**Changes in 20th Century Pacific Northwest Climate\***

The climate of the PNW has changed during the past 100 years. Observed 20th century changes include:

* **Temperature has increased.**Average annual temperature increased 1.5°F (0.7-0.8°C) in the PNW between 1920 and 2003. The warming has been fairly uniform and widespread, with little difference between warming rates at urban and rural weather monitoring stations. Only a handful of locations recorded cooling. Although the warmest year was 1934, the warmest decade was the 1990s ([figure 3a](http://cses.washington.edu/cig/pnwc/cc.shtml#figure3)). ([Mote 2003](http://cses.washington.edu/db/pubs/abstract101.shtml))
* **Trends in winter season and daily minimum temperatures have been largest.**Temperature trends from 1916-2003 were largest from January-March. Minimum daily temperature rose faster than maximum daily temperature through the mid-20th century. In the second half of the 20th century, minimum and maximum temperature rose at about the same rate. ([Mote 2003](http://cses.washington.edu/db/pubs/abstract101.shtml), [Hamlet and Lettenmaier 2007](http://cses.washington.edu/db/pubs/abstract524.shtml)).
* **Decadal variability has dominated annual precipitation trends.**Annual precipitation increased 14% for the period 1930-1995 for the PNW region. Sub-regional trends ranged from 13%-38% ([Mote 2003](http://cses.washington.edu/db/pubs/abstract101.shtml)). However, these trends are not statistically significant and depend on the time frame analyzed. Decadal variability is therefore the most important feature of precipitation during the 20th century.
* **Cool season precipitation variability has increased.**Cool season precipitation in the PNW is more variable from year to year, displays greater persistence, and is more strongly correlated with other regions in the West since about 1973 ([Hamlet and Lettenmaier 2007](http://cses.washington.edu/db/pubs/abstract524.shtml)).
* **April 1 snow water equivalent (SWE) declined at nearly all sites in the PNW since 1950.**The declines are strongest at low and middle elevations, and can be explained by observed increases in temperature and declines in precipitation over the same period of record ([Mote et al. 2003](http://cses.washington.edu/db/pubs/abstract108.shtml), [Hamlet et al. 2005](http://cses.washington.edu/db/pubs/abstract419.shtml),[Mote 2006](http://cses.washington.edu/db/pubs/abstract501.shtml), [Mote et al. 2008](http://cses.washington.edu/db/pubs/abstract560.shtml)). Low elevation declines at individual stations in the Washington and Oregon Cascades are frequently 40% or more ([Mote et al. 2003](http://cses.washington.edu/db/pubs/abstract108.shtml), [Mote et al. 2005](http://cses.washington.edu/db/pubs/abstract259.shtml)) ([figure 3b](http://cses.washington.edu/cig/pnwc/cc.shtml#figure3)). The linear decline in April 1 SWE for the Washington Cascades is roughly –15% to –35% (mostly around –25%) for a variety of starting points between 1916 and 1970 and ending in 2006 ([Mote et al. 2008](http://cses.washington.edu/db/pubs/abstract560.shtml)).
* **Timing of peak runoff has shifted.**Timing of the center of mass in annual river runoff in snowmelt basins shifted 0-20 days earlier in much of the PNW between 1948 and 2002 ([Stewart et al. 2005](http://meteora.ucsd.edu/cap/pdffiles/stewart_clch.pdf)). The greatest trends occurred in the PNW, including the mountain plateaus of Washington, Oregon, and western Idaho. These findings are corroborated by modeling studies which show similar changes in runoff timing ([Hamlet et al. 2007](http://cses.washington.edu/db/pubs/abstract482.shtml))

\*a 2017 report has similar findings and more recent data. Some modifications of the text above reflects recent updates.