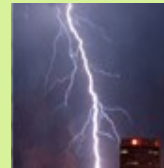




Jet Stream Jargon



National Weather Service Billings, MT

2018 Spring Issue

From the Desk of the Meteorologist in Charge

Inside this edition:

SkyWarn Spotter	2
Winter Recap	3
Hydrological Outlook	4
Summer Outlook	7
Spring/Summer Tables	8
Fire Weather	10
State of the Science	11
COOP Corner	14
CoCoRaHS	15
Are you Weather-Ready?	16
Information Stop	17

Now that winter is finally over, our attention turns to the mountain snowpack and the annual spring snowmelt runoff. The spring runoff can evolve in many different ways. High levels of mountain snowpack does NOT necessarily equate to flooding. A number of other factors dictate the timing, magnitude and impact of the annual spring runoff. The primary factors are: 1) extraordinarily slow moving, multi-day rainfall events in May/June (recall May 2011); 2) well-above normal temperatures (a string of daytime high temperatures near or above 80 degrees over the plains which equates to strong melting in the higher elevations) for a number of consecutive days; and 3) day/night temperature trends (i.e. do mountain areas stay above freezing at night).

We will continue to monitor snowpack trends through May while watching spring weather systems to determine if any of them will be significant contributors to the spring runoff.

As we move towards the end of May, our attention will turn to our severe weather season, which typically gets active at the end of May and continues at least through mid-July. By mid-July, we typically begin supporting wildfire suppression efforts with forecasts, as our strong winter/spring moisture typically leads to plenty of fine fuels which begin to cure in mid to late summer.

Entering the summer, we will have a couple of vacant positions within the office. Our Administrative Support Assistant position remains vacant (since August 2016). Additionally, Marc Singer, our former Science and Operations Officer moved to Tucson in February, as that office's new Meteorologist in Charge. Finally, Wright Dobbs, one of our younger Meteorologists, will be heading home to Tallahassee, FL to help restore staffing levels in that office prior to hurricane season. As always, we appreciate all the reports you provide as weather spotters and Coop Observers.

Keith W. Meier



 facebook.com/NWSBillings

 Twitter.com/NWSBillings



From the Warning Coordination Desk

Submitted by WCM, Tom Frieders

Skywarn Spotter Training - It's Fun & Free!

Become a volunteer severe thunderstorm spotter and learn how to identify and report severe weather to your local National Weather Service Office, keeping your local community informed of potentially hazardous weather!

Meteorologists rely on trained volunteers to supplement Doppler Radar and Satellite data. Storm spotter reports are an important step in the warning decision process for our Meteorologists regarding severe thunderstorms.

Training will be conducted through May with the full schedule at:

https://www.weather.gov/byz/spotter_training

How Do You Stay Informed?

Here are some options to stay informed on incoming hazardous weather:



NOAA Weather Radio: This is your direct link to NWS warnings! Specially built receivers will alert you when watches and warnings are issued for your area and also keep you informed on the latest forecast 24/7. Weather Radio receivers can be purchased in most electronic and many department stores for \$30 dollars or less.

More information at: <http://www.wrh.noaa.gov/byz/nwrhome.php>



Wireless Emergency Alerts: If you have a newer smartphone that is Wireless Emergency Alert Capable, you are already signed up! Your phone will alert you for Tornado Warnings, Flash Flood Warnings, Amber Alerts or critical Presidential alerts during national emergencies. More information:

<https://www.fema.gov/frequently-asked-questions-wireless-emergency-alerts>



Red Cross Apps: Apps available for all types of emergencies. Specifically for severe weather, a Tornado App is available. This app will alert you for both Tornado and Severe Thunderstorm watches and warnings. Check out the wide variety of apps available.

More information: <http://www.redcross.org/get-help/prepare-for-emergencies/mobile-apps>



FEMA App: Receive National Weather Service Alerts for up to 5 locations along with safety reminders and tips.

More information: <https://www.fema.gov/mobile-app>



2017-2018 Winter Recap


Submitted by Lead Forecaster/Climate Program Manager Joe Lester

The 2017-18 winter will be remembered for its abundant snowfall and lack of significant warm spells, both of which resulted in an extended period of snow cover in our region. After a very warm late November (remember the 70s on Thanksgiving?), the first half of December was actually quite mild, but the weather pattern turned much colder and snowier before Christmas. By the end of the year, we had experienced a significant winter storm and cold spell. Mizpah reached -41 degrees on New Year's Day!

The weather pattern remained favorable for periods of snow and cold throughout January and February. Miles City had its coldest February since records began in 1937, and Sheridan was coldest since 1936. Billings' three-month snowfall total was over three feet above normal! The cold and snowy winter can be at least partially attributed to the weak La Nina in the tropical Pacific Ocean, a condition that favors increased storminess across the northern Rockies. Also, warmer conditions and less sea ice in the Arctic likely contributed to greater atmospheric moisture through the winter season.

Through April 6th, Billings' total snowfall of 102.4 inches ranked 2nd most all-time for an entire season. With almost two months yet to go, there is potential to approach the record of 103.5 inches, set in 2013-14.

