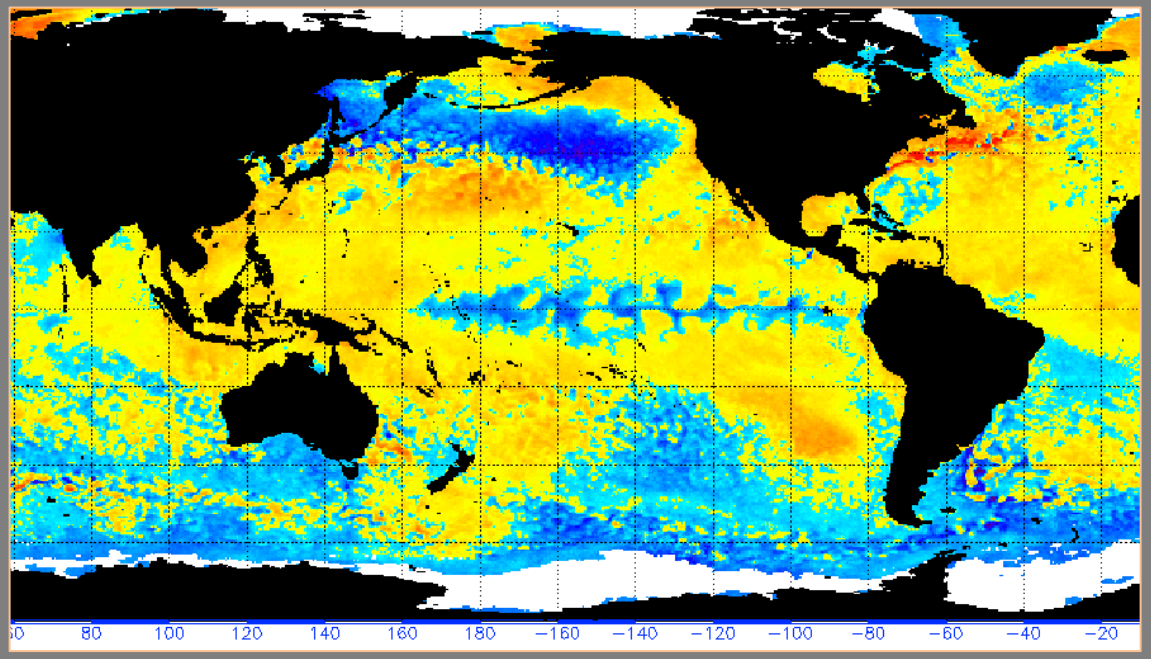
Winter Outlook 2016-2017

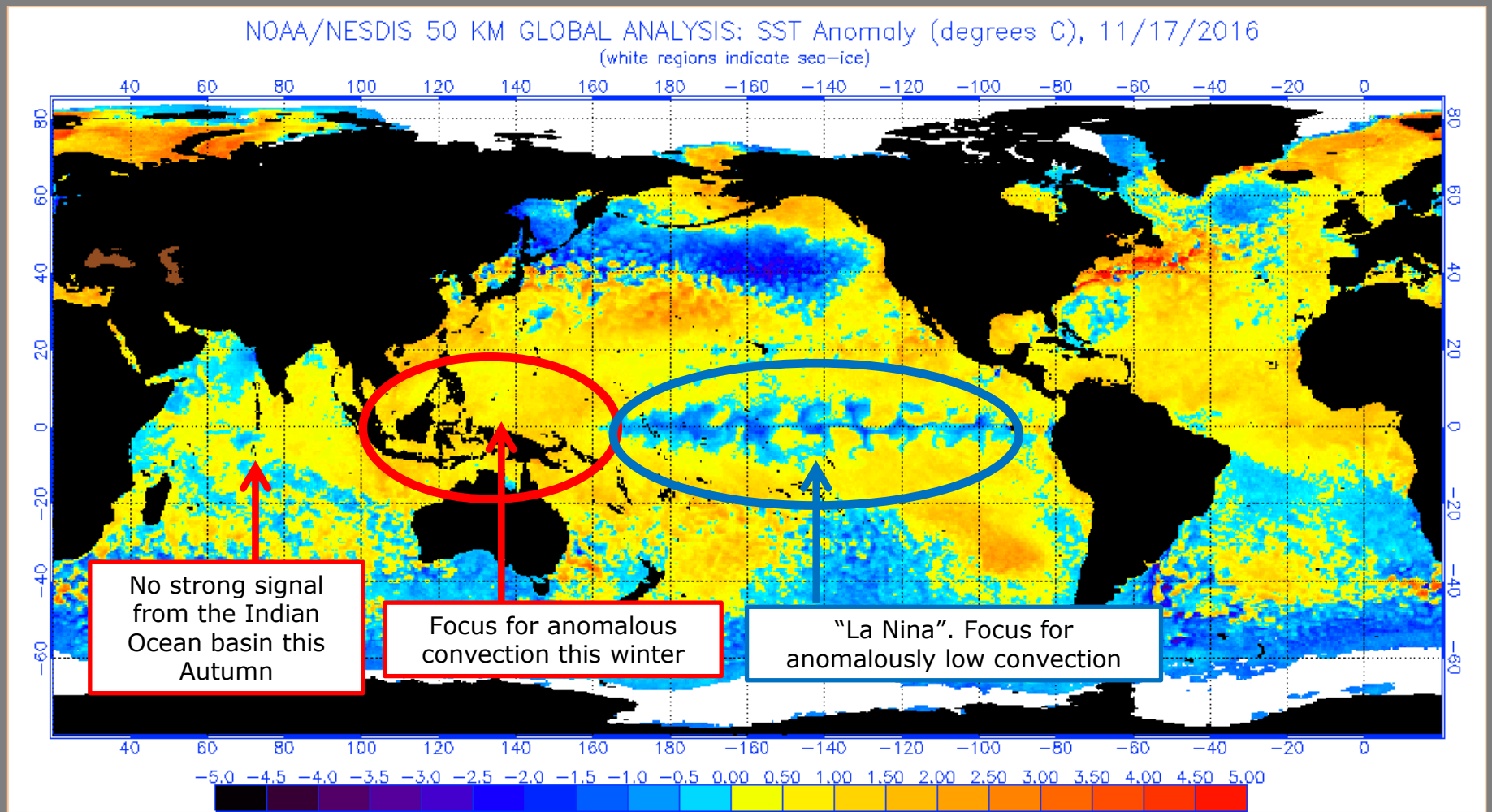
Southeast Lower Michigan



Slide 11: Winter Outlook for SE Michigan
Slides 2-10: Forecast Reasoning

Current Observations
Sea Surface Temperature Anomalies

Tropical SSTs are always important for seasonal forecasts because they change slowly and they drive convection, which releases significant energy into the atmosphere and alters prevailing weather patterns. This year, a weak la Nina is forecast. This means convection will be prominent in the western Pacific Basin.



Current Observations
Stratospheric Polar Vortex

The influence of the stratospheric polar vortex on the lower atmospheric polar vortex in the Northern Hemisphere is an active area of research, but it has often been the case that a weak (strong) stratospheric PV can portend a weak (strong) lower atmosphere PV .

