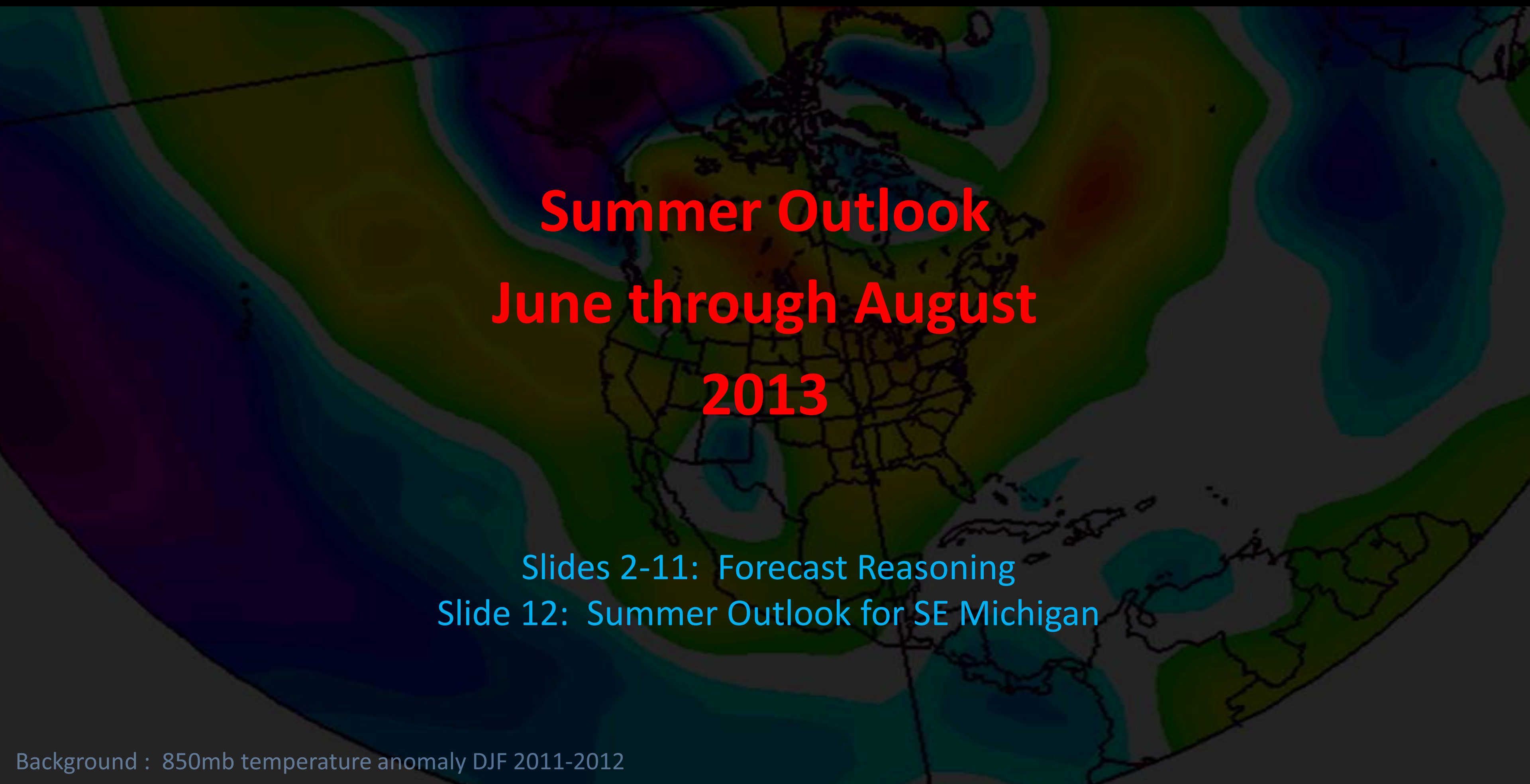
Summer Outlook 2013

Southeast Lower Michigan



Summer Outlook
June through August
2013

Slides 2-11: Forecast Reasoning
Slide 12: Summer Outlook for SE Michigan

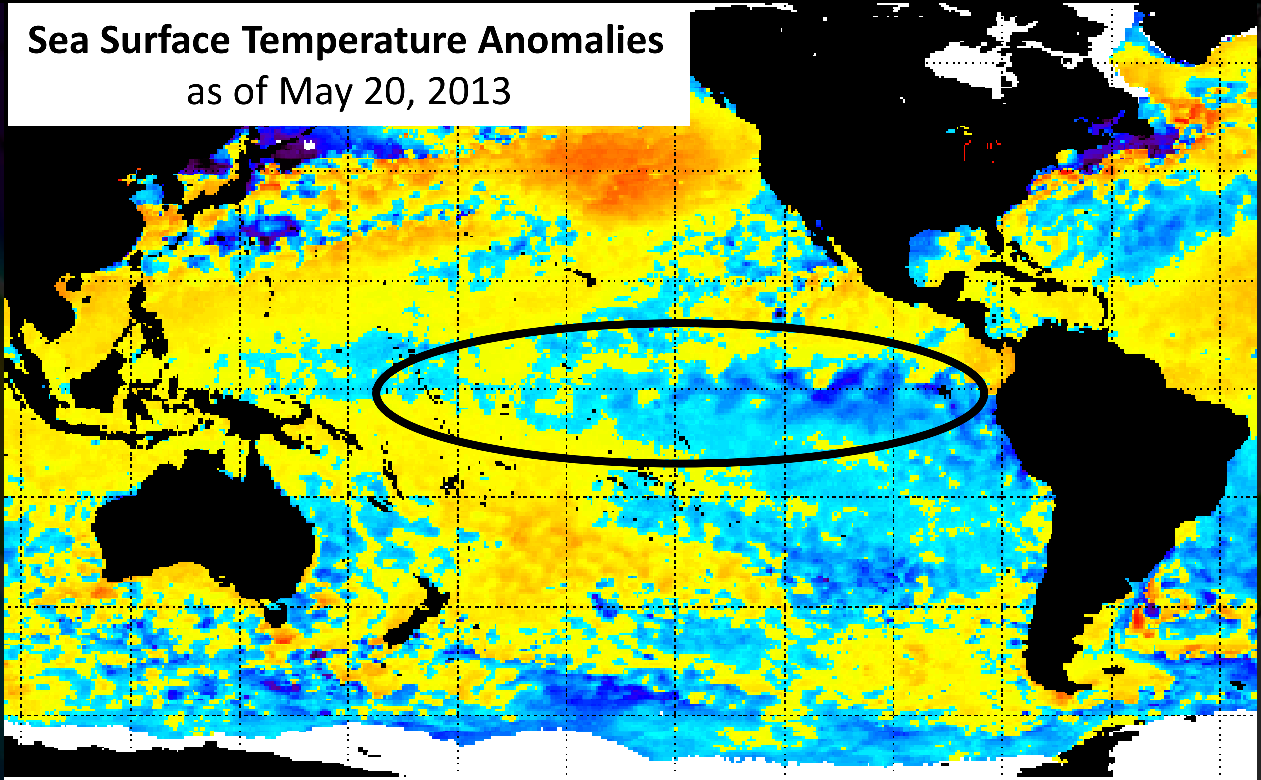
Background : 850mb temperature anomaly DJF 2011-2012

Current Conditions

ENSO and the Walker Circulation

ENSO is a powerful forcing mechanism for weather patterns on the hemispheric spatial scale and seasonal time scale and is typically the starting point for any type of seasonal outlook.

Currently, upwelling in the east Pacific Ocean has supported the recent emergence of a coherent field of below normal sea surface temperature (SST) anomalies.



