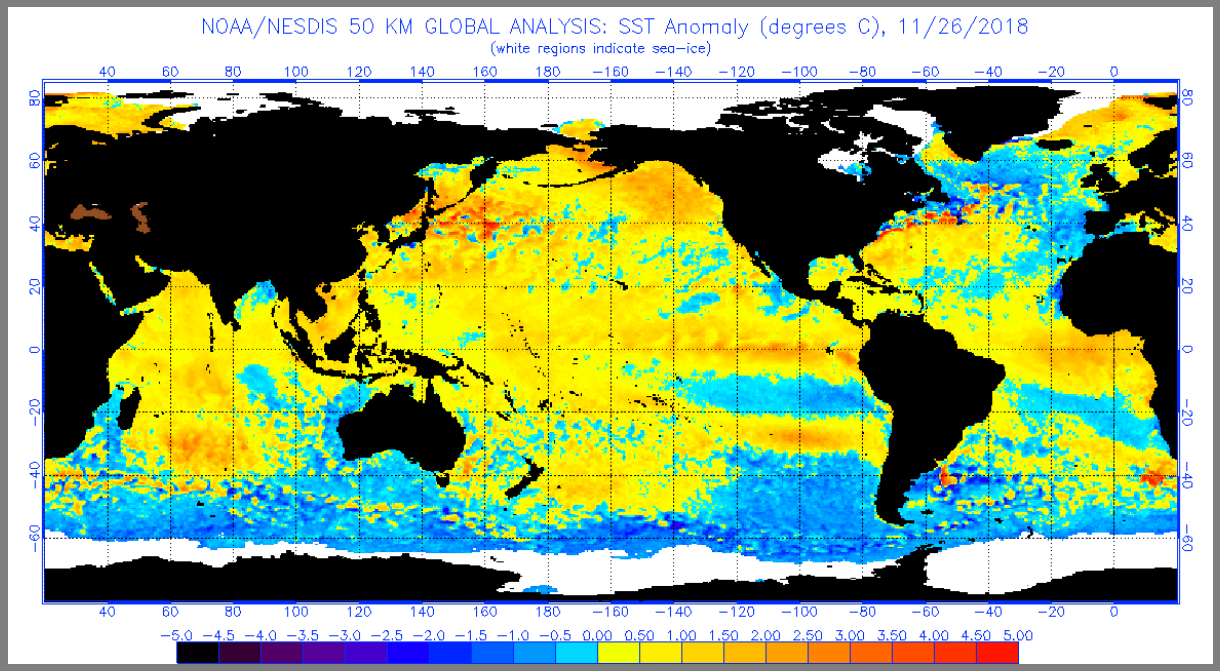
Winter Outlook 2018-2019

Southeast Lower Michigan

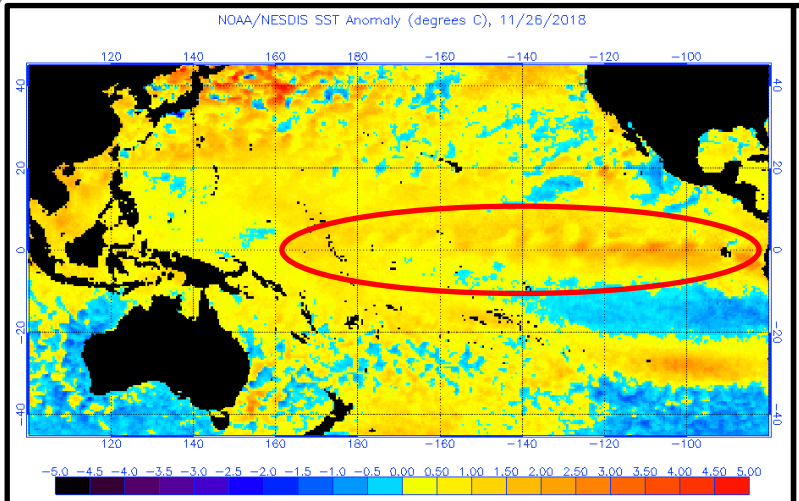
December through February



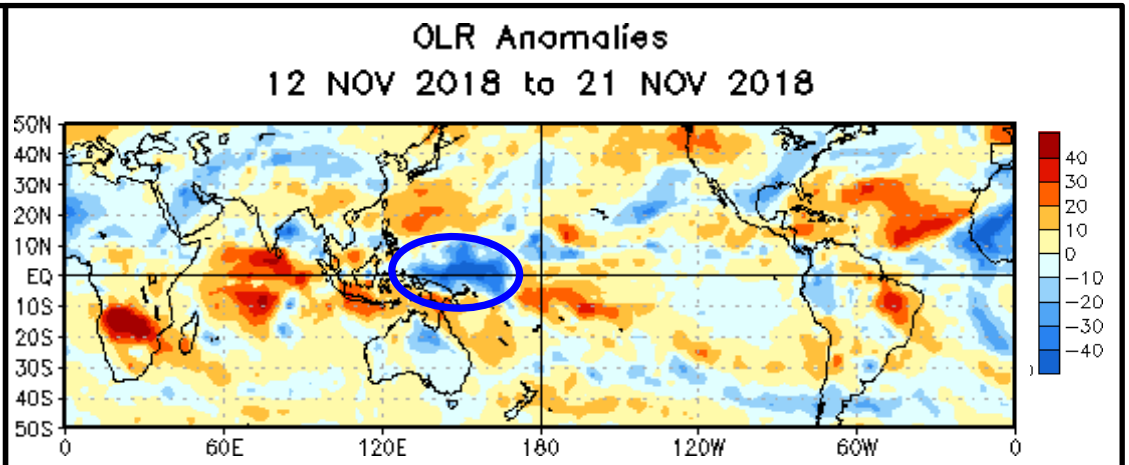
Slide 6: Winter Outlook for SE Michigan
Slides 2-5: Forecast Reasoning

Current Conditions in the Tropics
Sea Surface Temperature (SST) Anomalies

ENSO (el Nino/la Nina) is one of the most predictable forcing mechanisms on seasonal time scales. It directly affects the placement of tropical convection. The subsequent changes to heating and momentum distribution then impact mid-latitude weather. This year, warming SSTs in the highlighted area indicate potential for el Nino or el Nino-like forcing.



