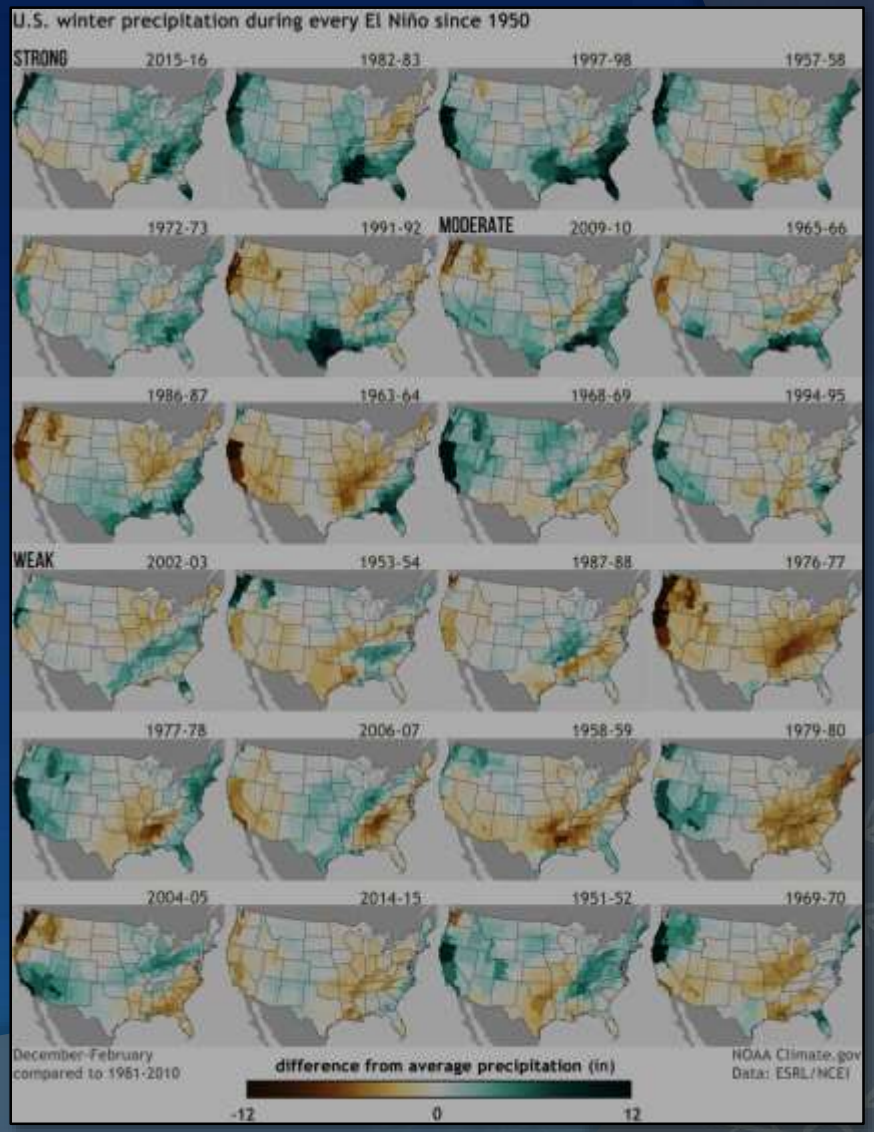
Historical El Niño Winter Temperatures over the CONUS

- Strong events produce more reliable impacts on the CONUS, but it's not always the case.
- Quite a bit of variability between episodes.
- A majority of weak and moderate episodes had near to below normal temps in eastern ½ of US.



Historical El Niño Winter Precipitation over the CONUS

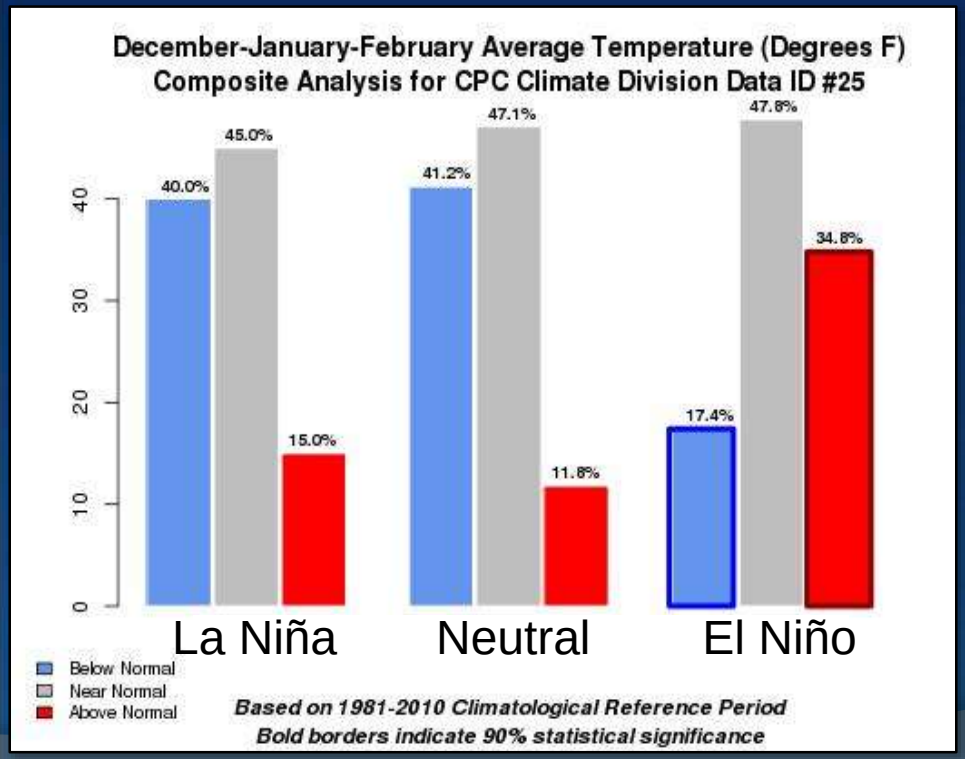
- Stronger events produce more reliable impacts on the CONUS, but it's not always the case.
- Signal for below normal precip in/near our area in many of the cases, especially in the weak and moderate episodes.

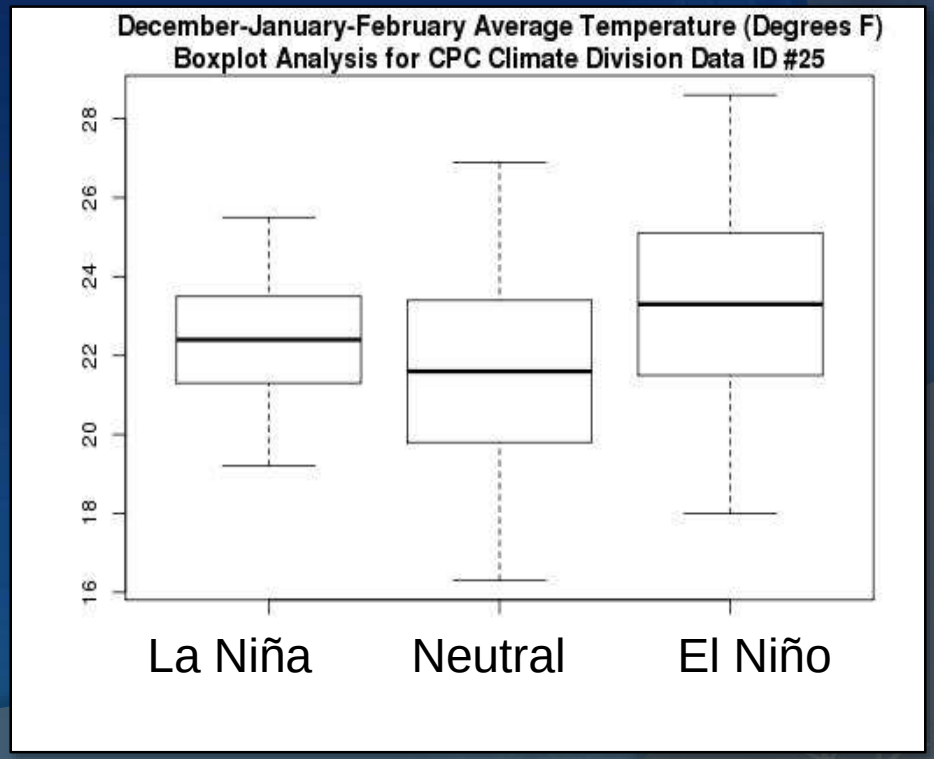


Local Temperatures During El Niño Winters

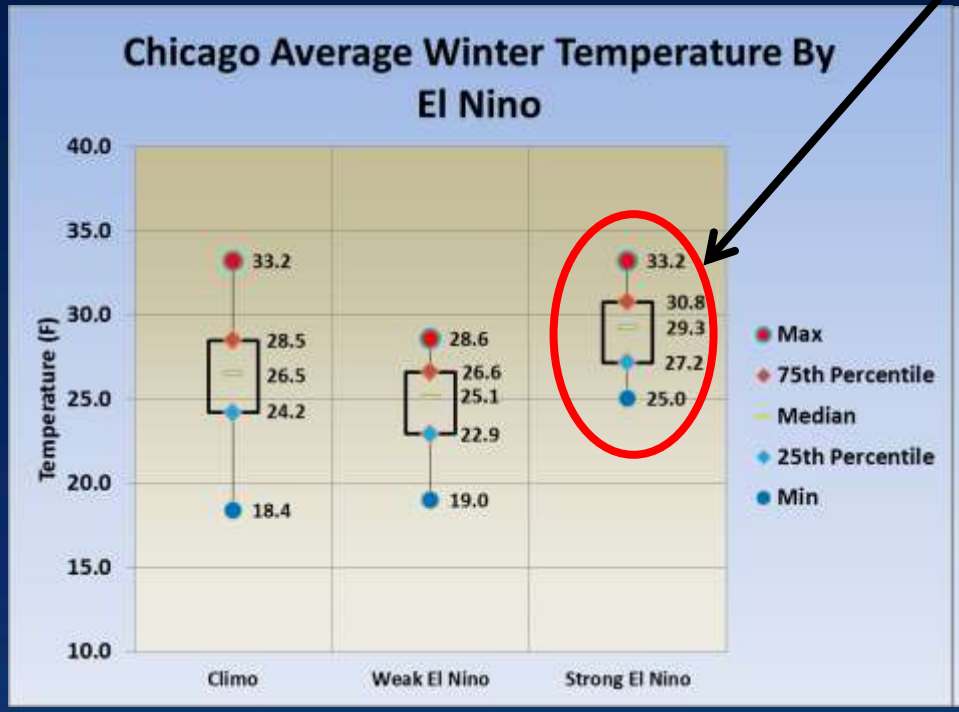
El Niño events *overall* have shows a skew towards warmer winters in northern Illinois and northwest Indiana.

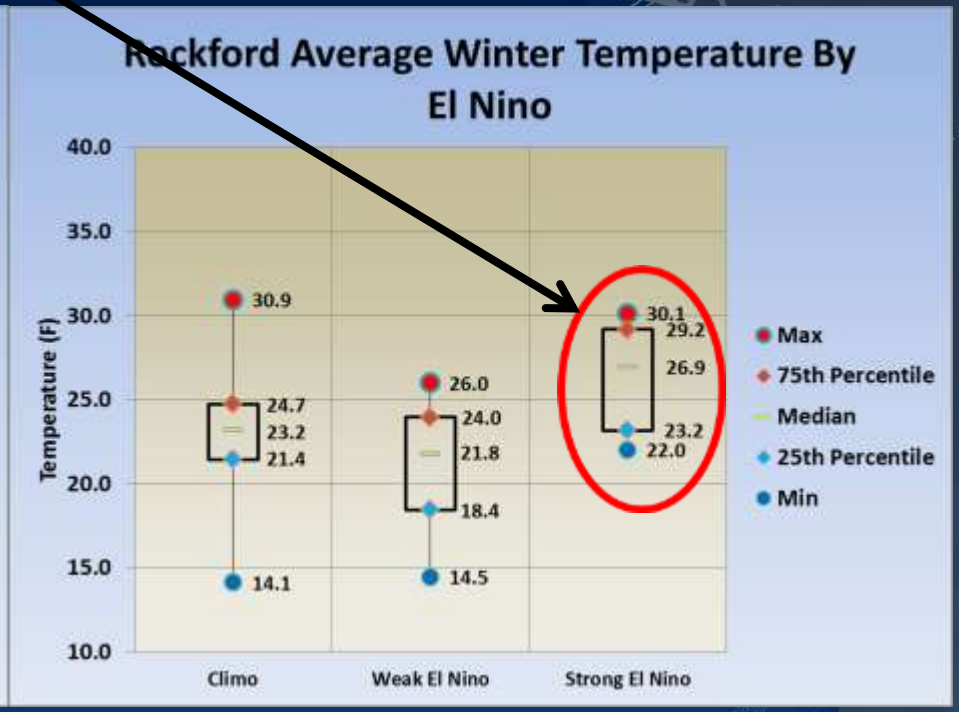
Median = 22.7°





Much Warmer during Strong (Colder during weak) El Niño Winters





Info Based off 8 weak events and 6 strong events.

- 75th percentile near the Climo Median during weak events.
- 25th percentile near or just above the Climo Median during strong events.

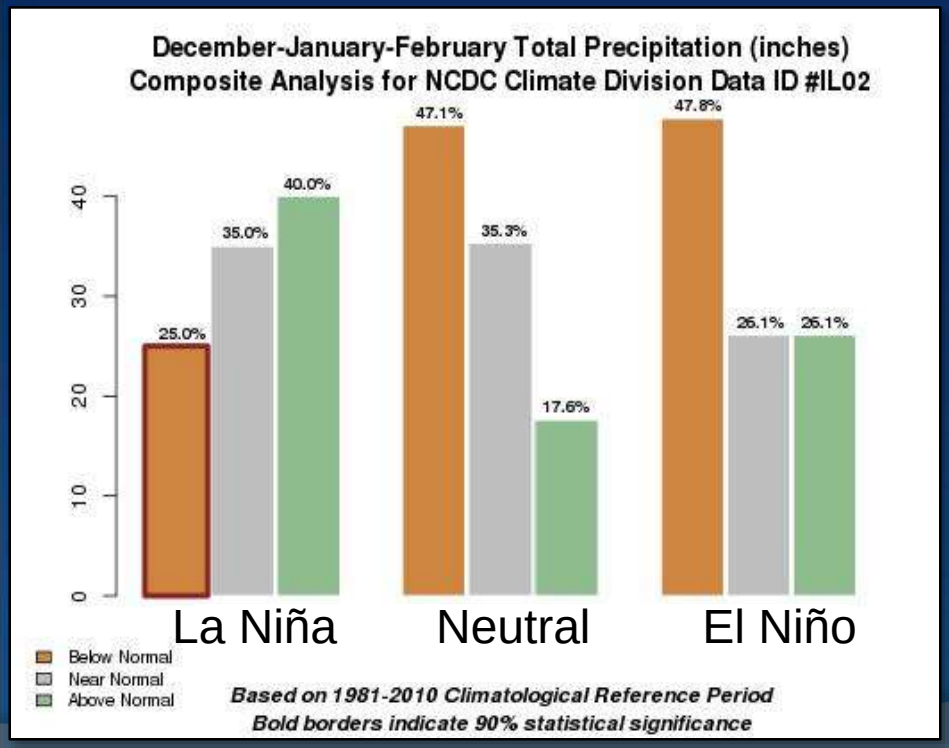
Chicago, IL	All Years	Strong	Weak
Temperatures	Average	El Nino	El Nino
December	28.1°F	+2.5°F	-1.3°F
January	23.2°F	+3.6°F	-2.3°F
February	27.4°F	+2.5°F	-2.1°F
Winter Season	26.2°F	+2.9°F	-1.9°F

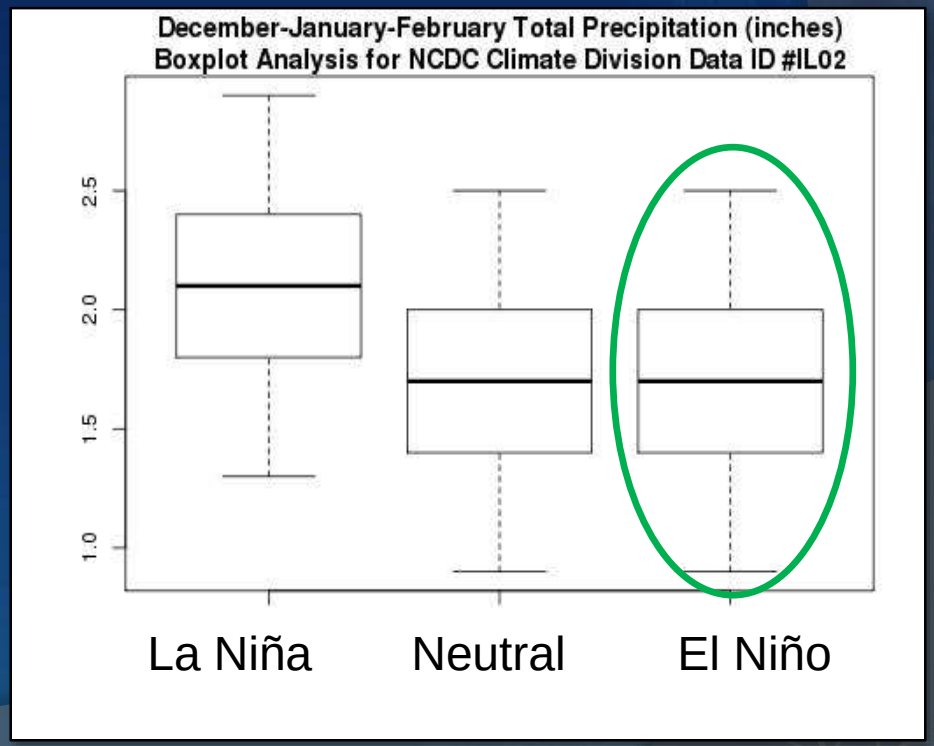
Note: The figures above display the percentiles of each distribution. So, for example, the 25 percentile (shown as a blue diamond) means that 25% (75%) of the years were colder (warmer) than the indicated value.