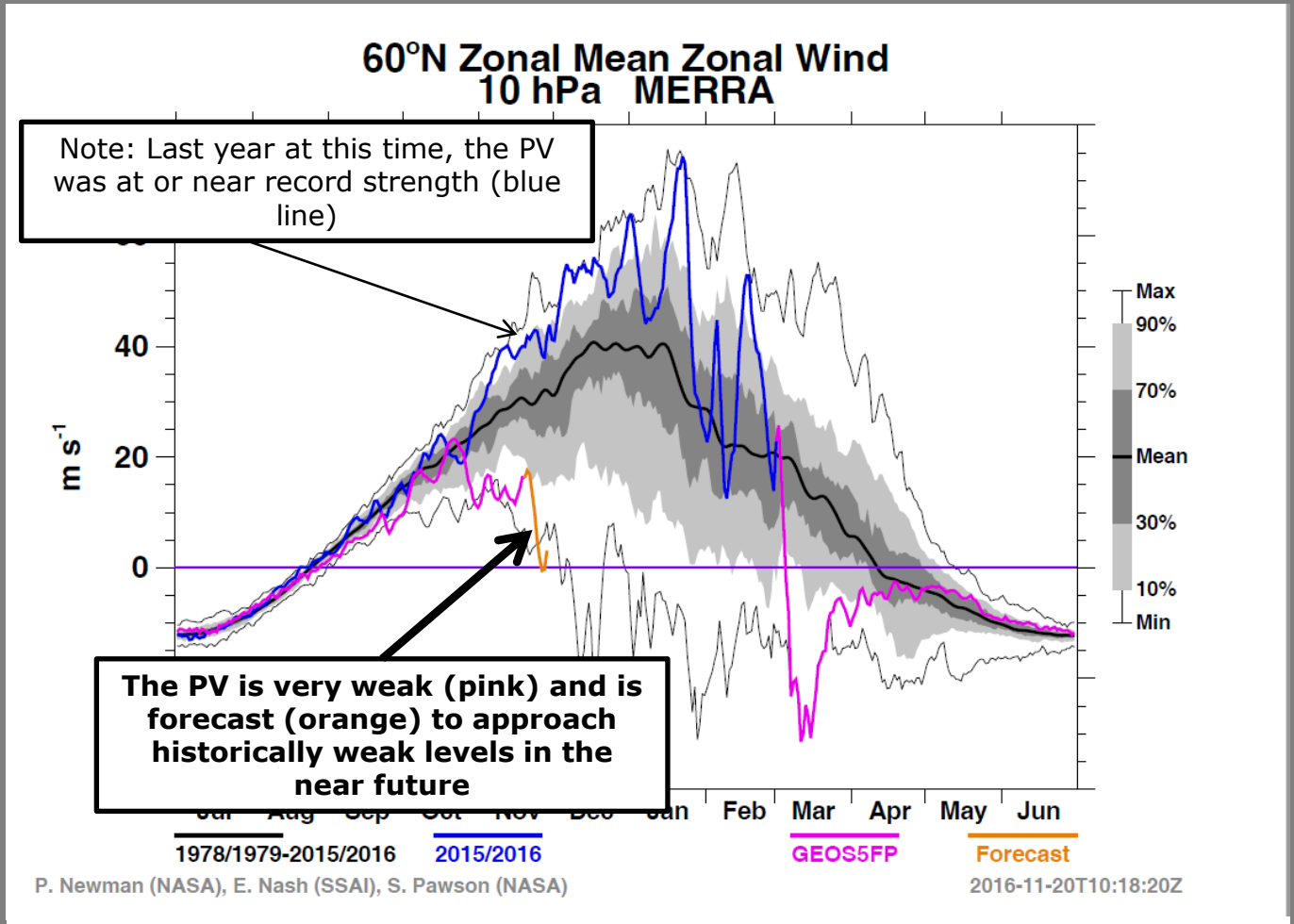
