YOUR NATIONAL WEATHER SERVICE SPOKANE QUARTERLY REPORT

VOL XXVI, ISSUE 4
DECEMBER 2021

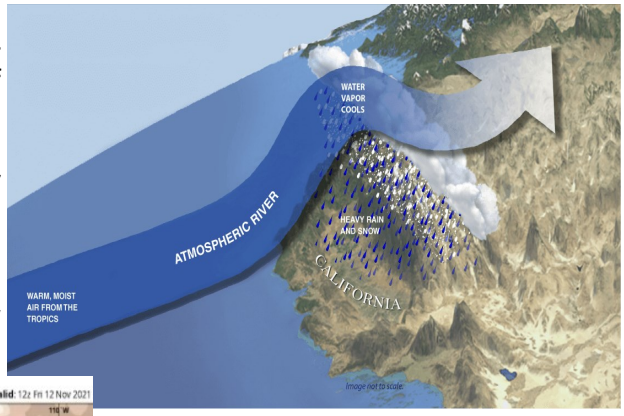
The Weather Watcher

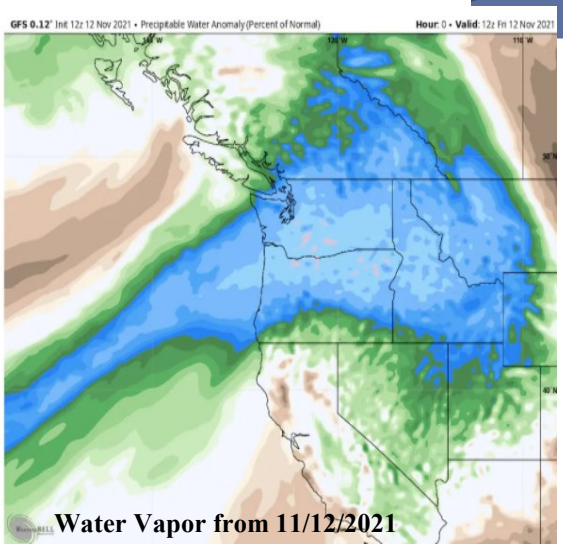
of the Inland Northwest

www.weather.gov/Spokane

Atmospheric Rivers

Atmospheric rivers are relatively long, narrow regions in the atmosphere – like rivers in the sky – that transport most of the water vapor outside of the tropics. These plumes of vapor move with the weather, carrying large amounts of water vapor, roughly equivalent to the average flow of water at the mouth of the Columbia River. When the atmospheric rivers make landfall, they often release this water vapor in the form of rain or snow.



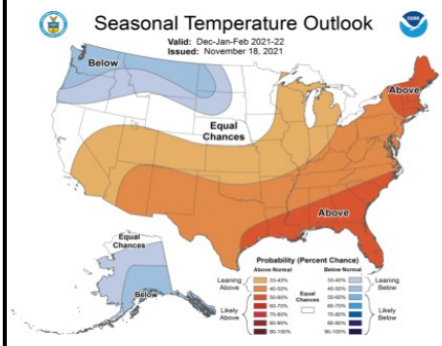


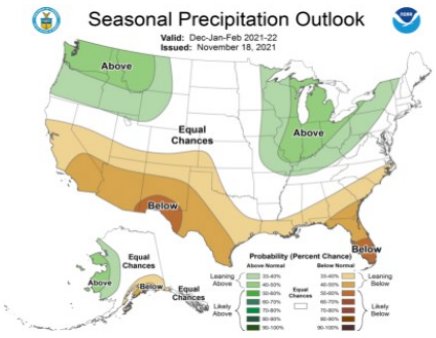
Water Vapor from 11/12/2021

Although atmospheric rivers come in many shapes and sizes, those that contain the largest amounts of water vapor and the strongest winds can create extreme rainfall and floods, often by stalling over watersheds vulnerable to flooding. It's a bit like having a firehose, spraying water at one location for an extended period of time. These events can disrupt travel, induce rock and mudslides and cause catastrophic damage to life and property, like what was experienced in western Washington this fall. A well-known example is the "Pineapple Express," a strong atmospheric river that is capable of bringing moisture from the tropics near Hawaii over to the U.S. West Coast.

Not all atmospheric rivers cause damage; most are weak systems that often provide beneficial rain or snow that is crucial to the water supply. Atmospheric rivers are key features in the global water cycle and are closely tied to both water supply and flood risks, especially in the western United States. While atmospheric rivers are responsible for great quantities of rain that can produce flooding, they also contribute to beneficial increases in the mountain snowpack, which is what we need in the Inland NW. Check out more information on atmospheric rivers from the NOAA Physical Sciences Laboratory.