Precipitation During El Niño Winters

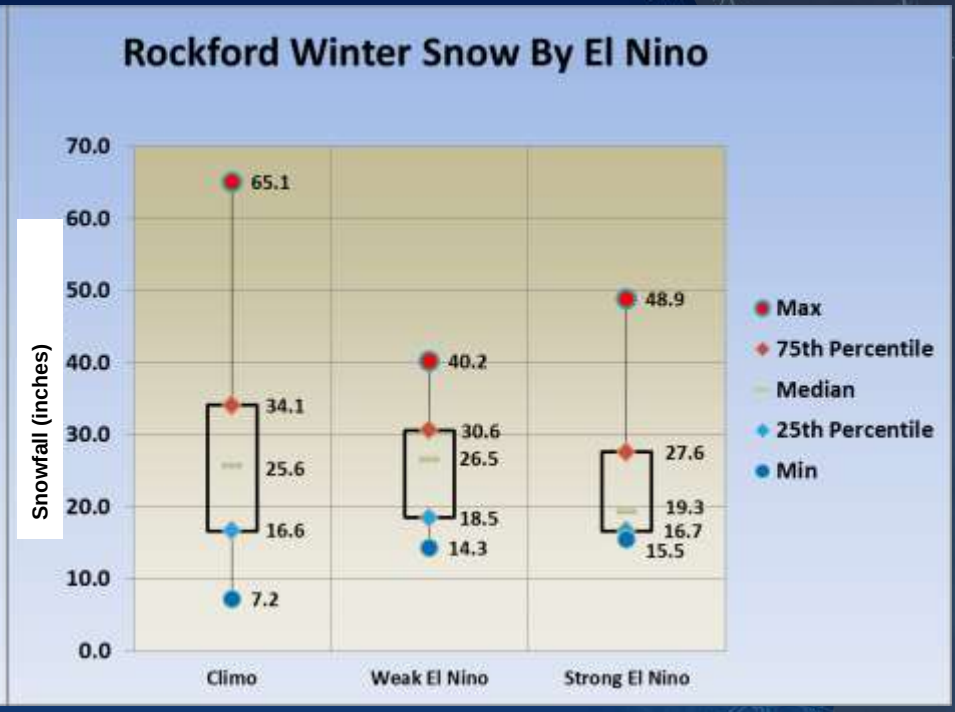
There is a tendency for El Niño winters to favor below normal precipitation, but not statistically significant.

Median = 1.77”





Weak Versus Strong El Niño Snowfall



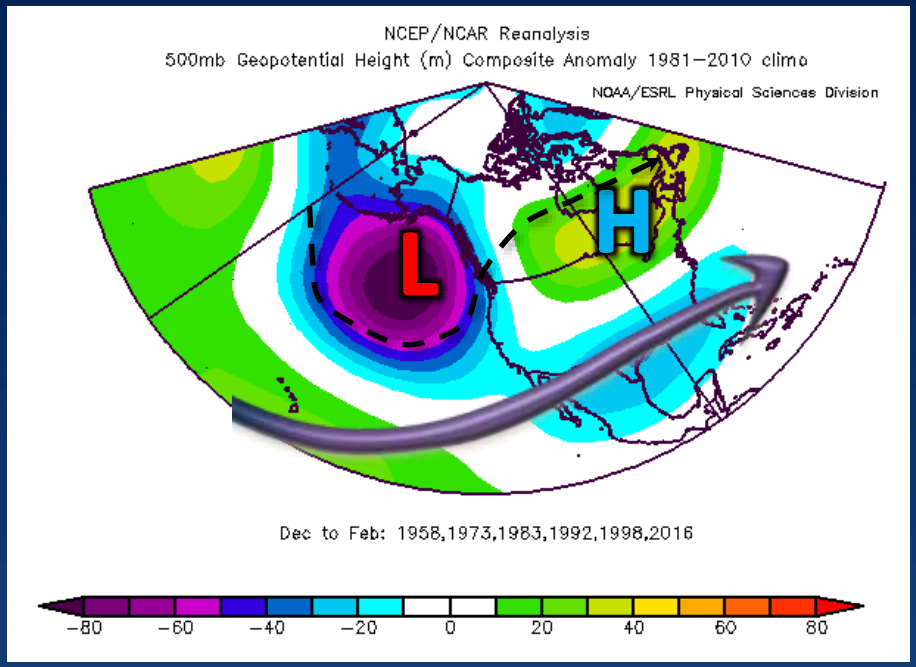
- **Weak El Niño events tend to produce more snow locally than stronger counterparts.**
  - **Colder conditions in weak El Niños can be more favorable for lake effect snow, favoring near or even above average snowfall for areas near Lake Michigan.**

- **However, overall there is no statistically significant tendency for snowier than normal winter seasons during weak ENSO events, especially away from Lake Michigan.**

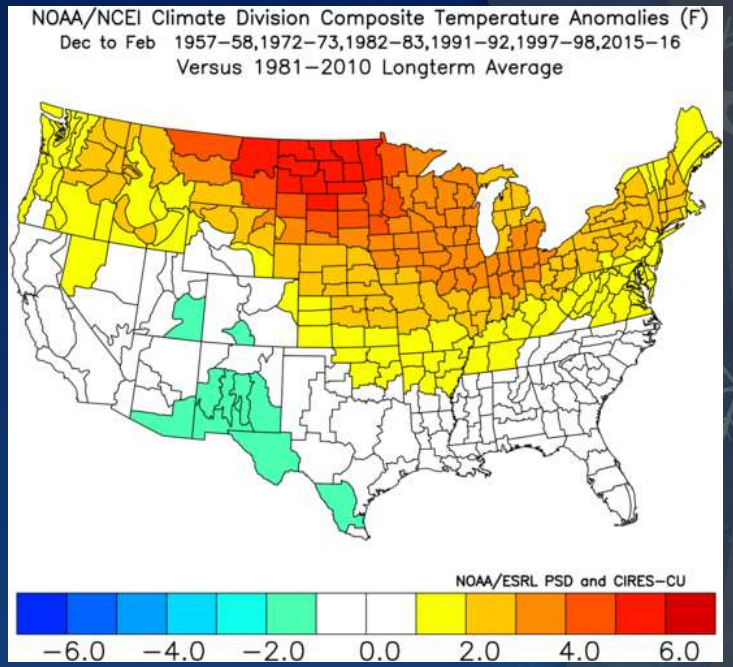
Note: The figures above display the percentiles of each distribution. So, for example, the 25 percentile (shown as a blue diamond) means that 25% (75%) of the years had less snow (more snow) than the indicated value.

Strong El Niño Composite

Upper Pattern



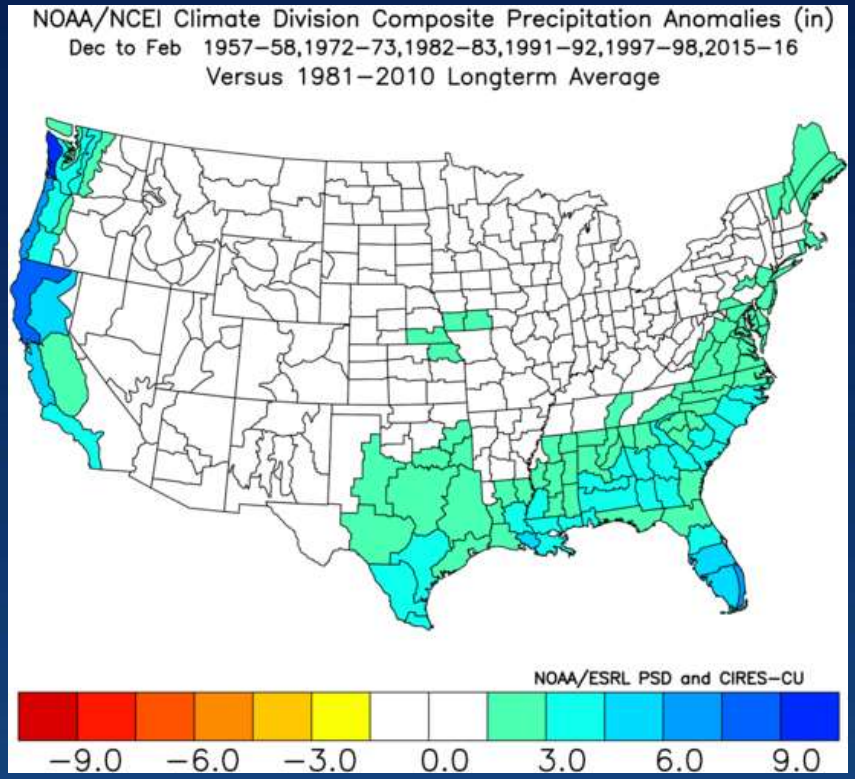
Temperature Anomalies



- Well above normal temps and less snowy winters.
- Good example 1997-98 and 2015-16 winter seasons.

Strong El Niño Composite

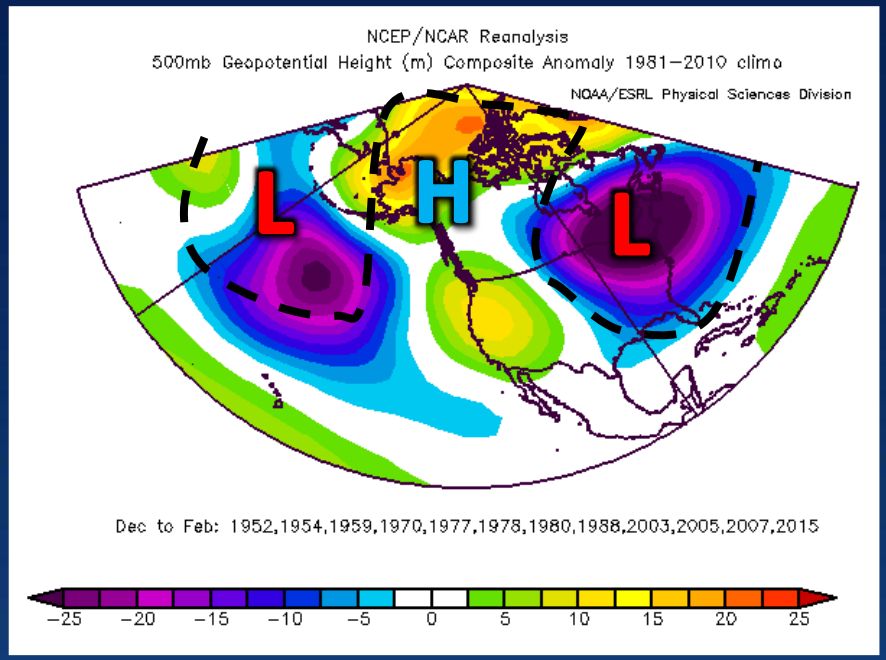
Precipitation Anomalies



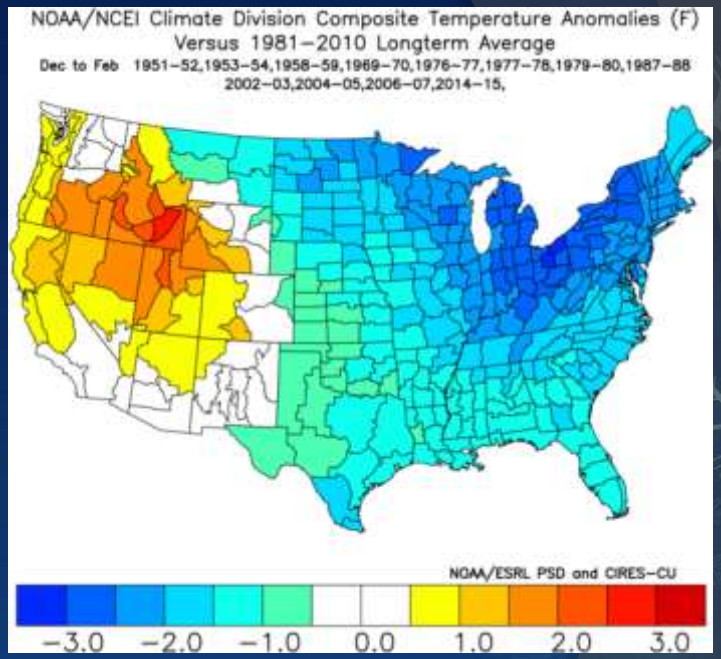
- No signal for precipitation departures from normal locally

Weak El Niño Composite

Upper Pattern



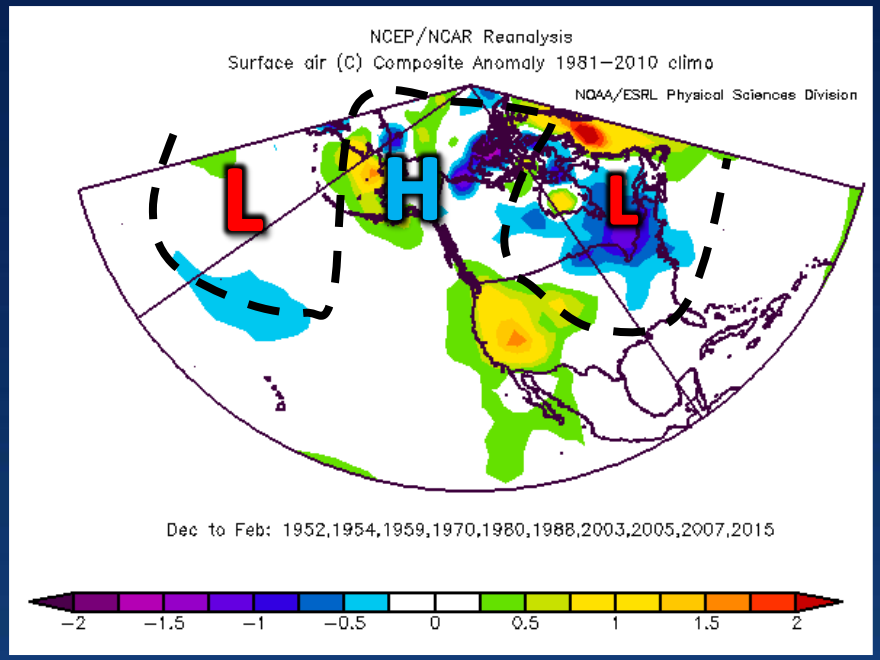
Temperature Anomalies



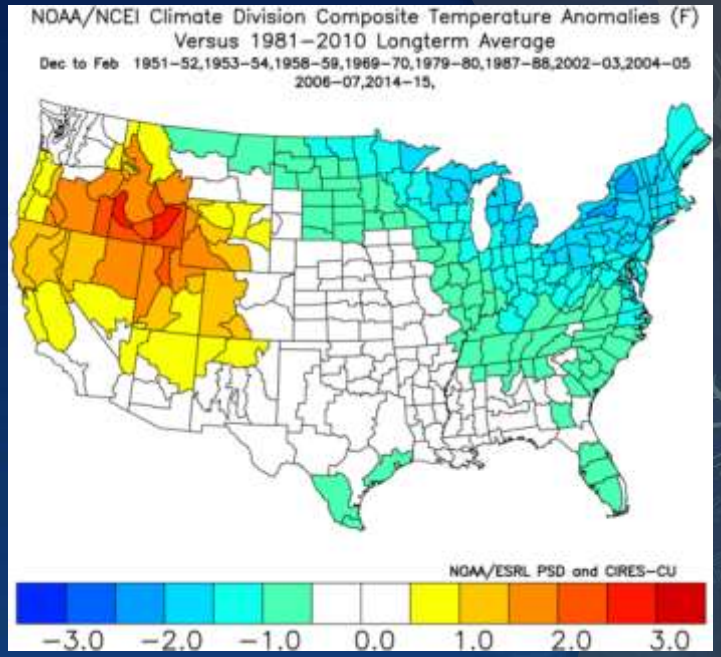
- The upper level jet stream tends to become buckled southward over the eastern half of the country.
  - Can favor colder than average conditions across much of the eastern CONUS.