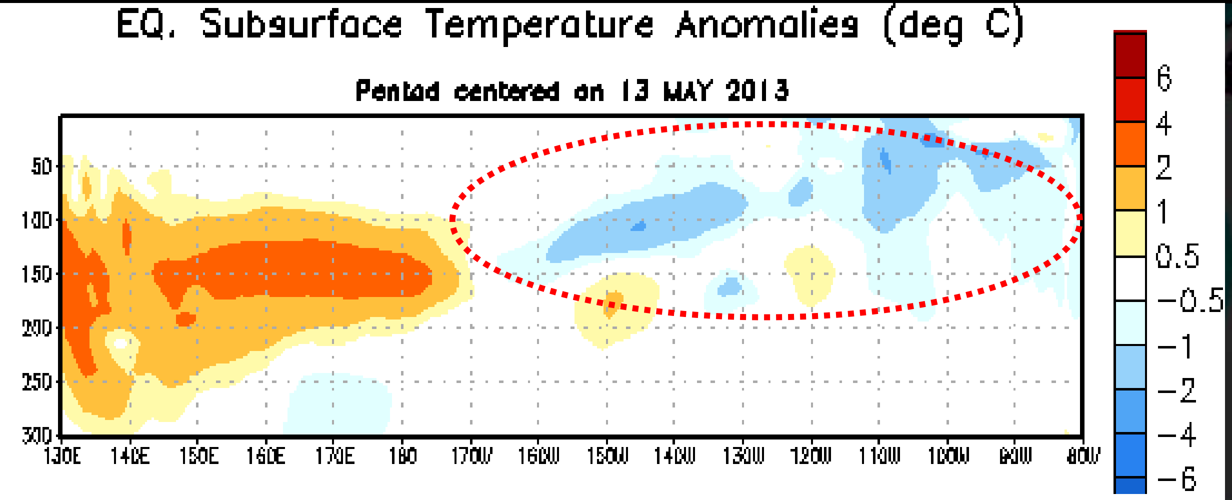
For the latest ENSO conditions, visit the Climate Prediction Center's (CPC) [ENSO page]

Current Conditions

ENSO and the Walker Circulation

This cross-section analysis of temperature anomalies beneath the ocean surface reveals another coherent pattern of cold anomalies 0 to 200 meters below the ocean surface.

This suggests that the surface cold anomalies on the previous slide may have some staying power, at least through the first part of summer.



Pentad analysis as of 20 May, 2013

For the latest ENSO conditions, visit the Climate Prediction Center's (CPC) [ENSO page]

View the latest subsurface temperature anomalies [here]