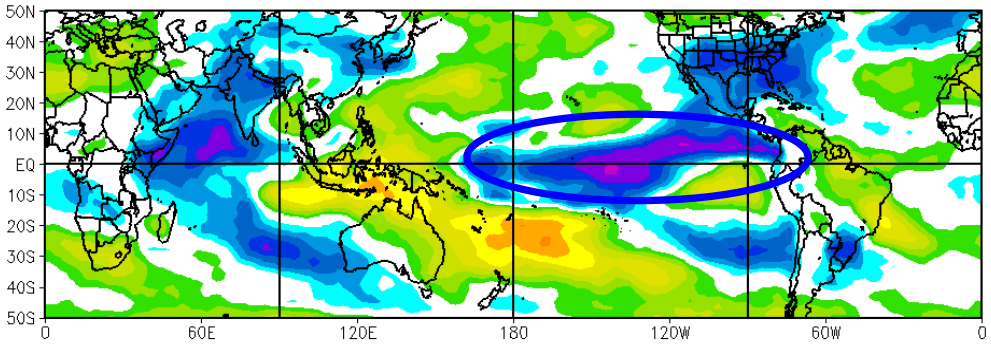
The highlighted band of warmer-than-normal water is the potential focus for winter convection in the tropics, but the specific location of the convection matters.



The dominant area of convection, highlighted, is near 150E. Conditions have been variable recently and, by this metric, do not resemble a coupled ocean-atmosphere el Nino state.

Blue shading (convection) on the *top right* image would be expected to resemble something closer to pattern shown to the *right* in a "classic" el Nino scenario.