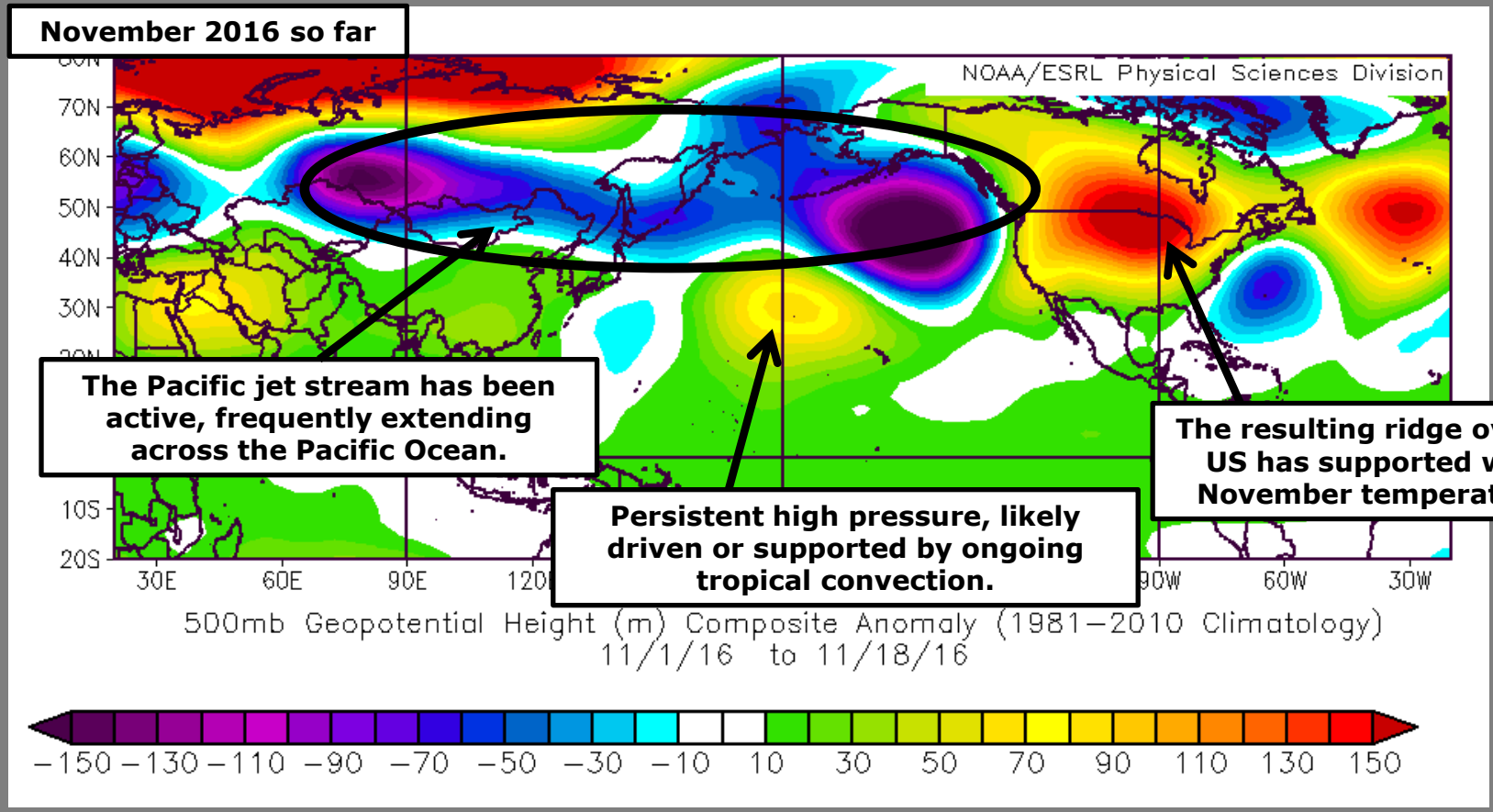


