



August 22, 2011

Third Winter of “Super-Blocking” Appears Likely

NCEP/NCAR Reanalysis
500mb Geopotential Height (m) Composite Anomaly 1981–2010 climo
NOAA/ESRL Physical Sciences Division

Dec to Feb: 2009,2010

What is “Super-Blocking”?

The previous two winters featured record breaking high-latitude blocking patterns that offset expected warmer influences from the Tropical Pacific. A blocking pattern occurs when a large area of upper level high pressure sets up in the far north. This pattern redistributes cold air south into the mid-latitudes— leading to colder winter conditions in the U.S., Europe, and Asia. For the Eastern U.S., the key area to monitor for blocking is Greenland (the North Atlantic Oscillation), which has seen record strong levels since the summer of 2009.

Composite Temperature Anomalies (F)
Dec to Feb 2009–10,2010–11
Versus 1971–2000 Longterm Average

Temperature Anomalies
Winters 2009-10 and 2010-11
NOAA/ESRL PSD and CIRES-CDC

-3.0 -2.0 -1.0 0.0 1.0 2.0 3.0

What is Causing It?

Winters with stronger blocking patterns appear to be somewhat cyclical. North America saw frequent cold-winter blocking impacts in the 1950s to 1970s, which coincided with the cold phase of long-term cycle known as the Pacific Decadal Oscillation (PDO). The positive phase saw less cold blocking opportunities in the 1980s and 1990s. Some debate exists as to when the shift back to a new -PDO phase began, but it is clear it is here now. Also, there may be a lagged blocking response to the warm phase of the oceanic cycle known as the Atlantic Multi-decadal Oscillation (AMO), which started in the middle to late 1990s. While these recent “super-blocking” winters resemble cold blocking episodes in the late 1950s to 1970s, we are breaking records for intensity and longevity. A potential contributor may be the recent longest solar minimum in over a century. Research has connected quiet solar periods to stronger cold winter blocking patterns.

Three Year Running Dec-Feb NAO Anomalies

Why Should it Continue?

The impressive trend line for the North Atlantic Oscillation (see chart far left), the warm North Atlantic sea surface temperature signature, the arriving negative QBO pattern this winter (see chart to left), the persistent blocking over the Arctic and Greenland this summer, the expected weaker year-on-year La Niña event, and the very slow ascent of the next solar cycle all argue that we should see another winter of exceptional blocking and cold air transport. Since 1950, all summers that saw this much Arctic blocking also had a subsequent winter with prevailing blocking (Arctic Oscillation).

12-Month Running Average NAO

Negative NAO = North Atlantic Blocking

The Quasi-Biennial Oscillation (QBO) is an east-west variation in stratospheric winds over the equatorial latitudes. Research shows that the negative, easterly phase increases winter blocking.

Avg NAO for weak/moderate La Niña with +AMO/-PDO

■ All ■ -QBO



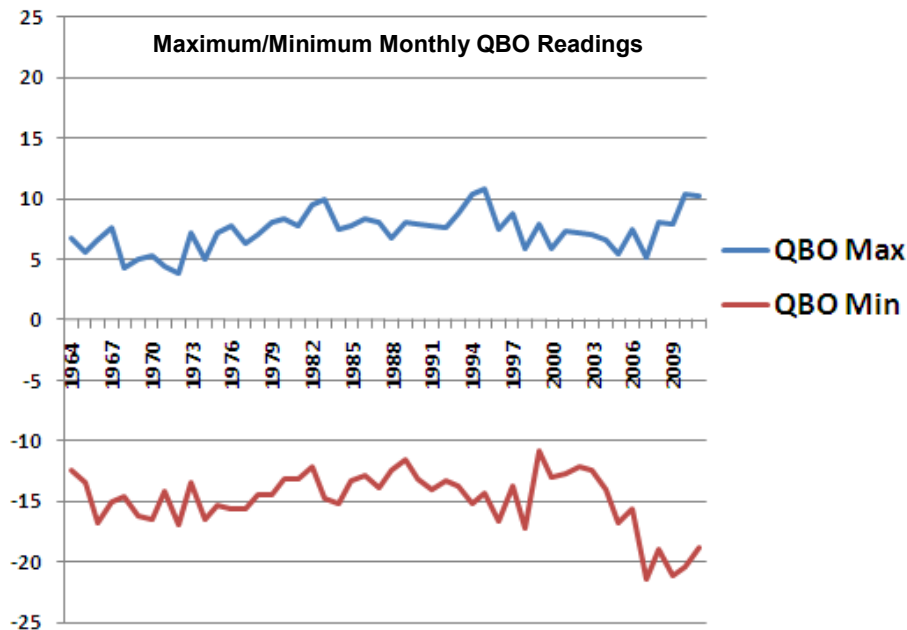
Reference Sheet

Interesting Research and Support

[Combined solar and QBO effects on the modes of low-frequency atmospheric variability in the Northern Hemisphere](#)

[Interannual and Intraseasonal Variabilities of the Stratospheric Polar Vortex in the Northern Hemisphere and Their Influence on the East Asian Winter Monsoon](#)

[Solar Forcing of Regional Climate Change During the Maunder Minimum](#)



Right around the same time as the record-setting solar minimum (2008-09), the QBO readings started seeing stronger negative values that falls outside of the range since the 1960s.

The positive QBO readings are not seeing this out-of-range response. But research listed above suggests that -QBO can enhance the amplified jet stream patterns in low solar states. But strangely the -QBO itself has become amplified too.

Date Source: <http://www.esrl.noaa.gov/psd/data/correlation/qbo.data>