Weak El Niño Composite Excluding 1976-77 & 1977-78*

Upper Pattern



Temperature Anomalies

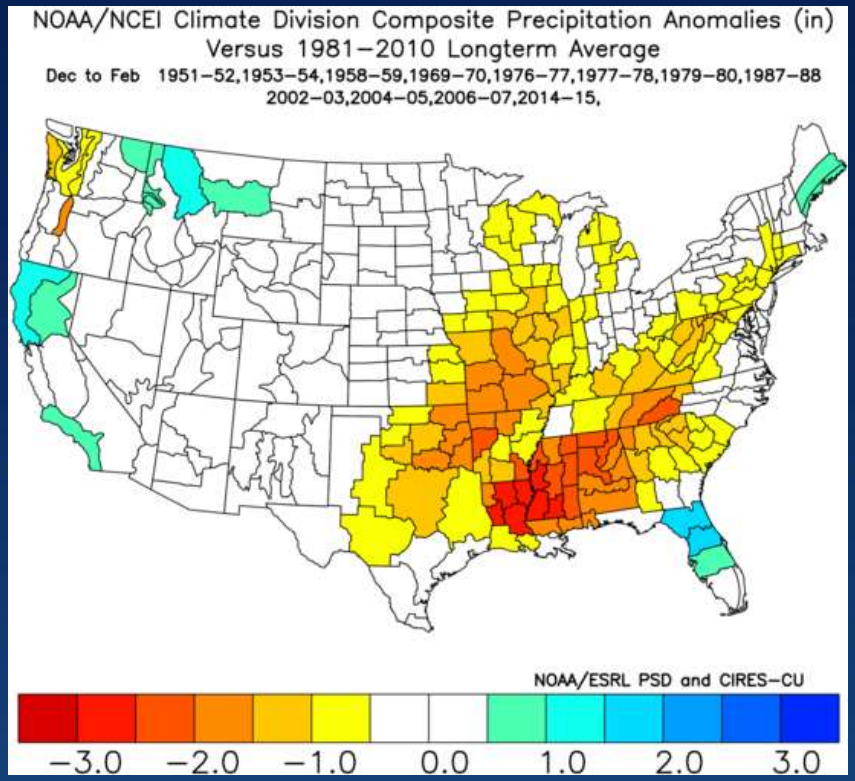


- The upper level jet stream tends to become buckled southward over the eastern half of the country.
  - Can favor colder than average conditions across much of the eastern CONUS.

*1976-77 and 1977-78 were 2 of the coldest winters on record locally in a colder climate period so to account for them possibly being cold outliers, created composites excluding these winters

Weak El Niño Composite

Precipitation Anomalies

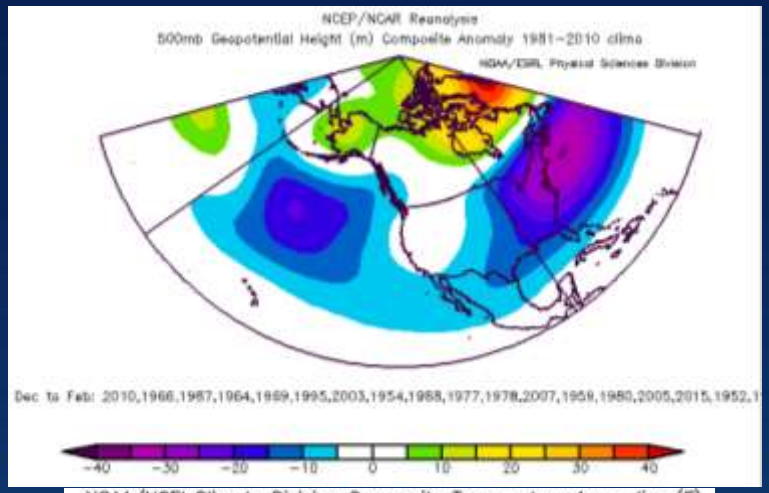


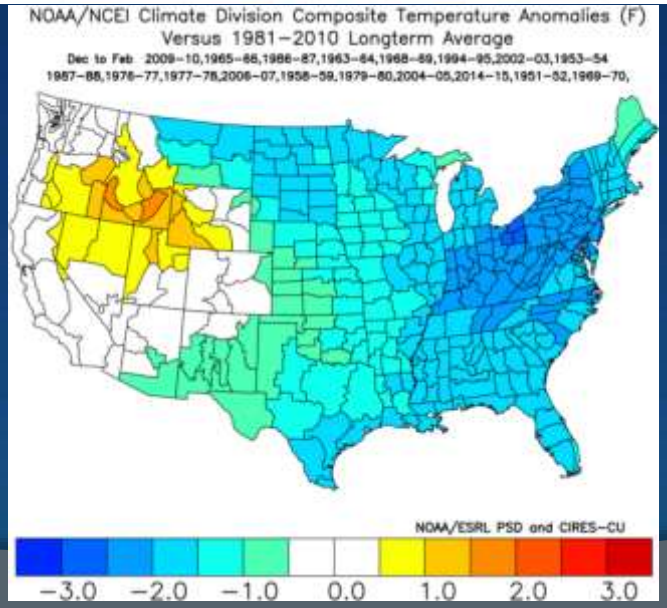
- Noteworthy signal for below normal liquid equivalent precipitation
- As you will see, this signal did not reliably translate to below normal snowfall

Weak & Moderate El Niño Composite

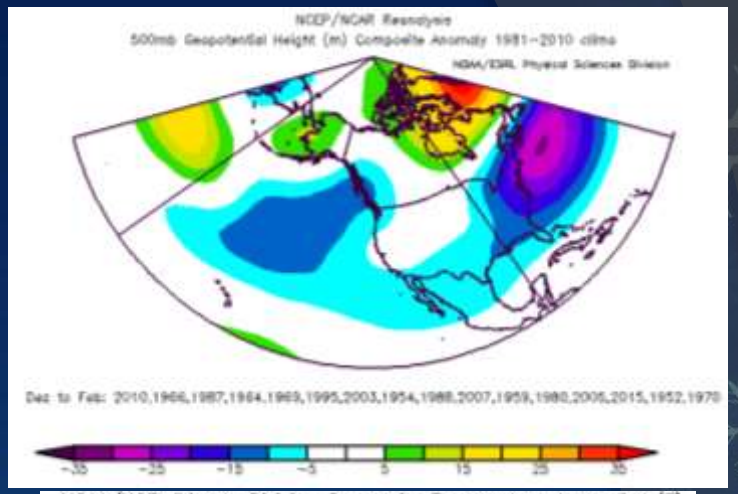
- Composite is very similar when including weak & moderate El Niños.

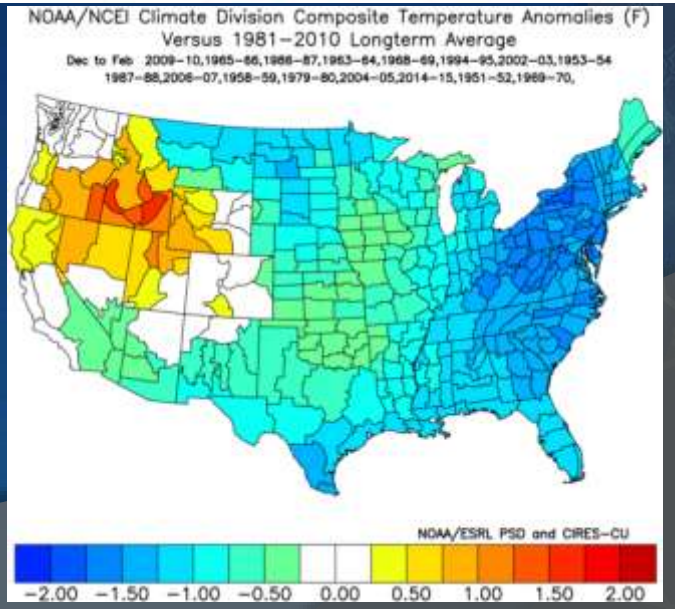
Upper Pattern & Temp. Anomalies (All Weak & Moderate El Niños)





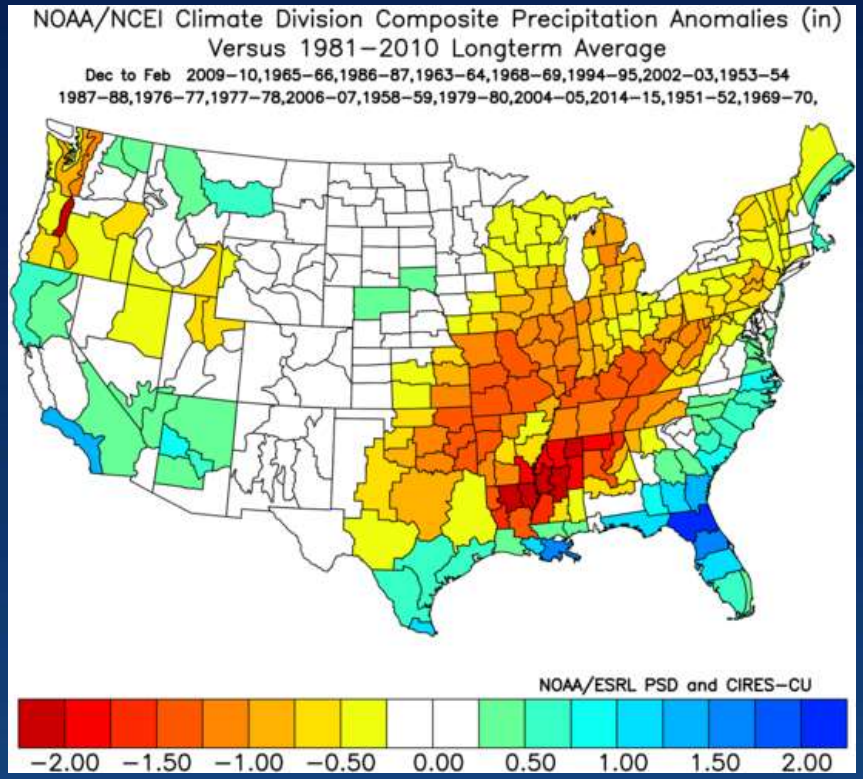
Upper Pattern & Temp. Anomalies (Weak & Mod. El Niños Except 76-77 & 77-78)





Weak & Moderate El Niño Composite

Precipitation Anomalies



- Noteworthy signal for below normal liquid equivalent precipitation
- Slightly more pronounced than with just weak El Niño episodes.

Weak El Niño Episodes Since 1950 (Chicago Data)

Normal winter season (DJF) temperature is 26.4°

Seasonal snowfall (Fall-Spring) normal is 36.3”

9 Near Normal to Colder than Normal:

1958 - 59 → 22.3° | Above normal snow (41.0”)
1969 - 70 → 24.2° | Well above normal snow (77.0”)
1976 - 77 → 19.0° | Well above normal snow (54.1”)
1977 - 78 → 19.1° | 2nd highest snowfall (82.3”)
1979 - 80 → 26.3° | Above normal snow (42.2”)
1987 - 88 → 24.9° | Above normal snow (42.6”)
2002 - 03 → 25.0° | Below normal snow (28.6”)
2006 - 07 → 26.6° | Near normal snow (35.6”)
2014 - 15 → 23.0° | Well above normal snow (50.7”)

3 Warmer than Normal

1951 - 52 → 28.6° | Well above normal snow (66.4”)
1953 - 54 → 32.3° | Above normal snow (43.2”)
2004 - 05 → 28.6° | A bit above normal snow (39.4”)

11 of 12 cases with near to above normal snow

Weak El Niño Episodes Since 1950 (Chicago Data)

Normal winter season (DJF) precipitation is 5.77”

DJF Snowfall Normal is 28.1” | Fall-Spring Snowfall normal is 36.3”

8 Near to Below Normal Precipitation

1951 - 52 → 5.38” | 43.6” DJF snow | 66.4” Fall-Spring
1958 - 59 → 5.09” | 35.6” DJF snow | 41.0” Fall-Spring
1969 - 70 → 3.86” | 44.7” DJF snow | 77.0” Fall-Spring
1976 - 77 → 2.30” | 42.7” DJF snow | 54.1” Fall-Spring
1977 - 78 → 5.68” | 71.2” DJF snow | 82.3” Fall-Spring
1979 - 80 → 4.79” | 24.5” DJF snow | 42.2” Fall-Spring
2002 - 03 → 2.48” | 13.8” DJF snow | 28.6” Fall-Spring
2014 - 15 → 3.65” | 40.7” DJF snow | 50.7” Fall-Spring

4 Above Normal Precipitation

1953 - 54 → 6.60” | 15.5” DJF snow | 43.2” Fall-Spring
1987 - 88 → 6.94” | 39.6” DJF snow | 42.6” Fall-Spring
2004 - 05 → 7.34” | 31.1” DJF snow | 39.4” Fall-Spring
2006 - 07 → 6.51” | 29.6” DJF snow | 35.6” Fall-Spring

Weak El Niño Episodes Since 1950 (Rockford Data)

Normal winter season (DJF) temperature is 24.2°

Seasonal snowfall (Fall-Spring) normal is 36.7”

10 Near Normal to Colder than Normal:

1951 - 52 → 25.0° | Well above normal snow (54.7”)
1958 - 59 → 17.8° | Well above normal snow (54.9”)
1969 - 70 → 19.7° | Above normal snow (46.0”)
1976 - 77 → 14.7° | A bit below normal snow (31.4”)
1977 - 78 → 14.5° | Well above normal snow (51.7”)
1979 - 80 → 21.7° | Near normal snow (33.9”)
1987 - 88 → 21.7° | Above normal snow (45.0”)
2002 - 03 → 23.2° | Well below normal snow (18.3”)
2006 - 07 → 24.3° | Near normal snow (37.5”)
2014 - 15 → 21.2° | Near normal snow (35.5”)

2 Warmer than Normal

1953 - 54 → 27.9° | Well below normal snow (22.5”)
2004 - 05 → 26.0° | A bit below normal snow (32.2”)

8 of 12 cases with near to above normal snow

Weak El Niño Episodes Since 1950 (Rockford Data)

Normal winter season (DJF) precipitation is 4.76”

DJF Snowfall Normal is 29.2” | Fall-Spring Snowfall normal is 36.7”

10 Near to Below Normal Precipitation

1951 - 52 →	3.30”	30.8” DJF snow	54.7” Fall-Spring
1953 - 54 →	4.74”	11.4” DJF snow	22.5” Fall-Spring
1958 - 59 →	3.89”	38.8” DJF snow	54.9” Fall-Spring
1969 - 70 →	2.27”	29.6” DJF snow	46.0” Fall-Spring
1976 - 77 →	1.62”	18.9” DJF snow	31.4” Fall-Spring
1977 - 78 →	3.12”	40.2” DJF snow	51.7” Fall-Spring
1979 - 80 →	4.33”	19.0” DJF snow	33.9” Fall-Spring
2002 - 03 →	1.28”	8.0” DJF snow	18.3” Fall-Spring
2006 - 07 →	4.76”	33.2” DJF snow	37.5” Fall-Spring
2014 - 15 →	2.85”	24.3” DJF snow	35.5” Fall-Spring

2 Above Normal Precipitation

1987 - 88 →	7.02”	40.3” DJF snow	45.0” Fall-Spring
2004 - 05 →	5.45”	23.7” DJF snow	32.2” Fall-Spring

2002 - 2003: Driest winter on record in Rockford with 1.28”

What Are Takeaways from Similar Past Events?