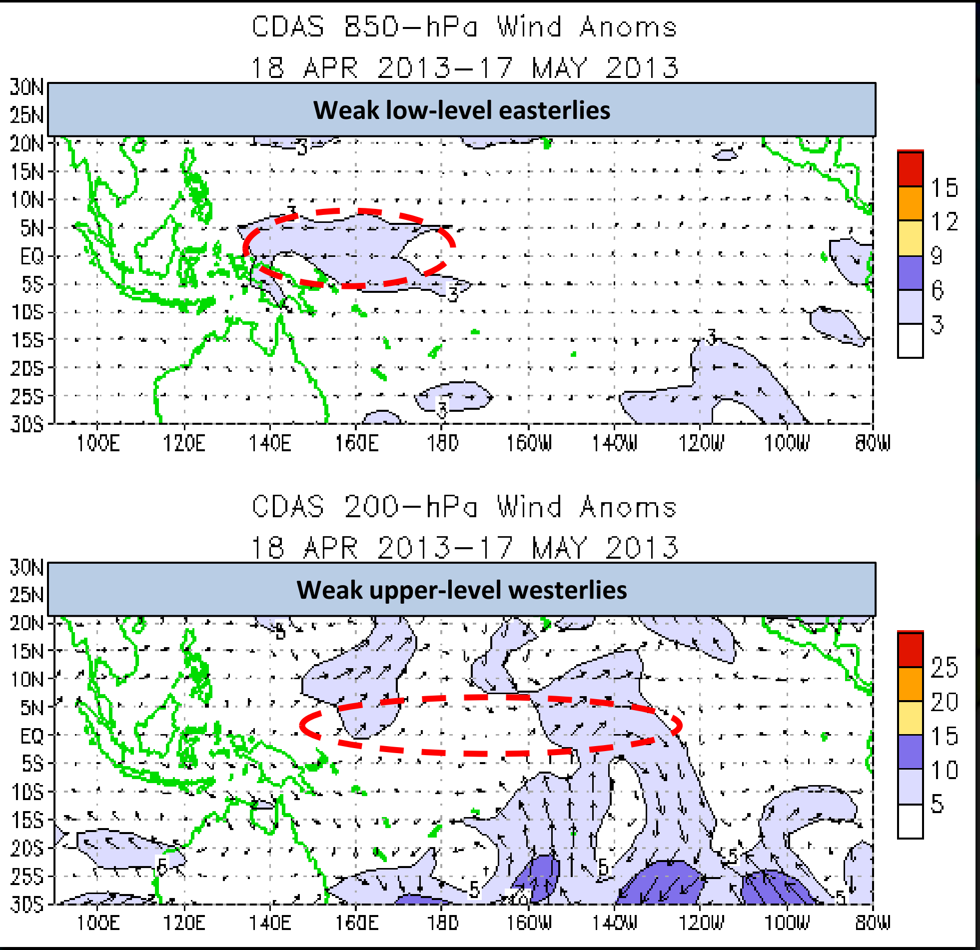
Current Conditions

ENSO and the Walker Circulation

Weak low-level easterlies (top right) and weak upper-level westerlies (bottom right) suggest that the tropical Walker Circulation is in a neutral to slightly negative state.

This will only be supported by the aforementioned SST patterns. *Therefore, ENSO can be expected to exhibit neutral to negative-neutral characteristics through the summer.*

The description of current conditions as neutral is quantitatively supported by the March-April bi-month MEI value of 0.009, where values near zero are considered “neutral”.

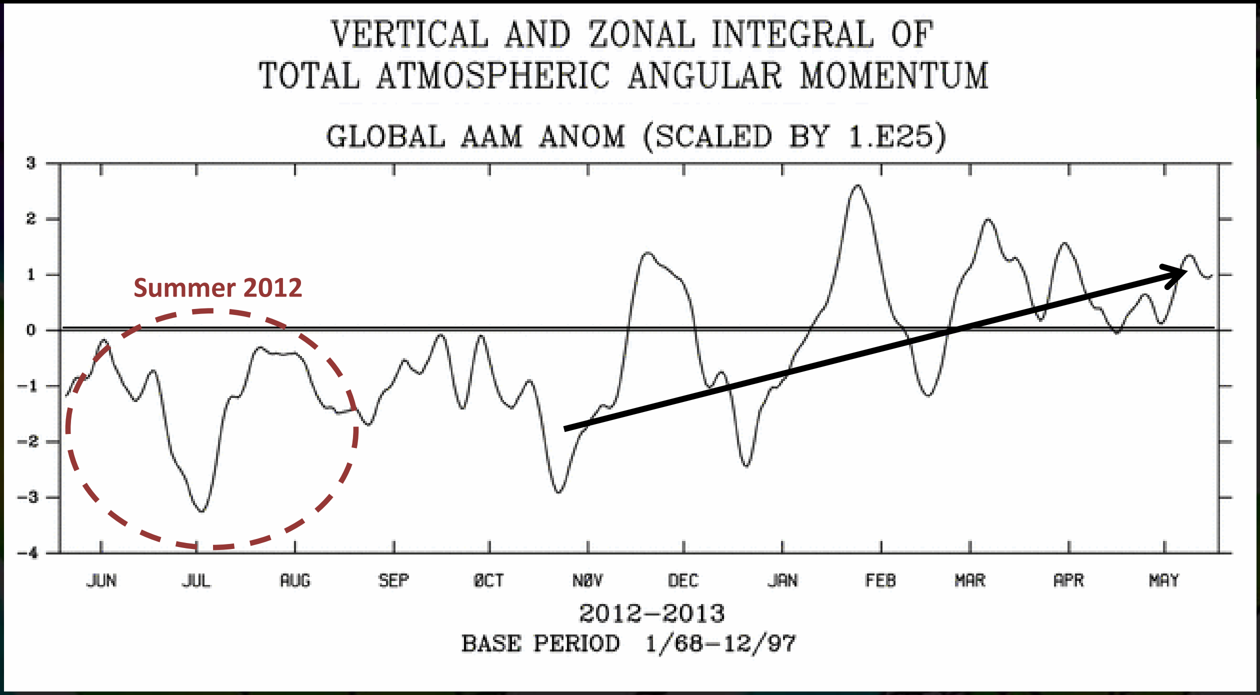


Read more about current the MEI [here]

Current Conditions

Total Atmospheric Momentum (departure from normal)

The atmosphere has been steadily climbing out of the anomalousy negative state that it spent much of the last year in. Although a negative-neutral type of ENSO state (previous slide) may tend to weakly act against this, the recovery toward positive territory is readily apparent and will be sustained, partially, by anomalous westerly winds that are currently downwelling from the upper stratosphere (more on next slide).



