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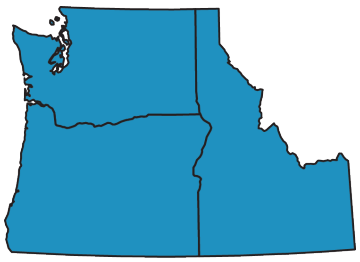


Regional Climate Trends and Scenarios: The Northwest U.S.

This document provides a brief overview of the observed changes in the climate of the Northwest[1] United States as well as possible future climate conditions as simulated by climate models, based on two scenarios of future greenhouse gas emissions. It summarizes the detailed findings presented in one of nine regional and national climate descriptions created by the National Oceanic and Atmospheric Administration (NOAA) in support of the National Climate Assessment (NCA). It is also hoped that these findings are of direct benefit to decision makers and communities seeking to develop adaptation plans. The full Regional Climate Trends and Scenarios report is available at http://scenarios.globalchange.gov/regions/northwest, and should be cited as:

Kunkel, K.E, L.E. Stevens, S.E. Stevens, L. Sun, E. Janssen, D. Wuebbles, K.T. Redmond, and J.G. Dobson, 2013: Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 6. Climate of the Northwest U.S., NOAA Technical Report NESDIS 142-6, 75 pp.

Observed Regional Climate Trends

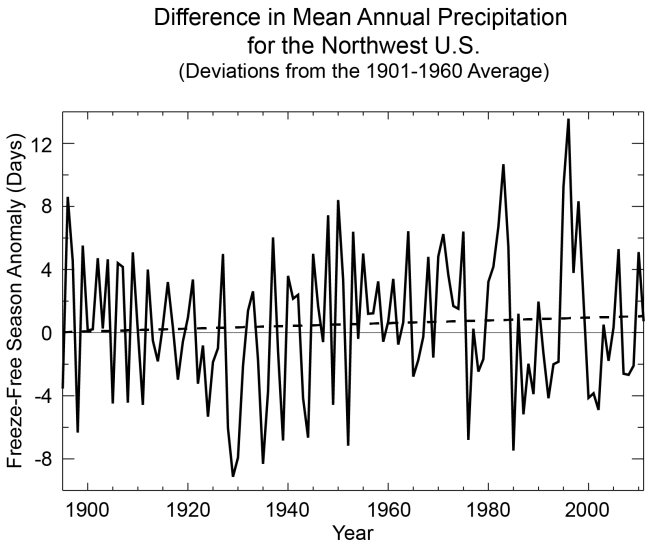
This section summarizes the observed climate trends of the Northwest U.S., focusing mainly on temperature and precipitation, as well as other climate features, including heat waves and extreme precipitation. These historical data are primarily from the National Weather Service's Cooperative Observer Network (COOP), which has been in operation since 1895.

Temperature

- Temperatures in the Northwest have generally been above the 1901-1960 average for the last 25 years, both annually and for all seasons. Temperature trends are statistically significant (at the 95% confidence level) for all seasons and for the year as a whole.
- Freeze-free season lengths during 1991-2010 averaged about 11 days longer than during 1961-1990. Since 1990, the last occurrence of 32°F in the spring has been occurring earlier and the first occurrence of 32°F in the fall has been happening later.

Precipitation

- Annual precipitation across the region has exhibited very high variability since 1976 (see figure). The most recent 35 years have seen several very wet years, including the wettest on record (1996). However, the majority have been below the 1901-1960 average. Seasonal averages are similar, with winter having notably high variability.



Extremes

- The occurrence of heat waves in the Northwest has been high in recent years, with five of the top 10 years for intense heat occurring in the last two decades. The frequency of cold waves has been generally low since 1990, with all of the top ten years for intense cold occurring prior to 1991.
- There is no evidence of an overall trend in extreme precipitation for the 20th century in the Northwest U.S. However, compared to other regions, the year-to-year variability is relatively modest.

[1] Washington, Oregon, and Idaho.

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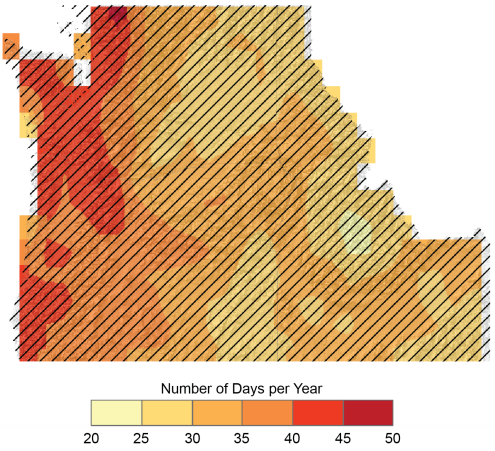
Future Regional Climate Scenarios

This section describes simulated future climate conditions based on climate models using two emissions scenarios generated by the Intergovernmental Panel on Climate Change: the high (A2) scenario, in which emissions of heat-trapping gases continue to rise, and the low (B1) scenario, where emissions peak in the mid-21st century and decline substantially thereafter. These scenarios were chosen because they incorporate much of the range of potential future human impacts on the climate system, and are used in a large body of literature. These simulations use data from the WCRP's Coupled Model Intercomparison Project 3 (CMIP3), as well as from statistically- and dynamically-downscaled data sets, including North American Regional Climate Change Assessment Program (NARCCAP) data (for A2, mid-century only).

Temperature

- CMIP3 models indicate statistically significant annual mean temperature changes across the Northwest for all three future time periods and both emissions scenarios. Increases in temperature show relatively little spatial variation for all three future time periods, although increases along the coast are generally less than those inland.
- There is uncertainty within the range of model-simulated temperature changes, but for each model simulation, the warming is unequivocal and large compared to historical temperature variations.
- The freeze-free period throughout the Northwest region is simulated by the NARCCAP models to increase by 25 to 35 days across much of the region, with larger increases west of the Cascade Mountains (see figure).
- NARCCAP simulations indicate the greatest increases in the number of hot days (maximum temperature of more than 95°F) in the southeastern portion of the region. The longest string of days with such high temperatures is simulated to increase by up to 10 days per year.

Simulated Change in Annual Mean Freeze-Free Season Length
(A2 Scenario, 2041-2070 minus 1980-2000)



Precipitation

- An increase in annual mean precipitation is simulated for the majority of the Northwest U.S., for all future time periods and both emissions scenarios. The CMIP3 models are mostly in agreement that precipitation will increase. However, they do not agree on the sign of the change in the southwest of the region under the high emissions scenario.
- NARCCAP model simulations for precipitation vary significantly by season and location. The models simulate an overall increase in precipitation for winter, spring, and fall, but a decrease in almost all parts of the region for summer (see figure). Spring and summer show slightly more spatial variability in precipitation change than fall and winter.
- The range of model-simulated precipitation changes is considerably larger than the multi-model mean change for both the high and low emissions scenarios, meaning that there is great uncertainty associated with precipitation changes in these scenarios.
- NARCCAP simulations indicate increases in the number of wet days (precipitation exceeding 1 inch) for most of the region, with the greatest increases occurring east of the Cascade Mountains. Changes are statistically significant only for small areas in central Washington and Oregon.

Simulated Change in Seasonal Mean Precipitation
(A2 Scenario, 2041-2070 minus 1980-2000)