Winter Outlook 2013-2014

Southeast Lower Michigan

Winter Outlook

December through February

2013-2014

Slides 2-8: Forecast Reasoning

Slide 9: Winter Outlook for SE Michigan

Background : 850mb temperature anomaly DJF 2011-2012

Current Conditions

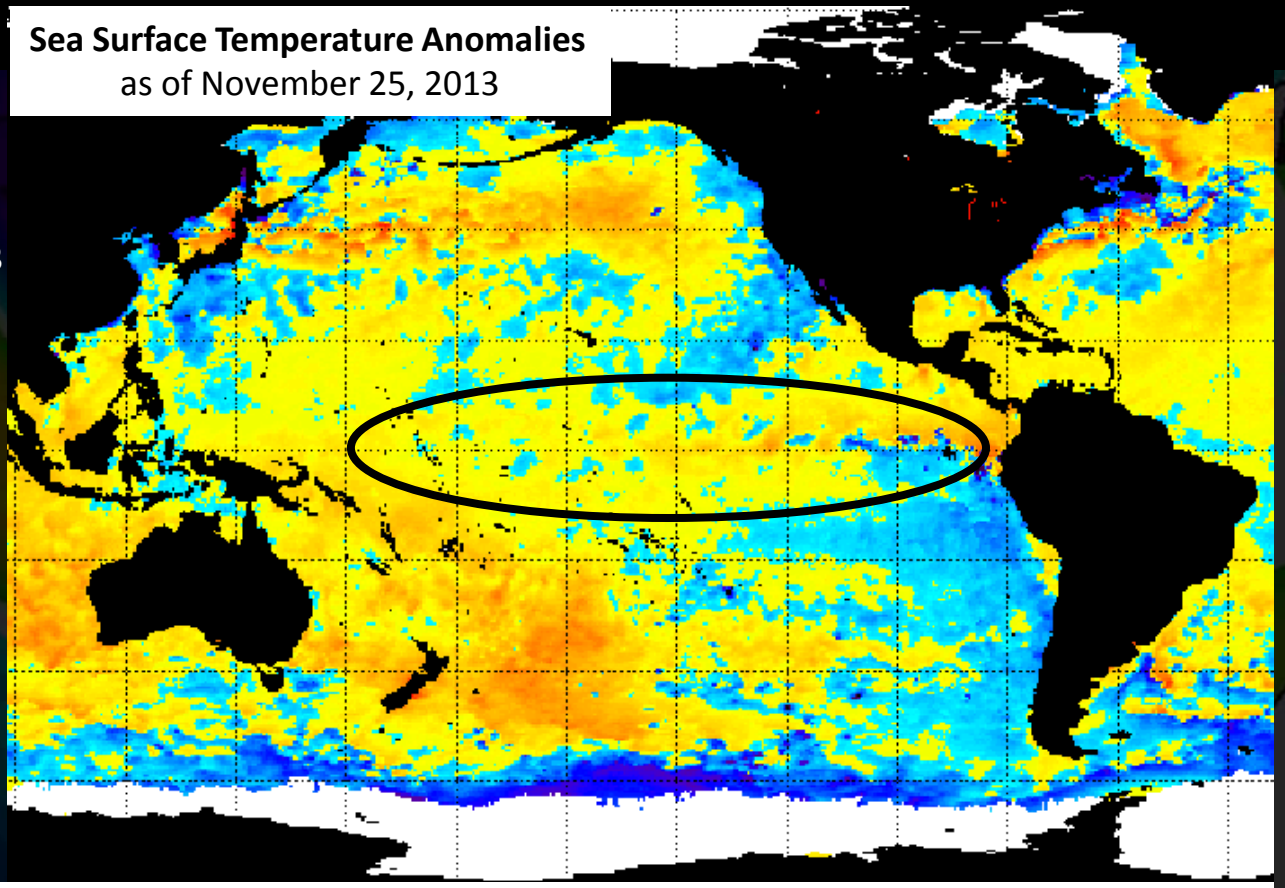
Neutral ENSO Conditions in the Tropical Pacific

There is no dominant ENSO signal in the tropical Pacific.