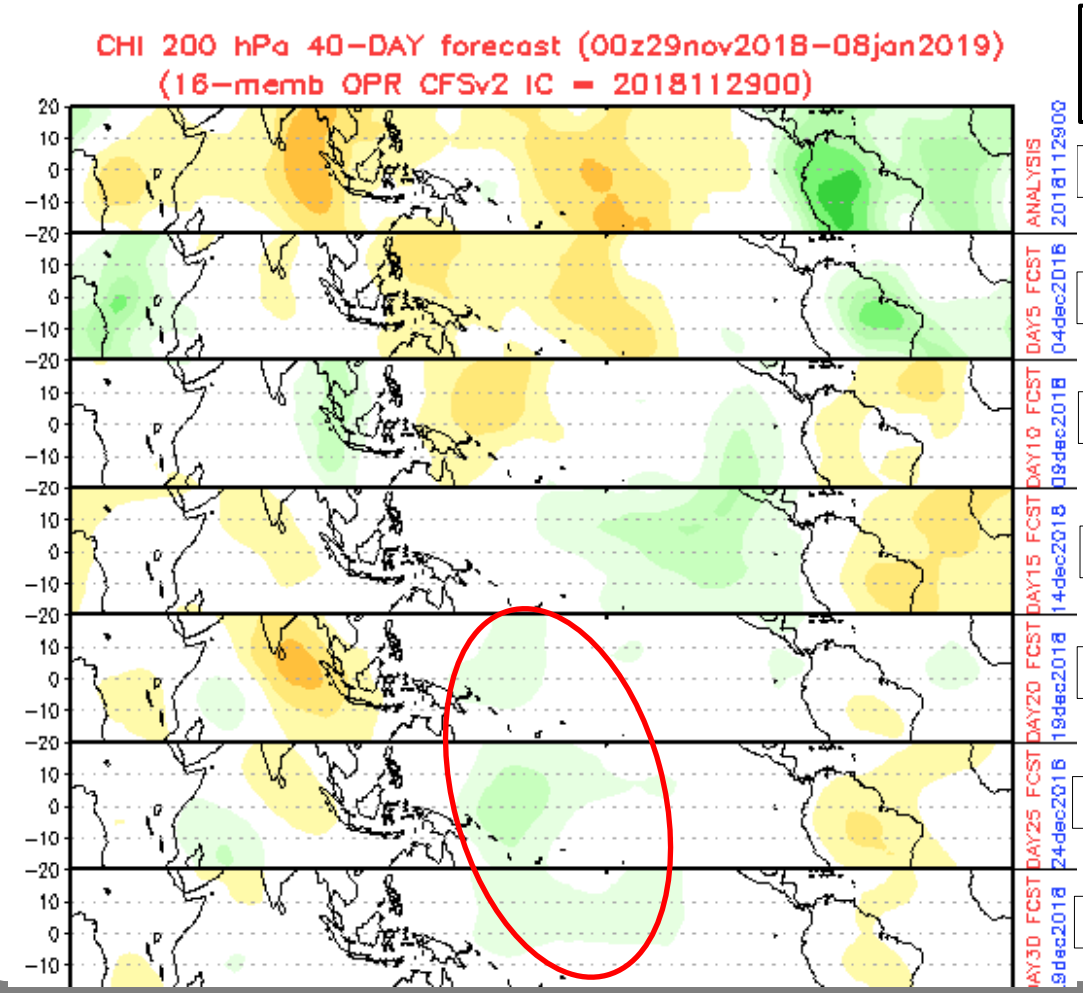
Not shown: the pattern has demonstrated intraseasonal variability recently, which is normal. However, el Nino patterns are generally more stagnant.



Nov 1950 to 2015: Surface OLR Seasonal Correlation w/ Nov MEI

CFS Tropical Output
Velocity Potential

Velocity potential, as in this plot from the Climate Forecast System, can be used as an estimate for the placement of tropical convection. It can be either variable or stagnant. If ENSO (either la Nina or el Nino) is dominant, the signal will usually be stagnant and can be leveraged to improve forecast skill. A standing pattern is not present as we begin winter, but is expected to develop.