Current Conditions

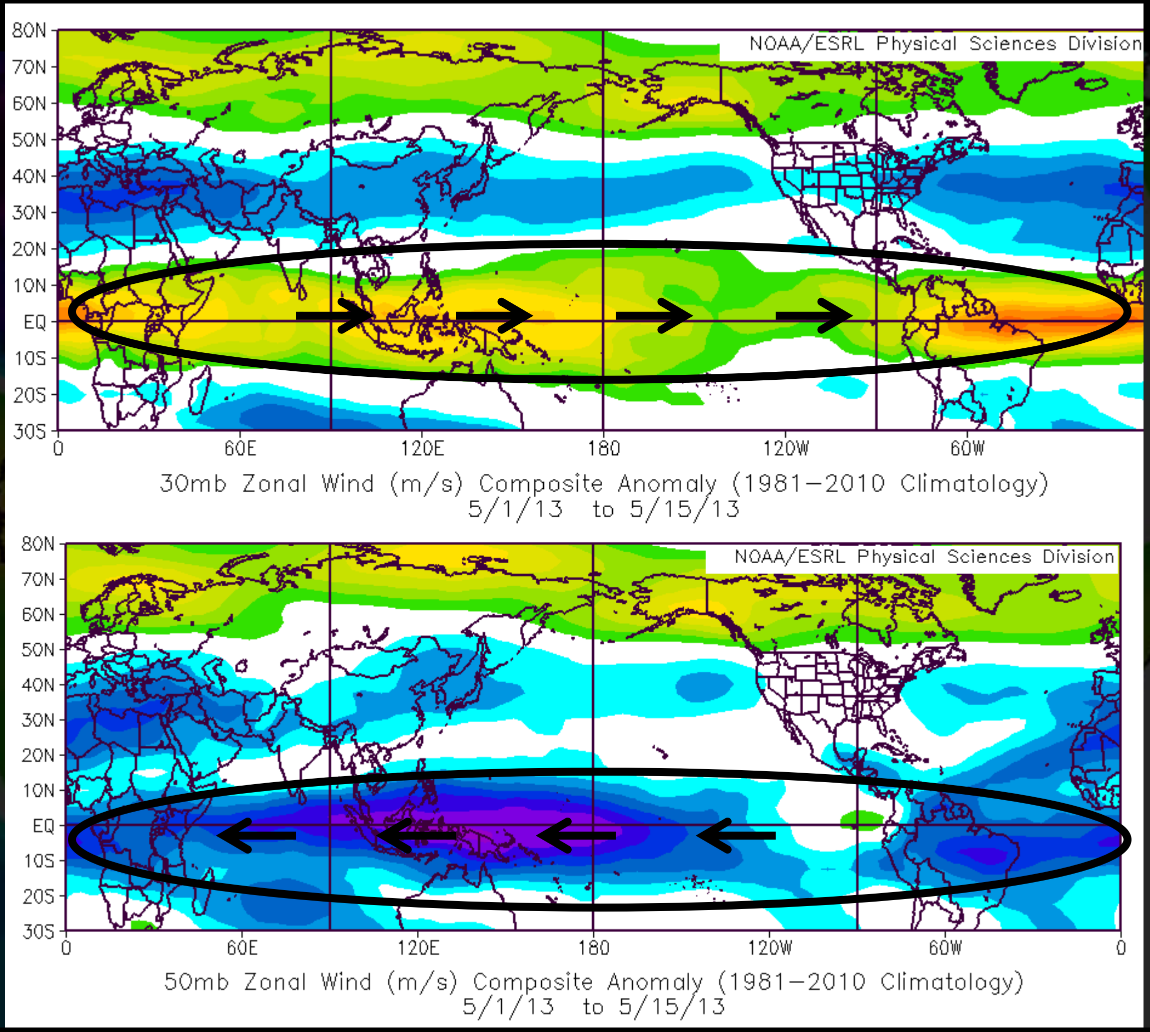
Downwelling westerlies in the tropical stratosphere

The aforementioned westerly winds observed in the upper stratosphere (top right) are now downwelling toward the lower stratosphere. However, they have yet to reach the lower stratosphere, where easterly flow still prevails, as it has for the last several months.

Based on past behavior, the easterly winds in the lower stratosphere should be expected to weaken, with westerly anomalies emerging during the summer.

This highly predictable phenomenon is often referred to as the “quasi-biennial oscillation”, or “QBO”.

The QBO can project onto the momentum budget (previous slide) and, without a well-defined ENSO circulation in place nor expected to develop, it represents one of Summer 2013’s primary predictable contributors to the momentum budget.