This is confirmed by late Autumn 2013 MEI values, a superior method of quantifying the tropical circulation, which remains near neutral values.

Forecast models suggest little change.

Sea Surface Temperature Anomalies
as of November 25, 2013



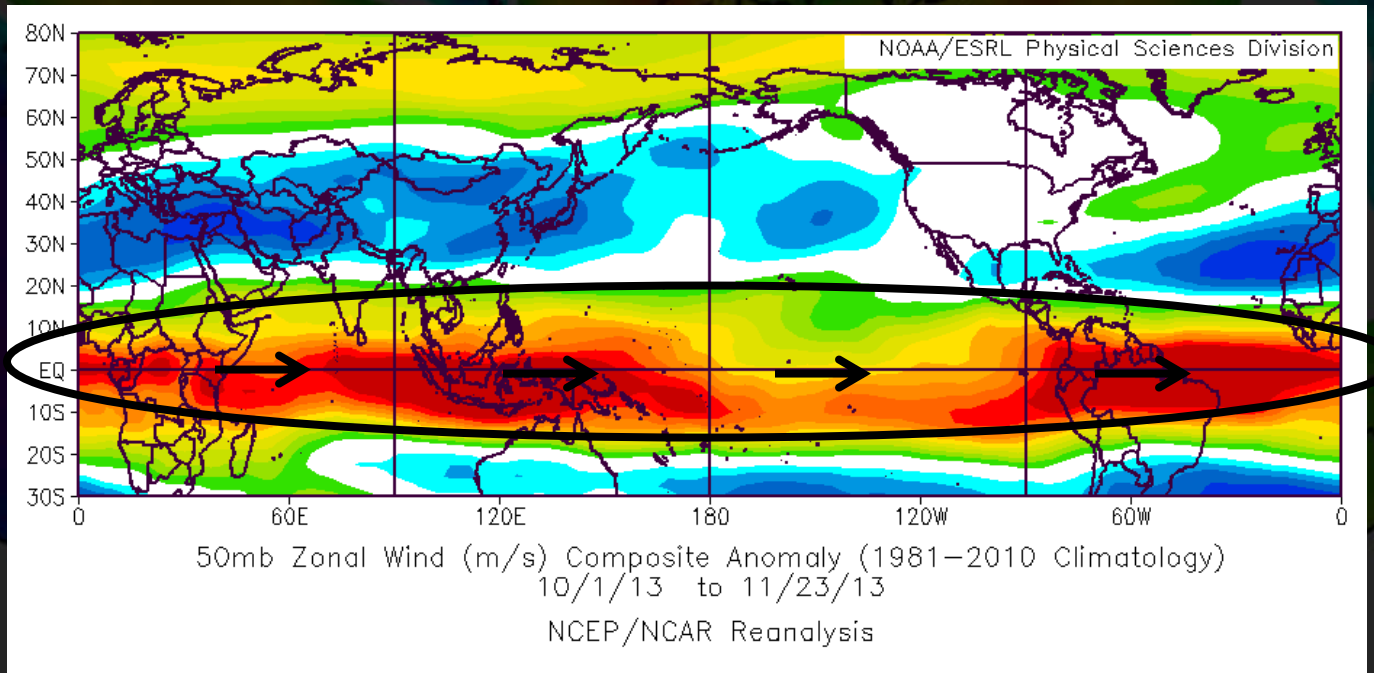
Read more about the multi-variate ENSO index (MEI) here. Get the most up-to-date information on ENSO here.

