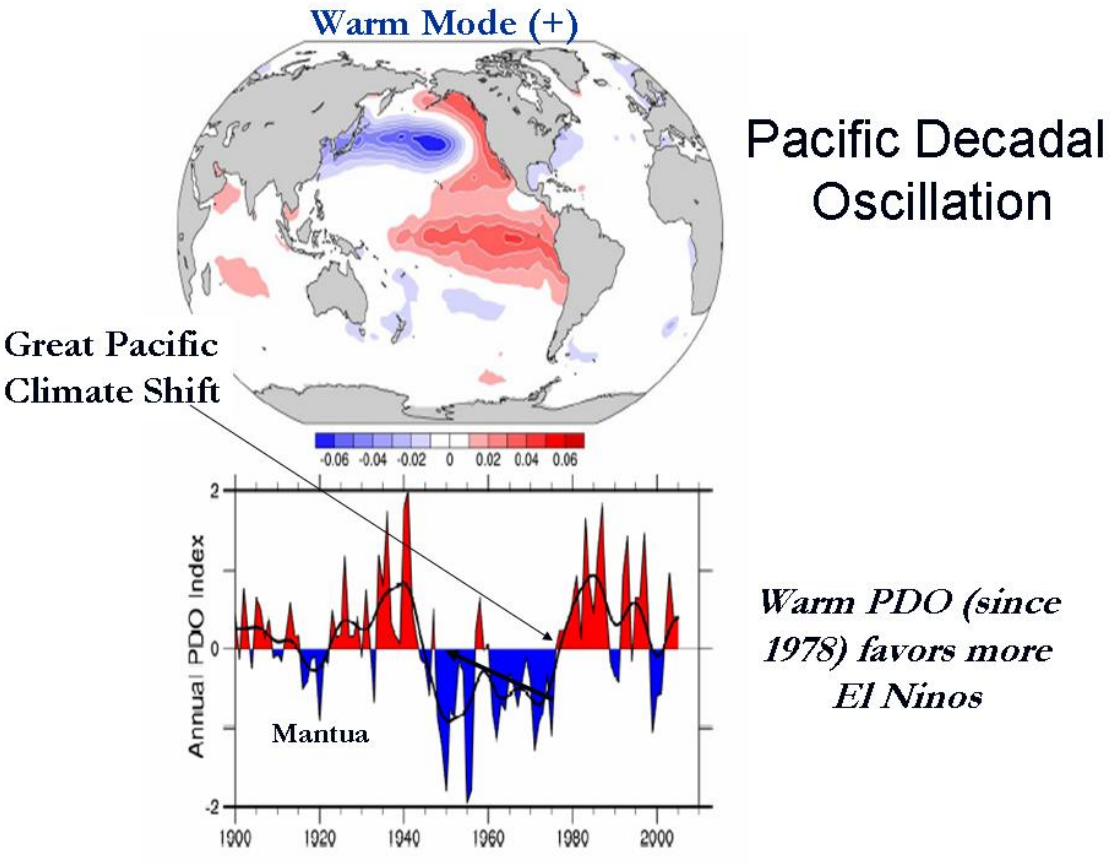
THE GREAT PACIFIC CLIMATE SHIFT II?