Here are some meteorological winter (Dec-Feb) statistics at our four main climate stations:

	Average Temp (°F)	Departure from Normal	Total Precip (inches)	Departure from Normal	Total Snowfall (inches)	Departure from Normal
Billings	22.5 (13 th coldest)	- 5.3	4.07 (4 th wettest)	+ 2.61	64.7 (3 rd highest)	+ 41.9
Livingston	25.9 (21 st coldest)	- 2.7	2.10 (12 th wettest)	+ 0.59	<u>Records begin:</u> 1934 @ Billings 1948 @ Livingston 1937 @ Miles City 1907 @ Sheridan	
Miles City	14.5 (14 th coldest)	- 7.5	1.00 (40 th wettest)	+ 0.16		
Sheridan	20.9 (29 th coldest)	- 3.9	3.27 (7 th wettest)	+ 1.61		



A Hydrological Outlook

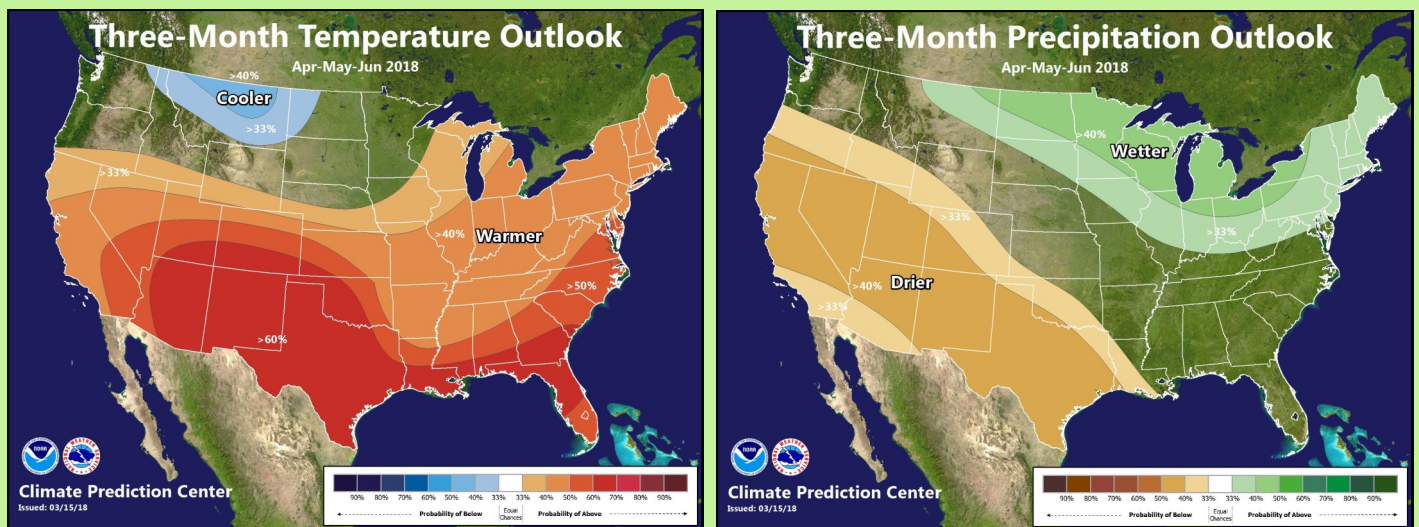
Submitted by Lead Forecaster/Hydrology Program Manager Todd Chambers

We have a heavy snowpack in the western mountains, and near normal in the Bighorns. Does this mean we will have river flooding during this summer's run-off season? Rivers and streams across our area have been carved out over time by heavy run-off seasons, and they have a large capacity to hold run-off from even record snow pack as long as it melts at a normal pace and the spring precipitation is around normal. The key to flooding of our rivers and streams is prolonged heat-waves, and extended periods of heavy rainfall. Thus, we will have to wait and see how wet and warm our late spring early summer is.

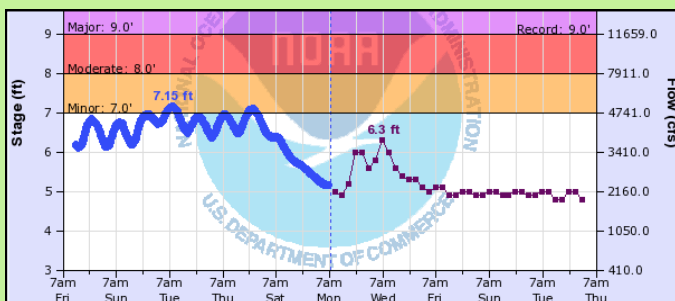
Nearly half of our region's annual precipitation occurs during the spring months and current indications are a bit uncertain with generally equal chances of above or below normal conditions. Temperatures are expected to trend toward cooler than normal conditions.

Will this lead to a gradual snow melt and limited flooding? Stay tuned to our forecasts!

Here are the temperature and precipitation outlooks for the months of April, May and June:



Now is the time to be preparing for flooding if you live, or have interests, along a waterway. Have a plan to move equipment and livestock to higher ground and safeguard your property. In recent years bank erosion has claimed several structures across our area. With an expected heavy and prolonged run-off we can expect to have more erosion issues this year as well. Look into flood insurance and remember there is a waiting period before it takes effect, so don't wait too long.