Winter Outlook—December 2021 through February 2022





For the Inland NW, the winter outlook favors better chances for **cooler and wetter** conditions. This supports the long range La Niña forecast.☼

Want to report precipitation? Check out CoCoRaHS at *www.cocorahs.org*

INSIDE THIS ISSUE:

Editor's Notes

When skies are clear, winter can be a great time to explore the night sky and identify stars, constellations and track the moon phases.

*December's full moon will be known as a **Micro-moon** when the full moon coincides with apogee, or when the moon's orbit is farthest away from the Earth in its elliptical orbit. The next full moon dates include: January 17th—the Wolf Moon & February 16th—the Snow Moon. Each full moon has a name based on the changing season and nature.*

The Winter Solstice arrives Tuesday, December 21, 2021 at 7:59 am PST. This marks the shortest day of the year, when the Earth is tilted away from the sun. After this date, days become longer and nights shorten as spring approaches.

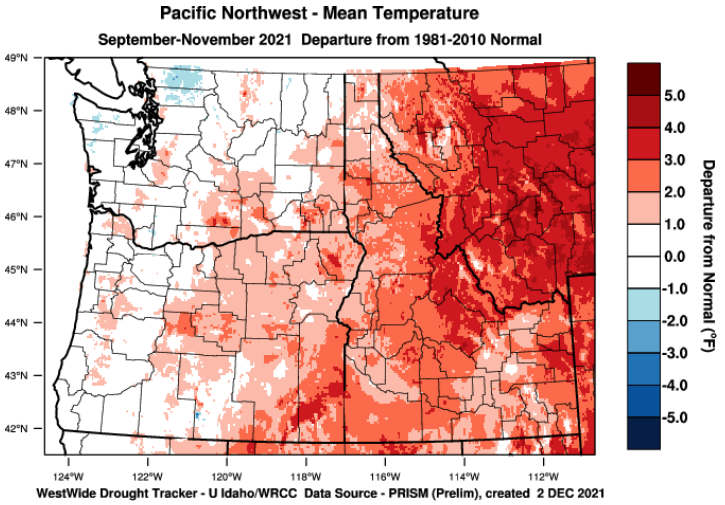
We're always looking for new ideas and stories for our publication. Please send to nws.spokane@ noaa.gov. Past and current newsletters are available on the NWS Spokane web page.

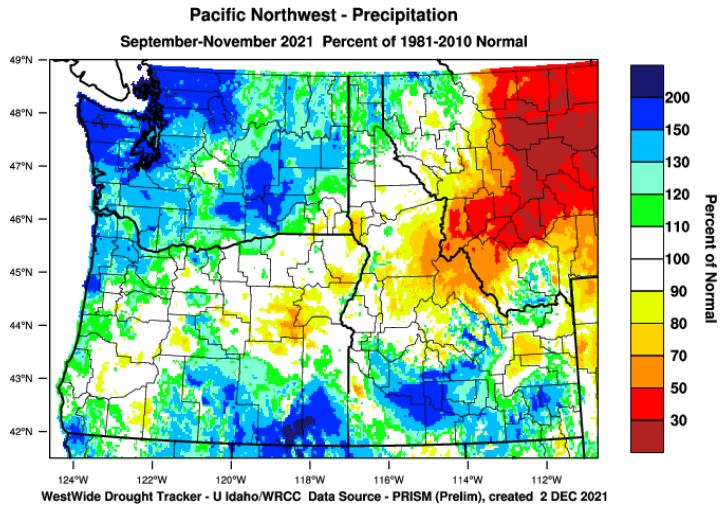
The main purpose of this publication is to keep our readers informed about NWS services and programs, and recognize those who help us with our mission, including weather spotters, observers, media, emergency managers, and government agencies.

All articles are written by the NWS staff. A special thanks goes to Jeremy Wolf for all of his contributions.

Fall 2021 in Review

Fall across the Inland NW brought seasonal to slightly warmer than normal temperatures and above normal precipitation as summarized by the maps below. The North Cascades was especially wet with Stehekin reporting 19.17" of precipitation from September through November, the 3rd wettest since 1916. This was welcome news as fall began with extreme to exceptional drought after a very hot and dry summer and record dryness from February to August for many locations.