Image courtesy of NASA's Atmospheric Chemistry and Dynamics Laboratory

Current Observations
Key Features of the Northern Hemisphere Atmosphere

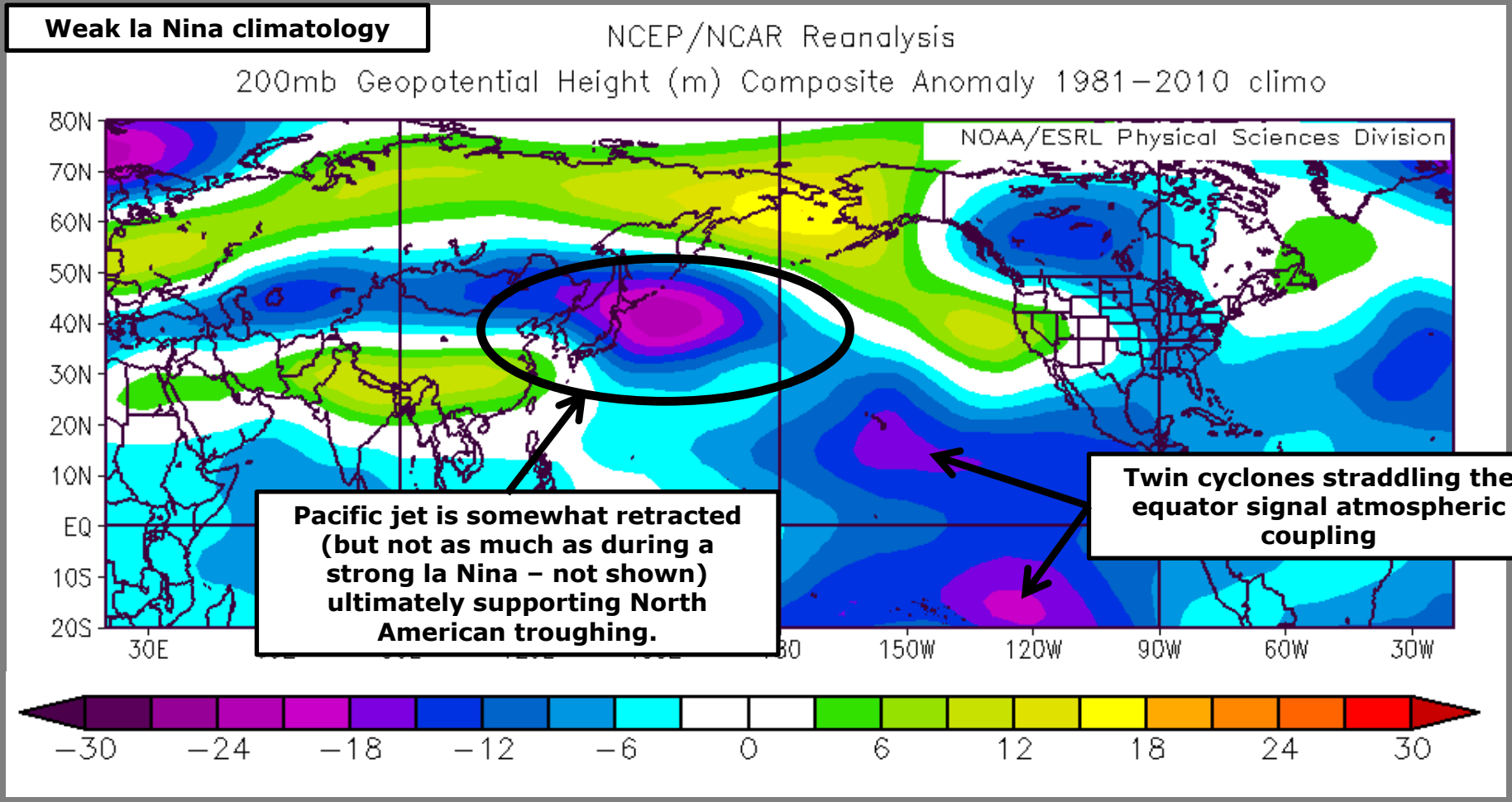
The current atmospheric state is important for two reasons. The first is the potential application of "persistence", which means assuming the current weather pattern will continue into at least the near future. The second is that we can judge how well it is already coupled with seasonal forcing mechanisms such as la Nina.



Analysis
What is a la Nina in November "supposed" to look like?

Below is a composite of October-November-December (OND) for **weak** la Nina years only. Key features are annotated.

