

# The Winter of 2006/07—El Niño and its effect on NW Winters

Summary prepared by Mark Moore, NWAC, October 2006  
Slightly revised February 2, 2007

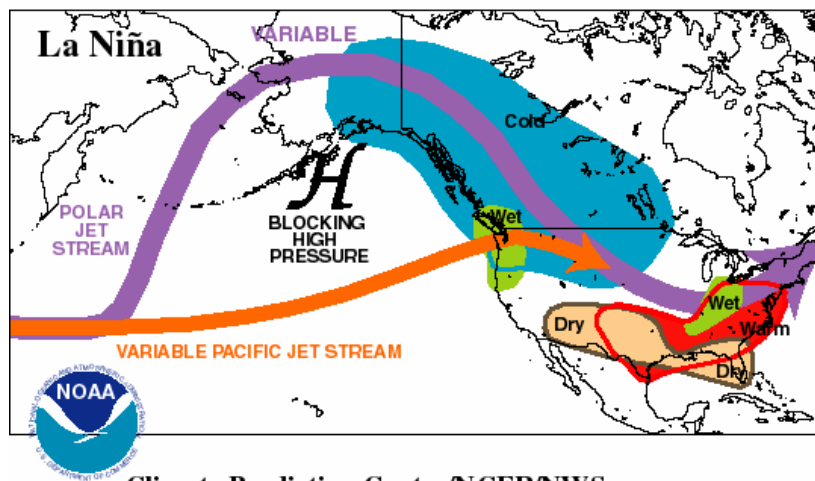
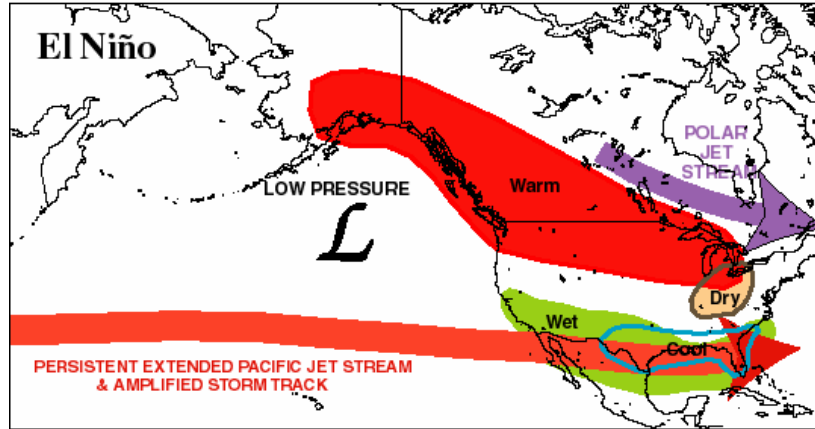
After indicating development of a weak El Niño (warm event) late last spring into early summer, late fall analyses and forecasts by the National Center for Environmental Prediction (NCEP—<http://www.cpc.ncep.noaa.gov/products>) indicated that this event could evolve into a moderate El Niño over the fall and winter of 2006/07. And to date this is what happened during the late fall and early part of winter 2006/07.

So what is El Niño and what sort of atmospheric circulation results from a moderate to strong El Niño in a typical Northwest winter? El Niño is normally defined as “an irregularly recurring flow of unusually warm surface waters from the Pacific Ocean toward and along the western coast of South America that prevents upwelling of nutrient-rich cold deep water and that disrupts typical regional and global weather patterns”. NCEP describes its primary effects on North America as:

*“El Niño episodes are associated with four prominent changes in the wintertime atmospheric flow across the eastern North Pacific and North America. The first is an eastward extension and equatorward shift of the East Asian jet stream from the International Date Line to the southwestern United States. The second is a more west-to-east flow of jet stream winds than normal across the United States. The third is a southward shift of the storm track from the northern to the southern part of the United States. The fourth is a southward and eastward shift of the main region of cyclone formation to just west of California. This shift results in an exceptionally stormy winter and increased precipitation across California and the southern U.S, and less stormy conditions across the northern part of the country. Also, there is an enhanced flow of marine air into western North America, along with a reduced northerly flow of cold air from Canada to the United States. These conditions result in a milder than normal winter across the northern states and western Canada.”*

While this description of drying and warming in the Pacific Northwest may bring tears and fears to much of the back country snow community, we must not lose sight of the fact that these are, after all, only statistics, statistics that skew the odds slightly in favor of such an outcome. Indeed, the Northwest has had reasonably robust winters during prior moderate El Niño events (see the graphs below). During the El Niño of 1994/95 most NW mountain sites reported above to much above average early season snowfall and snowpacks in November into mid January. Stevens Pass reported a 22 inch snowfall on November 1, 1994 and most sites near and west of the crest reported 30-40 inches of snow on the ground a few days later! While this may not be the norm during El Niño, it indicates that outstanding snow possibilities can and do still occur during these warm events. For a great site by site analysis of specific NW mountain stations during both El Niño and La Niña winters, please consult Amar Andalkar’s web site at <http://www.skimountaineer.com> and navigate to the pages on historical snowdepth data. But now let’s get back to the upper level flows that are more typical during an El Niño. The following graphic shows a generalized winter jetstream in North America and indicates the associated precipitation and/or temperature pattern that is often the result (as well as that for its colder sibling, La Niña). Unfortunately but not exclusively, statistics do favor a slightly warmer and slightly drier than average winter for our region.