Monitor observed and forecast river conditions via the Advanced Hydrologic Prediction Service:

<https://water.weather.gov/ahps2/index.php?wfo=byz>

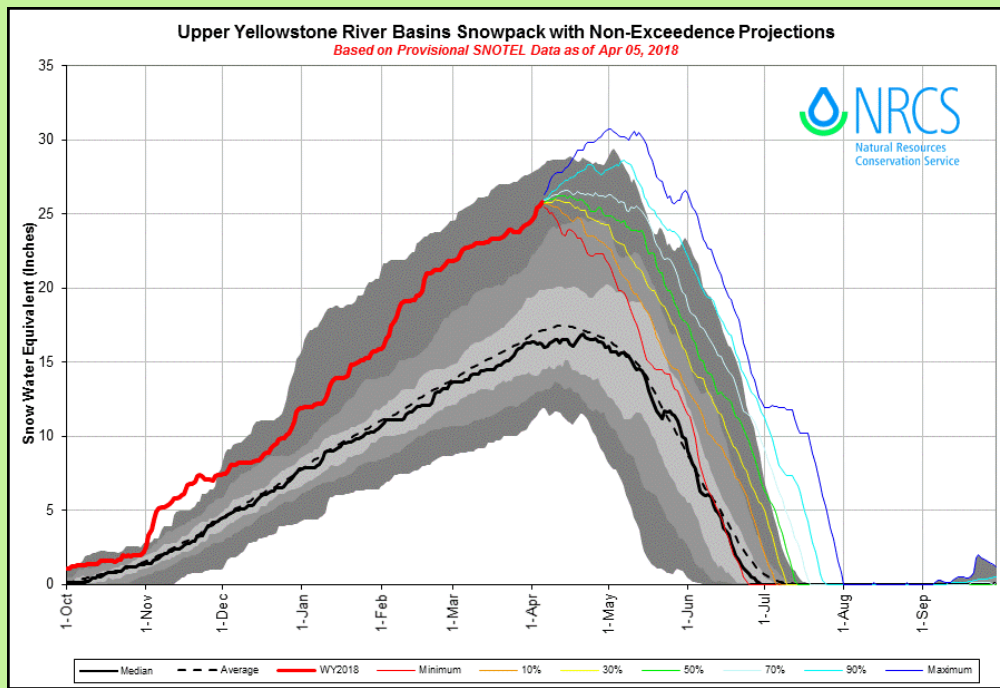


A Hydrological Outlook ...cont'd

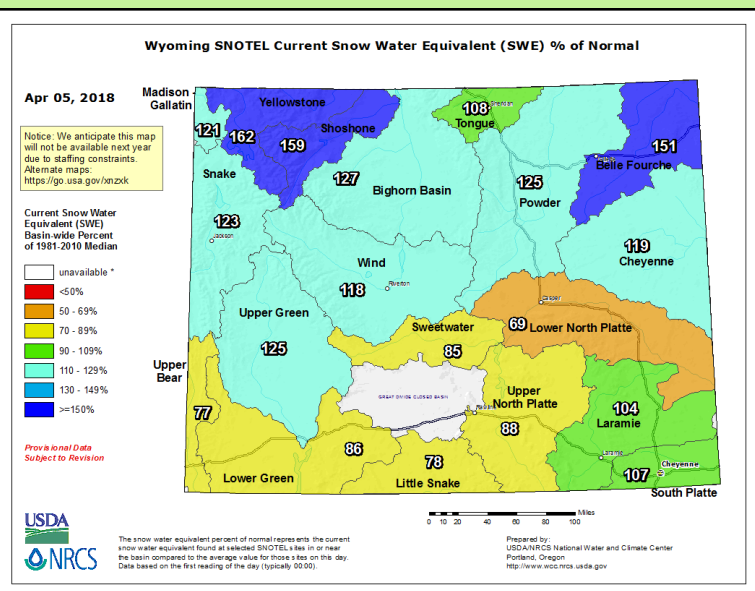
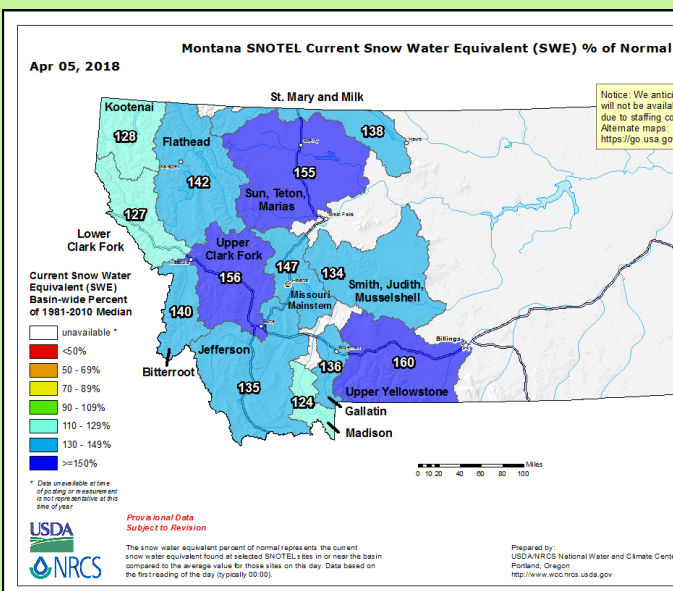
Submitted by Lead Forecaster/Hydrology Program Manager Todd Chambers

There will be plenty of water in rivers and streams for all uses this year. La-Nina winters in the Northern Rockies usually bring heavy snow to the western mountains, and this year was no exception. The Beartooth/Absaroka mountains are well above average for snow. In fact, the upper Yellowstone river basin exceeded its normal snow water for the season way back on the 1st of February, which usually occurs in late April.

Here is a graph of the accumulated water equivalent of the mountain snowpack in the Upper Yellowstone Basin courtesy of the Natural Resources and Conservation Service. Note this seasons trends (red line) have remained above the median (black line) throughout the season.



Below is the percentage of normal Snow Water Equivalent (SWE) mapped out for all basins of Montana and Wyoming, noting the above normal conditions for most of the region.