Weak la Nina climatology



Analysis

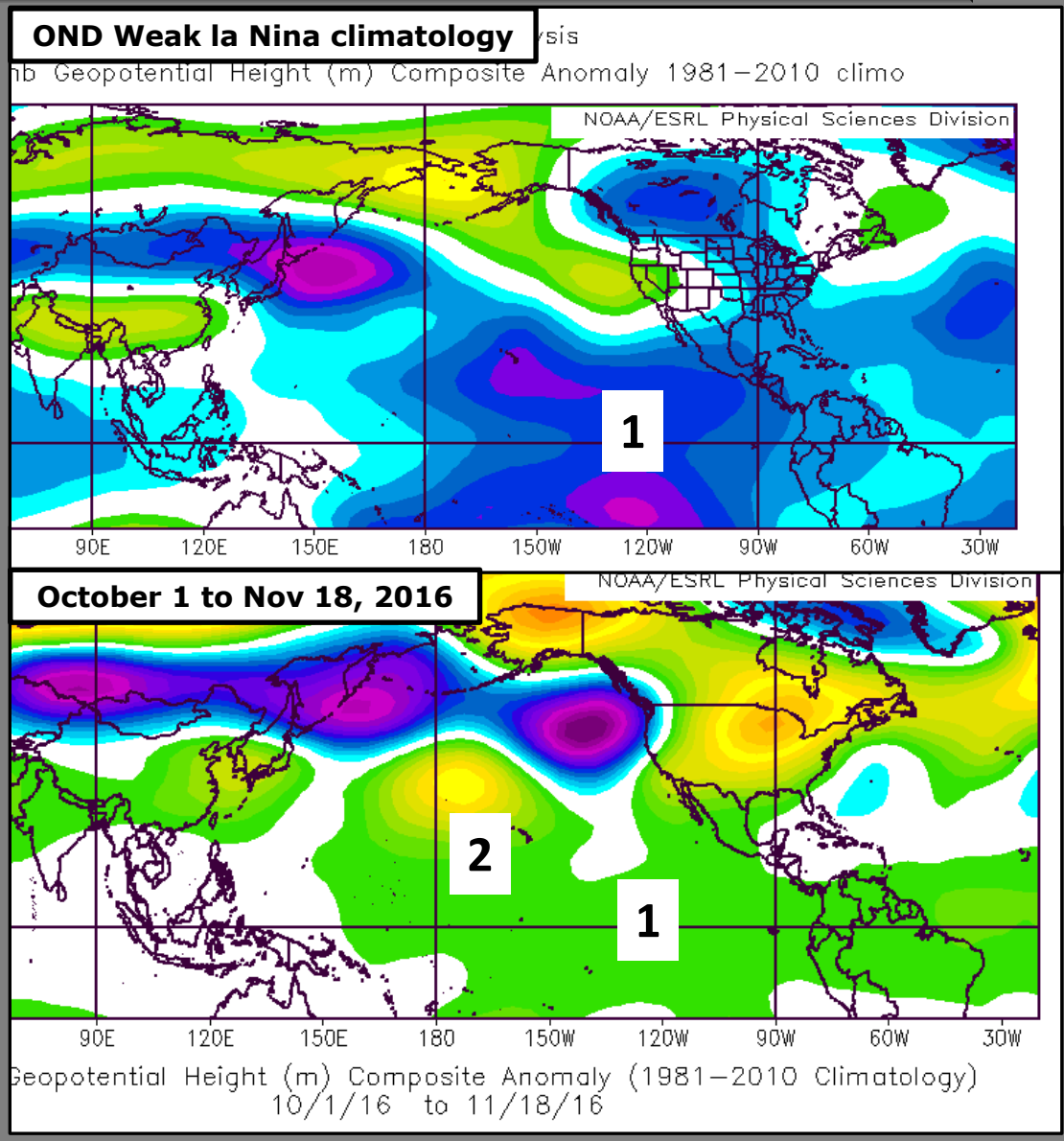
This year looks nothing like a weak la Nina so far

Right: Comparison of weak la Nina climatology (top) to this year so far (bottom)

1. No twin cyclones straddling the equator, meaning the Walker circulation is still too weak, perhaps a lingering effect of last year's strong el Nino.

2. The persistent ridge near the dateline may be supported by ongoing tropical convection and is helping orient the downstream pattern to support ridging over the Great Lakes.

What it means: la Nina coupling will likely improve through early winter. This should eventually favor a tendency toward more Great Lakes troughing and fewer extensions of the Pacific jet, but the atmosphere will take time to evolve toward that state.



Analogs?
Insight from past events

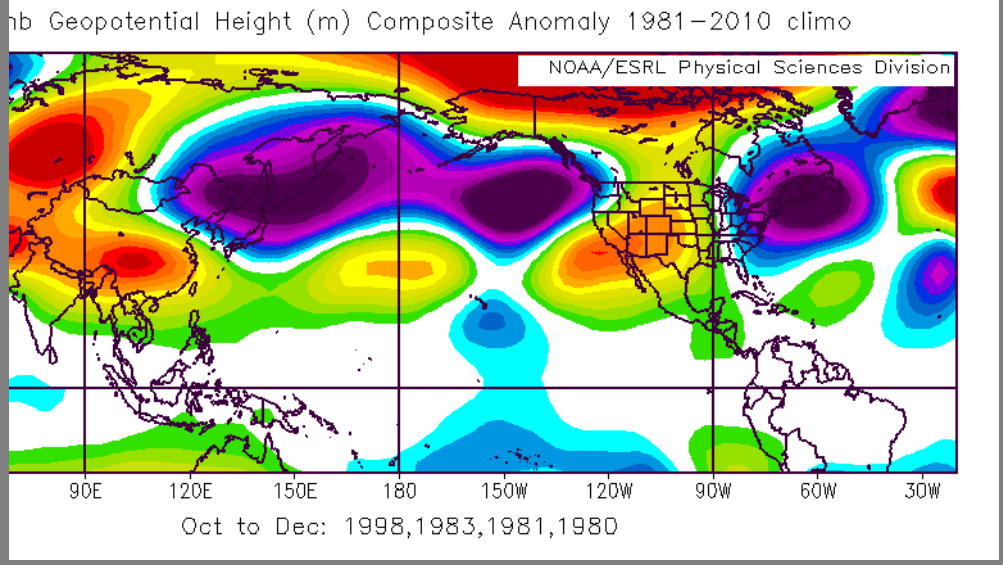
Analogs are a way of looking at historically similar years and seeing how they evolved. For a variety of reasons, there don't appear to be any good analogs for this year. However….