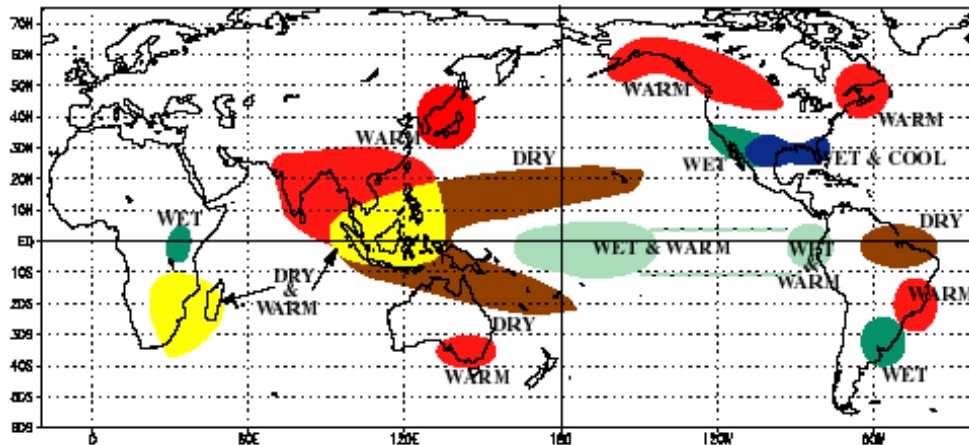
**TYPICAL JANUARY-MARCH WEATHER ANOMALIES  
AND ATMOSPHERIC CIRCULATION  
DURING MODERATE TO STRONG  
EL NIÑO & LA NIÑA**



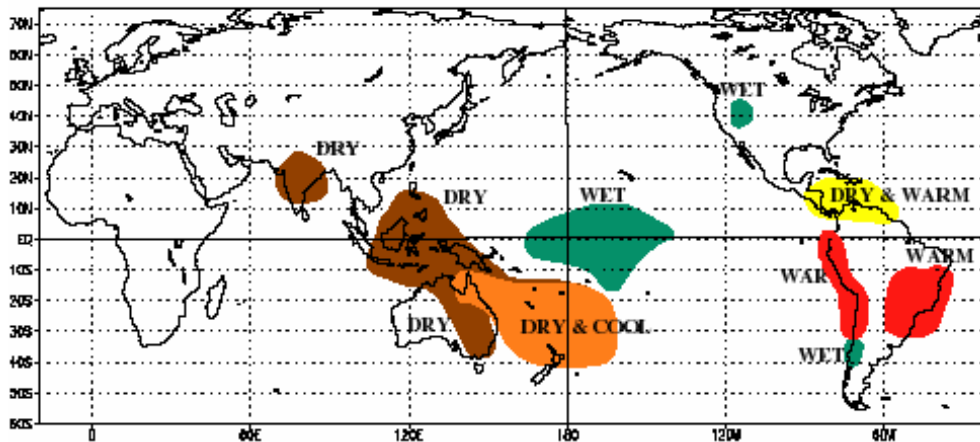
Climate Prediction Center/NCEP/NWS

The global influence of such a moderate El Niño event is shown below. At this point in our study of wide reaching weather effects, we should just be happy that we're not in the boomerang shaped very dry area to the northwest of Australia.

## WARM EPISODE RELATIONSHIPS DECEMBER - FEBRUARY



## WARM EPISODE RELATIONSHIPS JUNE - AUGUST



Climate Prediction Center  
NCEP

And how often does an El Niño occur, you might wonder? To answer this it must be noted that El Niño and La Niña events are often classified by a number of different criteria. Some classification systems use the strength and sign of the Southern Oscillation Index (SOI), while others use Sea Surface Temperature (SST) anomalies for a variety of Pacific regions. Still others use a combination of several criteria to gauge the type and strength of the event. Consequently there are number of different lists which are actively used. Four of the most widely used lists are:

- Western Region Climate Center at <http://www.wrcc.dri.edu/enso/ensodef.html>
- Climate Diagnostics Center at <http://www.cdc.noaa.gov/ENSO>
- Climate Prediction Center at [http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/ensostuff/ensoyears.shtml](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml)
- Multivariate ENSO Index from Climate Diagnostics Center at: [http://www.cdc.noaa.gov/ENSO/enso.mei\\_index.html](http://www.cdc.noaa.gov/ENSO/enso.mei_index.html)

In the web site <http://ggweather.com/enso/years.htm> an event consensus was arrived at by choosing years which appeared on three of the four above lists. In this list, there is obviously some crossover of the variables used in the various methodologies and no attempt has been made to give a weight of one list over another. When WRCC, CPC and MEI all indicated W+ and CDC gave a W (their strongest category) then that season was considered a strong event. Otherwise the strength was determined from the "average" of the strength of chosen events. The resultant data is expressed in Table 1 (below), where W- = weak El Niño, W = Moderate El Niño, W+ = strong El Niño, and similarly with cold events (La Niña).

