



Weather Summary

Olympic National Park – Water Year 2022

The North Coast and Cascades Network (NCCN) Inventory and Monitoring Program monitors climate, comparing current and historical data to understand long-term trends, provide data to model future impacts to park facilities and resources, and provide park staff with information needed to make management decisions. This brief summarizes climate data collected and notable weather events that occurred during Water Year¹ 2022 in Olympic National Park.

Significant Weather Events

The wet season began with a series of significant storms beginning in mid-October. The first was October 15th to 16th, followed by another from October 24th to 28th. By month's end, Quillayute Airport received 19.53" of rain, 183% of normal. Similarly, the Quinault received 25.9" in October, 200% of average.² This brought rivers and streams to bank levels, saturated soils, and set the stage for a series of damaging rain events in November.

On November 11th, heavy rainfall from a rapid series of storms began. A second event followed on the 13th and culminated on the 15th when park climate stations recorded rainfall intensities of more than a half inch per hour. The highest rainfall occurred in a northern swath of the Olympic Peninsula (Figure 1).

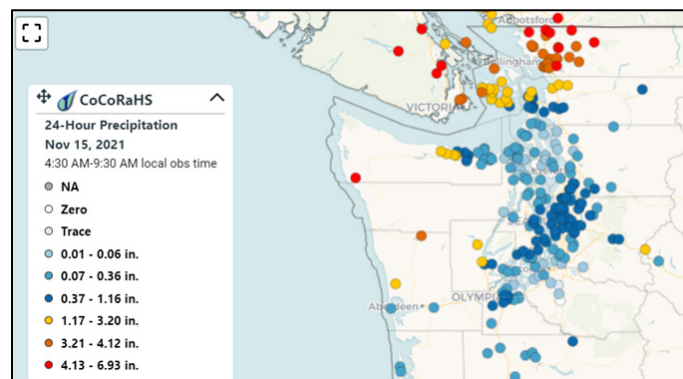


Figure 1. Daily precipitation collected at CoCoRaHS (volunteer precipitation measurement) stations near Olympic National Park on November 15th. Red and yellow markers indicate the areas of highest rainfall.

This event triggered a major landslide and several smaller slides that closed Hwy 112 and isolated the Makah Reservation and the Ozette area of Olympic National Park for nearly a week. A debris flow also temporarily closed Hwy 101 near Lake Crescent. Some severely damaged sections of Hwy 112 remained closed until July 2022.

The heavy rainfall on November 15th also caused major flooding on rivers of the Peninsula. Discharge on the Hoko River (near Ozette Lake) reached 20,000 cubic feet per second (CFS), the highest recorded in the 56-year record. Similar measurements were captured on the Calawah River, near Forks, Washington, a major tributary to the Quillayute River. The Calawah recorded a peak flow of 42,000 CFS, nearly 4,000 CFS higher than the previous record. These flows also coincided with an 11.2-foot ocean storm tide, which backed up flood waters from the Quillayute River and exacerbating the flooding in the coastal town of La Push and along the Mora Road accessing Rialto Beach.

Two additional storms impacted western Washington from November 24th to December 1st. These contributed to one of the highest water levels ever recorded at Ozette Lake, which flooded the park campground and maintenance facilities, leading to the closure of this area for several weeks (Figure 2).



Figure 2. Flood waters from Ozette Lake inundate the Ozette Ranger Station hiker's kiosk and Coal Creek bridge in late November 2021.

¹ Water year is defined as the period from October 1 to September 30 of the following year, to encompass a full cycle of precipitation accumulation.

² Quinault rainfall is compared to average as the weather station has a period of record of 25 years, inadequate to determine a 30-year climatological normal.

While the highest intensity of the November 15th storm was focused on the northern corner of the Peninsula, high rainfall and extreme flows also had major impacts on the park's west and southwest rivers, including the Hoh and Quinault. The Hoh River reached 51,100 CFS, comparable to at least a 10-year flood event. This flow was the highest in the last 14 years and had only been exceeded five times in the 60-year record from the Hoh.