1. There is at least a subset of weak la Nina years whose OND averages resembled this year relatively closely.

2. Note the extended Pacific jet and the dateline and North American ridging.

3. Rolling these years forward 8 weeks into winter may yield insight.

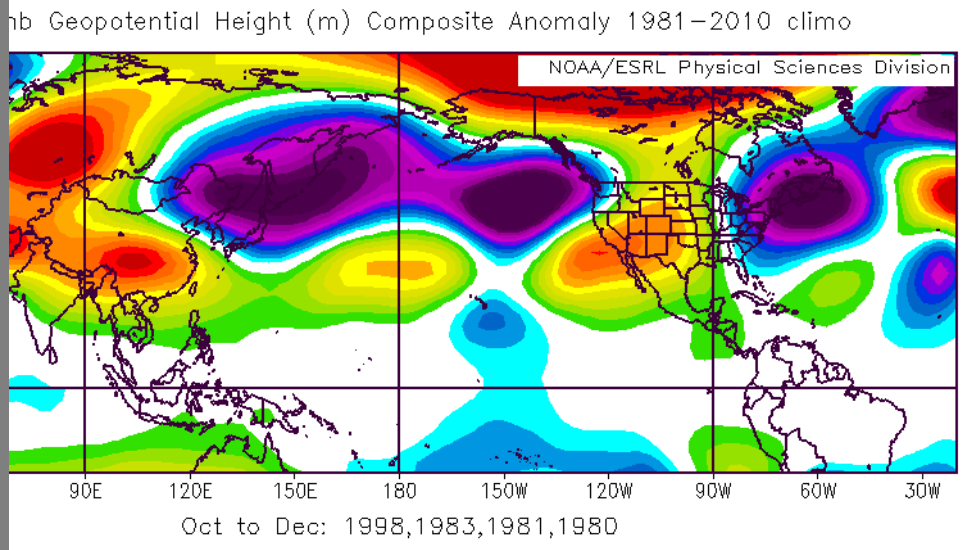
200mb OND for similar years



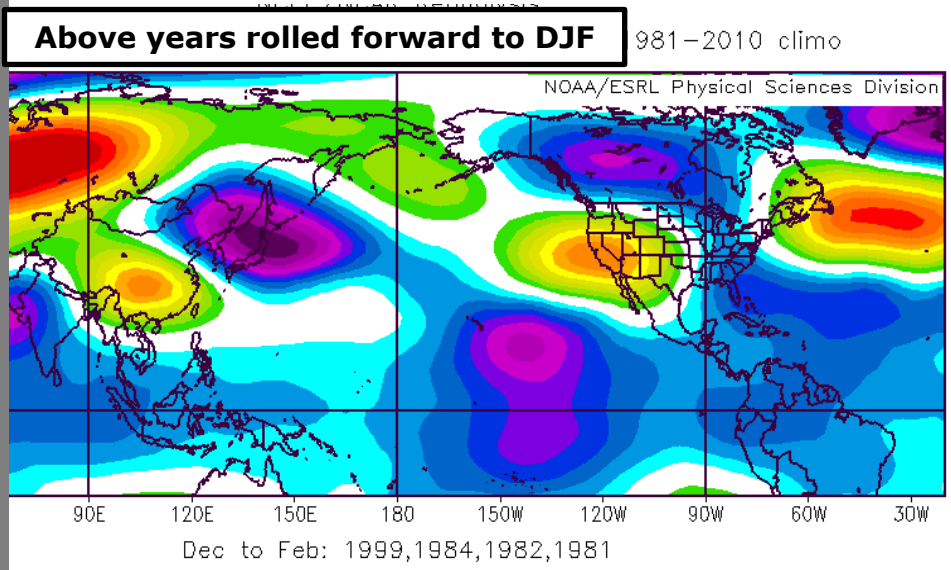
Analogs
Insight from past events

Rolling these years forward (bottom) from where they started in October-November-December (top) reveals a pattern evolution toward something still resembling the weak la Nina climatology (next slide).