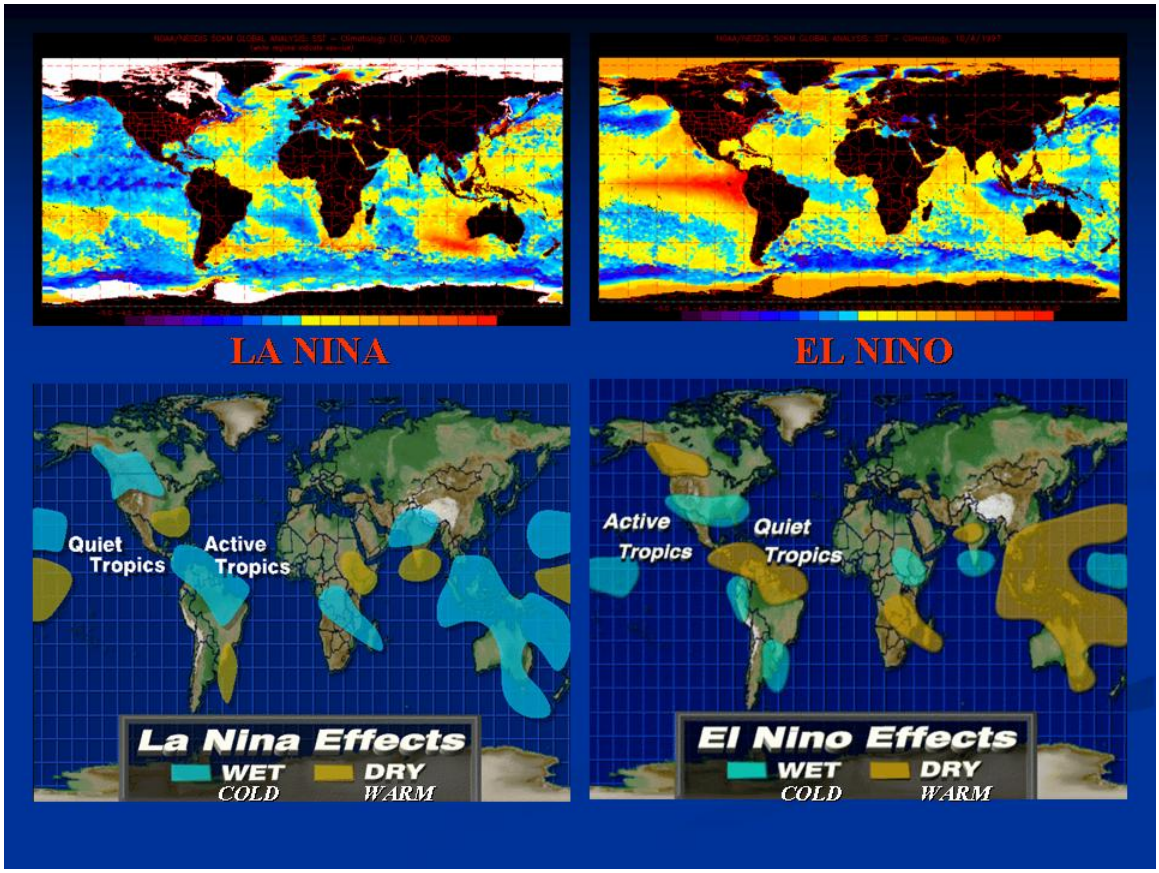
Back in 1977, the Pacific Ocean underwent a major transformation in sea surface temperature patterns that was called the Great Pacific Climate Shift. Suddenly warm water replaced cold water that had dominated for most of the prior three decades near the west coast of North America and along the equatorial eastern Pacific.

In 1997, researchers at the University of Washington in a paper in the Bulletin of the American Meteorological Society reported that a multidecadal oscillation in Pacific sea surface temperature and pressure had been discovered, while trying to explain decadal changes in salmon fishery production. They called it the Pacific Decadal Oscillation.