Temperature

Annual air temperature during Water Year 2022 was close to normal but varied greatly by season. Fall was slightly warmer than normal. However, temperatures quickly shifted at the beginning of December, culminating in a major lowland snow event at the end of the month (Table 1). From December 26th to 31st, coastal weather stations reported six straight days of below-freezing temperatures. Kalaloch Ranger Station recorded 24.1°F on December 27th. At the Quillayute

Airport, another lowland station, the month of December was 4.4°F below normal (Figure 3). The remaining winter months of January and February were slightly above normal in temperature.

Spring was unusually cool, with the combined months of April and May 2.8°F and 3.3°F below normal at Quillayute and Elwha stations, respectively (Figure 3). Summer months by contrast were extremely warm, followed by an above-average September. Averaged statewide, July-August was the warmest on record, with a +3.6°F anomaly from the 1991-2020 normal.³ The mean monthly temperature for August at the Elwha Ranger Station was 68.0°F, the highest in the period of record extending back to 1942. Quillayute, at 62.6°F, had the third highest August average since recordkeeping began in 1966 (Table 2). The four months of June to September were 2.0°F and 3.1°F above normal at Quillayute and Elwha stations, respectively (Figure 3).

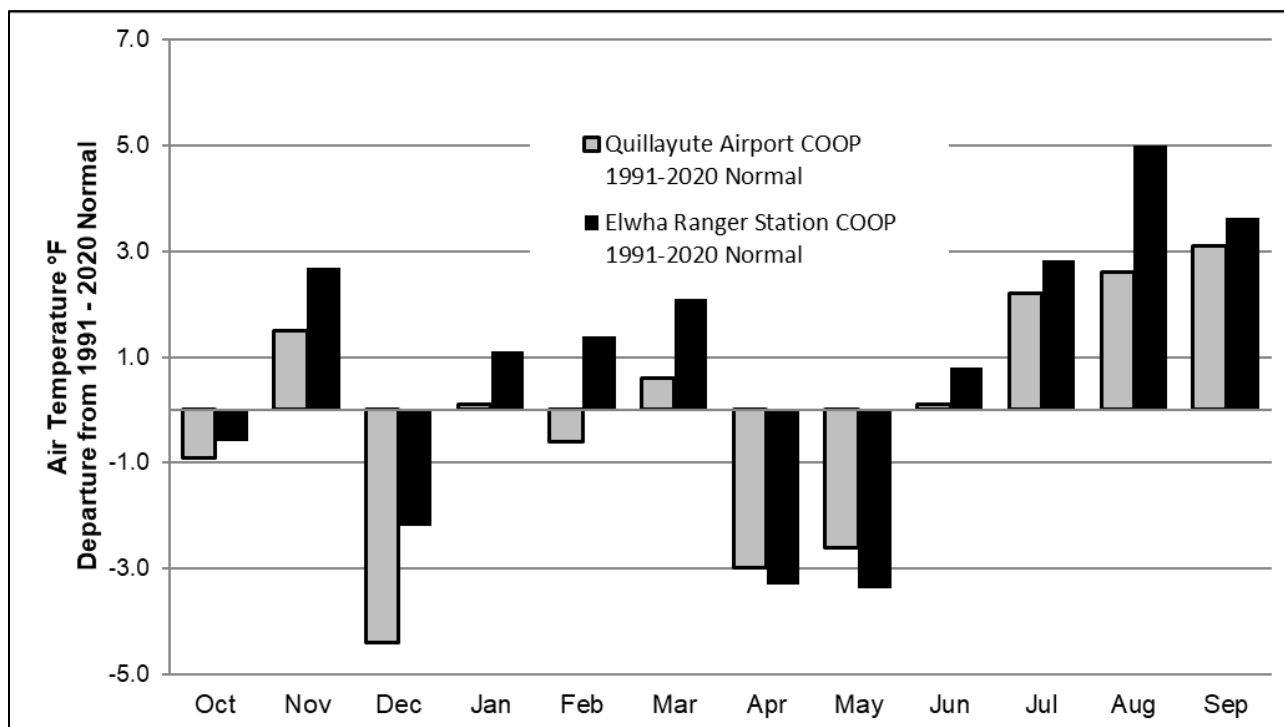


Figure 3. Comparison of Water Year 2022 average monthly temperature (°F) to the climatological normal 1991-2020 at Quillayute Airport and Elwha Ranger Station.