September began on a dry note but everything changed on the 10th as a series of weather systems brought cooler temperatures and rain to the region, which then lasted for the remainder of the month. A band of rain stalled over Moses Lake to Grand Coulee to Republic on the 10th, leading to 0.50-0.75" of rain. Ephrata's rainfall of 0.63" smashed the previous daily record of just .07". It was the Idaho Panhandle's turn on the 18th with reports of 1.50-2.00" around Sandpoint, Clark Fork, and Rathdrum. Spokane's measly 0.42" was still noteworthy, as it was the wettest day since January 12th or in 9 months! Similar story for Lewiston where 0.36" was the highest amount since February 15th.

October started off on a dry note with quiet weather through the 20th, then the wet pattern returned. On the 24th, around an inch of rain was reported in the Methow Valley with the surrounding mountains receiving up to 1.80". On the 28th and 29th, a subtropical moisture plume took aim at the northern Cascade crest and Idaho Panhandle. Stehekin picked up 2.59", while Saddle Pass—located in the mountains west of Bonners Ferry, received 2.84".

Road sign activation—Nov 15, 2021

November was active with several noteworthy events. The first was another warm and wet period from the 11th through the 14th in the Cascades. Snow melt and rain pushed the several rivers in the Cascades into minor flood stage including the Stehekin, Similkameen, and Okanogan basins. The Okanogan River at Tonasket reached flood stage on the 17th, making it the first fall flood since records began in 1929. It also got abnormally warm with the Wenatchee Airport tying its all time November temperature record of 70°F on the 14th. The warm temperatures gave way to a strong cold front on the 15th, bringing damaging winds to the area. Several downed trees were reported across eastern Washington and north Idaho resulting in power outages and localized damage. The downed trees closed Highway 20 over Sherman Pass with 4-5 trees on the road. Peak wind gusts from the storm included: 82 MPH Magee Peak—located in the mountains east of Athol, 72 MPH Athol, 72 MPH Alder Ridge—located in the Blue Mountains of southeast Washington, 67 MPH Leecher—located in the mountains east of Carlton, 63 MPH Pullman, 62 MPH Spokane Airport and Pomeroy, 61 MPH Coeur d'Alene, and Moses Lake 56 MPH. The cold front set the stage for the one significant lowland snow event of the meteorological fall across portions of the Inland NW. On the 18th into the 19th, the valleys of northeast Washington into the Idaho Panhandle received 4-7" of snow, including Naples, Newport, Diamond Lake, Deer Park, and Republic. The month finished with another mild and wet period for the Cascades, while mainly warm weather was the theme for most of the region with high temperatures back in the 50s and 60s, shattering more daily temperature records. ☼ *Jeremy Wolf*


High flows on the Stehekin—Nov 12, 2021

ANSWER: Spokane: March 20, Lewiston: February 26, Wenatchee: March 11, & Priest River: April 24

Fall Weather Statistics

Wenatchee Water Plant	Sept	Oct	Nov	Total
Avg High Temp	77.2	62.4	49.9	63.2
Departure from Norm	-1.6	-0.9	+3.3	+0.3
Avg Low Temp	52.4	40.7	34.1	42.4
Departure from Norm	+0.1	-0.6	+1.8	+0.4
Total Precip	0.14	0.56	1.55	2.25
Departure from Norm	-0.10	-0.16	+0.40	+0.14
Total Snowfall	0.0	0.0	0.0	0.0
Departure from Norm	0.0	0.0	-1.5	-1.5
Lewiston Airport	**Sept**	**Oct**	**Nov**	**Total**
Avg High Temp	80.0	64.6	53.2	65.9
Departure from Norm	+0.5	+1.6	+4.5	+2.2
Avg Low Temp	53.4	43.7	39.0	45.4
Departure from Norm	+1.1	+1.7	+4.5	+2.4
Total Precip	0.69	0.76	1.89	3.34
Departure from Norm	+0.09	-0.32	+0.66	+0.43
Total Snowfall	0.0	0.0	T	T
Departure from Norm	0.0	0.0	-1.3	-1.3
Spokane Airport	**Sept**	**Oct**	**Nov**	**Total**
Avg High Temp	73.5	58.0	46.1	59.2
Departure from Norm	-0.1	+0.3	+3.8	+1.3
Avg Low Temp	50.1	39.1	34.2	41.1
Departure from Norm	+1.5	+1.1	+3.9	+2.2
Total Precip	1.35	1.17	2.60	5.12
Departure from Norm	+0.77	-0.20	+0.54	+1.11
Total snowfall	0.0	T	2.0	2.0
Departure from Norm	-0.1	-0.5	-4.2	-4.8

Prepare for the unexpected When the power goes OUT

- Know where your flashlights are kept
- Have fresh batteries ready
- Keep devices charged
- Have an alternate heat source
- Stay with friends who do have power ☼

Staff News

We are exited to announce more staff changes at NWS Spokane. Meteorologist Ken Daniels will be new Observation Program Leader (OPL) at the office and he will work with the many cooperative observers across area. He's transferred here from Flagstaff, AZ just about a year ago.