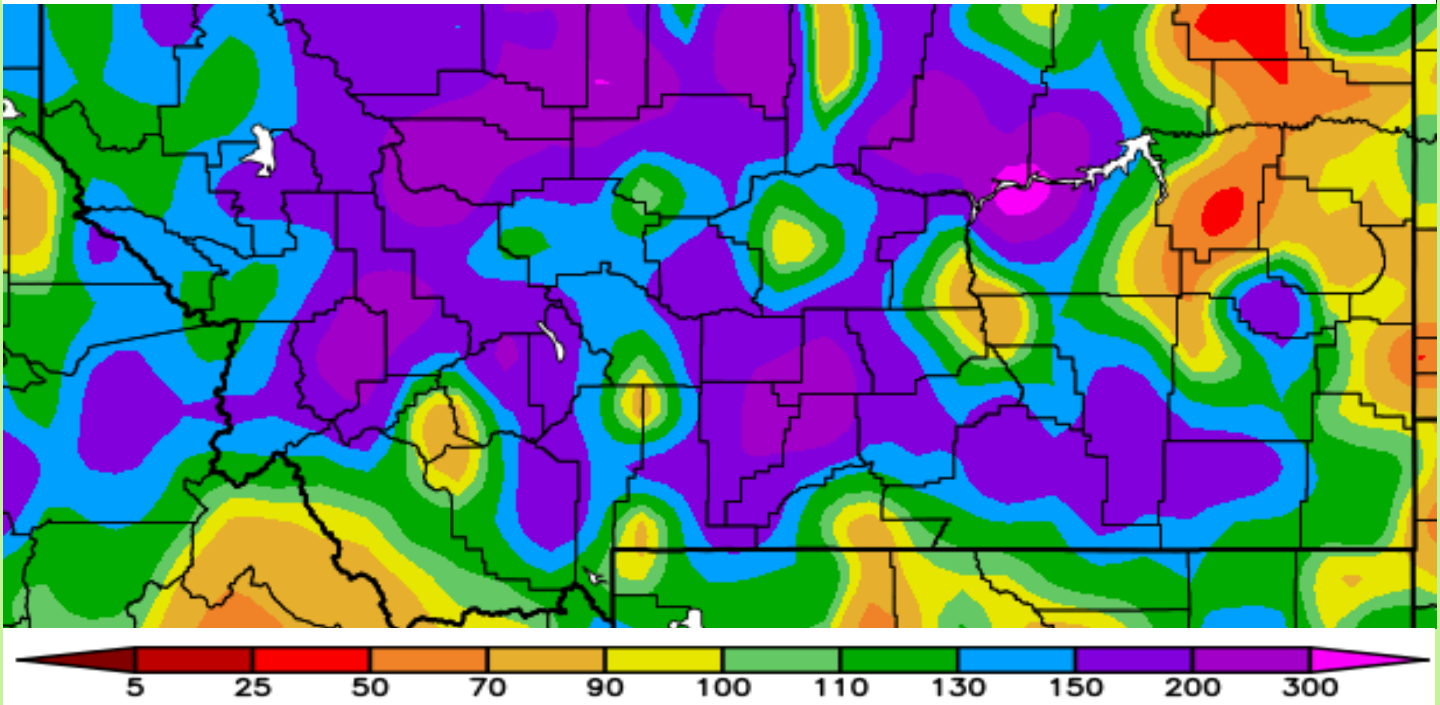


A Hydrological Outlook...cont'd

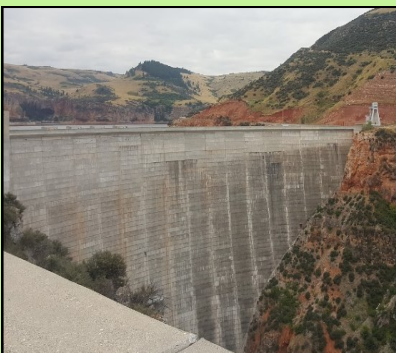
Submitted by Lead Forecaster/Hydrology Program Manager Todd Chambers

For the lower elevations east of the Divide it has been a wet winter as well with most locations seeing more than 130 percent of normal precipitation, and some areas over 200 percent of normal. Only areas around the Bighorn and Pryor mountains, and from Miles City to Baker, saw near to below average precipitation.

Percent of Normal Precipitation (%) 10/1/2017 – 4/4/2018



Much of this precipitation fell as snow over the winter, though a few rain/freezing rain events did make an appearance. Cold temperatures to go along with the precipitation have kept the snow around over areas east of Billings through late March, which is unusual. This late snow-pack lead to concerns about snow melt flooding and ice jams. But temperatures have cooperated so far resulting in a moderate melt rate helping to ease those concerns. Some areas have seen standing water in low lying areas and clogged culverts have pushed water over some roads, but overall impacts have been minor thus far. Ice Jams could have been a significant problem, but ice jam flooding was minor as the rivers opened up.