Current Conditions

Emerging Westerlies in the Tropical Stratosphere

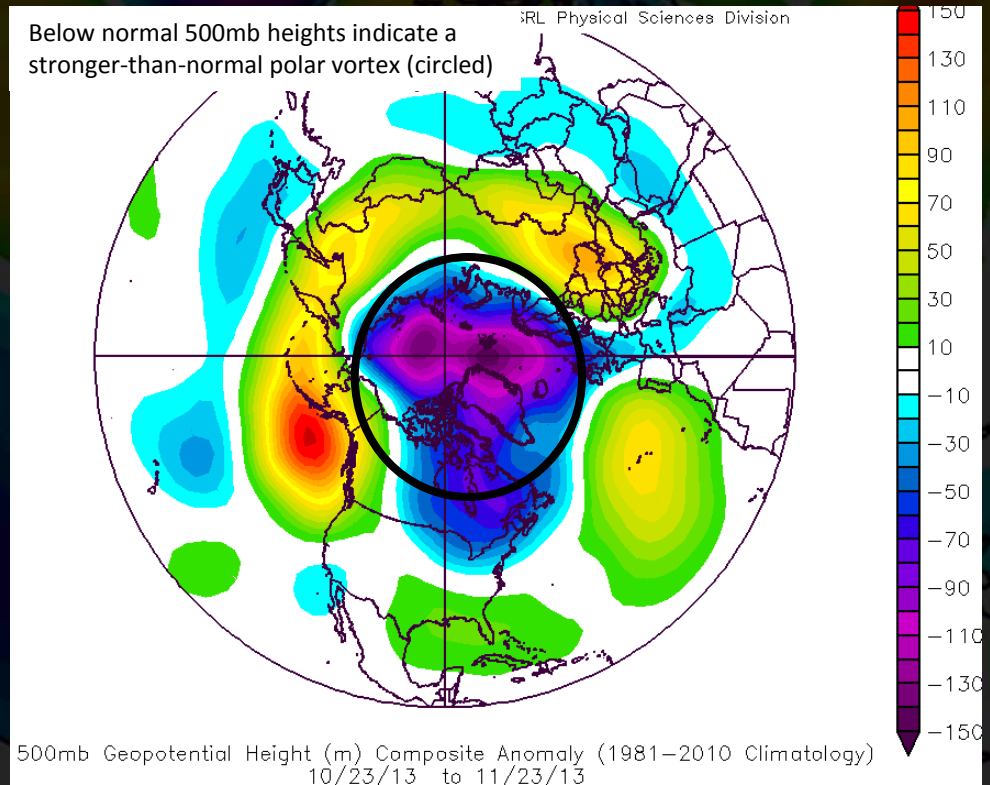
Winds in the stratosphere oscillate between westerly & easterly. Their direction is generally predictable on a seasonal timescale and they are quite possibly the most easily predictable seasonal-scale forcing mechanism. The physical implications of these winds, commonly known as the Quasi-biennial Oscillation (QBO), on the behavior of the wintertime atmosphere in the northern hemisphere are important.

A primary consequence of the *westerly* phase, or +QBO (*present*/below), is that it tends to be prohibitive of atmospheric wave energy being dissipated poleward. As a result, the polar jet is less likely to experience the type of decelerations seen during the easterly phase. *Major cold air outbreaks across the eastern U.S. can therefore be harder to come by.*



Current Conditions
Strong/Strengthening Polar Vortex

It was just noted that a +QBO is more prohibitive of the poleward direction of atmospheric wave energy. This provides a favorable background condition for the maintenance of a strong polar vortex extending through the stratosphere and the troposphere. Current conditions indicate that the polar vortex is *already* in rather strong state (circled). Shielded to some extent by the aforementioned westerlies, it is likely that a *strong polar vortex will persist for most or all of the upcoming winter*. This also means that popular indices such as the NAO ("north atlantic oscillation") and AO ("arctic oscillation") will be mainly positive through at least the first 2/3 or so of winter.



Current Conditions

Stratospheric Temperatures and Sudden Warmings

From another perspective, the circled area on the time series indicates that 10mb temperatures have remained colder than normal throughout the fall season, confirming what we now already know. The most prominent feature on the chart, however, is a significant warming episode that occurred last January (spike in the red contour). Such warmings can be extremely disruptive to the polar vortex and can ultimately lead to significant cold outbreaks across the United States. Such episodes are possible during a +QBO (like this winter*), but are less common*. This is because, as previously noted, it is the –QBO (such as during last winter) which directs dissipating wave energy toward the polar vortex resulting in its disruption and subsequent southward displacements of the polar jet.