Legend
Relatively dry
Relatively wet

Current

Dec 04

Dec 09

Dec 14

Dec 19

Dec 24

Dec 29

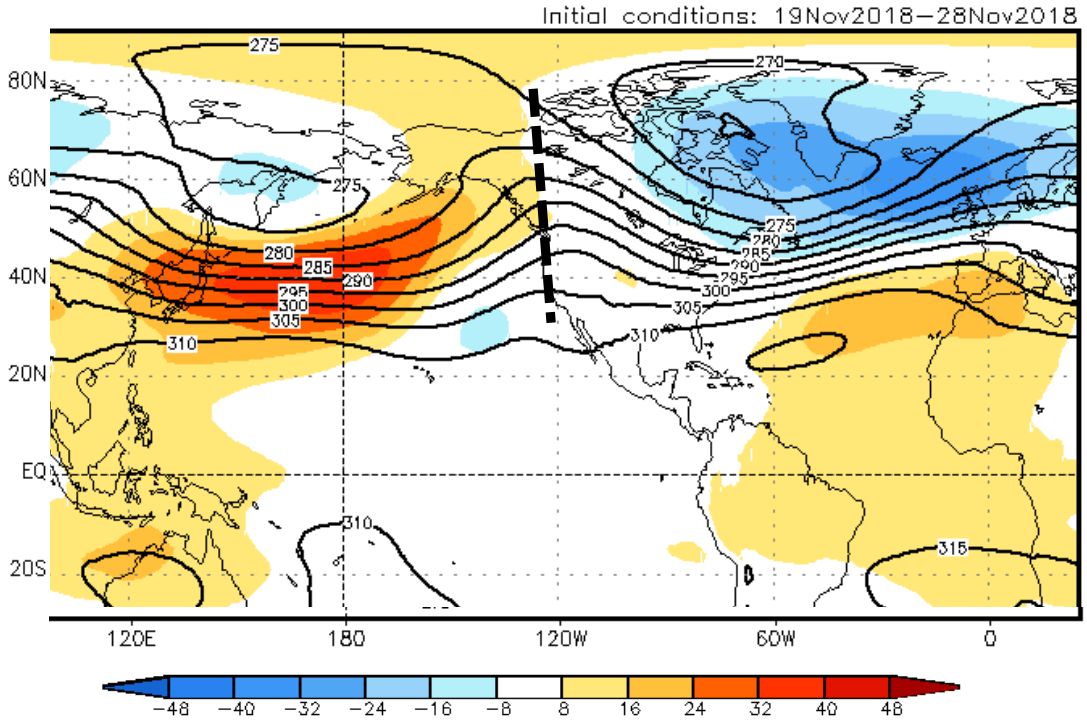
Tropical forcing is variable through mid-December. Medium range models can be used to predict this period.

The CFS suggests a standing seasonal signal, highlighted by the red circle, may be emerging by the end of December, likely related to ENSO processes.

Positioned around the International Dateline, this forcing would be at the western edge of the climatological envelope for el Nino events.

CFS Hemispheric Output
700mb Height

CFS 700mb Height for January 2019



As noted on the last panel, tropical forcing oriented around the International Dateline may take shape toward the end of December.

Left: This plot indicates a retracted Pacific jet. This outcome makes sense given the forecast on the previous slide, which indicates tropical forcing setting up near the International Dateline by the end of 2018. The result would be ridging over western North America (thick, dashed line). *This is a common occurrence during both weak el Ninos and more western-focused el Ninos* (*omitted for brevity*), so this output makes sense both physically and climatologically.

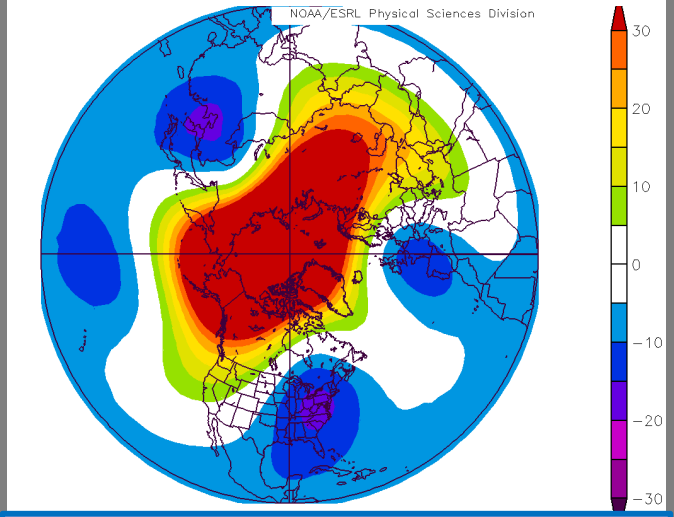
Furthermore, some retrograding and amplification of the depicted US pattern must be implied. This is due to the model's (any long range model's) coarse resolution.