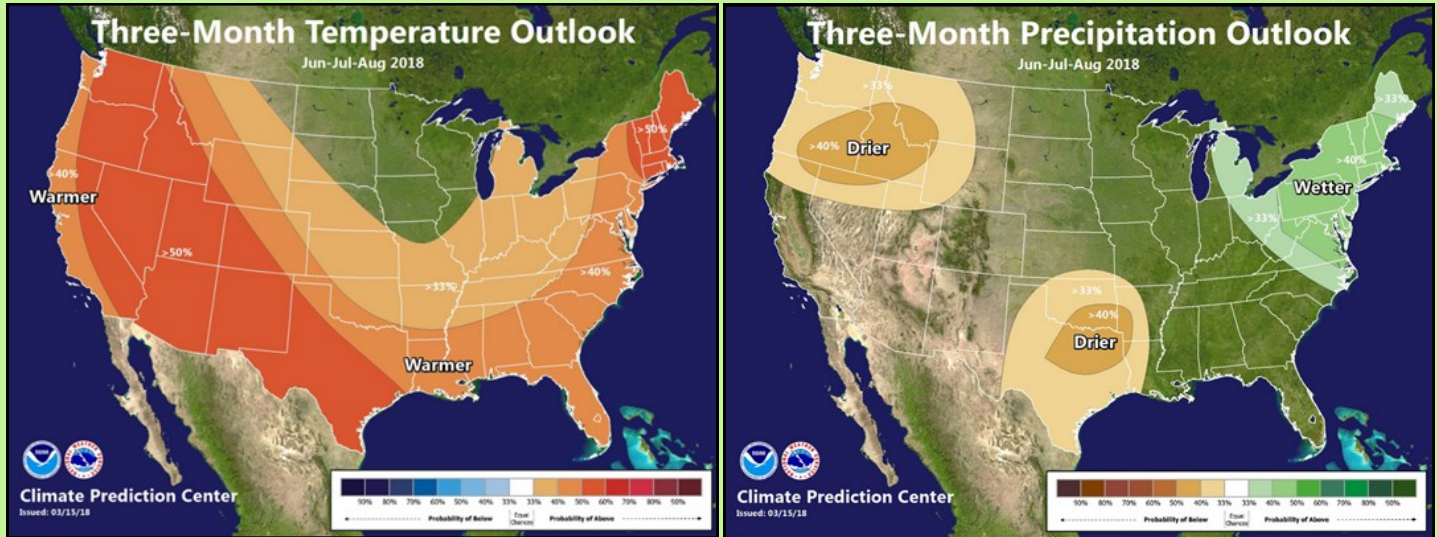
Yellowtail Dam has seen record releases into the Bighorn River so far this winter as residual water from last year's heavy precipitation in Wyoming continues to work through the Bighorn River system. Early April releases are at 6500 cubic feet per second (cfs) compared to a normal release of 2900 cfs. Officials expect additional release increases this spring to make room for this seasons run-off, so another high flow year can be expected. Whether it reaches anywhere near last year's prolonged record releases will depend on spring precipitation over central Wyoming.



2018 Summer Outlook

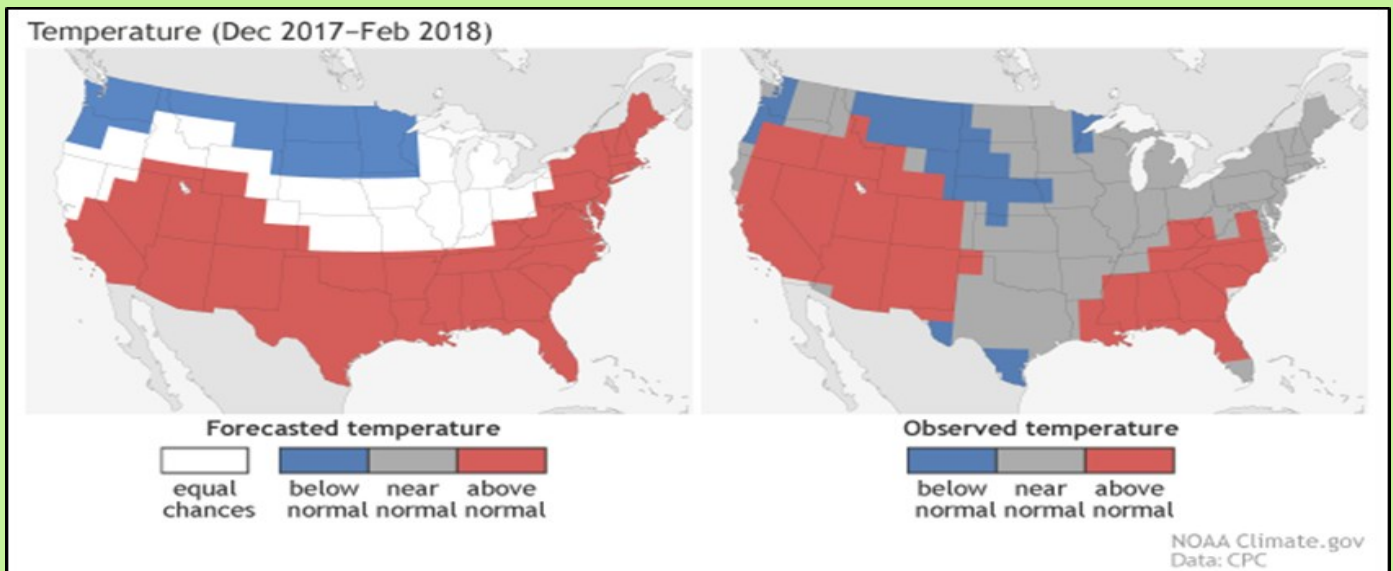
Submitted by Lead Forecaster & Climate Program Manager Joe Lester

With the passage of the spring equinox we are rapidly shifting gears toward the warm season. Climate signals are not real clear for the summer months (June/July/August), when precipitation is driven by thunderstorm activity rather than dynamic weather systems. Though recent summers have trended warmer, in general. The latest June-August outlook from the Climate Prediction Center shows a slight hedging toward warmer and drier than normal in our region.



How did the 2017-18 Winter Outlook verify?