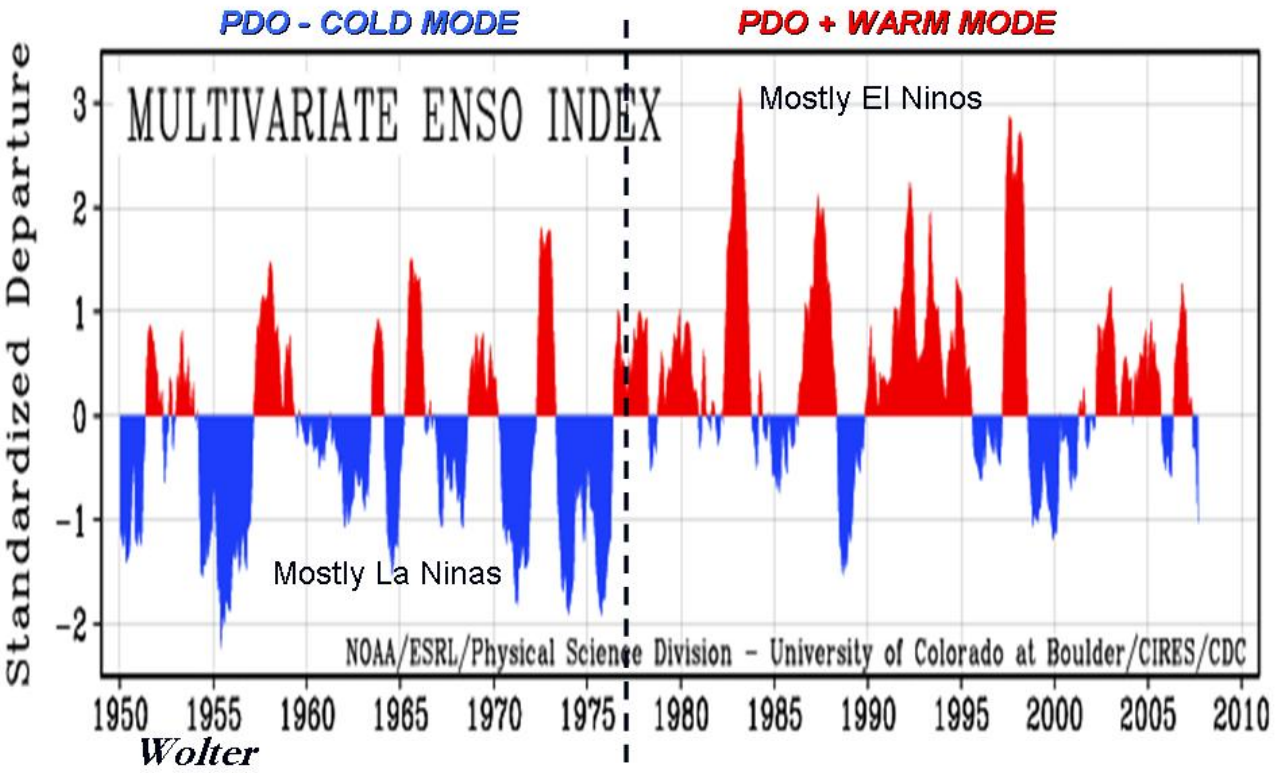
They noted that a major shift had taken place in 1977 in the PDO from what they termed the cold mode to the warm mode. In the warm mode, the Pacific Ocean sea surface temperature anomalies tend to look like the following IPCC AR4 chart with reds warmer than normal and blues colder than normal. In the cold mode, the mirror-opposite sea surface temperature patterns were observed. The IPCC described the causes as natural, related to decadal scale variations in the ocean gyre (Pacific high pressure) and the Aleutian low.



Since the warm mode of the PDO favors warm water in the ENSO region of the eastern tropical Pacific, one would expect a predominance of El Ninos during this phase of the PDO.



Indeed that has been the case since 1977 as indicated by the Multivariate ENSO Index or MEI. A positive MEI generally greater than 0.5 STD reflects El Ninos a negative MEI in excess of -0.5 La Ninas. As the following plot of the MEI shows, since 1977, El Ninos have dominated over La Nina. In the prior cold PDO mode, La Ninas had dominated over El Ninos.