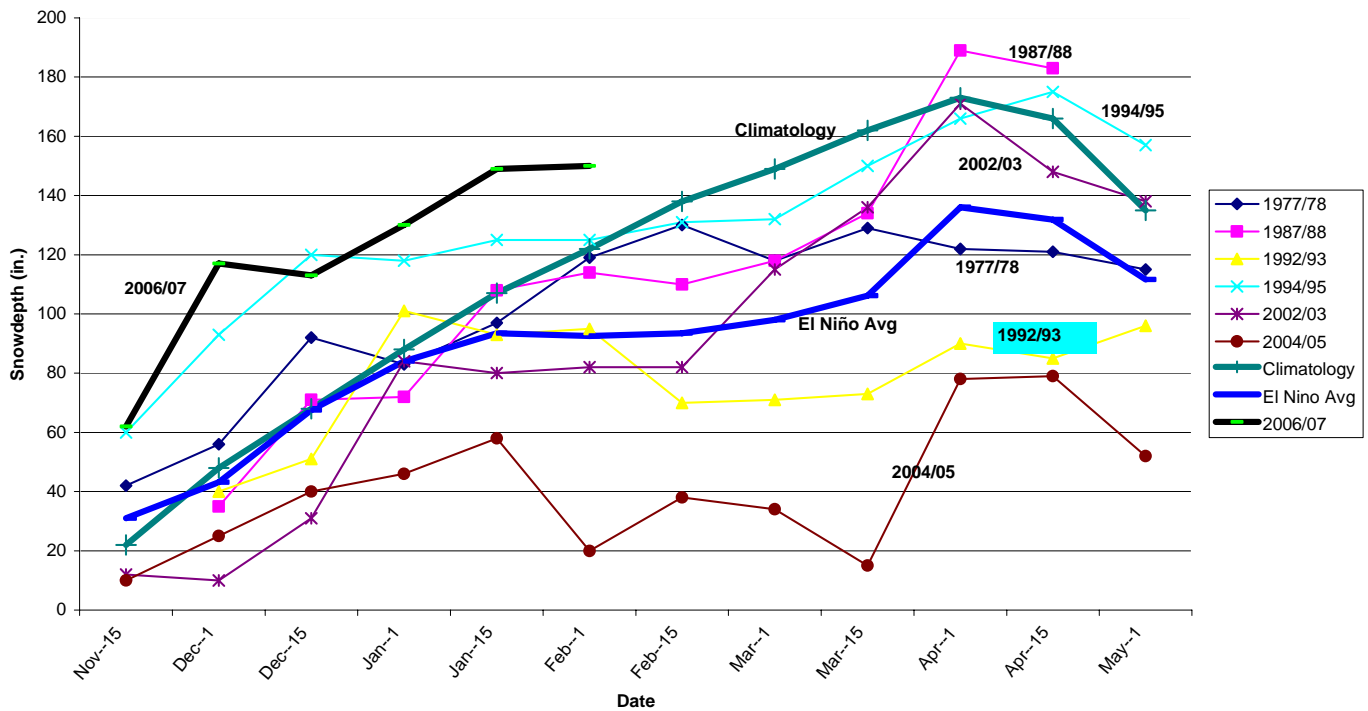
**Table 1. Consensus List of El Niño and La Niña Year**

Winter	WRCC	CDC	CPC	MEI	Consensus
1950-51	C+	C	C	C	La Niña
1951-52	W+		W-		
1952-53					
1953-54	W		W-		
1954-55			C	C-	
1955-56	C+		C+	C	Strong La Niña
1956-57	C		C-	C-	Weak La Niña
1957-58	W	W	W+	W	El Niño (moderate)
1958-59			W+	W-	
1959-60					
1960-61					
1961-62				C-	
1962-63				C-	
1963-64	W		W-		
1964-65	C		C	C-	La Niña
1965-66	W+	W	W	W	El Niño (moderate)
1966-67				C-	
1967-68				C-	
1968-69			W	W-	
1969-70	W		W		
1970-71	C		C	C	La Niña
1971-72	C		C-	C-	Weak La Niña
1972-73	W+	W	W+	W	Strong El Niño
1973-74	C+	C	C+	C+	Strong La Niña
1974-75	C		C-	C-	Weak La Niña
1975-76	C+	C	C+	C	Strong La Niña
1976-77	W		W-		
1977-78	W+		W-	W-	El Niño (weak to moderate)
1978-79					
1979-80			W-	W-	
1980-81					
1981-82					
1982-83	W+	W	W+	W+	Strong El Niño
1983-84			C-		
1984-85			C-	C-	
1985-86					
1986-87			W	W	
1987-88	W+	W-	W	W-	El Niño (moderate)
1988-89	C+	C-	C+	C	Strong La Niña
1989-90					
1990-91			W+		