- Regional and local signal for near to below normal temperatures
- Regional and local signal for near to below normal precipitation
- Fairly strong local signal for above normal snowfall, especially in Chicago data

What Are Some Other Factors to Consider? Teleconnection Patterns

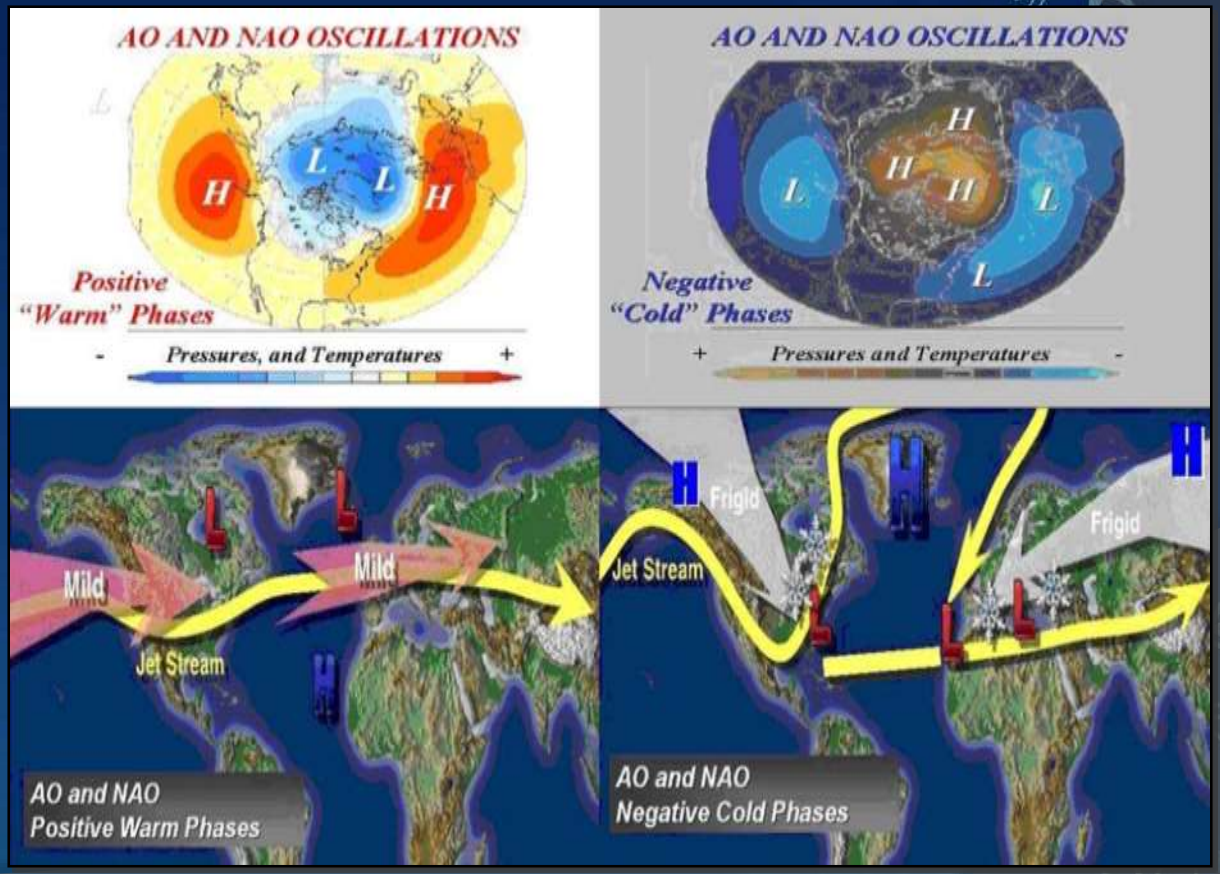
Teleconnections Definition

Recurring and persistent large-scale changes in atmospheric wave and jet stream patterns that influence temperature, rainfall, storm tracks, and jet stream location/intensity over vast geographical areas

The Arctic and North Atlantic Oscillations (AO/NAO)

- Consists of the positive and the negative phases shown in the image below. AO and NAO correlate fairly well with each other.

- Negative phase can favor more arctic outbreaks with colder than normal conditions and more snowfall across the eastern half of the country.
- Positive phase can favor warmer and drier conditions across the eastern half of the country.



The Arctic and North Atlantic Oscillations (AO/NAO)

Local Data

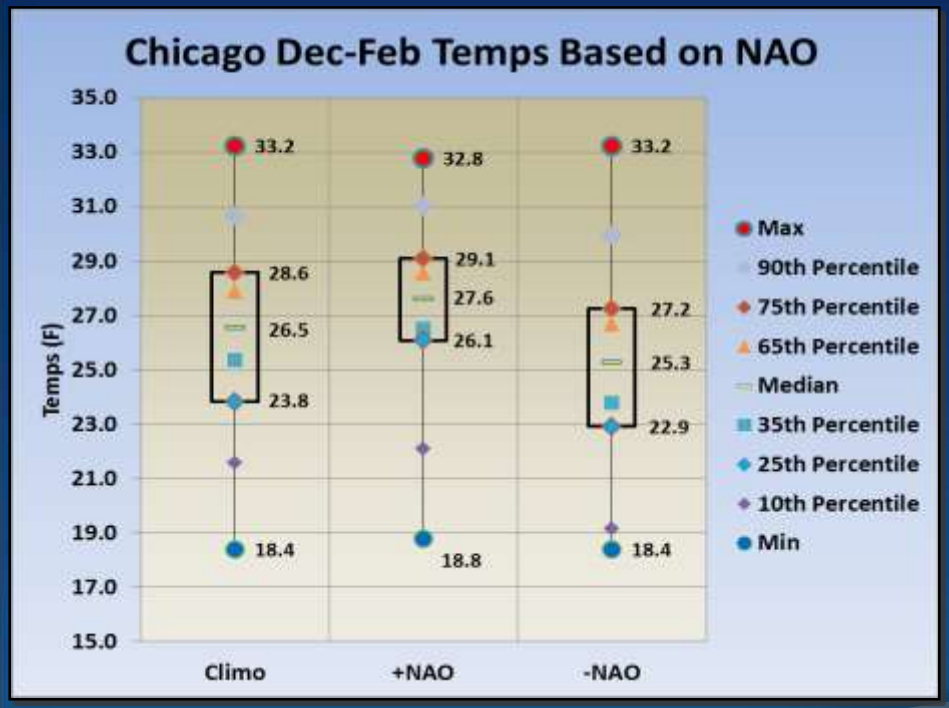
Chicago, IL	*35 events*	*27 events*
Temperature anomalies	*+AO/NAO*	*-AO/NAO*
December	+1.7°F	-2.7°F
January	+1.7°F	-2.3°F
February	+0.6°F	-0.5°F
Chicago, IL	***35 events***	***27 events***
Snowfall anomalies	*+AO/NAO*	*-AO/NAO*
December	-1.5”	+2.9”
January	-1.5”	+1.8”
February	-0.3”	-0.6”
Winter	-3.4”	+2.6”

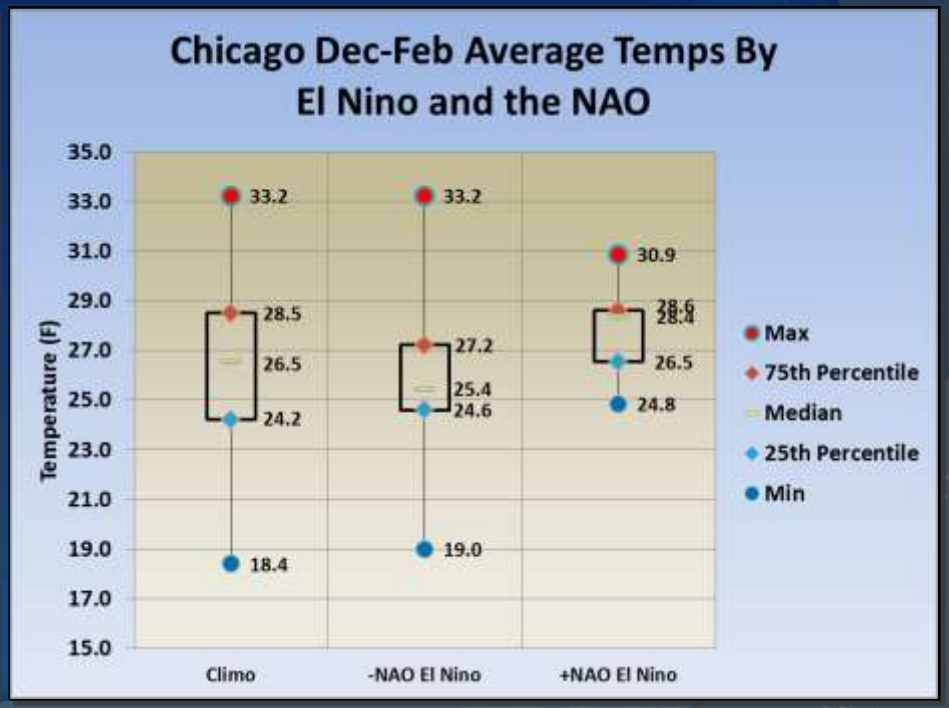
El Niño and the AO/NAO

The predominant phase of the AO/NAO can have an impact on how the El Niño event will impact the winter season across the region.

- **-NAO could favor a colder than normal winter.**
- **+NAO could help sway the odds for a mild winter season.**

Results similar at Rockford





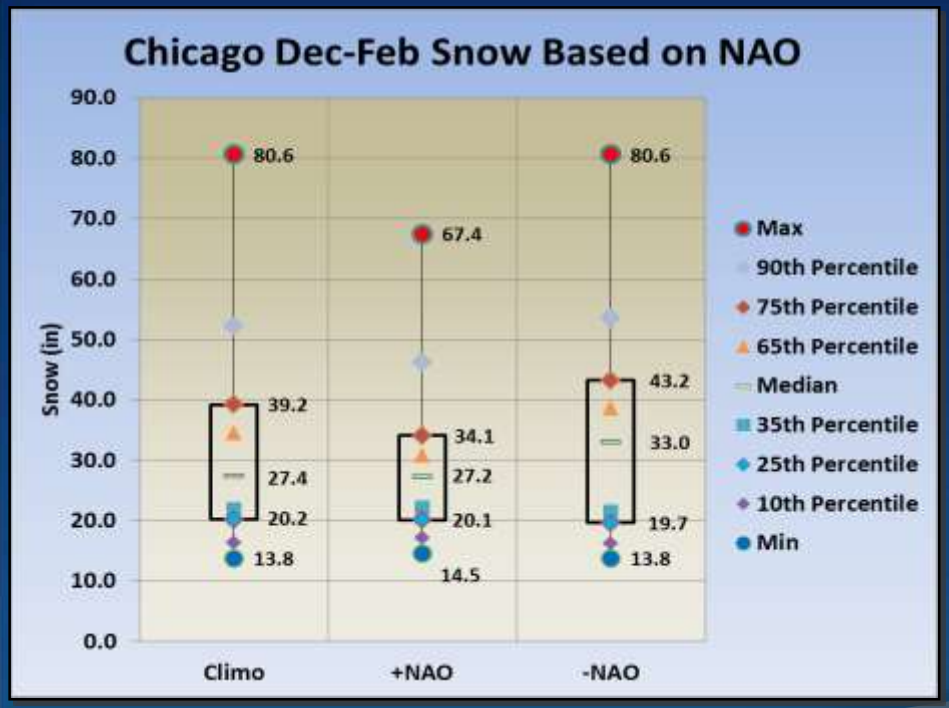
Sample sizes include: 38 +NAO, 28 –NAO, 6 –NAO EN and 8 +NAO EN.

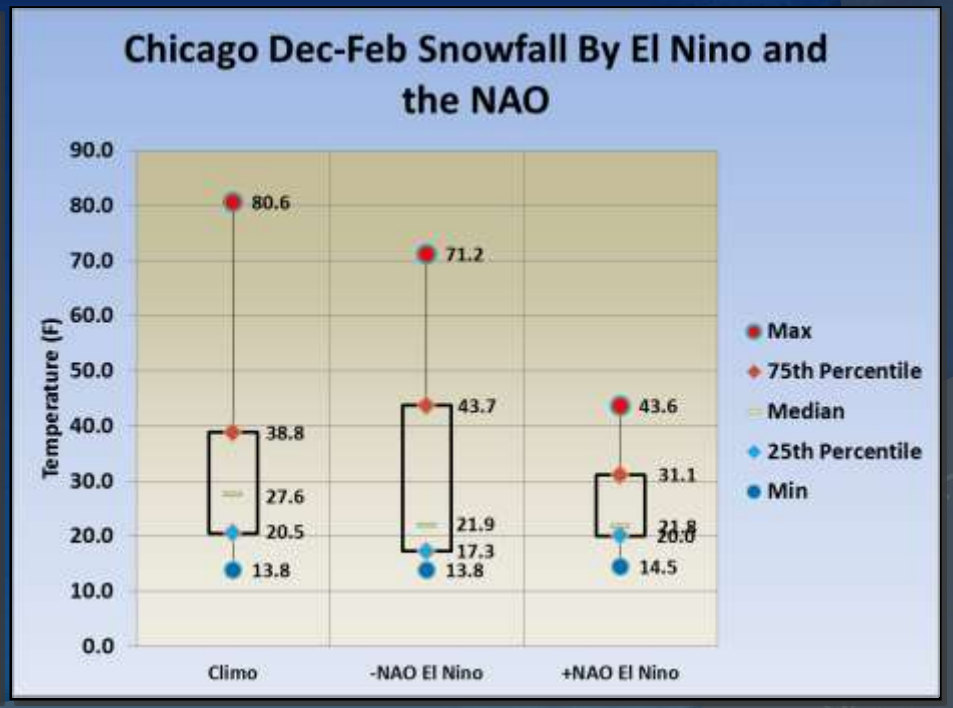
El Niño and the AO/NAO

The phase of the AO/NAO can have an impact on snowfall.

- -NAO can support a snowier than normal winter.
- +NAO may result in less snow due to warm conditions, but not always the case.

Results similar at Rockford





Sample sizes include: 38 +NAO, 28 –NAO, 11 –NAO EN and 9 +NAO EN.

The Arctic and North Atlantic Oscillations (AO/NAO)

- **A predominantly negative (positive) AO/NAO *could* enhance the chances for a lean towards colder (milder) conditions.**

  → ***Generally low predictability beyond a few weeks, though new research within the past few years is promising in terms of aiding predictability of the predominant seasonal scale AO/NAO pattern.***

  → ***Above normal Northern Hemisphere high latitude and North American snow cover this November could help favor more pronounced blocking episodes this winter.***

The Arctic and North Atlantic Oscillations (AO/NAO)

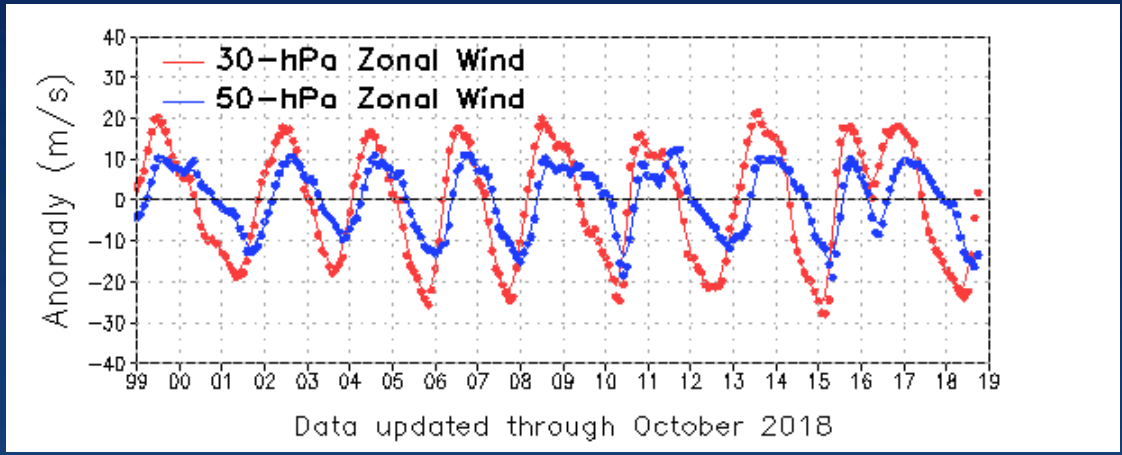
- *Possible* impact of the Quasi-Biennial Oscillation (QBO) on the predominant winter AO/NAO phase

- Quasi-biennial oscillation (QBO):
  - Regular variation of the winds that blow high above the equator.
  - Strong winds in the stratosphere travel in a belt around globe
  - These winds completely change direction every ~14 months.
  - Full cycle takes roughly 28 months to complete.
  - Cycle has an easterly (negative) & a westerly (positive) phase
- The stratospheric polar vortex (large area of low pressure across the high latitudes) is weaker in the easterly phase of the QBO than in the westerly phase.
- A strong (weak) stratospheric polar vortex tends to support a +AO/+NAO (-AO/-NAO).