This output therefore suggests greater potential for cold developing in Southeast Michigan during January.

Current Stratosphere State
Immature Westerly QBO in Progress

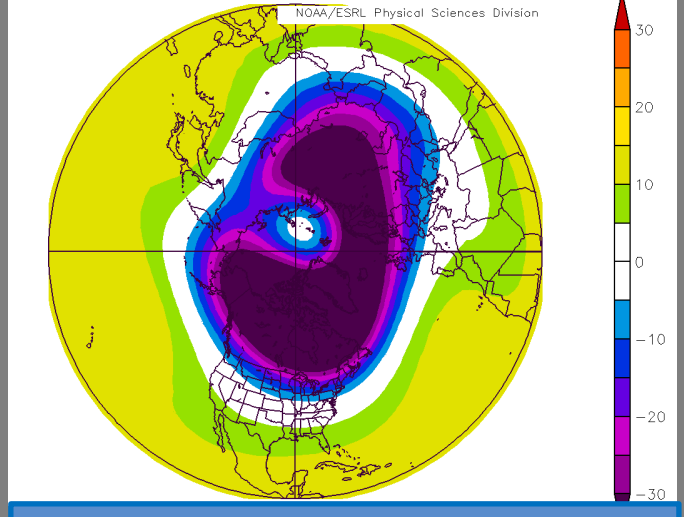
Composite 50mb geopotential height anomalies for 2 different stratospheric wind scenarios

Immature Westerly QBO



Immature +QBO: Developing westerlies in the stratosphere have yet to fully descend to the lower stratosphere at the onset of winter.

Mature Westerly QBO



Mature +QBO: Developing westerlies in the stratosphere have yet to fully descend to the lower stratosphere at the onset of winter.

The potential strength of the polar night jet is closely tied to the QBO, a predictable oscillation of stratospheric winds that can modulate the nature of Rossby wave breaking in northern hemisphere winter (Baldwin et al 2001, Hitchman and Huesman 2008). When a westerly QBO has fully descended by the onset of winter, climatology strongly favors a strong polar night jet (*right*) (Holton & Tan 1980) that is less favorable for outbreaks of cold air in the mid-latitudes.

When westerly descent is *still in progress*, however, the polar vortex is climatologically weak (*left*). *This is the case as we head into Winter 2018-2019*. Furthermore, this potential for weakening has an increased potential to be realized as medium-range forecast models indicate the development of a strong Aleutian low supported by a strong Pacific jet during December. Garfinkel et al (2010) note that wave breaking associated with this pattern is particularly effective in weakening the polar night jet because it reinforces existing climatological asymmetries in the polar vortex. A relatively weak polar night jet is therefore likely this winter. The implication is that cold air will be readily accessible to the mid-latitudes.

Winter Outlook for Southeast Michigan

Temperature Outlook

December and potentially part of January will be characterized by progressive pattern, likely anchored for a period of time by an Aleutian low pressure. This would favor more warmth than has been observed during the last 6 weeks, although such warmth is unlikely to be extreme. The development of such a pattern will likely weaken a polar vortex that may already be in a weakened state to begin with. Considered along with CPC's expectation for a weak el Nino and CFS modeling of a western-displaced longitude for associated tropical forcing, the eventual development of a cold pattern during mid-winter is more likely than normal.

December into early January: Normal or slightly warmer than normal
January into February: Colder than normal

Snowfall Outlook

More frequent warmer episodes and potential for a period of sustained warmth in December followed by signals for northwest flow are qualitatively suggestive of relatively low snow potential. However, minor adjustments in the position of a trough can lead to frequent clippers while an enhanced subtropical jet associated with el Nino serves as a pervasive wildcard for individually significant snowstorms.

December – Slightly below normal
January and February – Slightly above normal