

The State of the Northeast Pacific during the Winter of 2009/2010

by William Crawford

In December 2009, we sent in our PICES Report of the northeast Pacific Ocean, noting that typical El Niño warm conditions had not yet arrived in the coastal Gulf of Alaska despite a mature El Niño in the tropical Pacific Ocean. However, within a few weeks the storm tracks changed, the Aleutian Low pressure system deepened to new lows, and all through January and February 2010 the Gulf of Alaska coastal temperatures climbed quickly.

So what happened in December 2009? In a typical El Niño, the Aleutian Low pressure system from December to March drops in pressure and increases its area (Fig. 1). The west coast of North America, from California to Alaska, generally sees more southerly warm winds from Oregon to Alaska and more storms in California during El Niño.

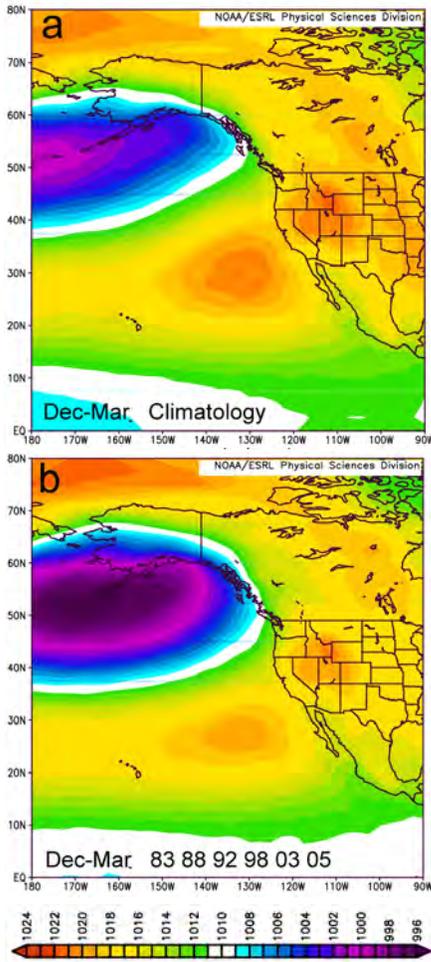


Fig. 1 Sea surface pressure average from December to March inclusive: (a) climatology from 1968–1996. (b) El Niño events in 1982/83, 1987/88, 1991/92, 1997/98, 2002/03, 2004/05. Air pressure is in millibars according to the scale at the bottom. Image provided by NOAA/ESRL Physical Sciences division (<http://www.esrl.noaa.gov/psd/cgi-bin/data/composites/printpage.pl>).

We blame the late arrival of warm winds in 2009–2010 on the Arctic Oscillation, which hit near-record negative values from December 2009 to February 2010. This oscillation is plotted in Figure 2, along with Niño 3.4 temperature anomalies. During the negative Arctic Oscillation, the high pressure regions of the Arctic spread to the south, as can be seen over western North America in Figure 3a.

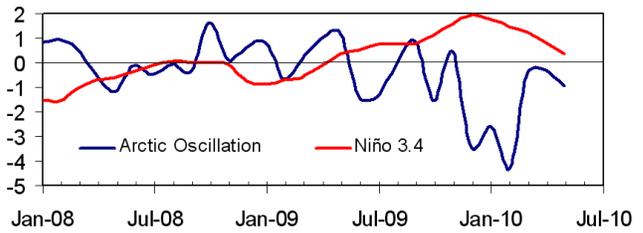


Fig. 2 Time series of monthly values of the Arctic Oscillation and Niño 3.4 temperature anomalies.

