

The Weather Watcher of the Inland Northwest

www.weather.gov/Spokane



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Flood Outlook

The official snow depth on March 1, 2019 was 16" in Spokane. This matched the snow depth on March 1, 1969. Who remembers that? The winter of 1968-69 was a record breaking snow year and by March 1969, the snowpack was slowly melting with only a couple inches of additional snow. Temperatures warmed through the 40s to the lower 60s by the end of the month, while the snow depth dropped to a trace. Fortunately there were no reports of significant flooding that spring.

Let's fast forward 50 years, will we see a repeat of this? March 2019 started out with a very unusual late lowland snowpack while the mountains were 80-100% of normal. Below normal temperatures and snowy weather persisted for at least the first half of March. Meanwhile, the three month outlook for April through June suggests warmer than normal temperatures with near normal precipitation.

By early March, gages were experiencing ice on many of the rivers and streams, especially in the northern valleys, including in Stehekin, the Okanogan, Kettle and Kootenai river basins. Once this thaws, the NW River Forecast Center forecasts the rivers across the Inland NW to remain 60 to 90% of peak flow this spring with average chances or lower of reaching flood stage. Current stream flows are low. Some local flooding problems are possible, although widespread flooding is not expected at this time. This is based on a slow melt off of both lowland and mountain snow and the current snow water equivalent in the snowpack (SWE). Yet under any rapid warmups or heavy rains, there's the potential for rapid rises on the smaller streams and rivers. Remember for the latest river levels and forecasts, please visit <https://water.weather.gov/ahps2/index.php?wfo=otx> ☀ Robin Fox

When will the cold end?

That's the big question most want to know—at least this March. The cold and snowy weather has been slow to release it's grip across the Inland Northwest. Temperatures have been running 10 to 20 degrees (or more) below normal as snow amounts mounted, all since Groundhogs day! The outlooks for late March into early April show better chances of warming and drying weather with above normal temperatures and below normal precipitation. ☀

Normal Temperatures for 1st Day of Spring

Spokane	50	33
Sandpoint	49	30
Colville	56	32
Omak	55	32
Wenatchee	55	36
Moses Lake	57	33
Pullman	50	33
Lewiston	56	37

Editor's Notes

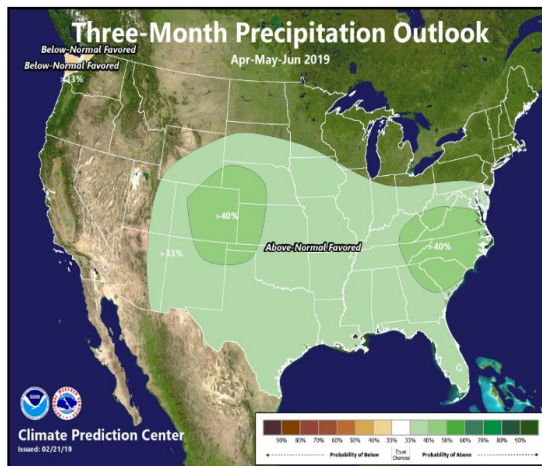
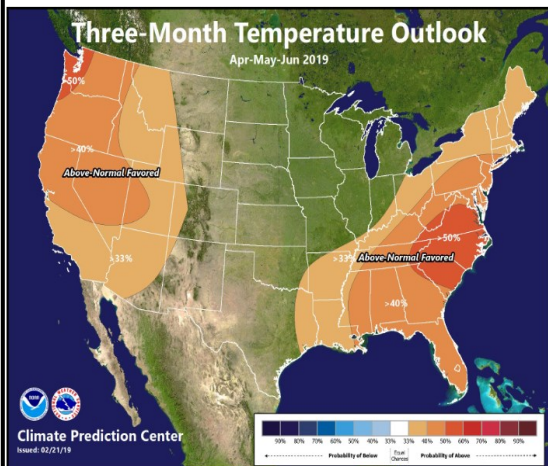
Yes, it's a fact. The snow will melt and the grass will green up as spring arrives. March 20th is the official day of spring—the vernal equinox at 2:58 PM PDT. This marks the moment the Sun crosses the celestial equator from south to north. It's also when days get longer than the nights.