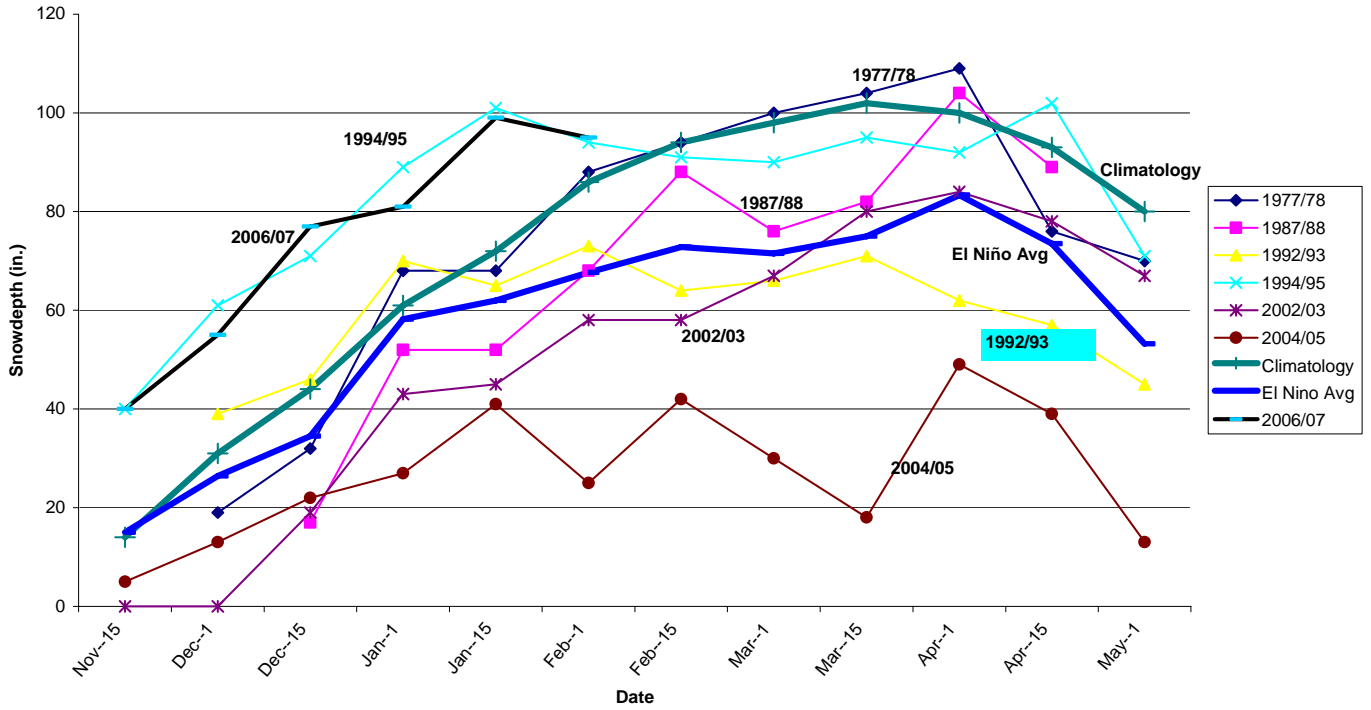
1991-92	W	W	W+	W+	Strong El Niño
1992-93	W		W+	W-	El Niño (moderate)
1993-94	W+		W		
1994-95	W+		W	W-	El Niño (moderate)
1995-96			C-	C-	
1996-97					
1997-98	W+	W	W+	W+	Strong El Niño
1998-99	C+		C	C-	La Niña
1999-00			C	C	
2000-01	C	C	C-	C-	La Niña
2001-02					
2002-03	W	W	W	W	El Niño (moderate)
2003-04					
2004-05	W	W	W-	W/W-	El Niño (weak to moderate)
2005-06					
2006-07	W	NA	NA	W/W-	El Niño (weak to moderate+?)

How do the moderate or weak to moderate El Niño winters of the past 20-30 years stack up against overall climatology for some key NW mountain sites? For informational purposes the plots of representative sites in the NW are shown below from north to south: Mt Baker, Stevens Pass, Mission Ridge, Paradise (Mt Rainier), and Stevens Pass. As previously mentioned, these graphs indicate overall lower snowdepths than normal during most but not all recent El Niño years (like the currently evolving 2006/07 winter).