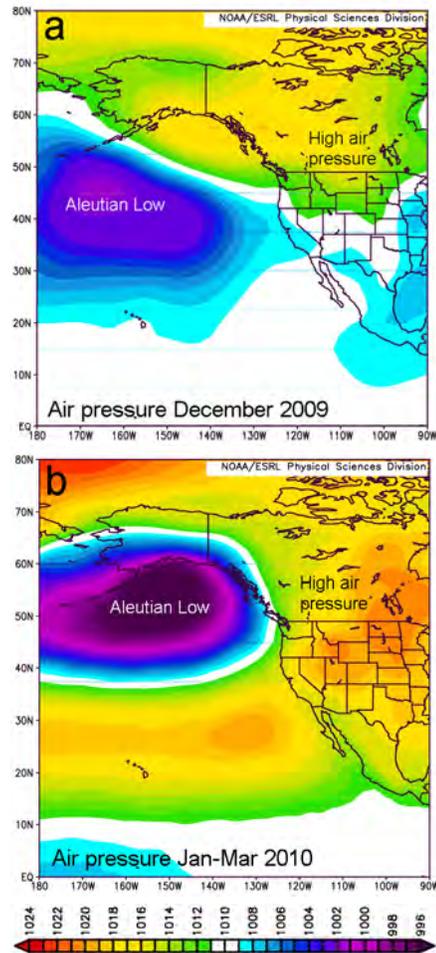


Fig. 3 Sea surface pressure averages through winter 2009/10. Air pressure is in millibars according to the scale at the bottom. Image provided by NOAA/ESRL Physical Sciences division.

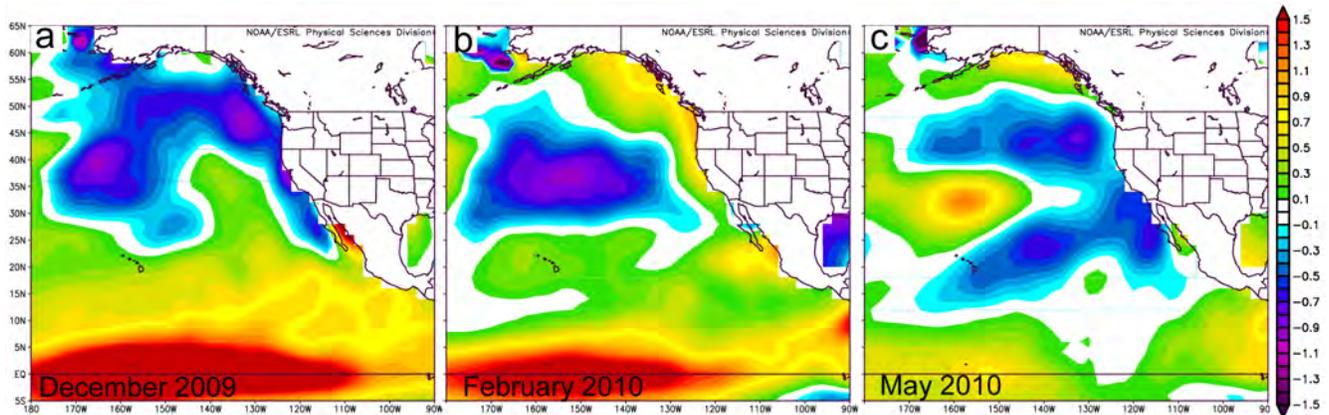


Fig. 4 Sea surface temperature anomalies for (a) December 2009, (b) February 2010 and (c) May 2010. Anomalies are in °C at intervals of 0.1°C, according to the scale at the right. Image provided by NOAA/ESRL Physical Sciences division.

In December 2009, the high pressure cell over western Canada and northwestern contiguous U.S.A. brought very cold air from the north. According to the Global Snow Laboratory of Rutgers University, more of North America was covered by snow than in any other December on record (going back to 1966). The ski runs of the Vancouver Olympics filled with snow, but it was not to last. If there was a contest between the high pressure of the Arctic Oscillation pushing south, and the Aleutian Low pressure system of an El Niño winter pushing north, the Aleutian Low lost in December 2009, but dominated in January and February 2010. Figure 3b reveals an Aleutian Low as intense as during the massive El Niño winters of 1982/83 and 1997/98. Its southerly winds carried warm air and water northwards along the North American west coast, and also downwelled warm water at the coastline. These same winds quickly melted snow on the Olympic ski hills, and only by importing snow did the Vancouver Olympic Games succeed in February.

Ocean temperature anomalies are plotted in Figure 4. El Niño appears as a warm region along the Equator. Note the cool waters in eastern Gulf of Alaska in December 2009, which had persisted for about two years. The intense Aleutian Low of January to February warmed the west coast in February 2010, but by May 2010 these warm surface temperatures were confined to Central American and Alaskan waters. Equatorial anomalies were close to zero in May, signaling the end of the 2009/10 El Niño.



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