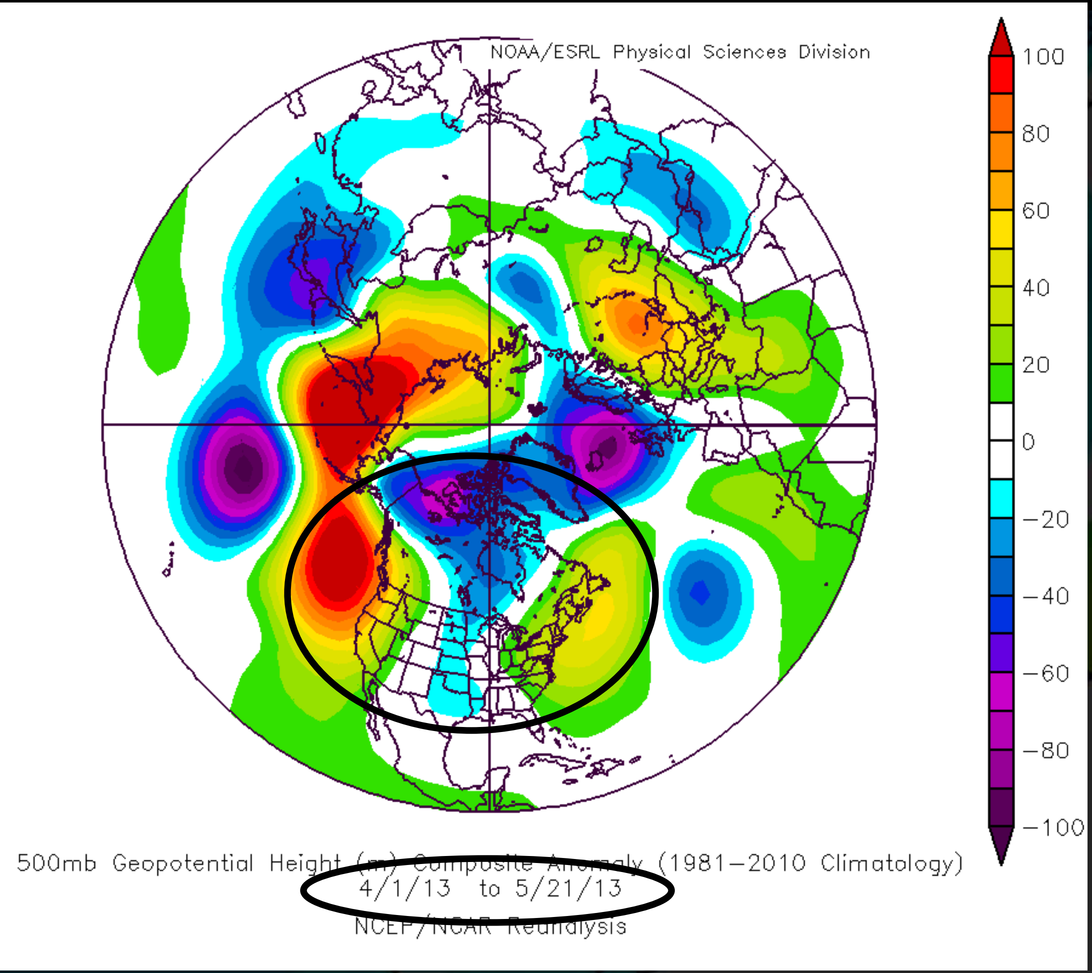


Current Conditions

Downwelling westerlies in the tropical stratosphere

Past years during which the QBO behaved similarly (downwelling westerly phase underway or recently completed by early summer) exhibited a strong tendency for dominant low pressure to reside over northern Canada with the North American continent flanked by ridging on either side.

In fact, this is not dissimilar to what has been observed during the latter portion of Spring 2013. Note the upper air pattern across North America between 4/1 and 5/21 2013 (right).