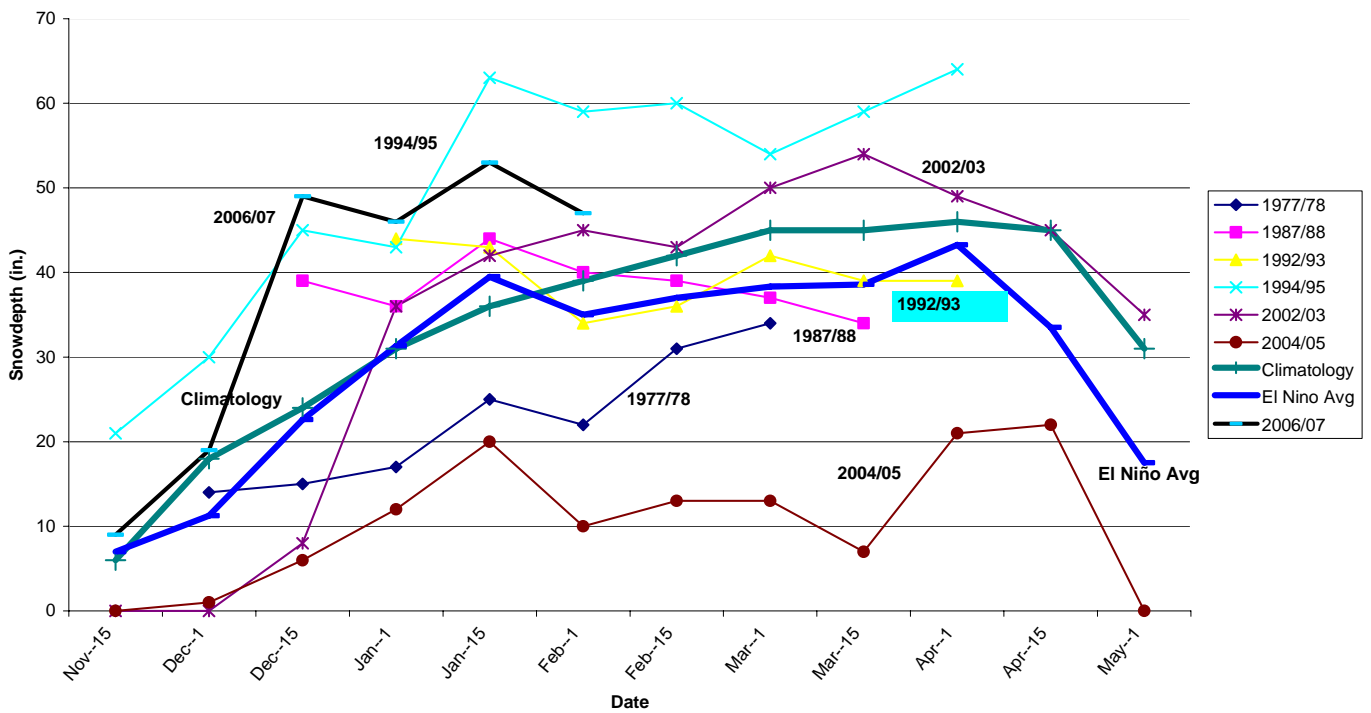
Mt Baker--Consensus weak to moderate El Niño years versus climatology



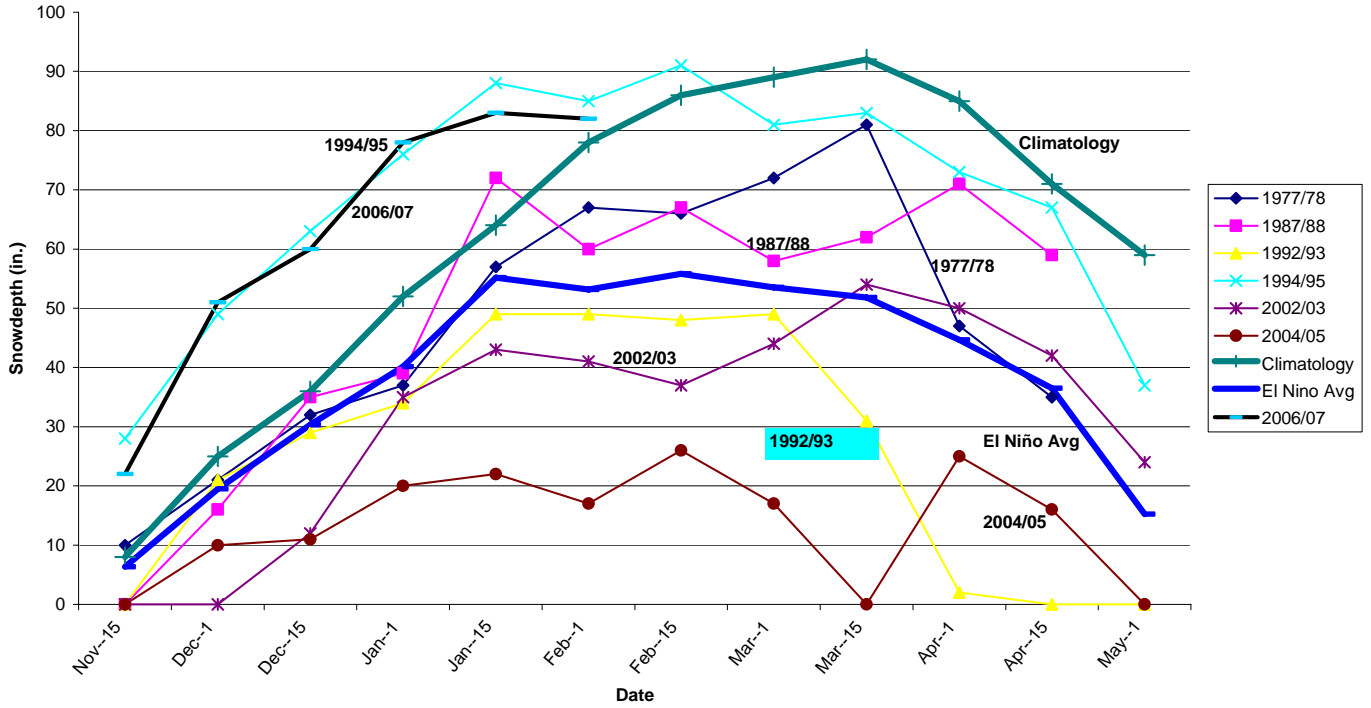
Stevens Pass--Consensus weak to moderate El Niño years versus climatology



