January 2053...

I DON'T CARE WHAT THEY SAY, THIS GLOBAL WARMING SCARE IS JUST A BUNCH OF LOONY LEFT-WING ENVIRONMENTAL ANTI-GROWTH HYPE!

SO, IS THIS YOUR FIRST WINTER HERE IN BLAINE?
What Does the Crystal Ball Indicate for Future Precipitation and Streamflows?

Description of Recent Event

Regional Historical Trends

Climate Change Projections
About OWSC

- Expert source for climate and weather information and data for the public, state agencies, other researchers, local decision makers
- Over 100 requests/year from public, state agencies, media, researchers, etc.
- www.climate.washington.edu
- Links to reputable climate information
- OWSC-developed climate tools
- Monthly newsletter
Oct-Mar Cascade Mountains temperature and precipitation

courtesy of Karin Bumbaco
El Nino Winters
June 26-30 Heat Wave

- All-time June max T records set at Pullman (99°F), Moses Lake (106°F), Ephrata (107°F), Colville (104°F), Omak (107°F) on 27th

- Warmest June T recorded anywhere in the state: 113°F at Walla Walla and Chief Joseph Dam on the 28th
- Averaged statewide, June was record warmest
  - 7.8°F above 20th century average
The mouth of the White Salmon River in July 2015
USGS 12210000 SF NOOKSACK RIVER AT SAXON BRIDGE, WA

Discharge, cubic feet per second

- Median daily statistic (6 years)
- Period of approved data
- Discharge
- Period of provisional data
1920-2012 Temperature Trends

Squares aren’t significant linear trends; circles are significant at 95%

Abatzoglou et al. 2014 (J. Climate)
WA State Summer Temperatures

Washington, Average Temperature, June-August

1895-2015 Trend
+0.2°F/Decade
Avg: 61.8°F

Avg Temperature

NOAA National Oceanic and Atmospheric Administration
US Department of Commerce
Summer Minimum Temperatures – Puget Sound Climate Division

Washington, Climate Division 3, Minimum Temperature, June-August

1895-2016 Trend
+0.3°F/Decade
Avg: 50.4°F

Min Temperature
Low-level Humidity
trend for 1944–2015: -1.8 in / decade

Statistically Significant
USGS NF Stillaguamish at Arlington: Highest Daily Flow

Trend for 1929–2015: +950 cfs / decade

Statistically Significant
USGS Sauk R. Nr. Sauk: Highest Daily Flow

trend for 1929–2015: +960 cfs / decade

*Not Statistically Significant*
USGS Sauk R. Nr. Sauk: Date of Peak Flow

Trend for 1929–2015: -6.6 days since Aug 1 / decade

Not Statistically Significant
trend for 1929–2015: -5.1 cfs / decade
Not Statistically Significant
Temperature Changes by Season

Changes relative to 1970-1999 mean
Modeled Change In Temperature

Nov-Dec-Jan

Jun-Jul-Aug
Precipitation Changes by Season

- Changes relative to 1970-1999 mean

Wetter winters

Drier summers

(slide courtesy of Ingrid Tohver - UW CIG)
Modeled Change in Precipitation

Nov-Dec-Jan

Jun-Jul-Aug
Mean Change in Modeled 1-year Lag Correlation in Annual Precipitation – Multi-year Dry and Wet Periods
2014-15: A preview of our winters in the future?


Oct-Feb Temperature vs. Oct-Feb Precipitation

Δ Temperature Oct-Feb (°C)

Δ Precipitation Oct-Feb (%)

Lower CO₂ values

Abatzoglou 2015
Large Drop in Snowpack in the Mountains with Climate Change
Expected Transitions in Watershed Types

Hamlet et al. 2013
Chehalis River at Porter

Yakima River at Parker

Columbia River at The Dalles

Elsner et al. 2010
Watershed Classification

Ratio of Peak SWE to October to March Precipitation
- < 0.1 Rain dominant
- 0.1 - 0.4 Transition
- > 0.4 Snow dominant

Historical

A1B
- 2020s
- 2040s
- 2080s

B1
- 2020s
- 2040s
- 2080s

Tohver et al. 2014
Observed and Modeled Peak Flows on Skagit River near Mt. Vernon

Lee et al. 2016

2040s

2080s

Flow (cms)

Peak Flow Date (starting from Oct 1st)
Observed and Modeled Lowest 7-day Flows on Skagit River near Mt. Vernon

Lee et al. 2016
Modeled 1 July Soil Moisture (percentiles)

Elsner et al. 2010

Historic (mm/in) Percentile

A1B

B1

2020s

2040s

2080s
August Mean Surface Air Temperature and Maximum Stream Temperature

A1B

B1

2020s

2040s
Figure 1. Topography of the Columbia River Basin, and composite mean monthly hydrographs for natural flows at The Dalles, Oregon, and flows originating in Canada.
Historical Hydrograph

2080s Hydrograph

Much greater flow in spring; lesser flow in autumn

Courtesy of Alan Hamlet
Summary

- Record temperature anomalies have occurred during the last 1-2 years in the NE Pacific and the Pac NW.

- Future decades are liable to bring not just warmer temperatures but also probably wetter winters and maybe slightly drier summers.

- Relative to historical norms, regional streams are expected to have greater flows in winter and lower flows in summer.

- Will overall water supply or water quality be a bigger issue?
Puget Sound, 2045...

Yeah, I miss the salmon, too, but you gotta admit global warming has brought us some cool new species!
References