The 2017-18 winter has come to an end, but do you remember what the winter outlook showed last fall? The Climate Prediction Center examines its accuracy after each season. Below is how the temperature outlook verified, with forecast temps on the left and observed on the right. Not too bad for the northern Rockies and high plains! Please see this article for more information: <https://www.climate.gov/news-features/blogs/enso/meteorological-winter-over-how'd-we-do>





Spring Data Tables

Spring Averages

Meteorological spring is classified as the months of March, April and May. Here are the average temperatures and precipitation for the Billings Airport, the Miles City Airport, and the Sheridan Airport for the spring season. Averages are calculated using a 30-year period of record: 1981 to 2010. All temperatures are in degrees Fahrenheit and all precipitation amounts are in inches.

Billings					
Date	High	Low	Average	Precipitation	Snowfall
3/1 - 3/31	48.6	26.9	37.7	1.06	10.2
4/1 - 4/30	57.6	34.7	46.2	1.66	8.3
5/1 - 5/31	67.5	43.6	55.6	2.18	2.0
3/1 - 5/31	57.4	35.1	46.3	4.90	20.5

Miles City				
Date	High	Low	Average	Precipitation
3/1 - 3/31	46.5	22.8	34.7	0.60
4/1 - 4/30	58.8	33.2	46.0	1.37
5/1 - 5/31	68.6	43.1	55.9	2.18
3/1 - 5/31	58.4	34.2	46.3	4.15

Sheridan				
Date	High	Low	Average	Precipitation
3/1 - 3/31	48.4	22.0	35.2	0.98
4/1 - 4/30	57.4	29.8	43.6	1.60
5/1 - 5/31	66.7	38.2	52.5	2.35
3/1 - 5/31	57.8	31.4	44.1	4.93

“In the Spring, I have counted 136 different kinds of weather inside of 24 hours.”

Mark Twain



Summer Data Tables

Summer Averages

Meteorological summer is classified as the months of June, July and August. Here are the average temperatures and precipitation for the Billings Airport, the Miles City Airport, and the Sheridan Airport for the summer season. Averages are calculated using a 30-year period of record: 1981 to 2010. All temperatures are in degrees Fahrenheit and all precipitation amounts are in inches.

Billings				
Date	High	Low	Average	Precip
6/1 - 6/30	77.2	52.1	64.7	2.12
7/1 - 7/31	86.8	58.8	72.8	1.32
8/1 - 8/31	85.7	57.3	71.5	0.75
6/1 - 8/31	83.3	56.1	69.7	4.19

Miles City				
Date	High	Low	Average	Precip
6/1 - 6/30	78.6	52.6	65.6	2.51
7/1 - 7/31	88.3	59.5	73.9	1.64
8/1 - 8/31	87.2	58.0	72.6	0.91
6/1 - 8/31	85.2	57.8	71.5	5.06

Sheridan				
Date	High	Low	Average	Precip
6/1 - 6/30	76.7	46.4	61.6	2.12
7/1 - 7/31	87.1	53.0	70.0	1.18
8/1 - 8/31	86.3	51.6	69.0	0.72
6/1 - 8/31	83.3	51.4	67.4	4.02

Last Hard Freeze, Freeze and Frost Dates in the Spring/Summer

Many people will start planting their crops and gardens over the next few months. To keep crops and plants protected from the cold, it is important to know when the **average** last hard freeze, freeze and frost typically occur in the spring/summer. It is also important to know the dates of the **latest** hard freeze, freeze and frost. The following are the **average** last hard freeze, freeze and frost dates and the **latest** hard freeze, freeze and frost dates for **Billings, Miles City and Sheridan**. The hard freeze temperature is based on 28 degrees Fahrenheit, the freezing temperature is based on 32 degrees Fahrenheit and the frost temperature is based on 36 degrees Fahrenheit. Averages are based on a 30 year period of record: 1981 to 2010. Recordkeeping began at the Billings Airport in 1934, at the Miles City Airport in 1937 and at the Sheridan Airport in 1907.

City	Average Last Hard Freeze	Latest Hard Freeze on Record	Average Last Freeze	Latest Freeze on Record	Average Last Frost	Latest Frost on Record
Billings	Apr 23	May 28	May 7	Jun 13	May 18	Jun 13
Miles City	Apr 27	May 28	May 9	Jun 8	May 18	Jun 18
Sheridan	May 8	Jun 3	May 19	Jun 24	Jun 5	Jun 30



From the Fire Weather Desk

by Lead Forecaster / Incident Meteorologist Dan Borsum

Where is the smoke coming from?

Have you ever wondered about where the smoke that you are breathing is coming from? Or, maybe what is going on with a fire in our area or somewhere else in the country? There is a convenient location on the internet to go to for information. The media and other local agencies may provide coverage and some information, but InciWeb (<https://inciweb.nwcg.gov>) has all the official information that land management agencies have shared about fires under their jurisdiction. You can find fire containment, current evacuation information, the latest maps, pictures, and more. Some smaller fires like those handled by a town or county fire department may not be available. If a fire is recently started, it may take some time to show up on InciWeb.

This site has undergone a recent change that is more user-friendly. With a new map interface, it is much easier to find fires around area and across the country. Here is a sample image of the interface:



So the next time there is smoke in the air and you are curious where it is coming from, you will know where to find out. Have a safe summer!