³ Office of the Washington State Climatologist Newsletter, September 2022 Report and Outlook. Available at: <https://climate.washington.edu/wp-content/uploads/2022Oct.pdf>

Table 1. Average monthly air temperatures (°F) from weather stations within northeast Olympic National Park in Water Year 2022.

Season	Month	Year	Buckinghorse SNOTEL	Deer Park Ranger Station	Deer Park Road	Elwha Ranger Station	Hayes River Guard Station	Waterhole SNOTEL
Fall	October	2021	38.0	34.7	42.5	47.9	---- ⁴	36.3
	November	2021	35.4	31.2	40.0	43.5	---- ⁴	33.4
Winter	December	2021	25.8	20.0	28.7	34.5	---- ⁴	24.4
	January	2022	36.5	31.3	40.2	38.1	---- ⁴	33.2
	February	2022	33.4	28.9	36.4	39.7	---- ⁴	30.0
Spring	March	2022	34.2	29.5	39.3	44.4	---- ⁴	32.0
	April	2022	30.7	25.9	38.0	43.8	---- ⁴	28.8
	May	2022	36.8	33.3	45.1	49.9	44.5	35.0
Summer	June	2022	46.1	43.2	54.4	58.0	53.7	43.3
	July	2022	57.2	54.8	65.2	65.0	62.5	51.0
	August	2022	60.7	58.4	65.4	68.0	63.8	56.7
Fall	September	2022	54.4	52.0	58.6	61.7	54.7	50.5
Water Year			40.8	36.9	46.1	49.5	----	37.9

Table 2. Average monthly air temperature (°F) from west side weather stations within and adjacent to Olympic National Park in Water Year 2022.

Season	Month	Year	Hoh Rainforest	Kalaloch Ranger Station	Ozette Ranger Station	Quillayute Airport COOP	Quinault Rainforest
Fall	October	2021	46.5	50.2	50.0	49.7	46.1
	November	2021	42.7	47.6	47.2	46.2	39.0
Winter	December	2021	33.8	38.4	38.3	36.6	29.7
	January	2022	35.6	41.8	41.5	41.8	33.1
	February	2022	38.2	41.8	42.7	41.5	38.2
Spring	March	2022	43.0	44.9	45.1	44.5	42.8
	April	2022	40.9	44.3	44.7	43.9	42.4
	May	2022	47.9	49.5	49.4	49.1	48.9
Summer	June	2022	56.6	55.7	56.5	55.6	57.9
	July	2022	63.2	58.4	60.0	61.5	64.3
	August	2022	64.8	60.0	61.7	62.6	65.5
Fall	September	2022	59.7	57.2	59.2	60.2	60.8
Water Year			47.7	49.1	49.7	49.4	47.4

Precipitation

Annual precipitation for Water Year 2022 was above average at most weather stations at Olympic National Park. Quillayute Airport received 122.4" of annual precipitation, 123% of normal. Elwha Ranger Station received 76.2 inches, 107% of normal (Tables 3 and 4). Spatial distribution was typical, with highest precipitation at the Quinault and Buckinghorse stations (both with 135.6"), and the lowest quantities recorded in the rain-shadowed Deer Park area (37.6"). As was the

case with air temperatures, there were stark contrasts between seasons. Fall months of October and November were much wetter than normal. Quillayute Airport received 183% and 181%, respectively, of normal precipitation over those two months. Winter months were slightly drier than normal, while the early spring month of March was extremely dry. The Elwha Ranger Station received only 2.3 inches of rain (33% of normal), the 6th lowest since 1942. The deficit of precipitation was offset by an extremely wet period between April and

⁴ Datalogger power failure. No data collected.

June. These months received 168% and 158% of normal precipitation at the Quillayute and Elwha, respectively.

Late summer and early fall were remarkably dry. The Quillayute Airport recorded 39% of normal rainfall during the period of July to September. The Elwha was even drier, recording only 0.36" of rain during this period. Even more unusual was that this dry period

extended into the next water year. By mid-October, the Elwha Ranger Station had received less than an inch of rain, while normally wetter locations such as the Hoh Rainforest, received less than 0.25 inches of rain. Most rivers on the Peninsula had alarmingly low volumes of water, and emergency fishing closures were enforced on most rivers within Olympic National Park.