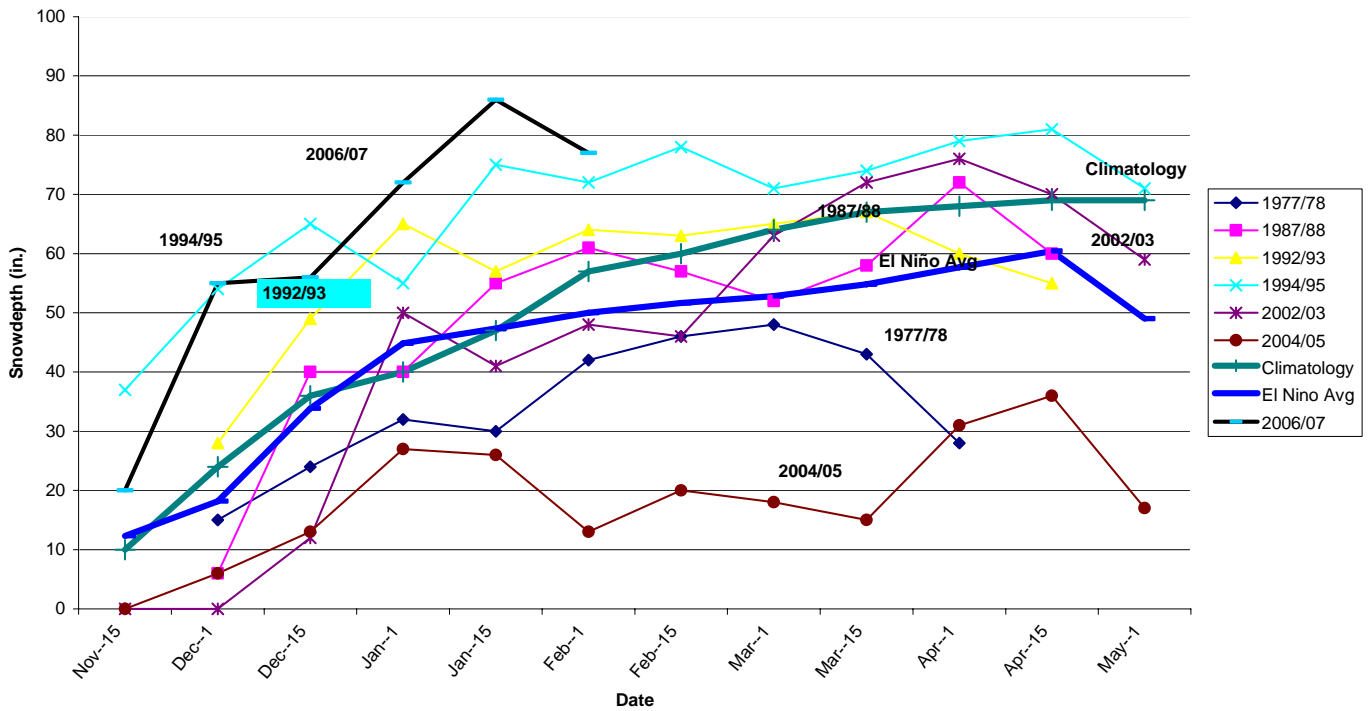
Mission Ridge--Consensus weak to moderate El Niño years versus climatology