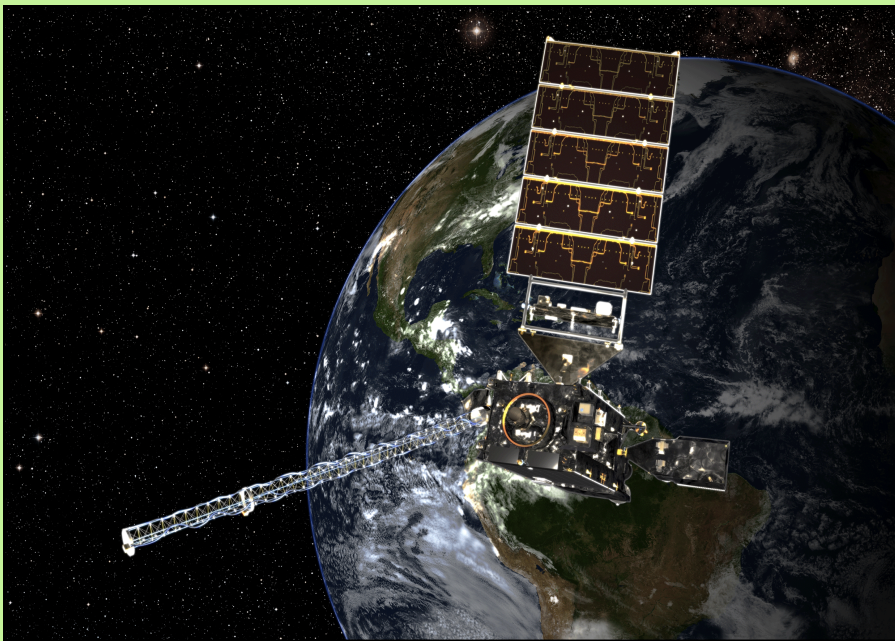
State of the Science: The New Satellite Era

by General Forecaster/Acting Science & Operations Officer Ryan Walsh

Our Billings forecast area encompasses portions of southeastern Montana and northeastern Wyoming. This vast landscape has significantly varying terrain and climate which can make forecasting extremely challenging. The primary tools we use to determine current conditions across our forecast area are radar, satellite, and surface observations from automated weather stations.

Radar is primarily used to detect precipitation such as in a thunderstorm, but is limited in range and can't adequately cover our entire forecast area. Weather observations can give us a sense of the temperature, humidity, and wind speed, but are limited to only a handful of locations around the area and only provide surface conditions. Satellite imagery is the observational piece that can give us the most information about the state of our atmosphere across our entire area.

Our legacy satellites provided new information every 15 to 30 minutes and were fairly coarse in resolution. Low resolution and long delays between images made it difficult to use satellite for timely detections of weather phenomenon such as wildfires or intensifying thunderstorms. In this part of the country where weather can change rapidly and vary significantly from one location to another, we needed some better tools to help us observe the atmosphere to improve our forecast and warning decisions.



To achieve that goal, NOAA launched a new generation of satellites called GOES-16 and GOES-17. GOES-16 was launched last year and is primarily responsible for monitoring the eastern half of the country. GOES-17 was launched this March and is currently undergoing testing and calibration but will become operational over the western U.S. later this year.

What does this mean for us? How will this improve forecast and warning decisions?

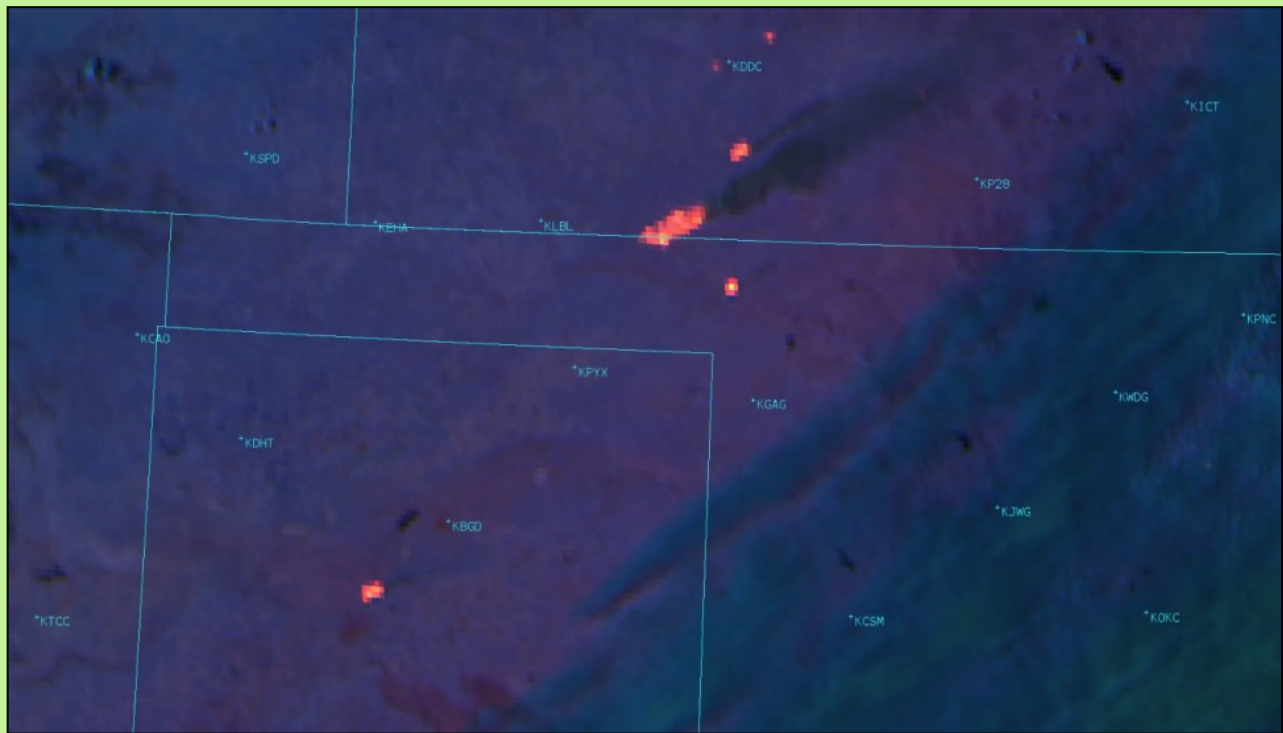
The technological improvement of this new generation of satellites is quite astounding; the equivalent of upgrading a first generation camera phone for this year's latest Apple or Samsung product. These satellites take visible and infrared images, detect atmospheric moisture, lightning, and much more; all with significantly improved resolution compared to their predecessors.