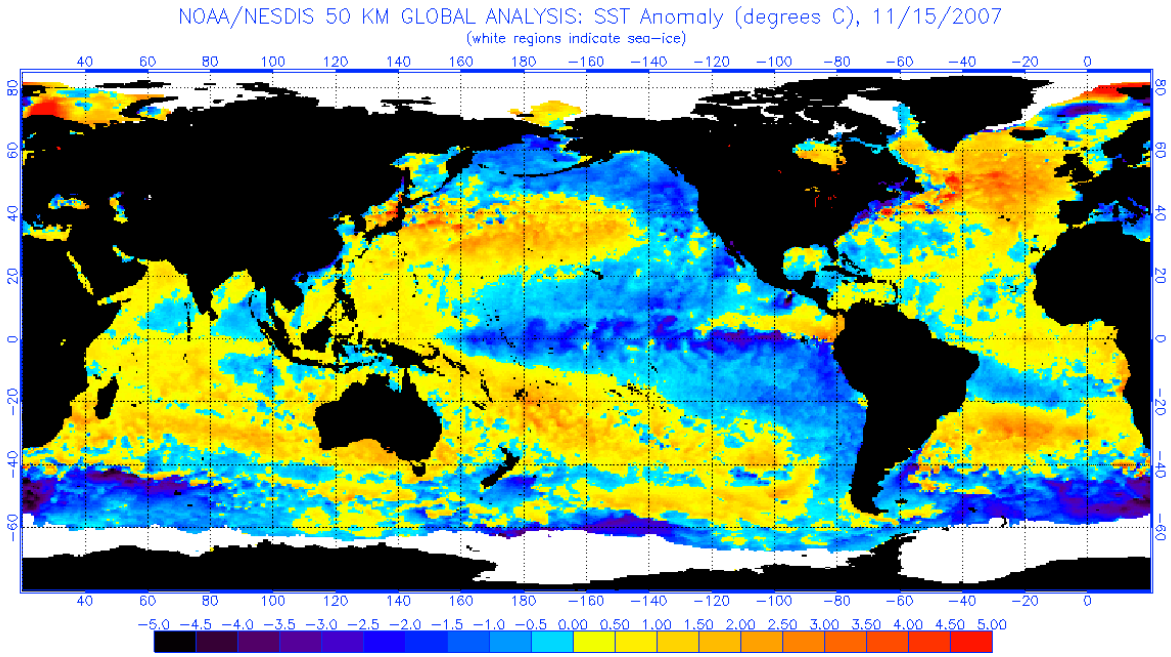

PDO - COLD MODE
PDO + WARM MODE
MULTIVARIATE ENSO INDEX
Mostly El Ninos
Mostly La Ninas
Standardized Departure
NOAA/ESRL/Physical Science Division - University of Colorado at Boulder/CIRES/CDC
Wolter
3
2
1
0
-1
-2
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010

# Years	Cold PDO 1947-1976	Warm PDO 1977-2006
El Nino		
Strong	3	8
All	7	13
La Nina		
Strong	8	3
All	13	7

Since El Ninos tend to lead to global warmth and La Ninas global cooling, we might expect temperatures to have been warmer on average in the last few decades (since 1978) and we know that has been the case.

GREAT PACIFIC CLIMATE SHIFT BACK NEGATIVE?

It was thought that we had shifted back into the cold mode in the late 1990s but a strong second solar max and a flurry of El Ninos caused a bounce in the PDO again in the early 2000s. However, it appears to be heading strongly negative again now with a moderate to strong La Nina in progress.



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The latest monthly PDO was strongly negative and decreasing rapidly.

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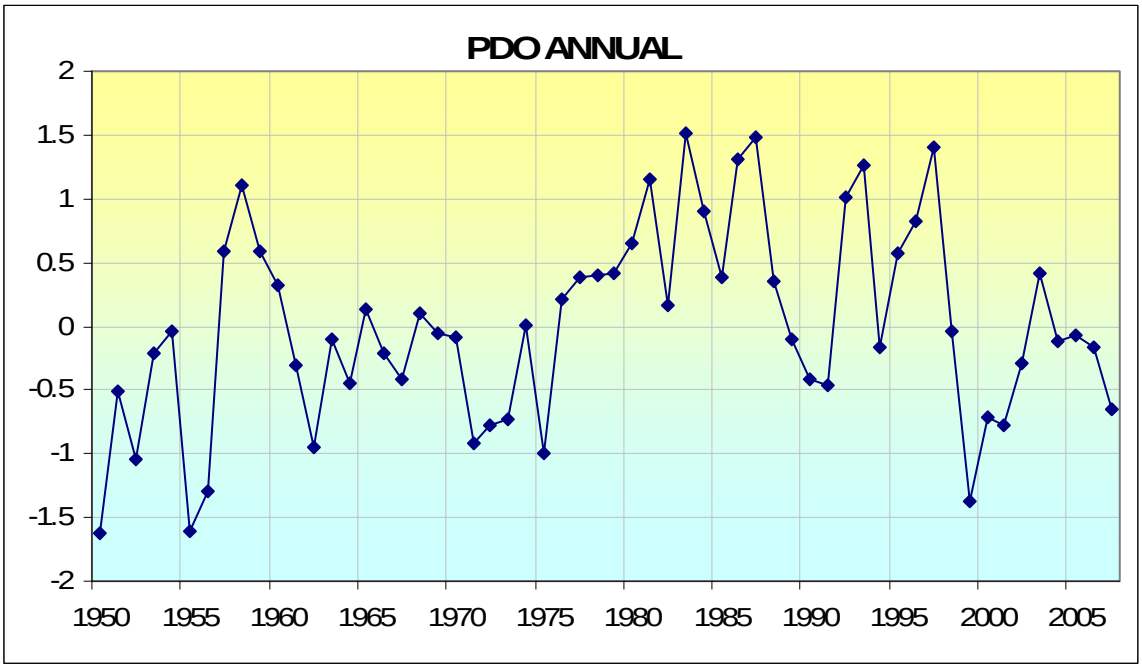


This would imply a tendency towards more global cooling on average. This will be especially likely if indeed the sun is about to go into its normal 200 year deep sleep.