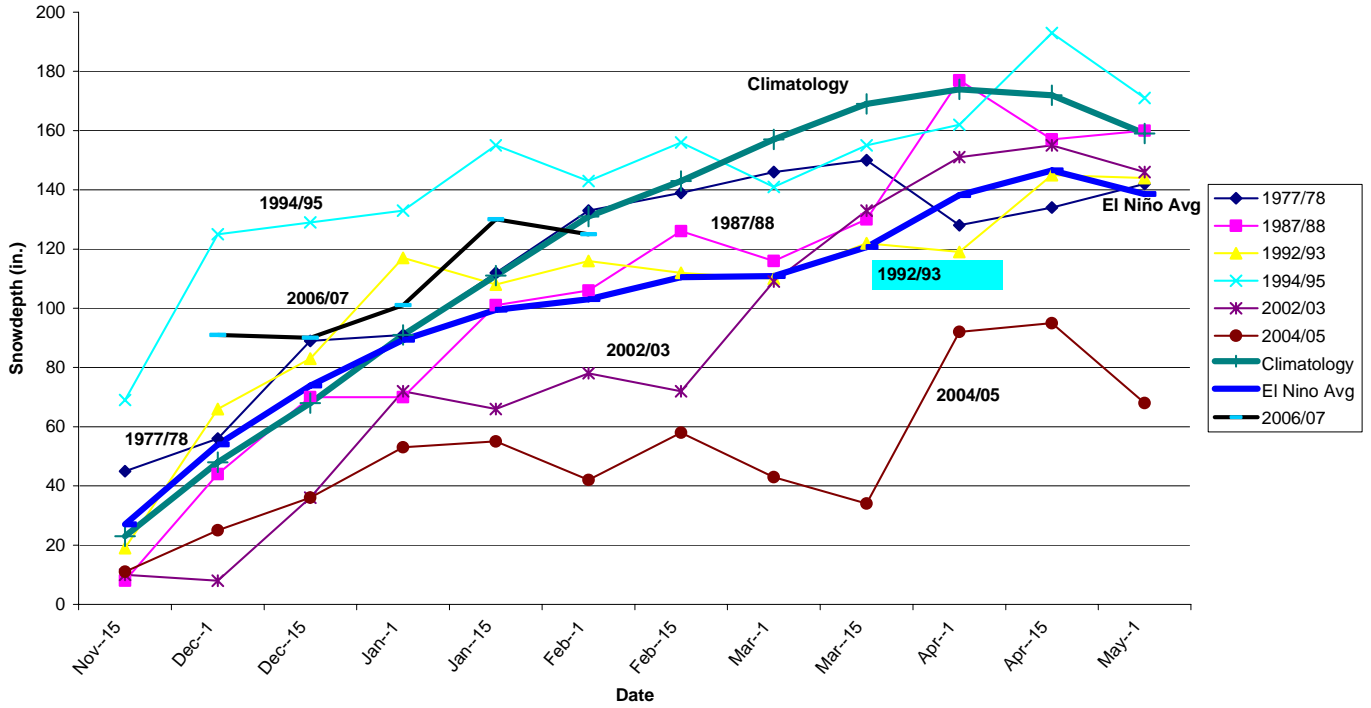
Snoqualmie Pass--Consensus weak to moderate El Niño years versus climatology



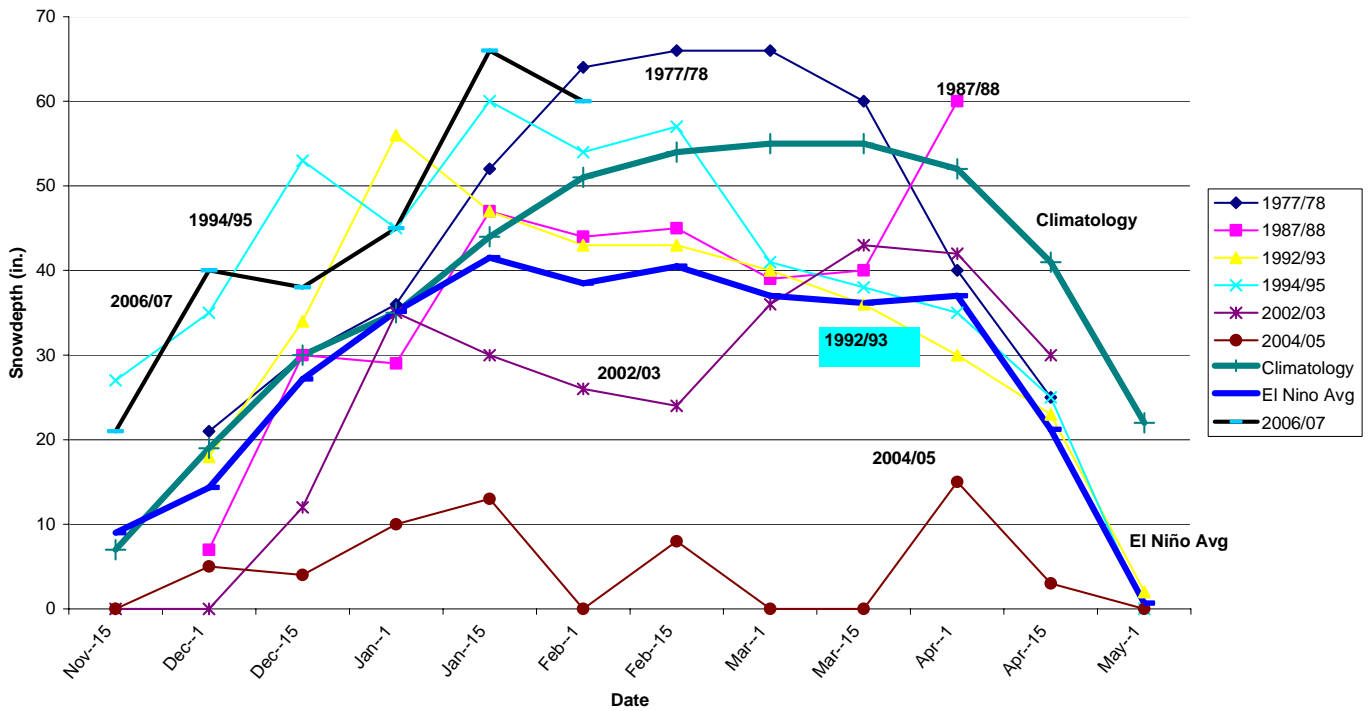
Crystal Mountain--Consensus weak to moderate El Niño years versus climatology