The Arctic and North Atlantic Oscillations (AO/NAO)

- *Possible* impact of the Quasi-Biennial Oscillation (QBO) on the predominant winter AO/NAO phase

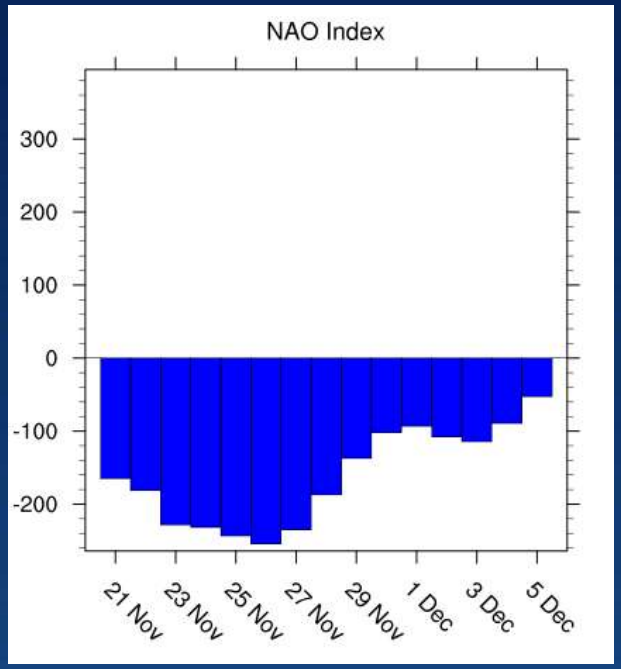
- Latest 50 mb QBO anomaly value: -13.42 (easterly)
- Latest 30 mb QBO anomaly value: +1.83 (westerly)

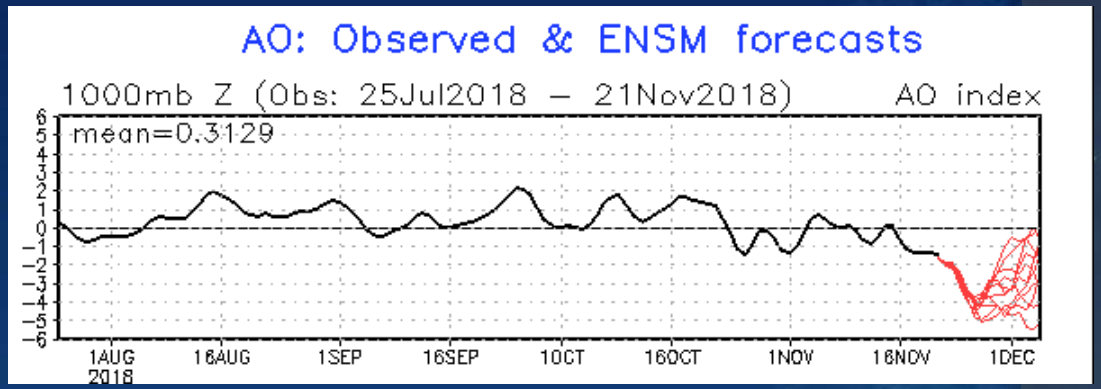


- The QBO at 50 mb is likely to be easterly (negative) through at least a portion winter 2018-19, which *may* support longer periods of -AO/-NAO. Weakly positive QBO at 30 mb *may* argue against prolonged strongly negative AO/NAO.

The Arctic and North Atlantic Oscillations (AO/NAO)

- AO and NAO are deeply negative and will remain so through early December.

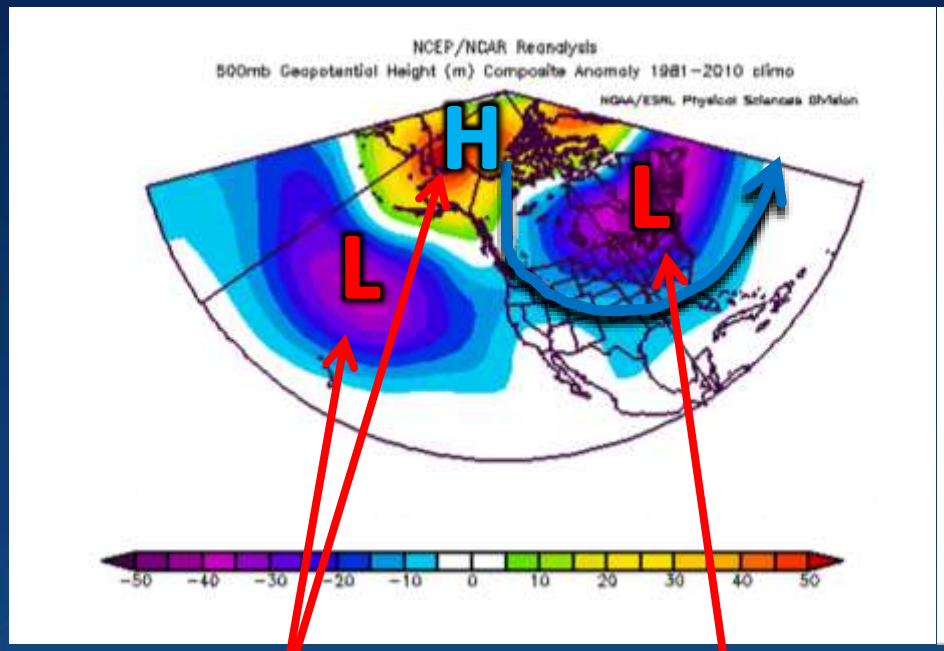


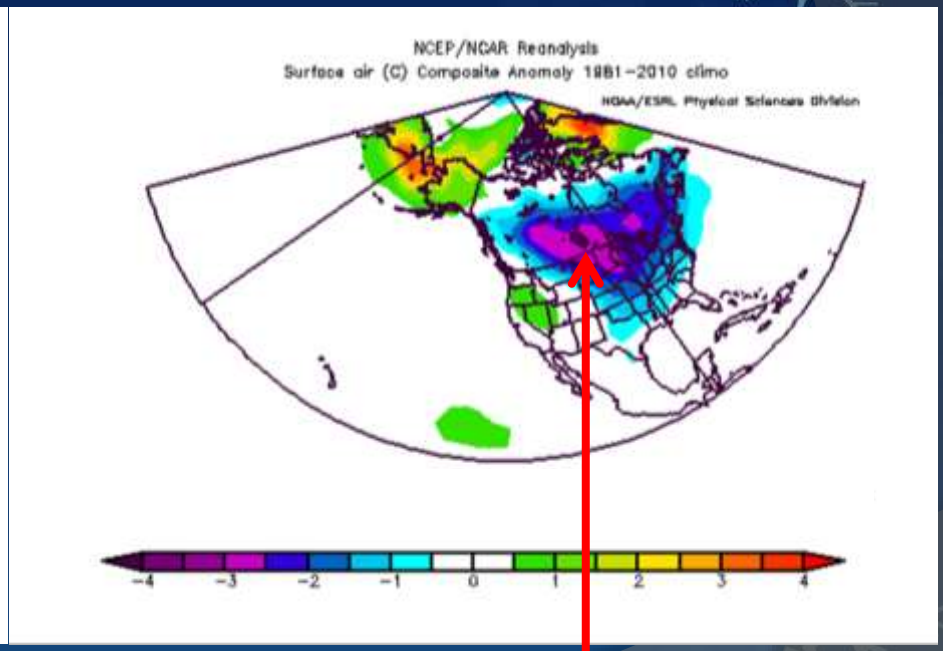


- **Conclusion: This winter may be conducive to more frequent episodes of -AO/-NAO, which if it occurs would increase chances of near to below normal temperatures.**

“Alaska Ridge Pattern”(-EPO)

- The jet stream pattern becomes buckled in this phase, with a deep trough and colder than normal conditions over the central and eastern CONUS.





Strong Blocking

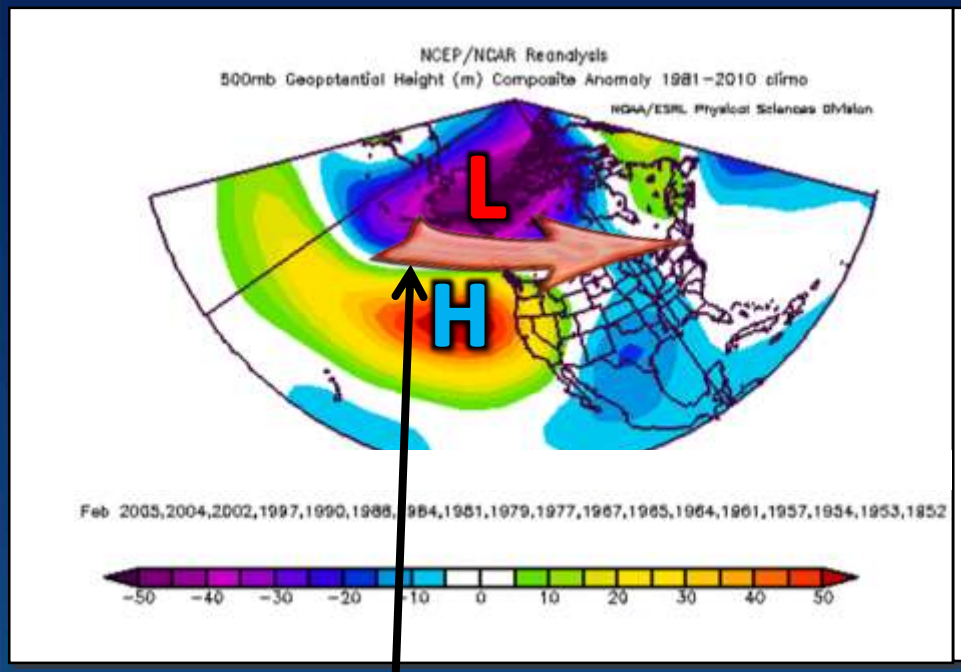
-NAO/AO signal

Deep cold

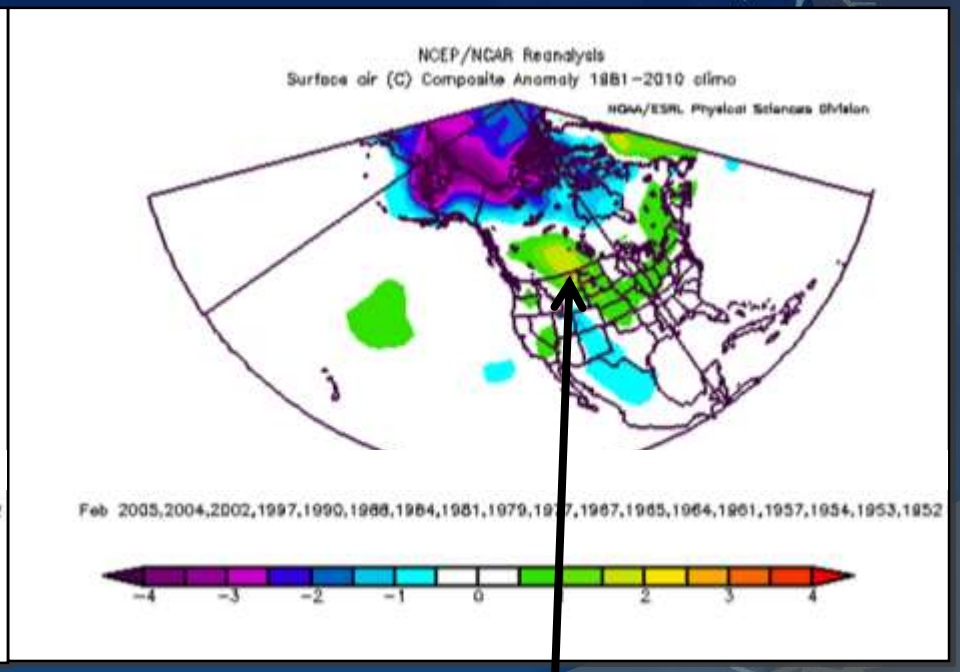
EPO: East Pacific Oscillation

“Alaska Trough Pattern”(+EPO)

- The jet stream becomes strong over the eastern Pacific, which allows mild Pacific origin air masses to dominate over the CONUS, with the deep cold remaining well north.