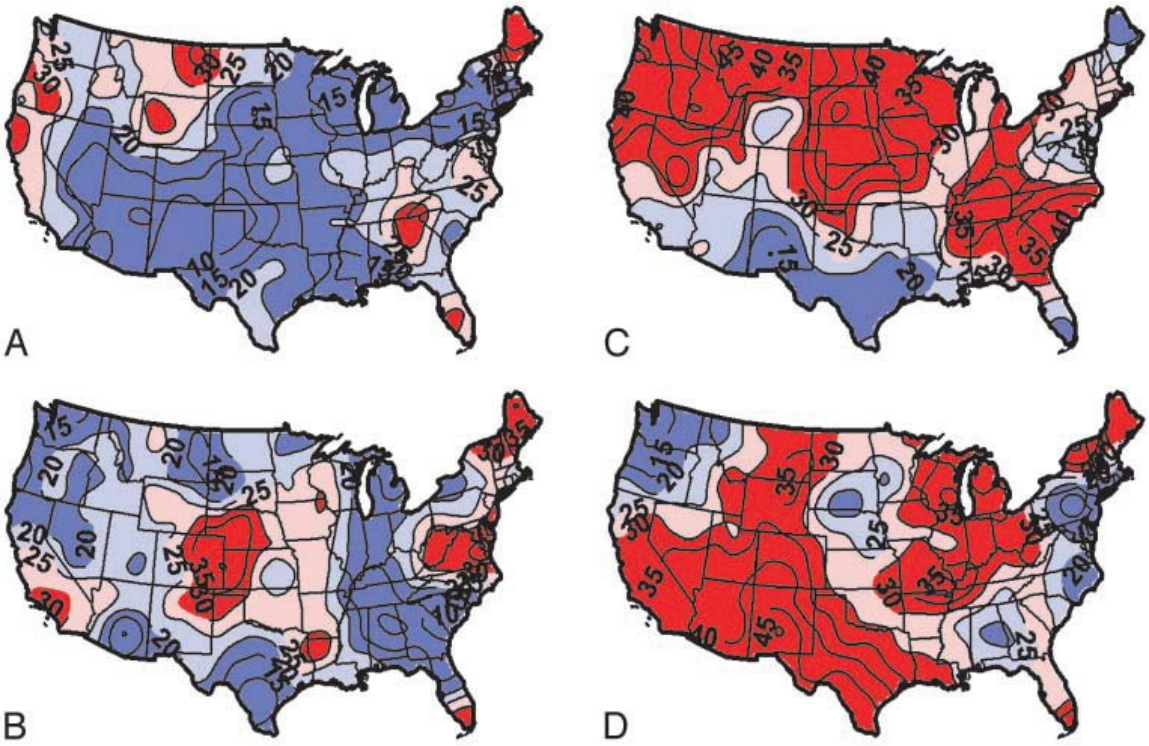
What Else Would a Negative PDO Mean?

If indeed this is a lasting shift, it would mean the following:

(1) More frequent La Ninas than El Ninos like we saw in the last cold phase from 1947 to 1977 and thus declining global temperatures
(2) More Atlantic hurricanes threatening the east coast from Florida north, especially as long as the Atlantic stays warm (Atlantic usually lags up to a decade or so after the Pacific in its multidecadal cycles).
(3) More tornado outbreaks in the fall through the spring months .
(4) Dry winters and early springs in Florida with spring brush fires
(5) More cold and snow across the northern tier from the Pacific Northwest and Northern plains to the Great Lakes and Northern New York and New England
(6) More winters with below normal snow Mid-Atlantic south
(7) Greater chances of drought in the southwest and parts of the Corn Belt

Droughts Depend on The State of Both Oceans

McCabe and Bentancourt (2004) did an analysis of the frequency of drought and the PDO and its Atlantic equaivalent cycle (the AMO) in 2004. They found the drought potential was highest during the years with the Atlantic in its warm mode (AMO+: the right two maps C and D).



Drought frequency (in percent of years) for positive and negative regimes of the PDO and AMO. (A) Positive PDO, negative AMO. (B) Negative PDO, negative AMO. (C) Positive PDO, positive AMO. (D) Negative PDO, positive AMO. (McCabe and Betancourt 2004)

Note with the shift strongly negative of the PDO this fall that the southwest drought might be expected to worsen and there could be an expansion of the drought in the Corn Belt next year (map D).

In an upcoming blog, we will explain why this winter will not be typical of most La Ninas and why the majority of forecasts calling for a warm winter will miss.