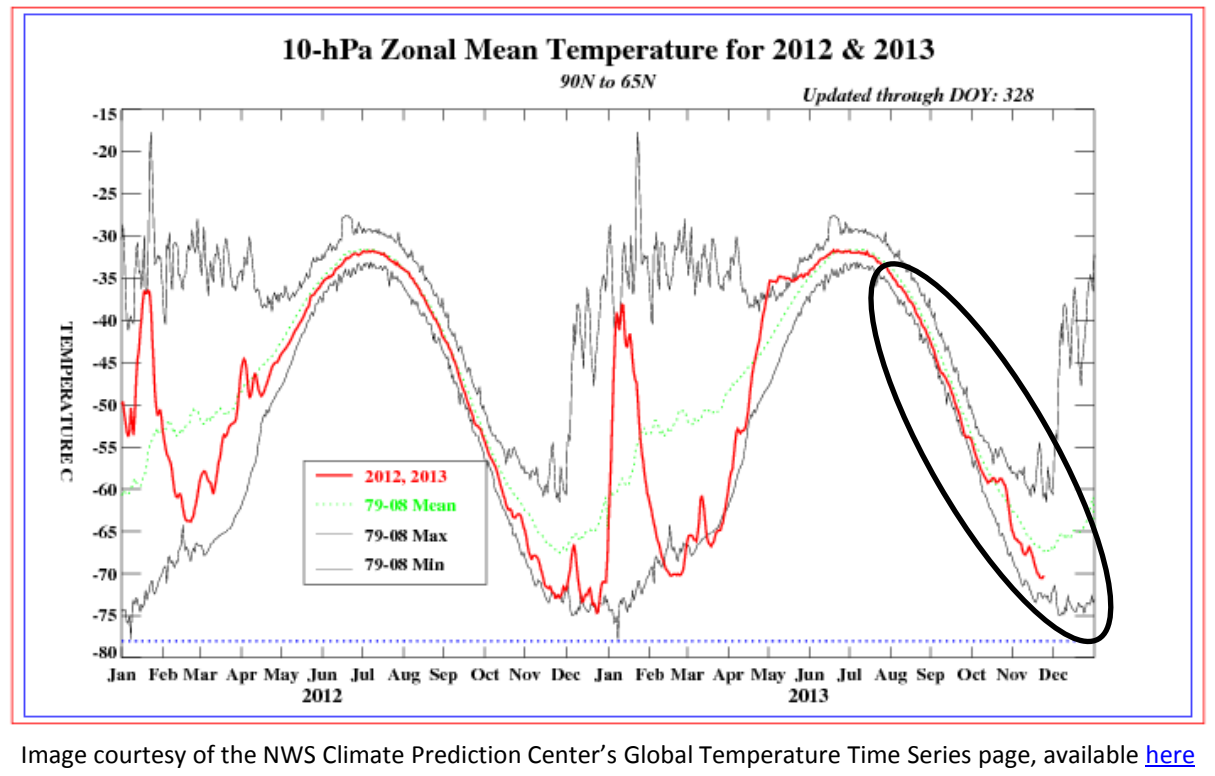
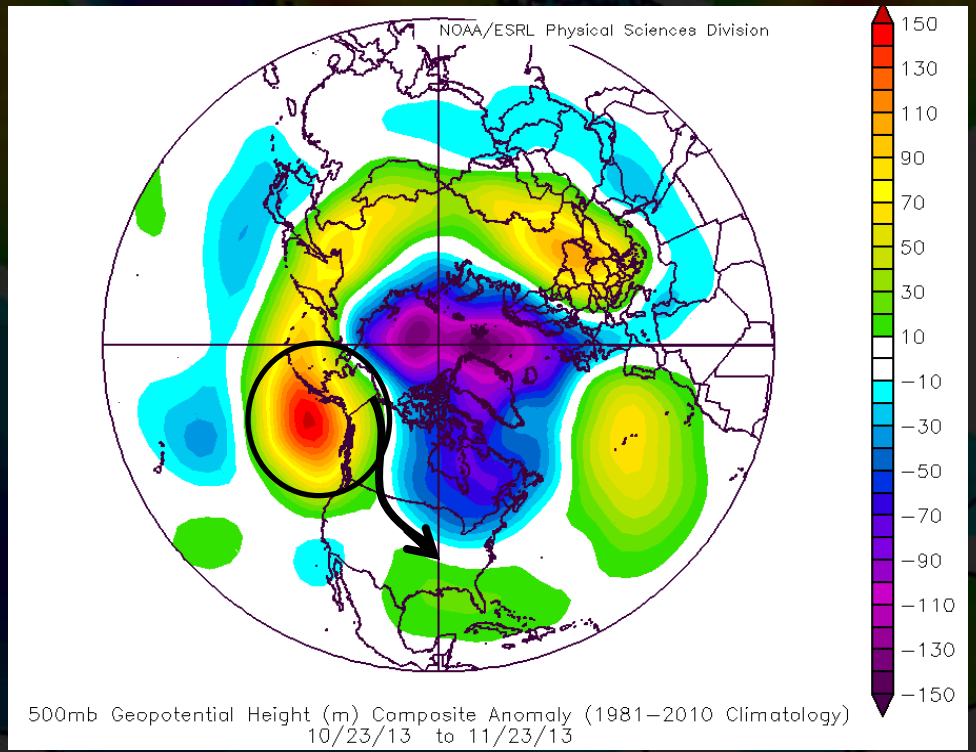