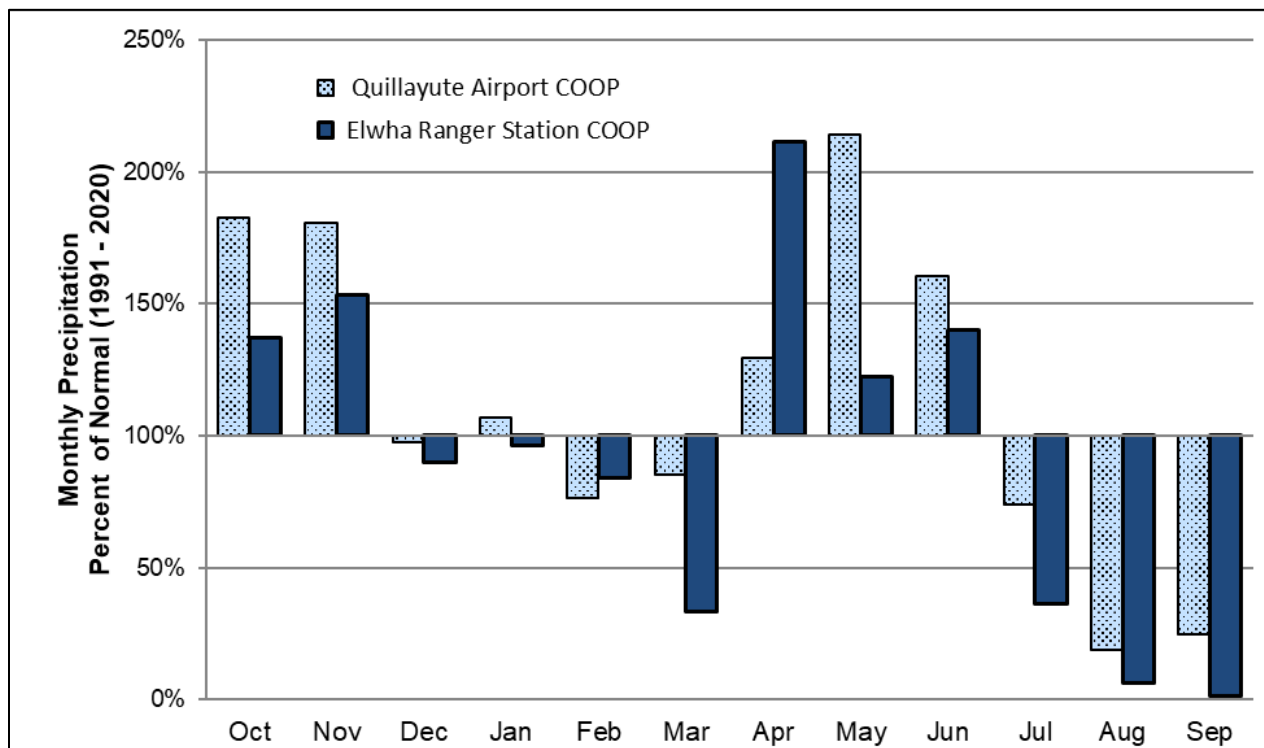


Figure 4. Water Year 2022 monthly total precipitation (inches) as a percent of the climatological normal 1991-2020 at Quillayute Airport and Elwha Ranger Station.

Table 3. Total monthly precipitation (inches) from weather stations within northeast Olympic National Park in Water Year 2022.

Season	Month	Year	Buckinghorse SNOTEL	Deer Park Ranger Station	Deer Park Road	Elwha Ranger Station	Hayes River Guard Station	Waterhole SNOTEL
Fall	October	2021	22.6	4.42	5.00	8.03	---- ⁶	7.6
	November	2021	32.9	---- ⁵	8.34	15.42	---- ⁶	16.6
Winter	December	2021	17.8	---- ⁵	5.37	8.92	---- ⁶	15.6
	January	2022	19.9	---- ⁵	4.17	8.54	---- ⁶	11.1
	February	2022	5.6	---- ⁵	3.71	5.15	---- ⁶	3.2
Spring	March	2022	11.6	---- ⁵	1.72	2.30	---- ⁶	6.1
	April	2022	11.7	---- ⁵	3.43	6.94	---- ⁶	9.1
	May	2022	8.1	1.08	2.83	2.34	4.65	4.0
Summer	June	2022	4.9	2.53	1.78	1.95	3.32	2.6
	July	2022	0.0	0.01	1.14	0.27	0.08	0.2
	August	2022	0.0	0.35	0.08	0.07	0.00	0.0
Fall	September	2022	0.5	4.05	0.07	0.02	0.06	0.1
Water Year		2022	135.6	---- ⁵	37.65	59.95	---- ⁶	76.2

⁵ Unheated rain gauge. No data collected during winter months.