Strong and Mild Pacific Jet



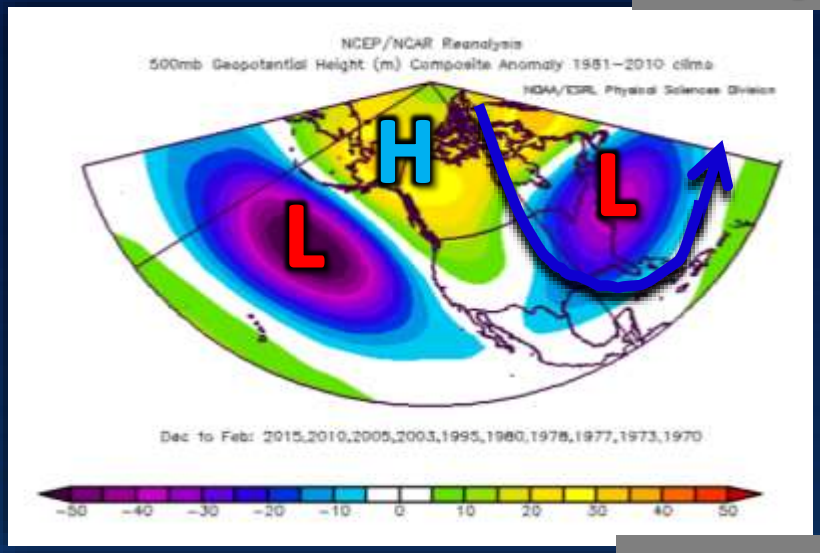
Near to above normal temperatures

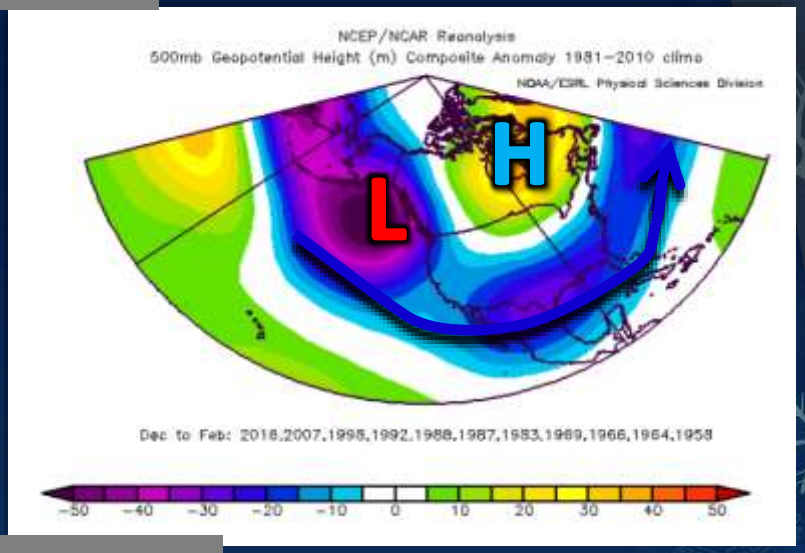
El Niño and the EPO

-EPO El Niño

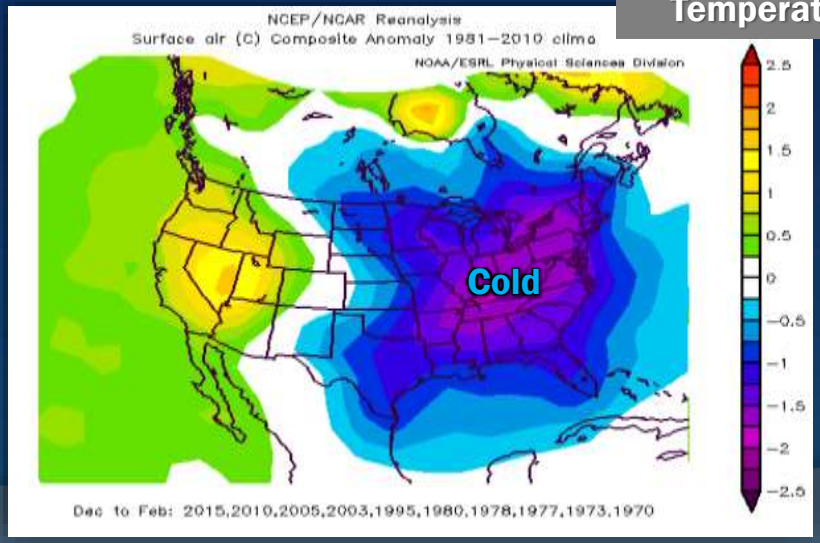
+EPO El Niño

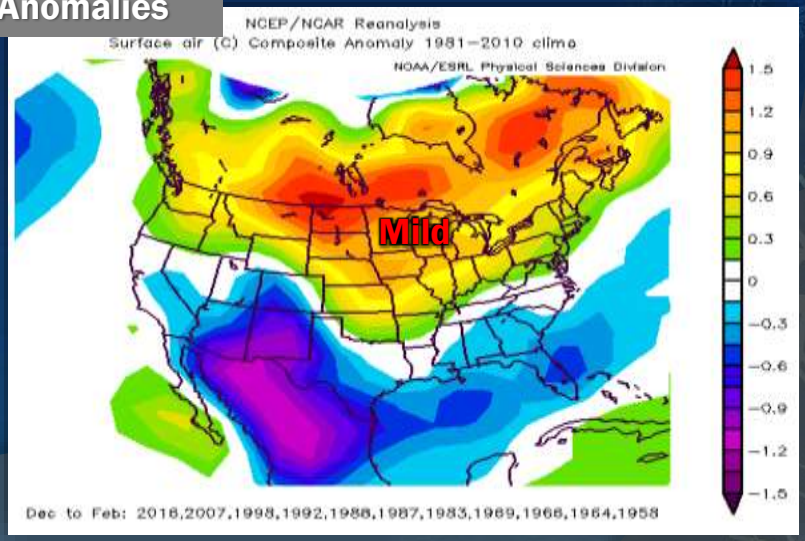
500 Height Anomalies





Temperature Anomalies

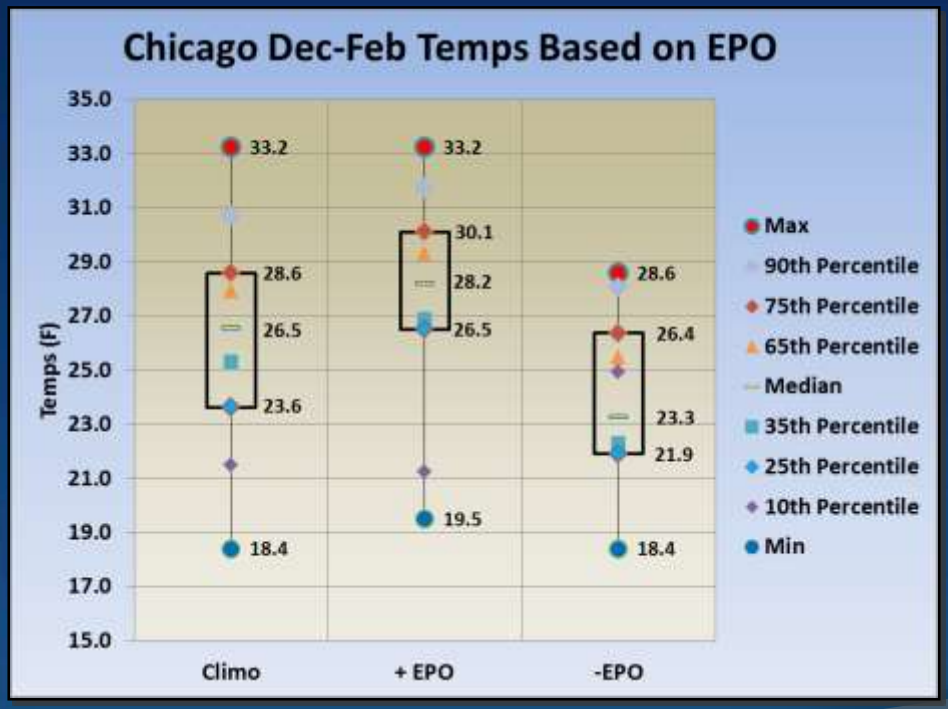


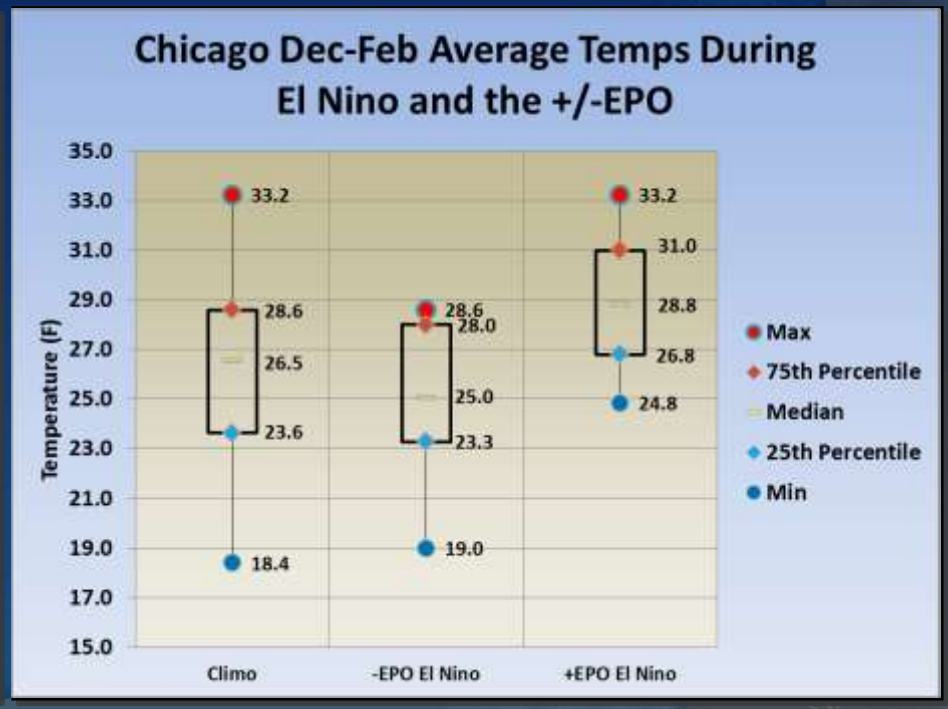


El Niño and the EPO

The predominant phase of the EPO can have a large impact on how the El Niño event will impact the winter season across the region.

- **-EPO (Alaska and North Pacific upper ridging) can result in a colder than normal winter.**
- **+EPO could help support a milder winter season.**



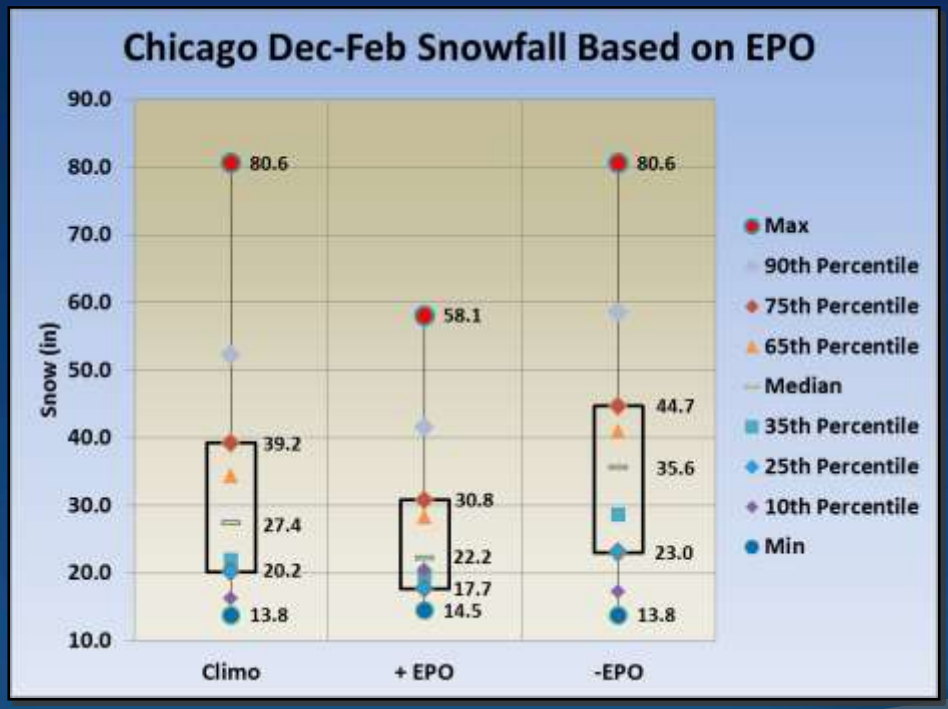


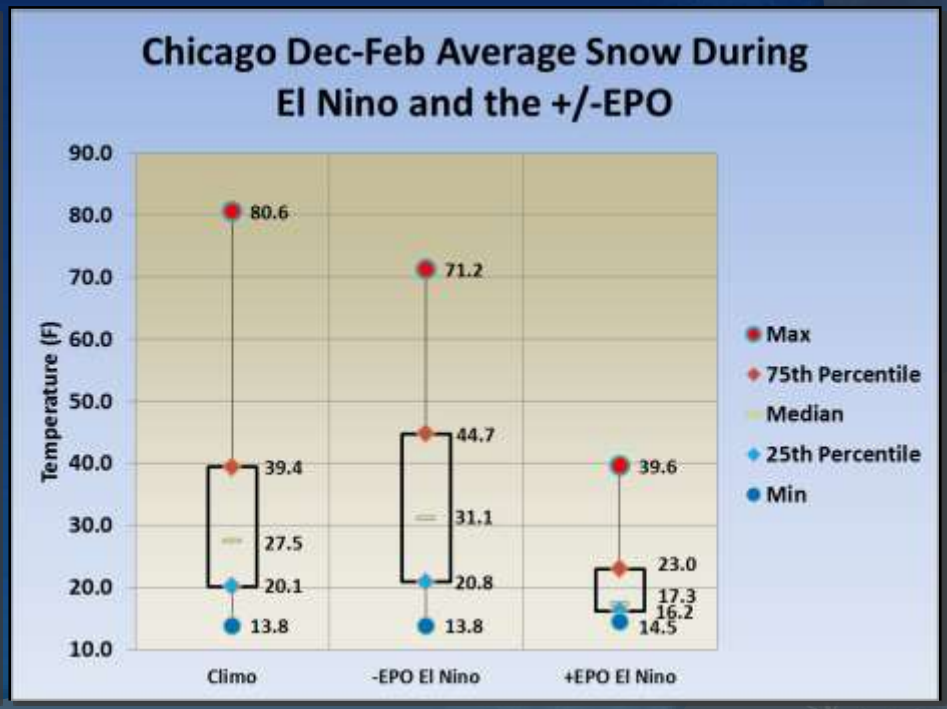
Sample sizes include: 37 +EPO, 29 –EPO, 10 –EPO EN and 12 +EPO EN.

El Niño and the EPO

The predominant phase of the EPO can impact snowfall during El Niño winters across the region.

- **-EPO (Alaska and North Pacific upper ridging) can result in above normal snowfall due to colder conditions with an active weather pattern.**
- **+EPO winters tend to produce below average snow.**

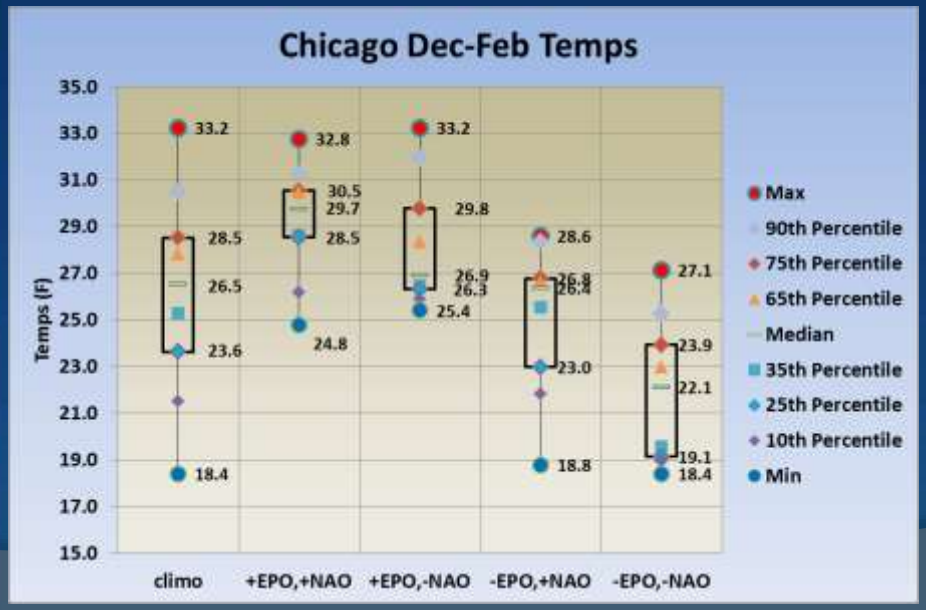


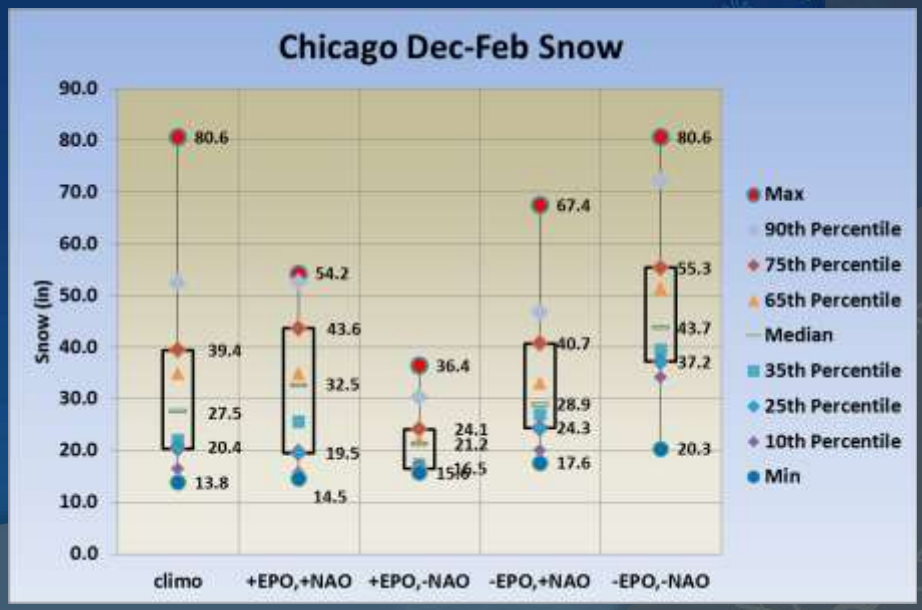


Sample sizes include: 37 +EPO, 29 –EPO, 10 –EPO EN and 12 +EPO EN.

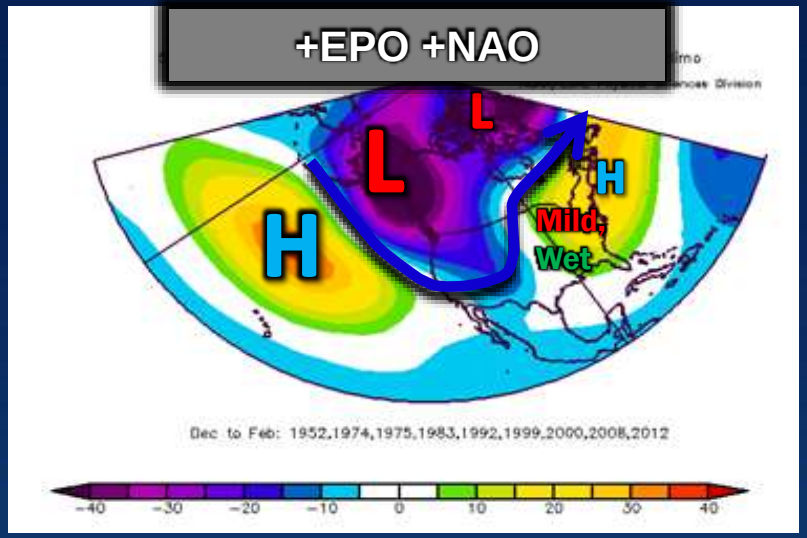
“Constructive” and Destructive phases of the EPO and NAO

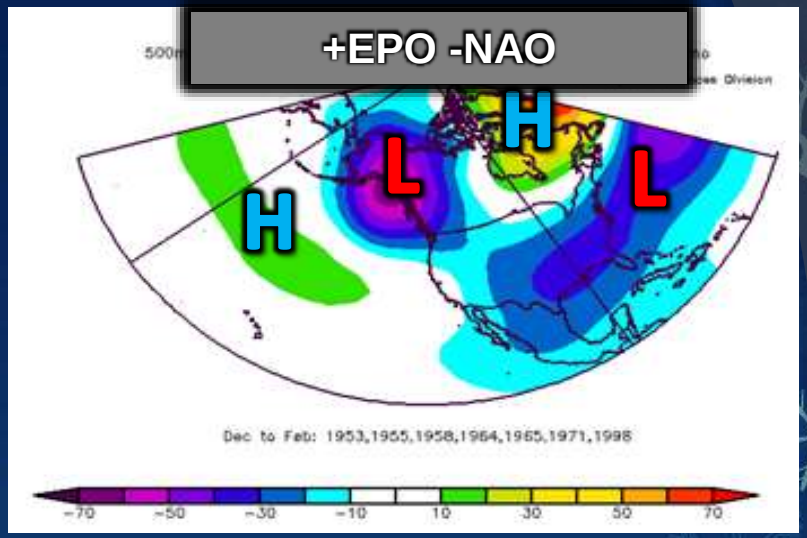
- When both are in favorable phases for cold (warm), our winter season is almost always cold (warm).
  - Somewhat mixed results for snowfall.
  - Negative phases favor cold and snowy winters (e.g., 2010, 2011, and the late 70s).
- Opposing phases can work against each other.
  - +EPO and –NAO tend to result in warmer and less snowy winters in Chicago.