Image courtesy of the NWS Climate Prediction Center's Global Temperature Time Series page, available here

Current Conditions

Blocking in the East Pacific – A Seasonal Feature

The factors discussed thus far seem to favor a warmer pattern across the Great Lakes. In fact, many similar past years did exhibit such warmth. However, the current pattern has shown a strong tendency to favor ridging in the east Pacific since early Autumn. This has, in turn, funneled colder-than-normal air into the Great Lakes Region. There is no reason to expect this to change in the near term, especially with support from medium range forecast models through early December. However, as the length of planetary longwaves shortens during mid-winter, there will be an increased possibility that the influence of this blocking will wane and leave the Great Lakes in the vicinity of, or perhaps completely south of, a baroclinic zone supported by zonal polar westerlies. This would generally favor warm anomalies during January.



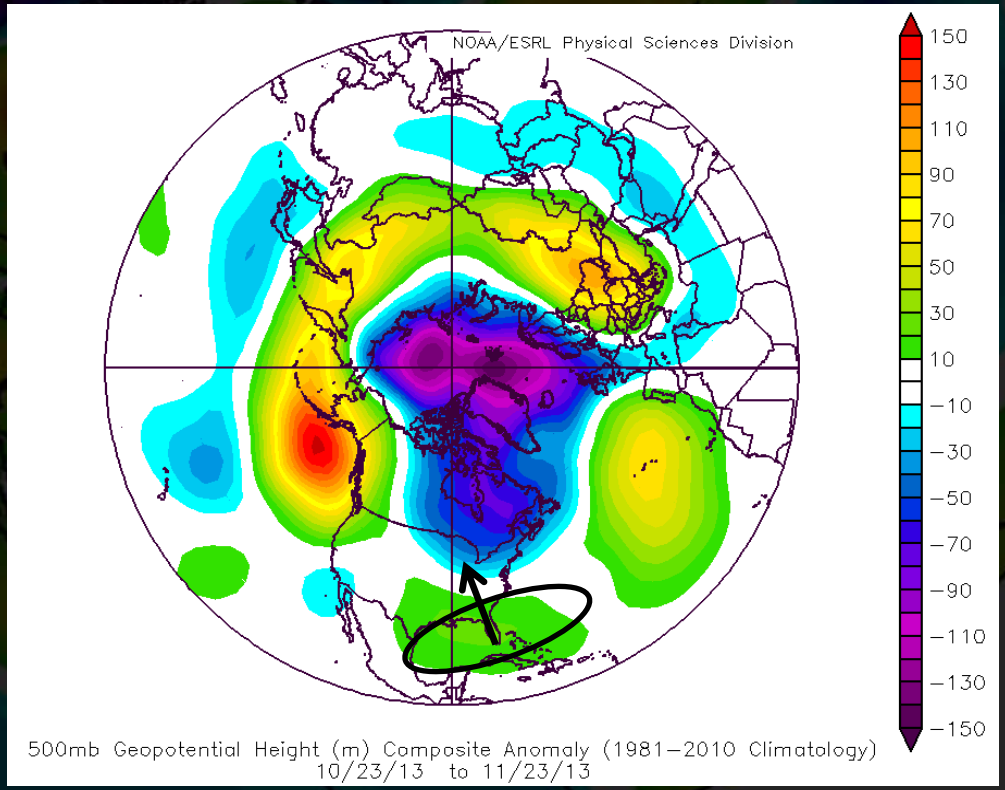
Similar Past Years and the Heart of Winter