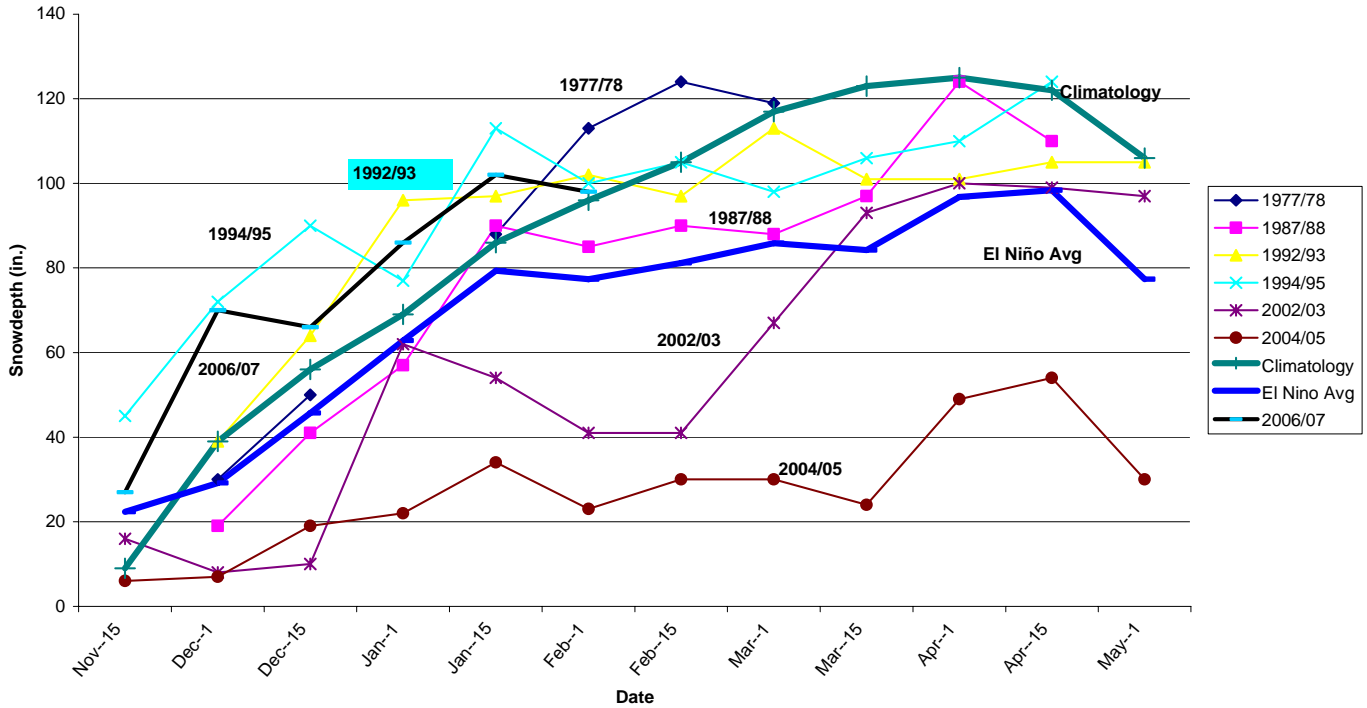
Paradise (Mt Rainier)--Consensus weak to moderate El Niño years versus climatology



White Pass--Consensus weak to moderate El Niño years versus climatology



Hood Meadows--Consensus weak to moderate El Niño years versus climatology



Obviously the charts above indicate that potential snowfalls for a weak to moderate El Niño may fall a little short of the norm. However, some reasonable years are indicated as well and we can all hope that this El Niño year is one of those. Certainly the good early season snowpack through January indicates this.

The most recent El Niño discussion indicates that the effects of this season's El Niño should wane by late winter or early spring with Eñso-neutral conditions likely evolving during the spring. While this would likely have the impact of producing a split in the westerly flow for February and March (resulting in enhanced precipitation across the southern tier of the US), a more normal and perhaps wetter pattern may return to the Northwest by springtime.