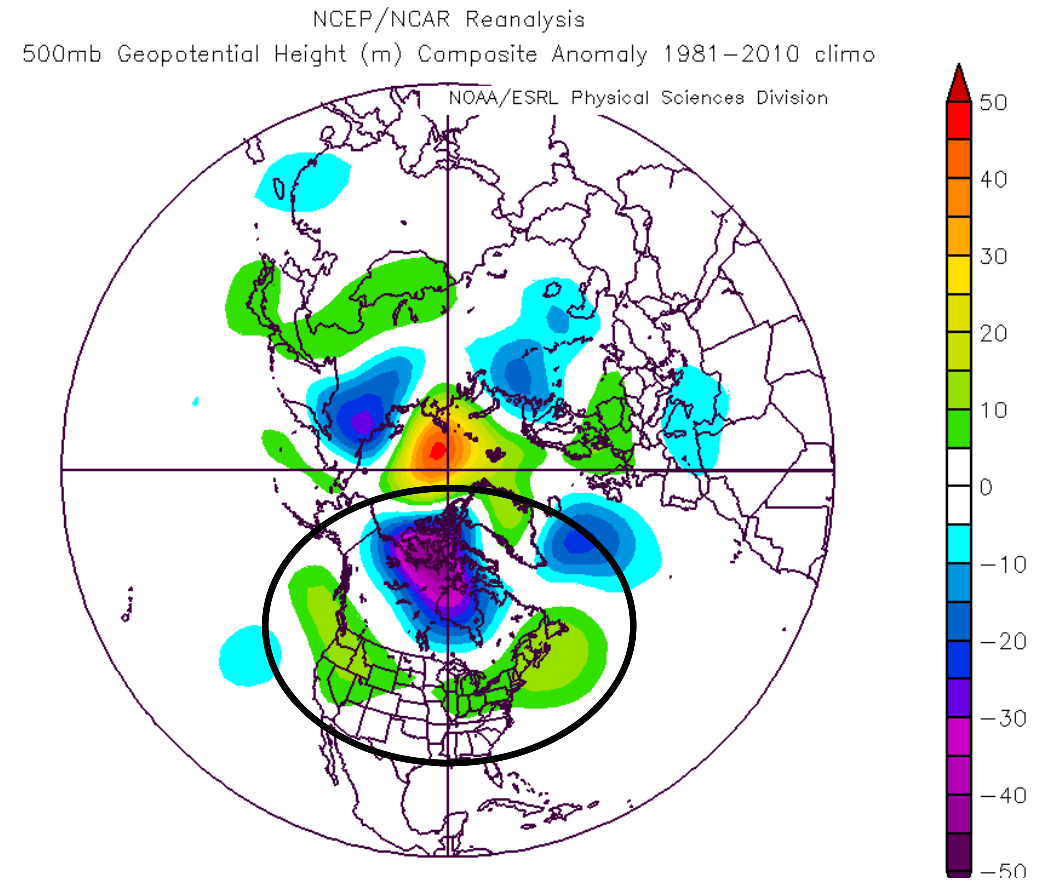


Current Conditions

Downwelling westerlies in the tropical stratosphere

Note the strong similarities to the average of nine previous years (right) which exhibited a similar behavior of downwelling stratospheric westerlies during summer's onset.

It should be noted that while the signal was quite strong through July, it washed out by late summer. This general idea matches well with ideas discussed thus far, which support little change through approximately the first half of summer.

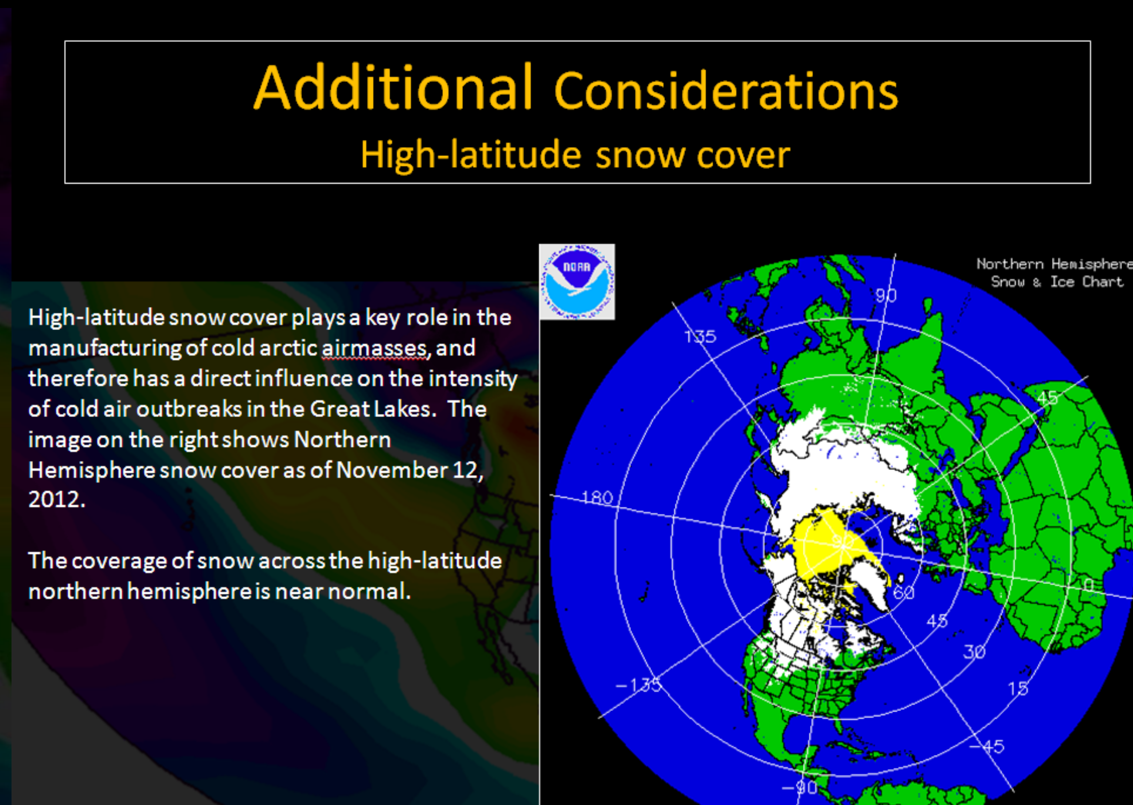


500mb composite anomaly for **July** of nine years with similar QBO behavior

Additional Considerations
The boundary layer

In the winter, snow cover plays an important role in the development of cold airmasses which are eventually carried into SE Michigan by the numerous weather systems that affect the region during a given winter. As a result, analysis of Northern Hemisphere snow cover in late Autumn is often an important part of a winter outlook.

During the Drought of 2012, SE Michigan saw first-hand how boundary layer conditions can affect the intensity summer airmasses. Hot and dry air generated upstream led to multiple hot stretches and ultimately to 2012 tying 2005 for the Detroit Area's hottest summer on record. How might drought affect us this year?