January

Similar years' past have also featured a combination of preferential blocking in the east Pacific and a strong polar circulation. During those winters, ridging downstream of the Rockies - generally positioned over the Southeast U.S. - became very prominent by mid-winter (circle with arrow). The prominence of such ridging risks putting SE Michigan on the warm side of more systems than normal during mid-winter due to increased proximity to the baroclinic zone, or temperature gradient, as opposed to being safely north of it where it is persistently cold.

- Ridging centered over the southeast U.S., is expected to become much more prominent during the heart of winter.
- This will favor a warmer-than-normal pattern during January but will not eliminate the potential for cold outbreaks.
- This will also put SE Michigan in the vicinity of a baroclinic zone, the nature of which will be important for determining whether Detroit is favored to fall on the cold or warm side of low pressure systems.

Key to January outlook: Amplitude of east Pacific blocking. Failure for its influence to wane as expected could easily result in widespread cold anomalies for the Great Lakes.

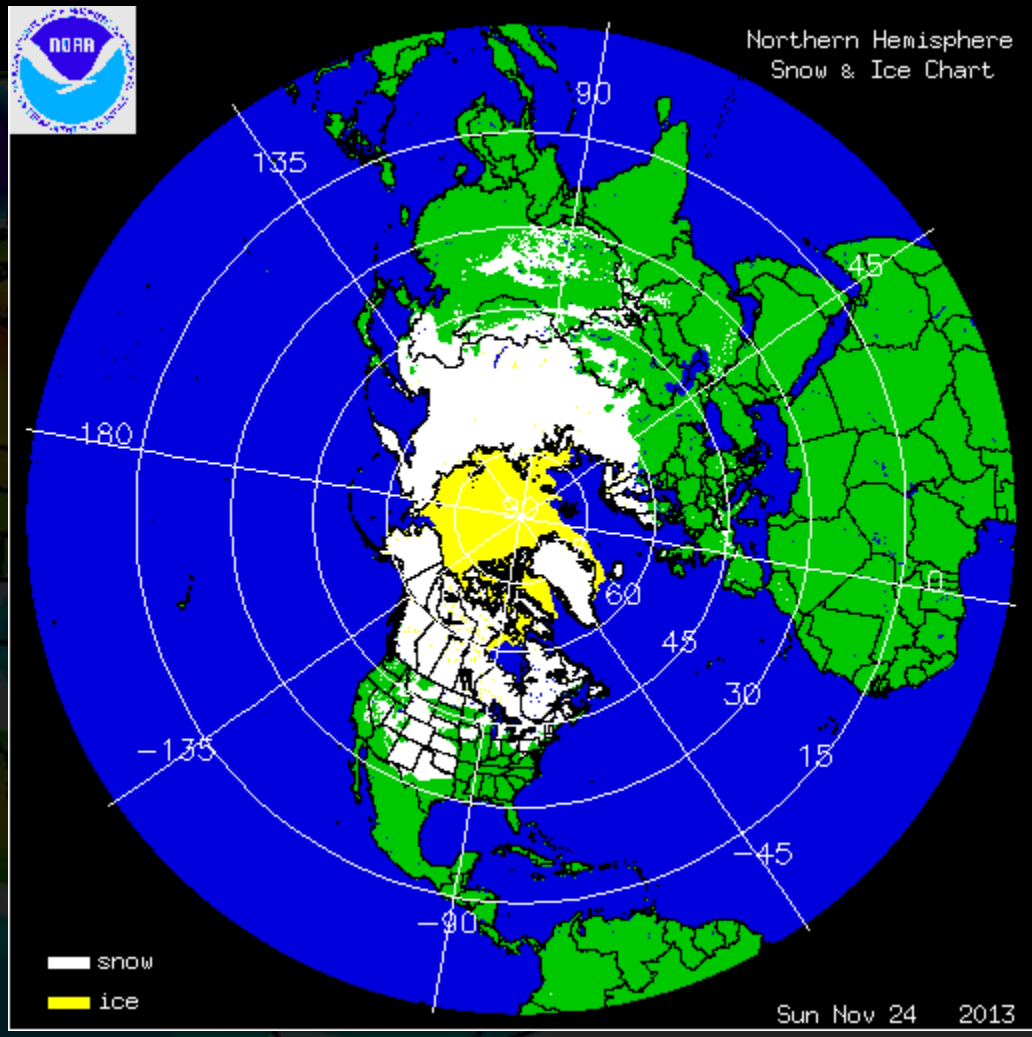


Additional Considerations

High-latitude snow cover

High-latitude snow cover plays a key role in the manufacturing of cold arctic airmasses, and therefore has a direct influence on the intensity of cold air outbreaks in the Great Lakes. The image on the right shows Northern Hemisphere snow cover as of November 24, 2013.

The coverage of snow across the high-latitude northern hemisphere is near normal.



Winter Outlook for Southeast Michigan

Expect a Typical Winter – With Potential for a Break in January

Temperature Trends

The pattern through December is one of persistence given that no noteworthy changes are expected in the near term. Decreasing length of longwaves during mid-winter is then expected to result in decreasing influence of east Pacific blocking and the assertion of ridging centered over the southeast U.S. In the absence of continued blocking, this will result in a greater-than-normal chance for warm anomalies during January. Longwave growth will then return conditions closer to normal for the end of winter.