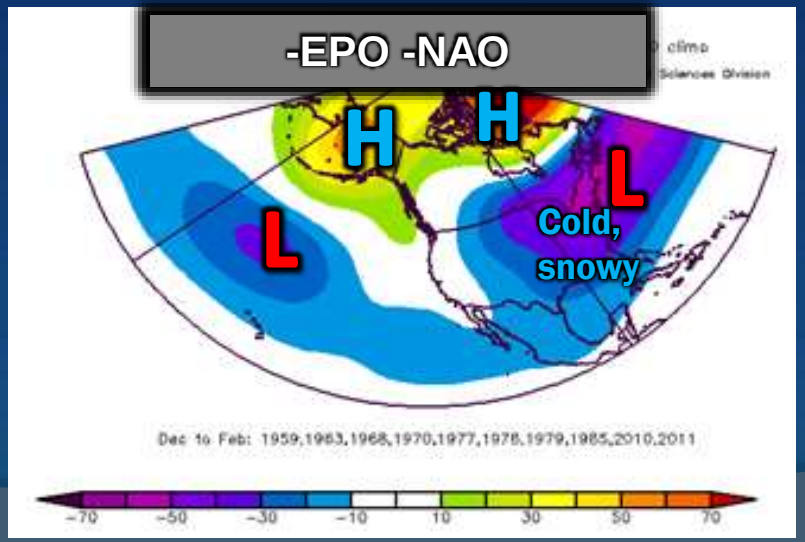


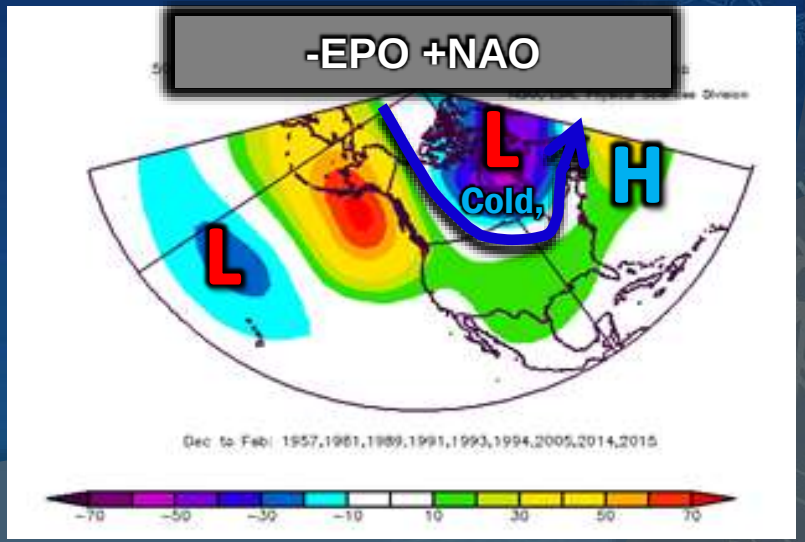


EPO and NAO


+EPO +NAO
L
L
H
H
Mild,
Wet
Dec to Feb: 1952,1974,1975,1983,1992,1999,2000,2008,2012
-40 -30 -20 -10 0 10 20 30 40


+EPO -NAO
H
L
H
L
Dec to Feb: 1953,1955,1958,1964,1965,1971,1998
-70 -50 -30 -10 10 30 50 70


-EPO -NAO
H
H
L
L
Cold,
snowy
Dec to Feb: 1959,1963,1968,1970,1977,1978,1979,1985,2010,2011
-70 -50 -30 -10 10 30 50 70


-EPO +NAO
L
H
L
Cold,
Dec to Feb: 1957,1961,1989,1991,1993,1994,2005,2014,2015
-70 -50 -30 -10 10 30 50 70

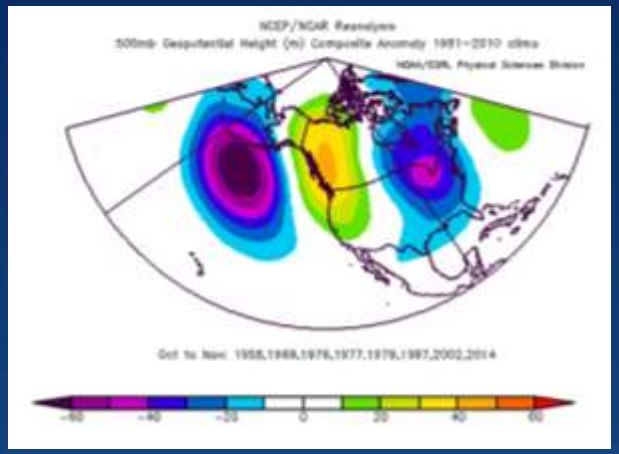
Can Pattern This Fall Help Tell Us How the Winter May Play Out?

Are There Signs of What Predominant EPO Phase Will Be?

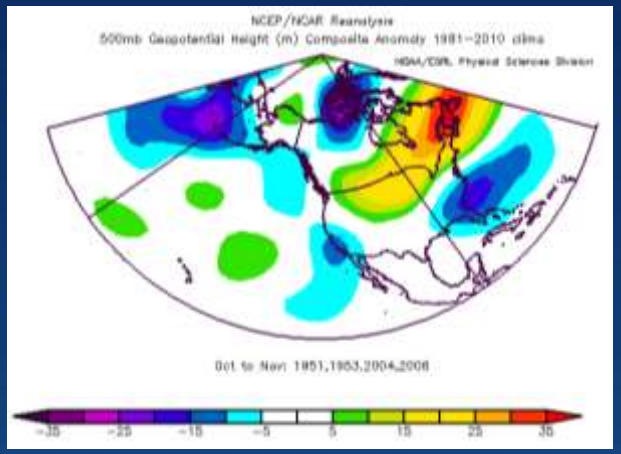
- **Of 12 weak El Niño's, by DJF climate division temp anomalies over Mid Mississippi Valley and Western & Lower Great Lakes:**
  - **8 cool to cold events, 4 mild to warm events**

October-November Upper Pattern

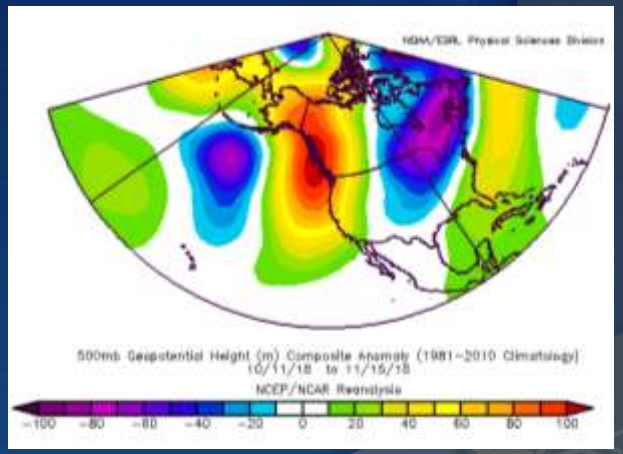
8 cool to cold events



4 mild to warm events



Oct 11 - Nov 15, 2018



- **Conclusion: The NA upper pattern since mid October may favor a -EPO on average for the winter, which would increase chances of near to below normal temperatures.**

Madden-Julian Oscillation (MJO)

- Tropical disturbance that propagates eastward around global tropics
  - Cycle averages about 30-60 days.
- Has wide ranging impacts on the patterns of tropical and extratropical precipitation, atmospheric circulation, and surface temperature around the global tropics and subtropics.
- Often quite variable
  - Periods of moderate-to-strong activity followed by periods of little or no activity.
  - NH late fall, winter, and early spring typically have greatest level of MJO activity.
- MJO influences both precip. & surface temp. patterns across US.
- Two most significant impacts over US during winter:
  - Increase in the frequency and intensity of heavy precipitation events along west coast
  - Increase in the frequency and intensity of cold air outbreaks across eastern US.
- Has 8 phases
  - ENSO state and month can result in some variance of impacts

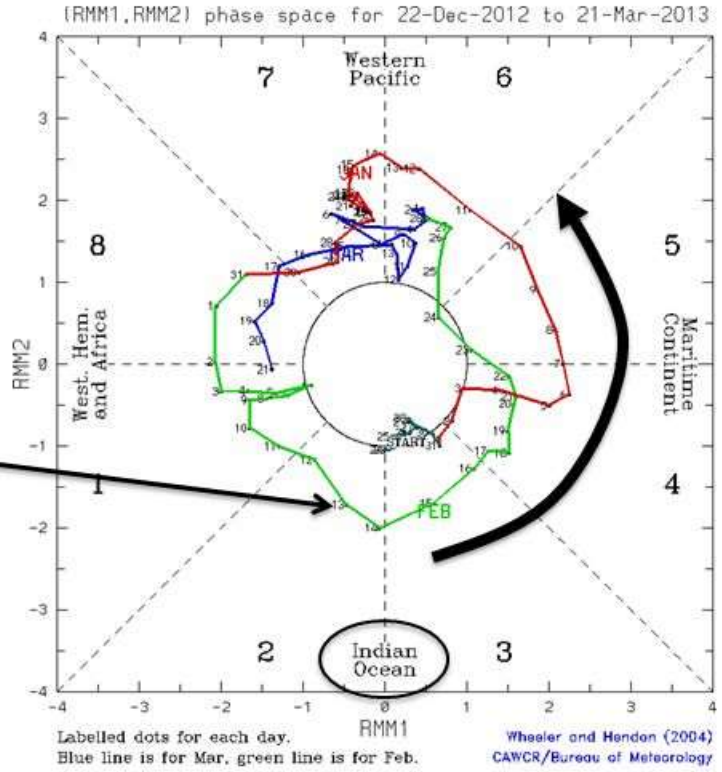
Madden-Julian Oscillation (MJO)

What is the MJO?

- Sub-seasonal (varies within a month/season) climate pattern that moves eastward around the global tropics in ~30-60 days.
- Has its strongest tropical impacts (winds, rainfall) over the Indian and Pacific Oceans when it moves slower (5 m/s). But still affects the Western Hemisphere even though moving faster.
- Exists ~40-50% of the time, but can go many seasons without an MJO.

CPC monitors the MJO with the Wheeler and Hendon MJO index

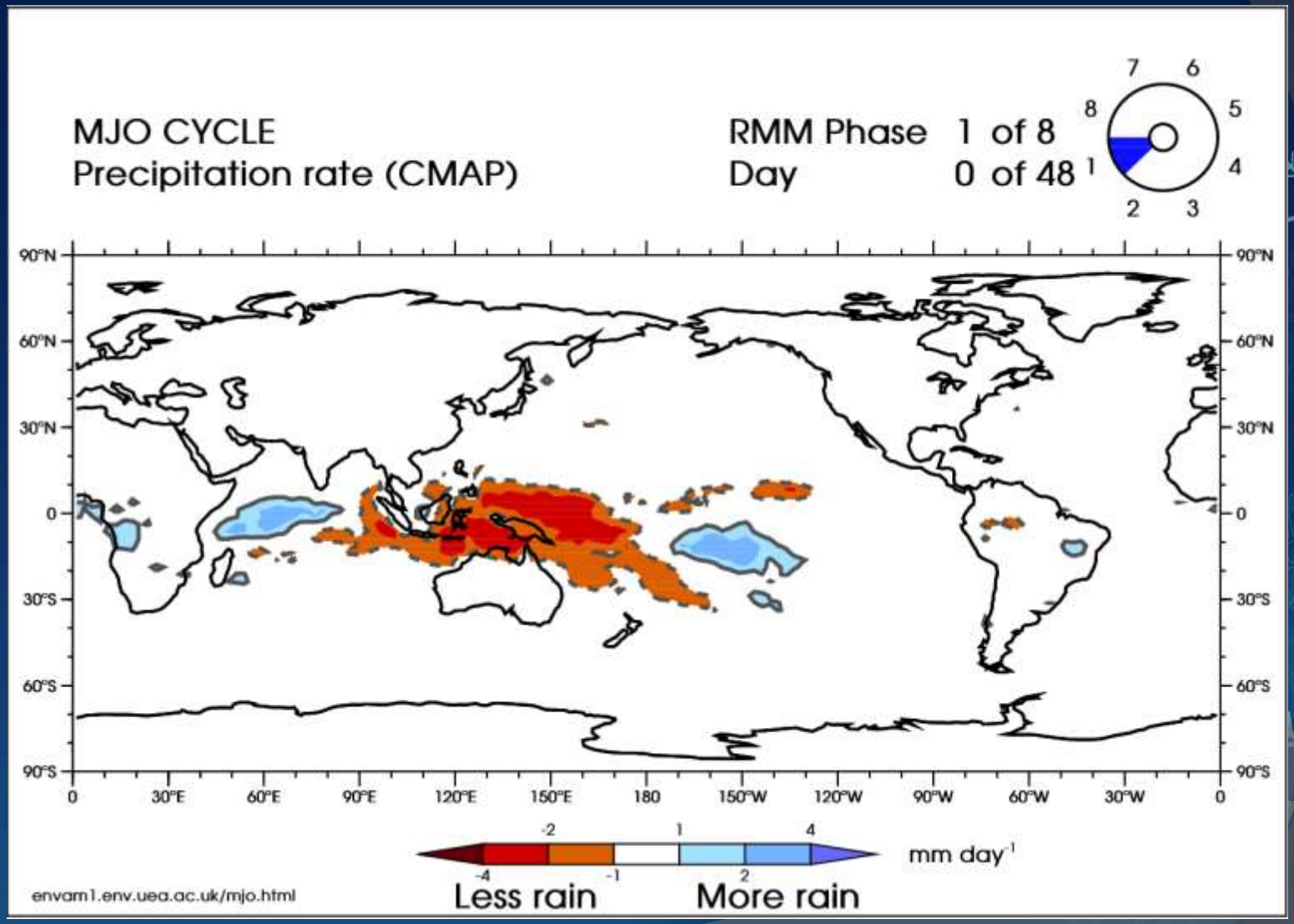
Each dot/number represents a single day and location of the MJO enhanced rainfall.