With spring comes new weather hazards. The melting snow brings concerns of flooding, especially for those near rivers and streams. It's important to clean any remaining snow away from drainages. The warmer temperatures bring renewed threats of thunderstorms—lightning, hail and gusty winds. It's important to keep an eye to the sky and check the latest weather forecast while making outdoor plans.

We're always looking for new ideas and stories for our publication. Please send to nws.spokane@noaa.gov. 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 his help.



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

Winter 2018-2019 in Review

This was an unusual winter with December and January mild as expected given a marginally weak El Nino. But conditions changed dramatically in February with cold and snowy conditions. It was the tale of two different winters.

December began on a dry note before a mild and wet pattern developed from the 10th through Christmas Eve. A mix of rain and snow fell in the valleys while the snow piled up in the mountains. The biggest event of the month was heavy snow on the 11th and 12th around Plain, Lake Wenatchee, and Stehekin where an impressive 24" to 30" of snow fell. A particularly mild and wet storm on the 17th and 18th brought 1.65" of rain to Rathdrum with 1.42" in Deer Park. Lewiston, ID reached the upper 40s to mid 50s several days during this mild stretch. A cooler system on the 26th brought the first widespread snow to the region with 1-3" for most. A strong but complex storm passed through on the 29th and 30th producing a wide variety of weather. The Spokane area received 2" of snow with 6" in Rathdrum followed by mild and windy conditions that melted this snow. On the Palouse a strong cold front brought an unusual early morning December thunderstorm with 0.59" of rain in Pullman in two hours. Wind gusts include 59 MPH Pomeroy, 48 MPH Pullman, and 40 MPH Lewiston. Meanwhile in the Cascades a mountain wave brought strong winds on the ridges with 111 MPH at the top of Mission Ridge, 86 MPH Dirty Face Mountain, and 58 MPH Tumwater Mountain.

After an active end of December, **January** left just a couple events to talk about. On the 8th and 9th snow fell along the East Slopes of the Cascades with 9" in Leavenworth and 4" in Wenatchee. Over Northeast Washington into north Idaho snow changed to freezing rain in Spokane, Northport, Sandpoint, and Deer Park while Bonners Ferry remained as snow with 6". The Spokane Airport and Deer Park reported between 0.15"- 0.25" of ice. On the 22nd and 3rd another round of snow moved through the region with the northern valleys the big winners with 6-10". Rathdrum came in with 10" and Newport 9".

February brought dramatic weather changes as an active Pacific jet stream brought moisture into the region while several cold air intrusions from the north kept temperatures well below normal. Several locations finished in the top 5 for February snow and in the top 10 for coldest February. Lewiston recorded its snowiest month ever with records back to 1881. The 8th through the 15th was especially snowy as the cold air and moisture collided. On the 9th an arctic front brought blizzard conditions to the Waterville Plateau and Moses Lake area leading to several road closures. Drifting snow closed numerous roads across the Columbia Basin and Palouse. During this snowy stretch Wenatchee and Spokane reported around a foot of snow from the 9th through the 13th. Bonners Ferry, ID was hardest hit where a two day snowfall record of 24.7" was set with most of this falling late on the 11th into the 12th. This storms kept com-

ing during the second half of the month with more rounds of light to moderate snow. Breezy winds again closed roads across parts of the Columbia Basin and Palouse from the 25th through the 27th. State Route 27 was especially hit hard with snow drifts up to 12 feet high. ☼ *Jeremy Wolf*