December: Slightly Below Normal
January: Slightly warmer than normal
February: Normal

Precipitation/Snowfall trends

Prominence of quasi-zonal/northwest flow has resulted in frequent clippers across the higher latitudes of the U.S. This is expected to continue into mid-winter. By January, high confidence in a strong polar vortex leads to concern that the clipper track will pull north. There is additional concern that this could also lead to SE Michigan falling on the warm side of one or more systems. As with temperature, a return to a more typical pattern is expected by February.

December: Normal
January: Slightly Below Normal
February: Normal

Winter Trivia for Southeast Michigan

Coldest temperature: **Tri-Cities: -23F** (Feb 1918), **Flint: -25F** (Jan 1976), **Detroit: -21F** (Jan 1984)
Coldest month: **Tri-Cities**: **9.4F** (Jan 1912), **Flint: 10.9F** (Jan 1977), **Detroit: 12.2F** (Feb 1875)

Coldest winter: **Tri-Cities**: **15.7F** (1962-63), **Flint: 16.7F** (1976-77), **Detroit: 18.8F** (1903-04)
Warmest winter: **Tri-Cities: 33.3F** (1931-32), **Flint: 32.2F** (1982-83), **Detroit: 36.9F** (1881-82)

Snowiest month: **Tri-Cities: 39.3”** (Feb 1908), **Flint: 35.3”** (Dec 2000), **Detroit: 38.4”** (Dec 2000)
Snowiest year: **Tri-Cities: 87.2”** (1966-67), **Flint: 82.9”** (1974-75), **Detroit: 93.6”** (1880-81)
Least snowy year: **Tri-Cities: 7.8”** (1941-42), **Flint: 10.9”** (1921-22), **Detroit: 13.4”** (1936-37)

Heaviest snow storms: **Tri-Cities: 23.8**" (January 26-27, 1967), **Flint: 22.7**" (January 26-27, 1967), **Detroit: 24.5**" (April 6, 1886)

Average first measureable snowfall: **Tri-Cities:** Nov 15th , **Flint:** Nov 16th, **Detroit:** Nov 17th
Average first 1+”: **Tri-Cities:** Nov 26th , **Flint:** Nov 29th, **Detroit:** Nov 30th
Average first 3+” snowfall: **Tri-Cities:** Dec 27th , **Flint:** Dec 29th, **Detroit:** Dec 26th

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