⁶ Datalogger power failure. No data collected.

Table 4. Total monthly precipitation (inches) from west side weather stations within and adjacent to Olympic National Park in Water Year 2022.

Season	Month	Year	Hoh Rainforest	Kalaloch Ranger Station	Ozette Ranger Station	Quillayute Airport COOP	Quinault Rainforest
Fall	October	2021	16.77	14.22	15.33	19.53	22.63
	November	2021	30.19	26.18	29.39	27.56 ⁷	33.34
Winter	December	2021	11.21	11.81	9.72	13.48	16.05
	January	2022	15.42	15.61	13.86	16.63	19.05
	February	2022	8.99	5.77	6.04	7.42	10.88
Spring	March	2022	7.20	8.97	7.45	10.03	8.59
	April	2022	12.92	9.73	8.83	10.52	10.96
	May	2022	7.20	7.51	8.79	9.09	6.99
Summer	June	2022	5.16	4.36	4.06	5.30	6.19
	July	2022	1.01	0.82	1.47	1.17	0.24
	August	2022	0.13	0.22	0.50	0.50	0.14
Fall	September	2022	0.16	1.03	1.08	1.12	0.56
Water Year		2022	116.36	106.23	106.52	122.35	135.64

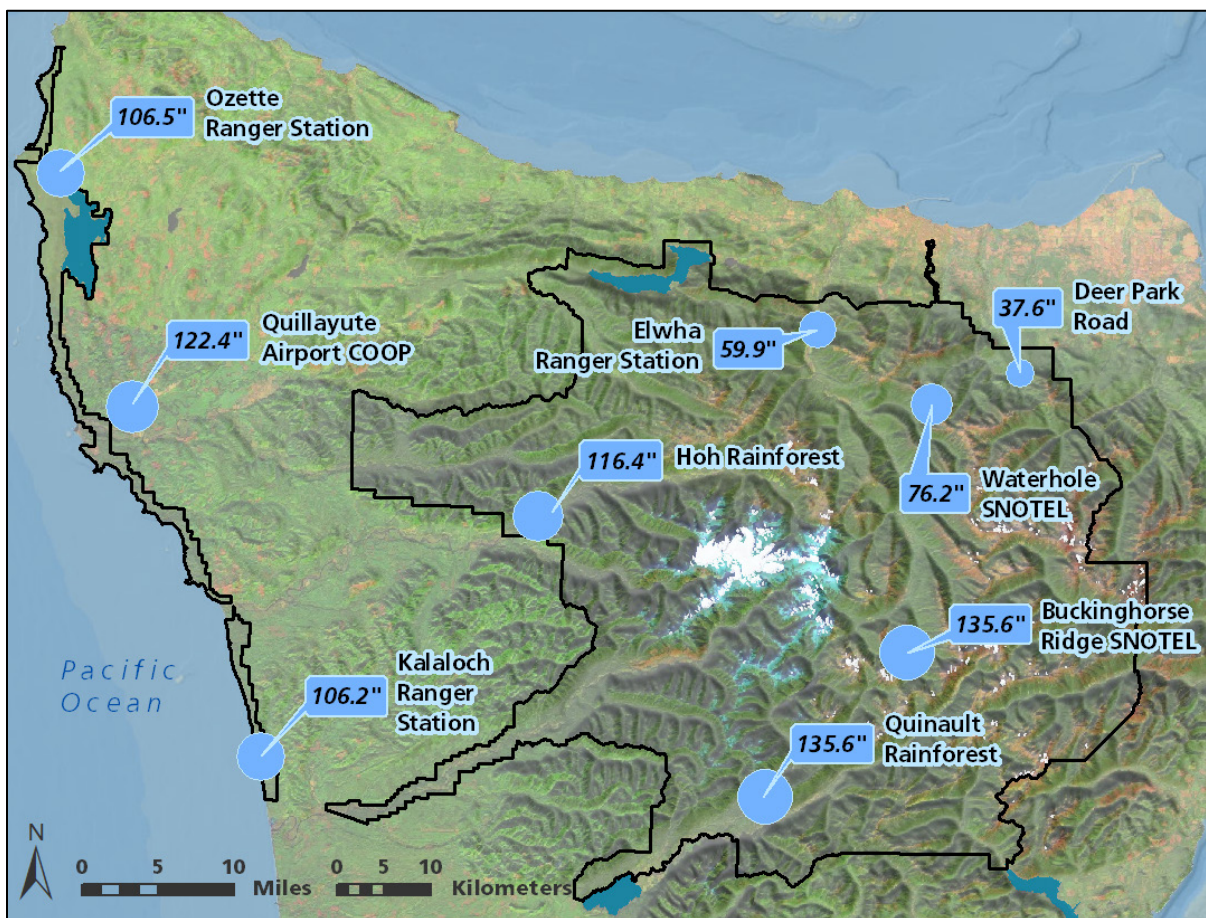


Figure 5. Total precipitation measured at weather stations located within Olympic National Park during Water Year 2022. Blue circles are proportional to the total amount of precipitation measured at each site.

⁷ Missing two days of data.

Snowpack

Cool and wet conditions in early November formed a promising snowpack early in the season. Unfortunately, a rapid series of warm and wet atmospheric rivers stripped the mountains of snow by December 1st. A remarkable 30" of snow depth was removed in a period of two weeks, contributing to some of the flooding issues on many Olympic rivers during this period. The snowpack began to recover during a prolonged cold period between December 3rd and January 10th, when the mountains experienced a run of 40 consecutive days of below freezing temperatures with ample snowfall. This was followed by a stagnant period of snowpack growth, due to a warmer than average January and a warmer and drier than average February (Figures 3 and 4). In fact, there was no net gain in snowpack from January 10th until February 25th, a period of 45 days

(Figure 6). By March 1st, the snowpack at Waterhole was only 81% of average. The month of March was also warmer and drier than average, and by April 1st, snowpack had further declined to a meager 73% of average.

A dire outlook for summer river flows turned around suddenly in the month of April, which ranked statewide as the 3rd coldest on record.⁸ The Waterhole SNOTEL at Hurricane Ridge recorded temperatures 4.5° and 4.9° F below average, while precipitation was 208% and 151% of average for the months of April and May respectively (Figures 4 and 5). This built the snowpack to near the median peak value of snow water equivalent. This peak, however, occurred 39 days later than average and melt out date was 13 days later than average (Figure 6).