200mb OND for similar years



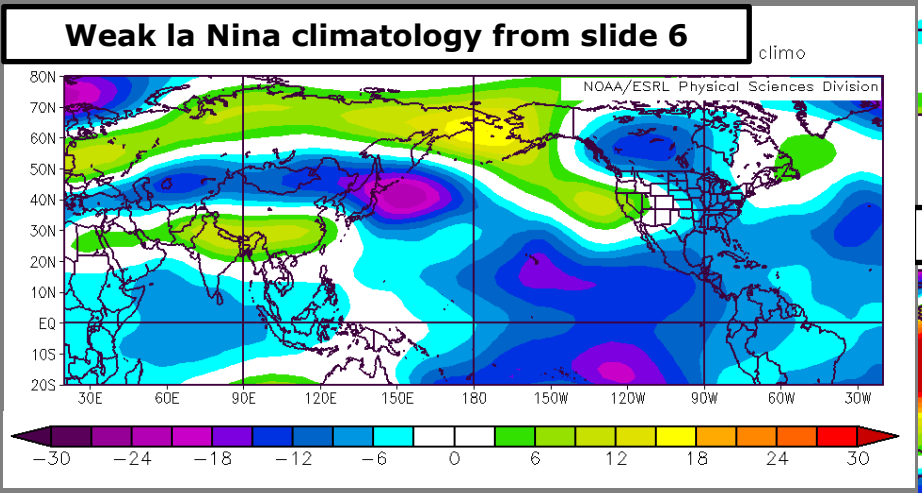
Above years rolled forward to DJF



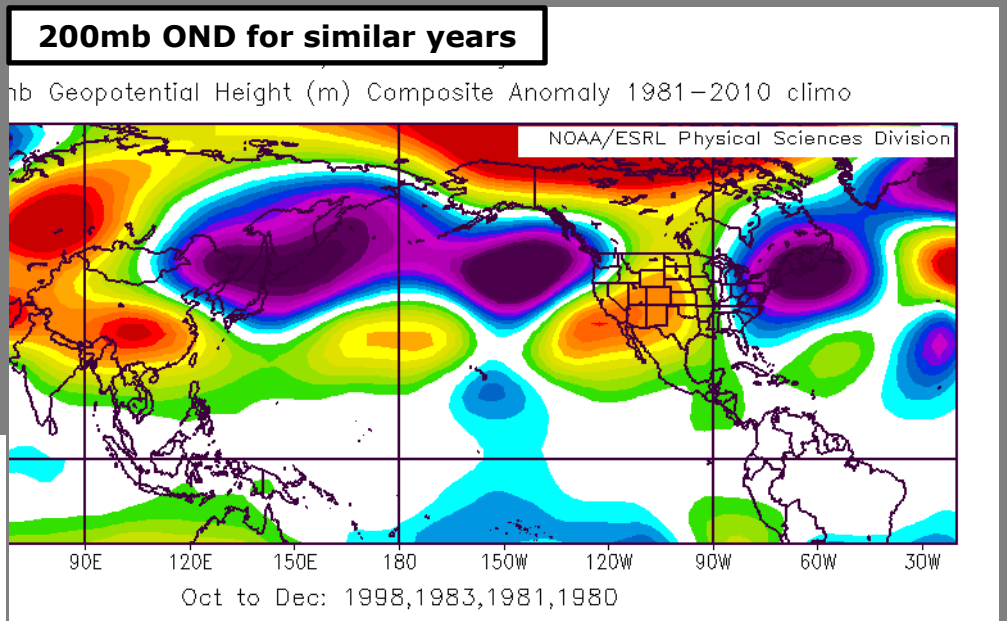
Analogs
Insight from past events

Compared to climatology (below), the DJF mean for those years (bottom right) contains more ridging over the US. The Pacific jet shows signs of retracting. However, this also instills confidence that something similar weak la Nina climatology will eventually unfold.

Weak la Nina climatology from slide 6



200mb OND for similar years



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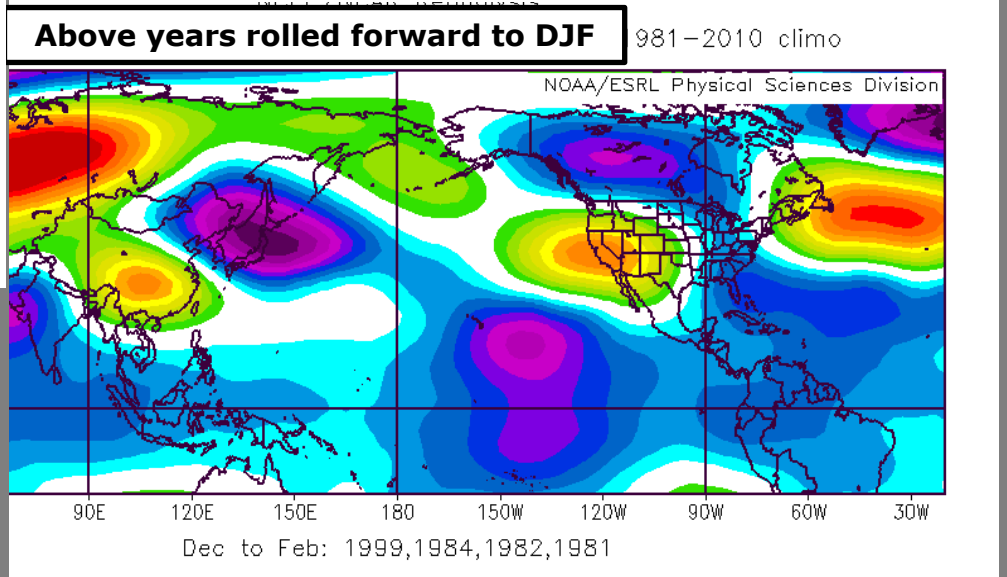