Chad Shafer will be the new Science Operations Officer (SOO). He was a lead forecaster at the Mount Holly office in Philadelphia, PA and also an Assistant Professor at the University of South Alabama. He will be arriving on station in February 2022.

John Neat will be the latest Electronics Technician (ET) at the office. He has served in the Navy and worked for the Defense Intelligence Agency. He will be coming on board before the end of the calendar year.

Congratulations to Ken, Chad and John. ☼

Need to Brush Up?

NWS Spokane offered virtual Spotter and Observer training this fall. The Spotter training classes were focused on cold season hazards, including snow, ice and wind. The Observer training classes provided specifics on taking snow measurements and how to report it correctly for the CoCoRaHS program. We trained 75 volunteers for the upcoming season.

If you still need to brush up on the latest spotter checklist or want to review snow measurements, recordings are available for both the Spotter and Observer classes. Keep in mind, if you have any changes to your contact information, make sure you email us at nws.spokane @noaa.gov to let us know or you can update us with the online spotter google form. ☼

NWS Spokane

Meteorologist In Charge
Ron Miller

Warning Coordination Meteorologist
Andy Brown

Science Operations Officer
Chad Shafer

Administrative Assistant
Jodi Fitts

Information Technology Officer
Todd Carter

Service Hydrologist
Robin Fox

Observation Program Leader
Ken Daniels

Lead Forecasters
Jon Fox
Greg Koch
Steve Bodnar
Jeremy Wolf
Charlotte Dewey

Meteorologists
Rocco Pelatti
Laurie Nisbet
Miranda Coté
Steven Van Horn
Joey Clevenger
Jenn Simmons
Valerie Thaler
Rebekah Cheatham

Electronic Systems Analyst
Mike Henry

Electronic Technicians
Paul Kozsan
John Neat

Remember your Winter Spotter Checklist

Snow:
2"+ valleys & 4"+ mountains

Strong Winds:
30mph+ or damage

Reduced Visibility:
under a mile due to fog, snow...