Screen capture from the NWS White Lake's 2012-2013 Winter Outlook

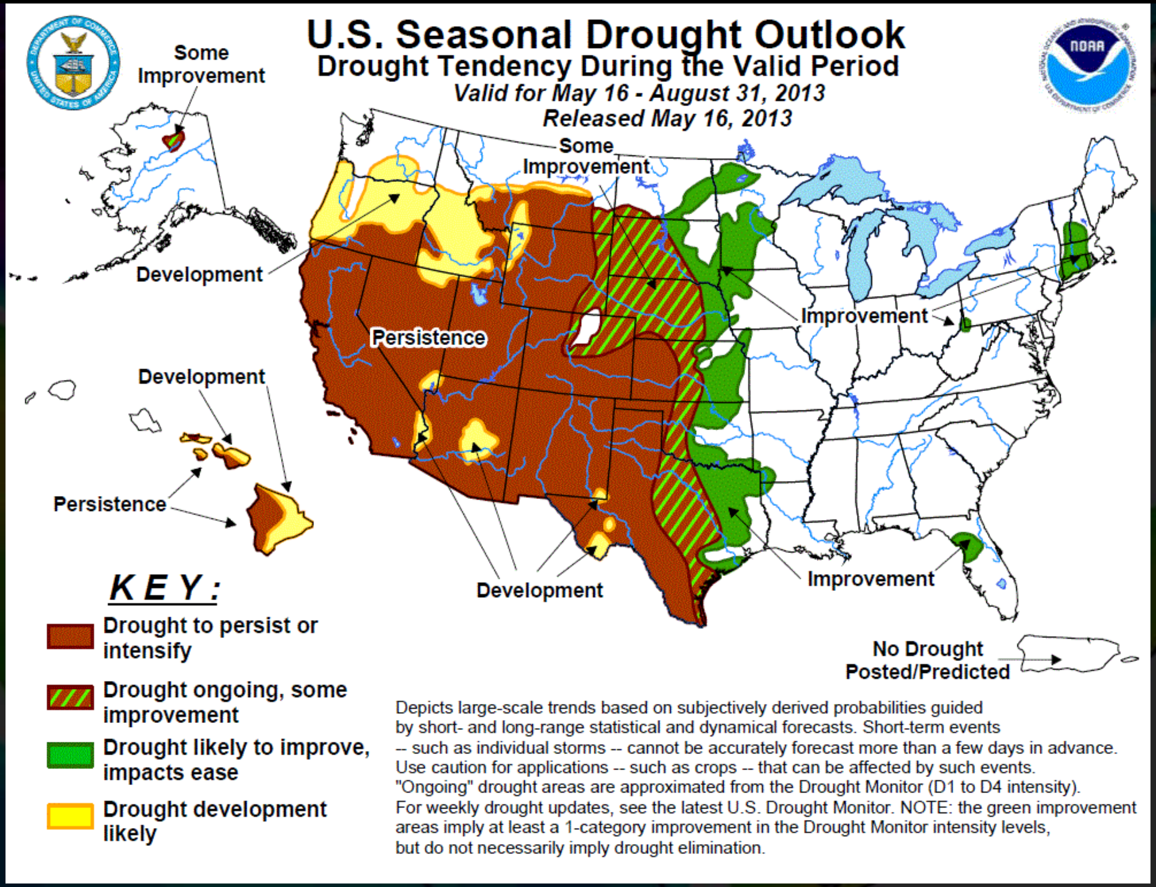
Boundary Layer Contributions

Drought Coverage

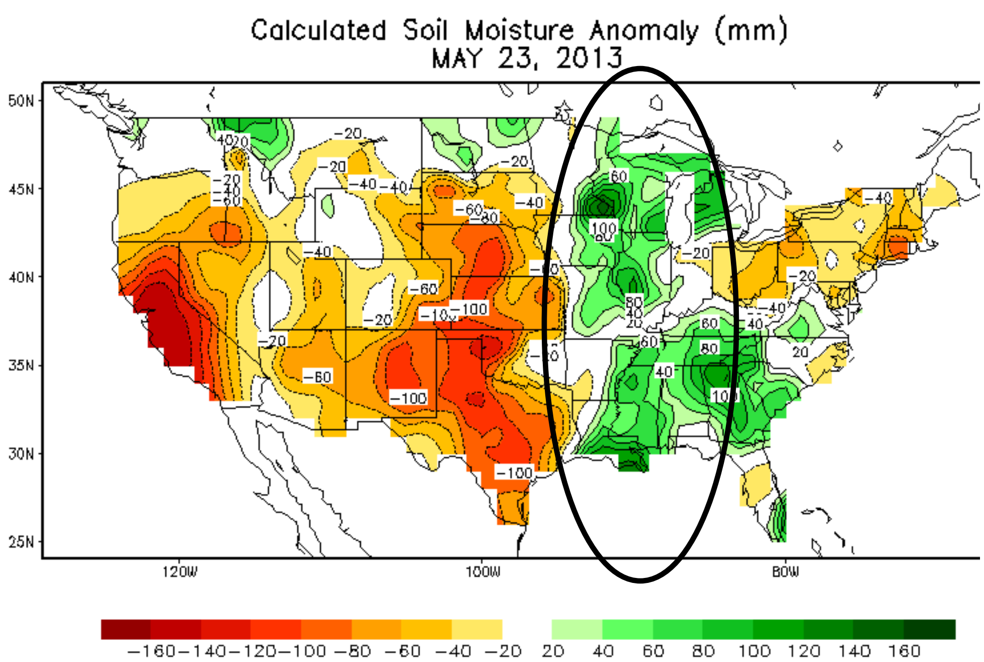
Persistent drought often becomes a first order driver of the pattern during summer. This was seen last summer as intense drought gripped much of the country and simultaneously reinforced the existing hot and dry pattern.