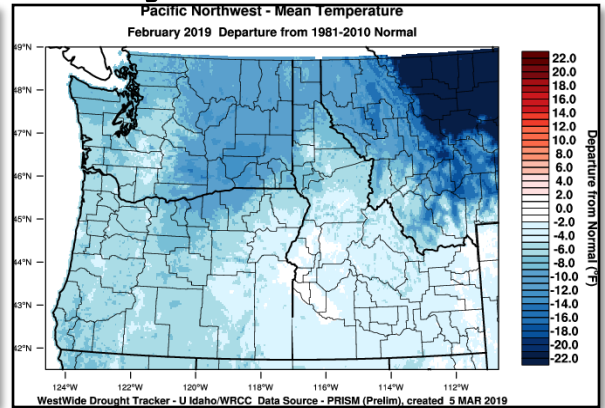
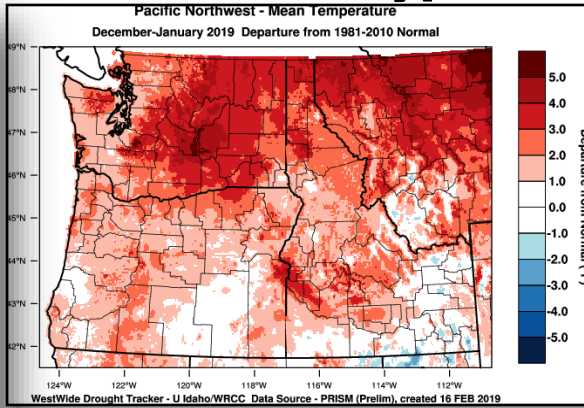
Winter Weather Statistics				
Wenatchee Water Plant	Dec	Jan	Feb	Total
Avg High Temp	40.1	38.3	30.9	36.4
Departure from Norm	+5.3	+2.4	-12.5	-1.6
Avg Low Temp	30.3	28.7	20.3	26.4
Departure from Norm	+5.1	+3.3	-7.4	+0.3
Total Precip	1.26	1.12	1.34	3.72
Departure from Norm	-0.27	-0.21	+0.34	-0.14
Total Snowfall	3.5	6.6	22.1	32.2
Departure from Norm	-3.2	+2.6	+19.4	+18.8
Lewiston Airport	Dec	Jan	Feb	Total
Avg High Temp	42.5	43.2	35.3	40.3
Departure from Norm	+3.0	+1.6	-11.2	-2.2
Avg Low Temp	31.4	30.6	24.6	28.9
Departure from Norm	+3.4	+1.0	-6.3	-0.6
Total Precip	0.80	0.57	3.42	4.79
Departure from Norm	-0.17	-0.51	+2.64	+1.86
Total Snowfall	0.5	0.0	31.3	31.8
Departure from Norm	-3.0	-2.4	+29.2	+23.8
Spokane Airport	Dec	Jan	Feb	Total
Avg High Temp	36.4	35.7	28.3	33.5
Departure from Norm	+4.2	+1.3	-11.3	-1.9
Avg Low Temp	27.2	26.1	14.3	22.5
Departure from Norm	+4.7	+1.4	-12.1	-2.0
Total Precip	2.62	1.75	2.40	6.77
Departure from Norm	+0.32	-0.04	+1.07	+1.35
Total snowfall	12.1	5.2	29.9	47.2
Departure from Norm	-2.5	-6.2	+23.1	+14.4

ANSWER: Soft hail or snow pellets that fall from convective showers, common in early spring across the Inland NW.

Not the typical February



Measuring Ice
Jan 9, 2019



The maps above show the temperature departures from normal for December through January and how it compared to February 2019. The table below lists the February weather stats for the region. Check out the NWS Spokane blog for more fun facts at inlandnorthwestweather.blogspot.com



Freezing Rain
Jan 9, 2019

City	Feb 2019 Snow	Rank	# Feb Snow days	Rank	Feb 2019 Avg Temp	Rank (coldest)
Lewiston	31.3	1 st	18	1 st	30.0	10 th
Wenatchee	22.1*	1 ^{st*}	12	1 st	25.6	7 th
Spokane	29.9	2 nd	16	2 nd	21.3	4 th
St Maries	35.8	1 st	13	1 st	23.6	3 rd
Moscow	45.6	2 nd	22	1 st	24.2	6 th
Pullman	36.0	2 nd	17	1 st	24.6	8 th
Lind	17.6	1 st	10	1 st	25.4	5 th
Kellogg	29.3	4 th	18	1 st	22.7	4 th



Drifting Snow—Feb 9, 2019

Staff News

A big congratulations goes to Katherine Rowden who received a promotion to the Western Region Hydrology Program Manager. Although she started her new position in January, she won't be moving to Salt Lake City until this summer. Even though she will remain in Spokane through the flood season, her time to assist on local flood events will be limited. Any flood questions or concerns should be directed to Robin Fox and/or Andy Brown. ☀

Spotter Corner

Spring spotter training will be gearing up in the coming months, where we focus on convection and thunderstorms. This training is open to current weather spotters who would like a refresher course and also new recruits who are weather enthusiasts eager to learn more. Stay tuned to the NWS Spokane web page for the latest schedule. Current spotters and observers will receive emails on training when it has been scheduled for your county. If you are interested in learning more about being weather spotter, email nws.spokane@noaa.gov for details. ☀

CoCoRaHS Notes

March marks a big recruiting time for the Community Collaborative Rain, Hail and Snow Network, and they're looking for more precipitation observers. If you enjoy weather and taking precipitation measurements—this might be a group for you! Check out their terrific web page at www.cocorahs.org to learn more.