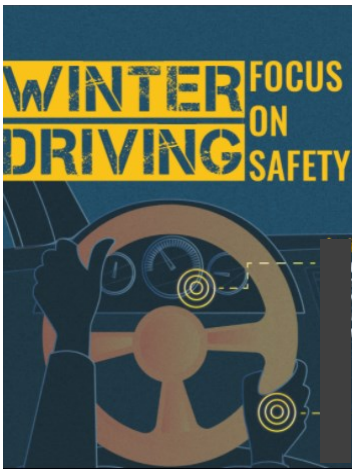
Hail: pea size or larger

Heavy Rain:
Showery: 1/2" + in 1hr
Steady: 1"+ in 12hr/1.5"+ in 24hr

Any **Mixed Precipitation**

Any Flooding

Travel Problems or Damage:
due to severe/hazardous weather



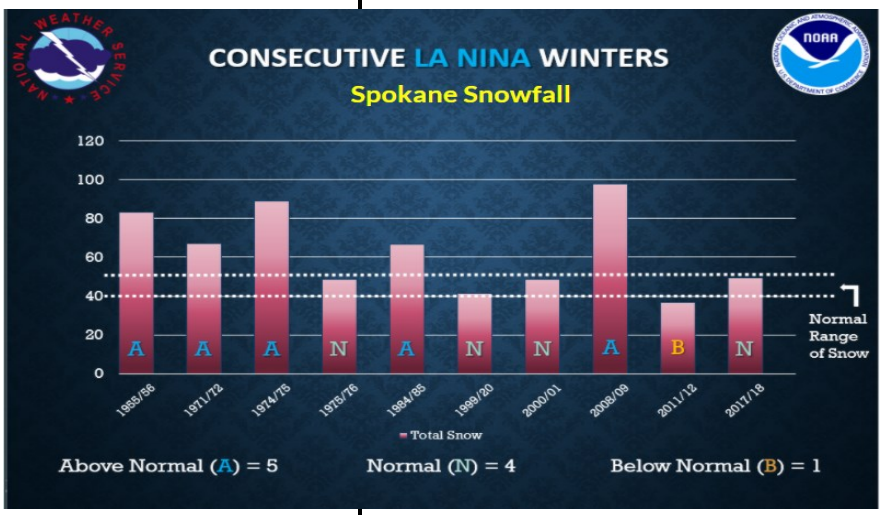
Be Prepared for Winter Driving

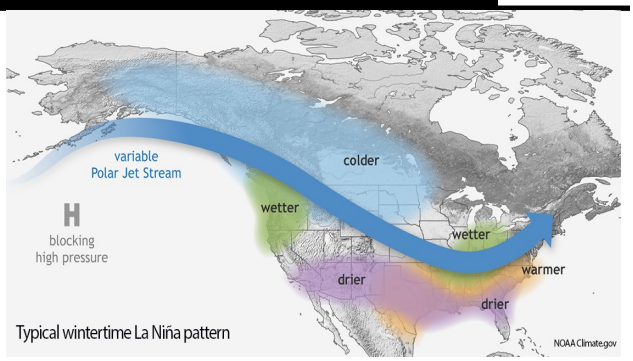
La Niña Explained

One of the "most discussed" winter season predictors is La Niña. It's a phase in the climate pattern across the Pacific Ocean. La Niña is defined by cooler than normal sea-surface temperatures near the equator in the eastern Pacific Ocean. These colder water are due to increased upwelling and stronger trade winds. The cold waters in the Pacific help guide the jet stream northward. This tends to promote drier conditions in the southern U.S. and heavy rains and flooding in the Pacific Northwest and Canada. During La Niña years, winter temperatures tend to be warmer than normal in the Southern tier states and favor cooler than normal across the North.

Not all La Niña's are the same and other factors come into play that affects our winter weather. It was a La Niña winter last year, and yes we did experience above normal precipitation especially in the mountain snowpack. So this year, we'll be dealing with a back-to-back La Niña and there have been ten of these dating back to the 1950s. Based on the data from Spokane, about half of these consecutive La Niña events (5) have experienced above normal snowfall and four of these events have experienced seasonal snowfall, including the 2017-18 season which was the last back-to-back La Niña. There was one season that saw below normal snowfall, and that was 2011-12.

The jury is still out on what to expect for the all-important winter element—SNOW. Local studies have shown that La Niña's bring above normal snowfall to the Inland NW most of the time. Snowfall climatology has been computed at many communities in the region.

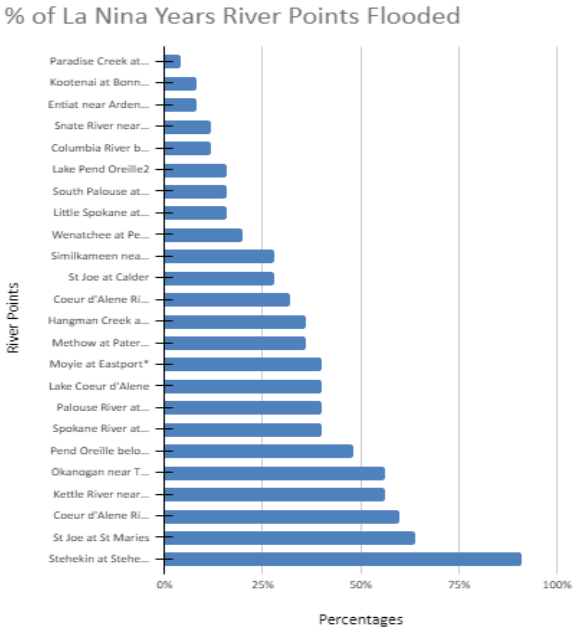




Flood Potential

With a seasonal outlook for above normal precipitation, the potential for river flooding increases. The region has already seen increased flows this fall from moderate to heavy precipitation and snowmelt across the northern Cascades and southern B.C. Fall flooding in the Inland NW is not out of the question, especially with river basins with headwaters near the Cascade crest—Stehekin. Yet we saw uncharacteristic flooding on the Similkameen and Okanogan basins and increased flows on the Kootenai River which don't typically see rises until the spring snowmelt season.

More elevated flows are possible this winter and spring on small and main-stem rivers. There are several river forecast points that have seen flooding at least 50% or more during La Niña years. It's still early, but the NW River Forecast Center's Peak Flow outlook remain low for exceeding flood stage for many locations. The mountain snowpack will continue to grow which feed the rivers. Keep in mind, under heavy precipitation events with warming temperatures, it would be prudent to prepare for higher flows and possible flooding on area rivers and streams. Be alert for the unexpected.



Question: With us now in winter, when do the average low temperatures rise above 32°F?