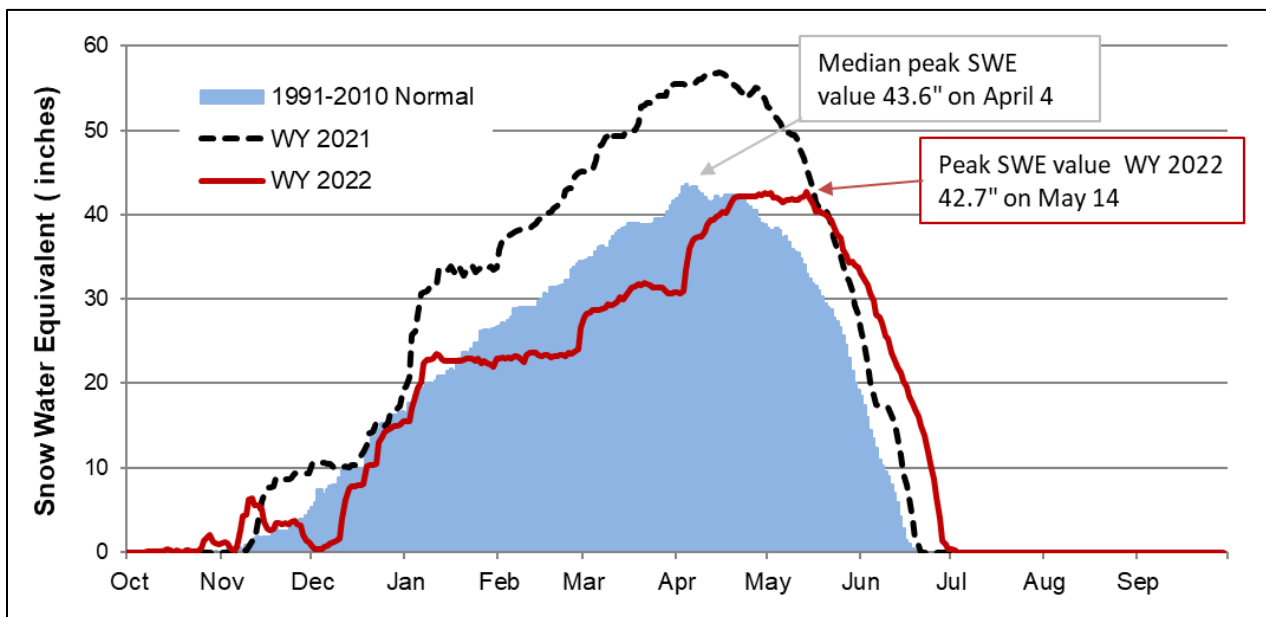


Figure 6. Daily snow water equivalent at the Waterhole SNOTEL, Hurricane Ridge, in Water Year 2022 compared to Water Year 2021 and the climatological normal 1991-2020. The graph clearly shows the impact of warm atmospheric rivers in late November, warm/dry January and February that limited growth of the snowpack, and the late increase in snowpack due to the cool and wet late spring months in the Olympic Mountains.

⁸ Office of the Washington State Climatologist Newsletter, April 2022 Report and Outlook. Available at: <https://climate.washington.edu/wp-content/uploads/2022May.pdf>

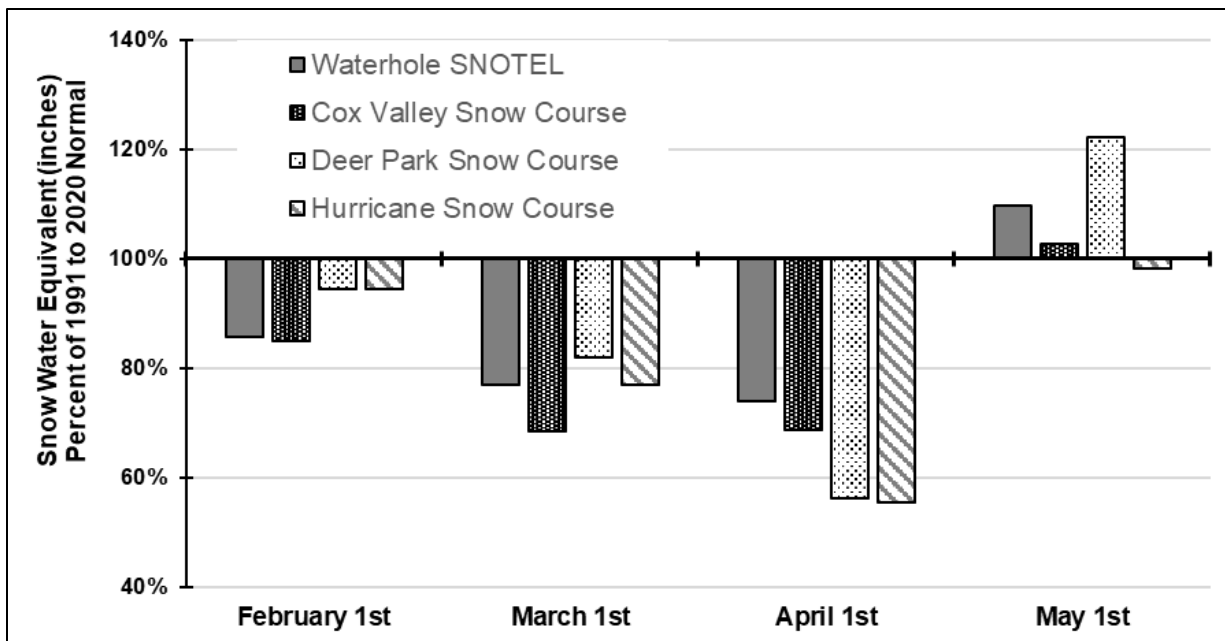


Figure 7. Monthly snow water equivalent at Waterhole SNOTEL and the Cox Valley, Deer Park, and Hurricane Snow Courses in Water Year 2022, compared to the climatological normal 1991 to 2020.

More Information

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