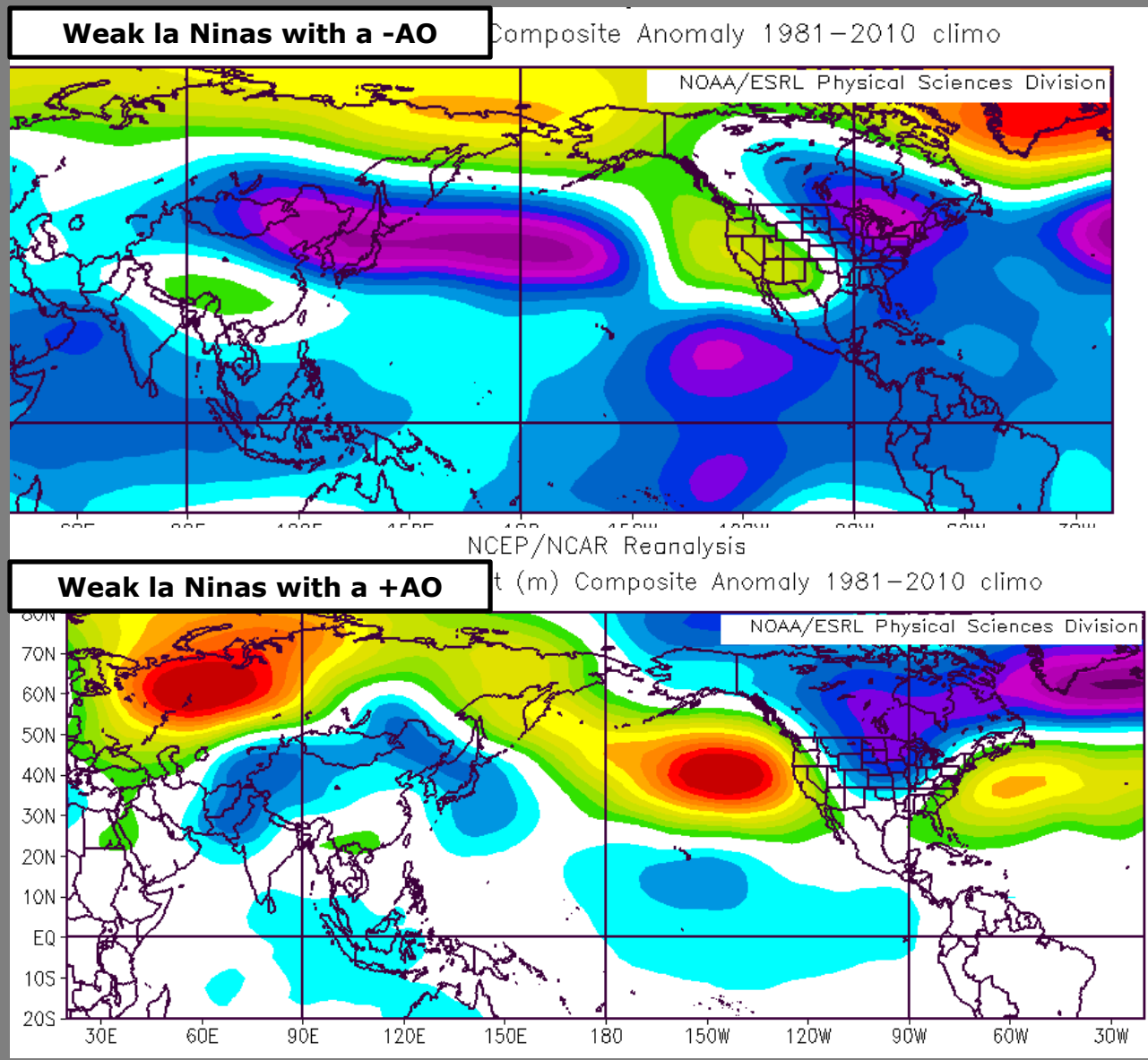
Arctic Oscillation

Weak stratospheric PV suggests a tendency for -AO

1. The AO is a proxy for the strength of the polar vortex. It has been noted that the PV is expected to be weak through at least early winter.

2. The difference between weak la Nina climatologies depending on PV strength is stark. The –AO case (top) has a strong tendency toward an extended Pacific jet.

3. The –AO case also shifts any blocking (e.g. NAO) to the Atlantic instead of the Pacific as in the +AO (bottom) case which features the strong Pacific ridge more characteristic of la Ninas.



Winter Outlook for Southeast Michigan

Temperature Outlook

Extensions of the Pacific jet are likely to continue into early winter until la Nina exerts a stronger influence. The expected tendency for a –AO will only exacerbate this tendency based on the aforementioned –AO/weak la Nina climatology. Early winter is therefore expected to be variable and warmer. As la Nina strengthens and winter goes on, the Pacific jet extensions are expected to become less frequent, possibly allowing blocking to shift to the Pacific which is usually more favorable for more sustained cold weather in SE Michigan.

December: Warmer than normal
January: Slightly warmer than normal
February: Slightly below normal

Snowfall Outlook

Southeast Michigan is likely to contend with milder air through the early part of winter. The potential to evolve toward more troughing will favor a transition toward more typical conditions by mid-winter.

First half of winter (Dec 1 – Jan 15) – Below normal
Second half of winter (Jan 16 – Feb 28) - Normal