MJO exists when there is counterclockwise movement on diagram

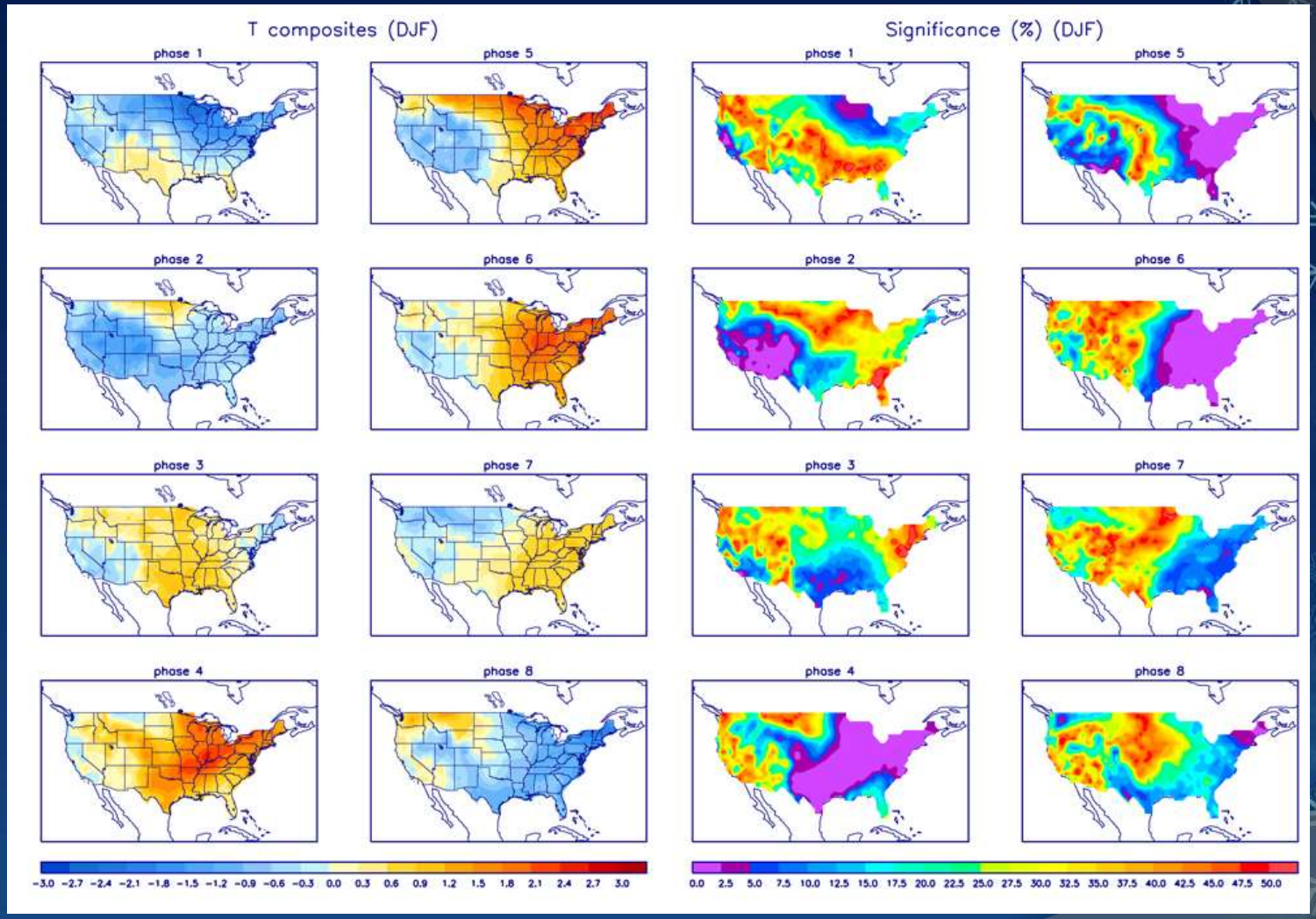
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml: Google CPC MJO

Madden-Julian Oscillation (MJO)



Animation from The Meteorological Service Singapore (MSS)

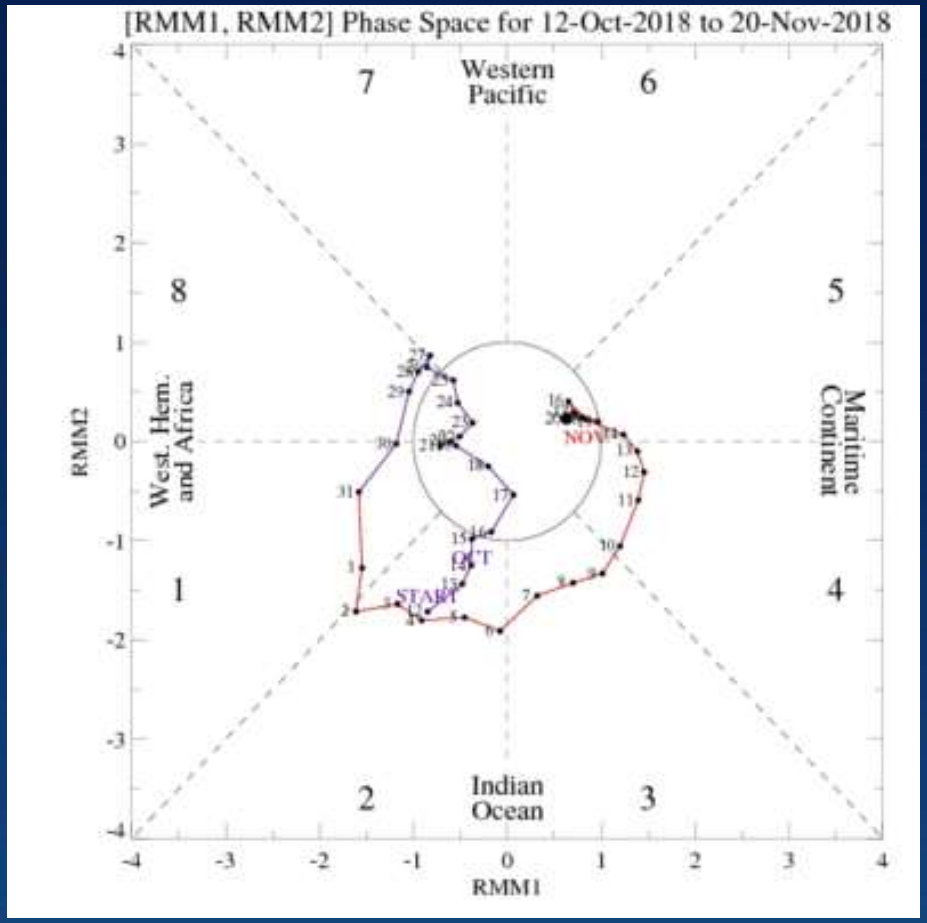
Madden Julien Oscillation (MJO)



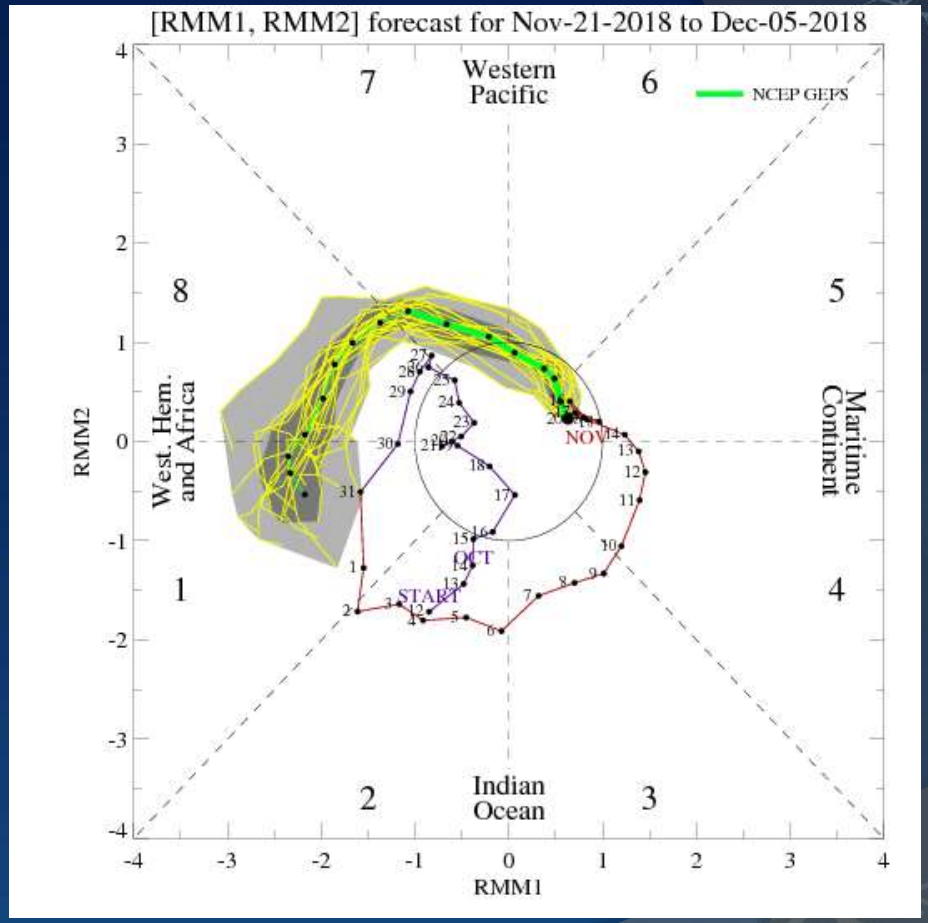
- **Conclusion: The MJO being in more favorable phases for cold (warm) more often can increase chances for near to below normal (near to above normal) temperatures.**

Madden Julien Oscillation (MJO)

MJO Observations Oct. 12- Nov. 20

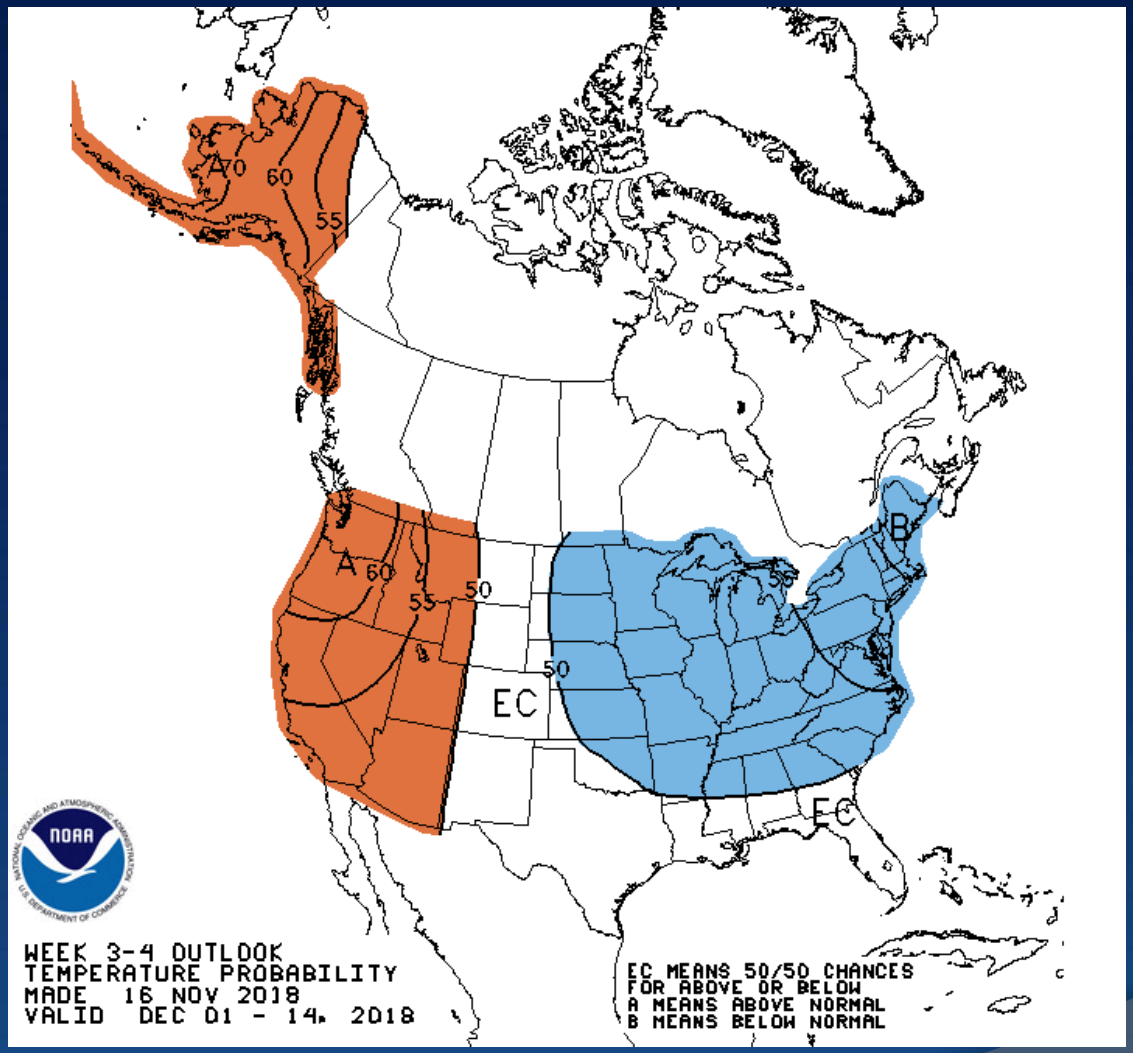


MJO Forecast (GFS Ensemble) Nov. 21-Dec. 5



- **Conclusion: The MJO being in more favorable phases for cold (warm) more often can increase chances for near to below normal (near to above normal) temperatures. MJO is forecast to be in a favorable phase for cold to start December (phase 8 into phase 1 on GFS Ensemble).**

A Brief Look Ahead



- **Latest signs point toward potentially colder than normal December, and potentially fairly active as well, at least to start the month.**

Summary

Based on what we know now:

- Weak El Niño conditions are favored to develop & persist through the winter.

- **Lower confidence in predominant temperature regime vs. normal**
  - Strong El Niño events favor mild winters.
  - Weak El Niño events can favor very cold conditions in central and eastern CONUS, especially if –NAO/-AO and/or -EPO dominates.
  - Extent of snow cover across the region can also modulate overall temp. regime.

- **Low confidence in Snowfall**
  - Weak El Niño events overall favor below normal precipitation.
  - Many weak El Niños since 1950 have produced near to above normal snowfall from numerous northwest tracked (“Clipper”) systems mixed with a few larger systems along with lake effect snow for LES favored areas.
  - Ultimately depends on favored storm track of individual storm systems and the availability of sufficiently cold air masses for snow.
  - Below normal snowfall still a possibility if storm track & temperature patterns are more often unfavorable or if pattern becomes extremely dry locally (ie. 2002-03).

Summary

Things to watch/keep in mind:

- Arctic Oscillation (AO) and North Atlantic Oscillation (NAO) and the Eastern Pacific Oscillation (EPO).
  - The predominant phases of these will likely play large roles in whether this winter will end up on the cold or the mild side.
- The predominant mid-upper level pattern over northeast Pacific and North America and temperature regime since mid October may provide a sign of the predominant winter pattern and temperature regime.
  - Upper pattern has been typified by predominantly -EPO since pattern change in mid October.
  - Coldest weak El Niño events had a predominantly -EPO in October-November.
- Madden-Julian Oscillation (MJO) Activity:
  - Strong MJO waves can have a large impact on CONUS upper pattern
  - Watch forecasts for expected MJO phase & whether these typically support cold or warm.
  - The MJO being in more favorable phases for cold (warm) more often can increase chances for near to below normal (near to above normal) temperatures.

Conclusion

NWS Chicago Outlook for Winter 2018-19

- **Temperatures: Near normal, to possibly below normal**
  - Confidence: Low
  - Latest signs point toward December potentially being below normal, at least to start.
  - Past winters similar to one we are going into (weak El Niños) have had near to below normal temperatures on average (with a few exceptions). *Past is not a forecast*
  - If factors that lead to cold December (if it happens), have led to cold mid Oct-Nov locally, and led to below normal temps in majority of past similar winters, chance of cold outcome for winter season will increase and lessen chance of warmer outcome. Opposite would increase warmer odds.
- **Precipitation: Near to below normal**
  - Confidence: Medium
  - Not a snowfall forecast
- **Snowfall: Near normal**
  - Confidence: Low
  - Many past weak El Niños had above normal snow despite below normal precip.
  - Seasonal snowfall is highly volatile & thus has little/no skill in long range predictions.
  - If a significant snowfall occurs prior to start of December, increased probability for > normal snow

Final Thoughts

- Alternating periods of warm and cold weather can be expected through winter, as is typical.
  - When AO/NAO/EPO are positive, we will trend warmer with higher chances for rainfall.
  - When AO/NAO/EPO are negative, we will become very cold with higher chances for snowfall.
- El Nino usually leads to an enhanced and stronger than normal jet stream over the southern U.S. with above normal precipitation.
  - Not uncommon for one or two strong storm systems to lift out of southern U.S. and into Ohio Valley during El Nino years as jet stream drifts north.
  - Could lead to a significant anomalous rainfall or snowfall event despite the overall greater chance for below normal precipitation for season.
    - Recent example: Jan 31-Feb 2, 2015 snowstorm (19.3” in Chicago)

Thanks for Reading!

Have any questions?
Ask us on Facebook or Twitter

Website: weather.gov/Chicago

Search: @NWSChicago