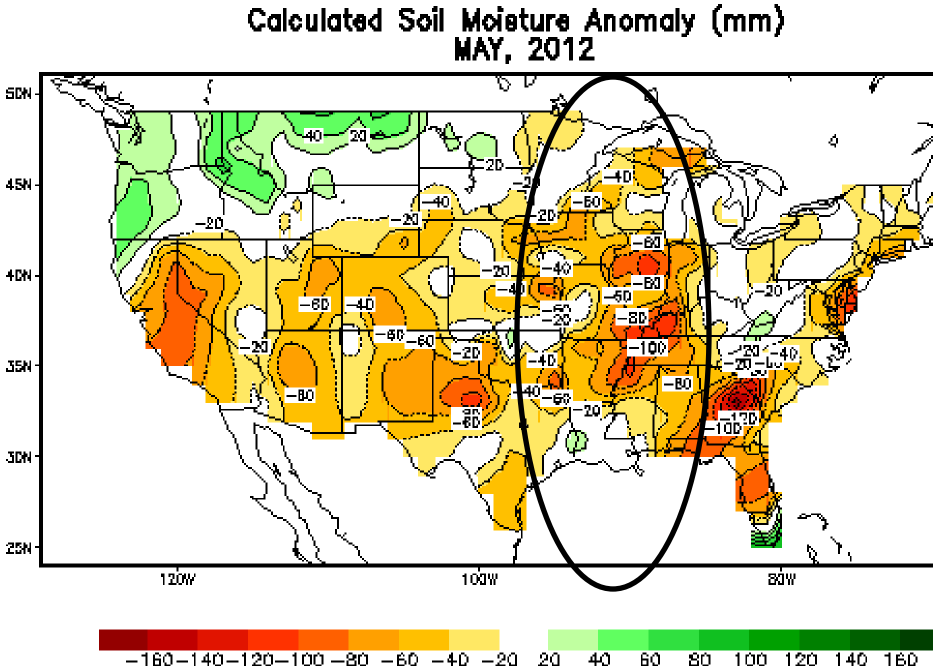
Expansive drought conditions are currently in place across the western United States, but improvement has occurred and continues to be expected throughout much of the plains.

A relatively wet springtime pattern east of the Rockies will promote a healthy green-up for vegetation, which can help immediate upstream areas act as a buffer between conditions in SE Michigan and much warmer air located to the west.



Upstream Boundary Layer
May 2013 (left) vs May 2012 (right)





Soil moisture plays a role in the green-up process, but is also an important player in its own right as it can also modulate drought to a certain extent. Note the pronounced difference in soil moisture content between late May 2013 (left) and May 2012 (right). The high moisture content between Michigan and much drier upstream areas should not only help vegetation in these areas thrive in comparison to last year (as noted on the previous slide), but will act as yet an additional buffer against extreme temperatures reaching SE Michigan from their upstream source regions over the central and western Great Plains.

Get more information on soil moisture here

Summer Outlook for Southeast Michigan

Expect a fairly typical summer

Temperature Trends

The discussed factors favor mainly neutral conditions for Summer 2013 in SE Michigan, not unlike what has been observed for much of this spring. Significant departures from normal are not expected, especially not during the first half of summer. However, the persistence of upstream drought cannot be ignored since it will help generate a significant pool of warmer temperatures from which weather systems affecting SE Michigan will be able to draw. Although there is currently some degree of a buffer in place (previous 2 slides), it is no guarantee that it will stand up against the persistent drought conditions immediately upstream. The second half of Summer 2013 therefore carries increased potential for above normal temperatures, although not necessarily a greater potential than normal. The temperature outlook is below:

First half (June 1 – July 16): Near normal temperatures

Second half (July 17 – August 31): Slightly above normal temperatures with the hottest days and longest duration heat spells expected during this period.

Precipitation Trends

Warm season precipitation is dominated by thunderstorm activity and is notoriously difficult to predict at seasonal time scales. Without a strong signal favoring any significant departures from normal, the outlook is for rainfall patterns to be near normal for SE Michigan this summer.

Summer 2013: Normal rainfall

Summer Trivia for Southeast Michigan

Warmest temperature: **Tri-Cities: 111F** (7/13/1936), **Flint: 108F** (7/13/1936), **Detroit: 105F** (7/24/1934)
Warmest month: **Tri-Citie**s: **77.5F** (Jul 1921), **Flint: 78.0F** (Jul 1921), **Detroit: 79.3F** (Jul 2011)
Warmest summer: **Tri-Cities: 73.3F** (1933), **Flint: 74.2F** (1933), **Detroit: 74.8F** (2012)

Coldest temperature: **Tri-Cities**: **33F** (6/8/1949), **Flint: 33F** (6/4/1998), **Detroit: 36F** (6/11/1972)
Coldest month: **Tri-Cities**: **60.6F** (Jun 1982), **Flint: 60.1F** (Jun 1969), **Detroit: 62.8F** (Jun 1985)
Coldest summer: **Tri-Cities**: **64.8F** (1915), **Flint: 65.4F** (1992), **Detroit: 66.5F** (1915)

Wettest month: **Tri-Cities: 9.43”** (Aug 2012), **Flint: 11.18”** (Aug 1937), **Detroit: 8.76”** (Jul 1876)
Wettest summer: **Tri-Cities: 16.28”** (1928), **Flint: 18.39”** (1937), **Detroit: 16.96”** (1896)

Driest month: **Tri-Cities: 0.27”** (Aug 1927), **Flint: 0.16”** (Jul 1939), **Detroit: 0.16”** (Aug 1894)
Driest summer: **Tri-Cities: 3.54”** (1927), **Flint: 3.76”** (1930), **Detroit: 3.58”** (1911)

Average first 90 degree temperature: **Tri-Cities:** Jun 17th , **Flint:** Jun 18th, **Detroit:** Jun 19th
Climatological chance of reaching 100 degrees: 13-14% or once every 18-20 years.