For those busy providing the daily precipitation reports, the NWS Spokane thanks you for your hard work and dedication, especially in February. Your data is invaluable! The forecasters use this precipitation data to verify warnings, advisories and keep forecasts current. Keep in mind the snow water equivalent core measurements will become more important in the weeks to come as the lowland snow melts. This data allows meteorologists and hydrologists to calculate how much moisture is in the snow pack which leads to runoff and is useful for flood forecasting. ☀

Remember your Spring Spotter Checklist

Tornado or Funnel Cloud
Hail: pea size or larger
Strong Winds: 30mph+ or damage
Any Flooding
Reduced Visibility: under a mile due to fog, snow...
Heavy Rain: Showery: 1/2" + in 1hr Steady: 1" + in 12hr/1.5" + in 24hr
Snow: 2"+ valleys & 4"+ mountains
Any Mixed Precipitation
Travel Problems or Damage: due to severe/hazardous weather

SNOWMELT PROCESSES

During certain times of the year, water from snowmelt can be responsible for almost all of the streamflow in a river. It's important for hydrologists to understand these processes in order to accurately forecast river floods.



FLOOD SCIENCE

Snowmelt Processes

Snow Distribution
The path that weather systems take is the most important factor in determining snowpack, but terrain and vegetation also influence how snow accumulates on the ground.


Snowpack Characteristics
The temperature and the amount of water (snow water equivalent) in the snowpack are important to the melting process. Before rapid melting can occur, the snowpack as a whole needs to be warmed to 32°F.

Snow Energy Exchanges
Incoming solar radiation, emitted longwave radiation, turbulent transfer of heat, ground conduction, and heat transferred during rainfall are all important factors in heating or cooling the snowpack.


Weather Factors
Strong winds and high dew point temperatures aid in melting by limiting the effects of evaporative cooling and allow the layer directly above the snowpack to remain warm due to turbulent mixing. Rain falling on a snowpack can accelerate the melt process, as

Where the Water Goes
Once rapid melting begins, the water will either infiltrate into the soil, run off into streams and other bodies of water, pool in place and potentially refreeze as ice, or a combination. Ice jam flooding can occur if the river channel has excessive ice cover.

WEATHER.GOV/FLOOD



LIGHTNING TYPES



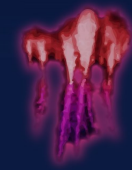
With **cloud-to-ground lightning (CG)**, a stepped leader, will zigzag downward in roughly 50-yard segments in a forked pattern. This stepped leader is invisible to the human eye.

A return stroke of bright luminosity travels about 60,000 miles per second back towards the cloud. A flash consists of one or perhaps as many as 20 return strokes.

Cloud flashes sometimes have visible channels that extend out into the air around the storm but do not strike the ground, known as **cloud-to-air (CA) lightning**.

The terms sheet lightning or **intra-cloud lightning (IC)** refers to lightning embedded within a cloud that lights up as a sheet of luminosity during the flash.

Lightning can also travel from **cloud-to-cloud (CC)**.




Large thunderstorms are capable of producing other kinds of electrical phenomena called **transient luminous events (TLEs)** that occur high in the atmosphere. They are rarely observed visually and not well understood.

The most common TLEs include **red sprites, blue jets, and elves**.

Ball lightning is a rare and randomly occurring bright ball of light observed floating or moving through the atmosphere close to the ground.

Observations have widely varying identifying characteristics for ball lightning, but the most common description is that of a sphere having a radius of 15–50 cm, orange or reddish in color, and lasting for only a few seconds.

weather.gov



The Weather Watcher Of the Inland Northwest



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Question: What is graupel?