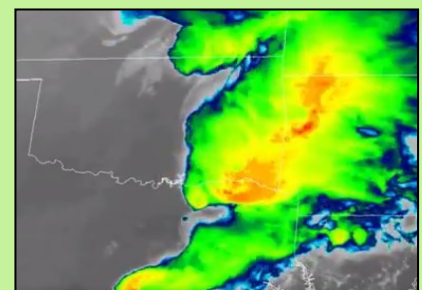
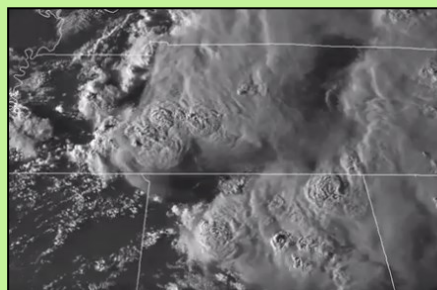
State of the Science: The New Satellite Era

by General Forecaster Ryan Walsh

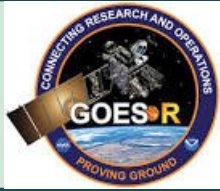
The newest GOES imagery resolution is so improved that we can now make out extremely small scale details in both the clouds and land surface. New images are sent every 5 minutes, and we have the capability to increase that to every 30 seconds during times of extreme weather! The image below is an example of how the new GOES satellites can detect detailed hot-spots from wildfires, allowing us to provide critical weather updates to resources fighting those fires. Note the wildfires show up as a bright pink on the satellite.



The new GOES series is able to provide unprecedented detail (as seen below) which will allow forecasters to determine differences between cloud types, composition, assess small scale features which will improve forecasts across the board.



Our new satellite images will actually update quicker than our radar in many cases. While satellite cannot tell us the same type of information our radar tells us about thunderstorms, it will provide us basic information about structure and storm height that can help us better predict severe thunderstorms; especially in areas of poor radar coverage such as eastern Montana and Wyoming.



State of the Science: The New Satellite Era

by General Forecaster Ryan Walsh

Pictured below is an example of how our new satellites can detect the features of a severe thunderstorm. Looking down from above the thunderstorm, the satellite is detecting a bubbling crunchy looking dome. This is called an overshooting top, and it indicates the storm has a significant column of rising air known as an updraft. The shape and notch appearance indicates a very organized thunderstorm with a rotating updraft which could support hail or possibly tornadoes. A forecaster could make a warning decision earlier in many cases with the addition of this timely and extremely detailed satellite information.



These were just a few examples of the many ways in which the new GOES satellites will improve our forecasts in the future. The launch of these satellites has ushered in a *New Satellite Era* which will change the way we observe the atmosphere across all meteorological disciplines for years to come!



COOP Corner ***(Cooperative Observer Program)***

by Observing Program Leader Larry Dooley

2018 Cooperative Observer Length of Service Awards

Recognition for many years of service and for special or sustained achievements is part of the culture in a successful organization. Awards are a time honored, tangible method of showing appreciation for many years of dedication. The awards may be given to individual observers, families and institutions for length of service or in recognition of one or several significant achievements. The awards recognition program is the most visible way to honor sustained volunteer service and when combined with constructive feedback, is essential for the retention of observers.

This year at the National Weather Service forecast office here in Billings, we have several dedicated Cooperative Observers being recognized and will receive awards.

- John Jonutis of Mizpah will receive a 60 Year Award.
- Willis and Nadine Busenitz of Busby will receive 45 Year Awards.
- Dan Becker of Colstrip will receive 40 Year Award.
- Jacquelyn Hudecek from Springdale will receive 30 Year Award.
- Jim Goodwin from Ashland will receive 25 Year Award.
- Joann Ferguson from Livingston will receive 25 Year Award.
- Bill and Donna Linger from Molt will receive 25 Year Awards.
- Mary Ann Johnson from Vananda will receive Year Award.
- Elsie Shellenberger from Reedpoint will receive 20 Year Award.
- Vicky Schwartz from Big Timber will receive 20 Year Award.
- Judy A. Rue from McLeod will receive 20 Year Award.
- Susan E. Wood from Lavina will receive 15 Year Award.
- Marvin Crusch at Mystic Lake will receive 10 Year Award.

We will also be recognizing two of our Cooperative Observers with the prestigious John Companius Holm Award this spring. This award was named in honor of John Companius Holm, a Lutheran minister, who was the first person known to have taken systematic weather observations in the American Colonies (1644-1645). Each year, up to 25 Cooperative Observers are honored with the prestigious Holm award for outstanding public service in the provision of daily observations in support of the climate and weather programs of the National Weather Service. The awards will be presented to Dick Brewer of Brandenburg and Clint Dietz of Plevna, in separate ceremonies in May.

For more information about the NWS Cooperative Observer Program visit:

<http://www.weather.gov/coop>



Community, Collaborative, Rain, Hail and Snow Network (CoCoRaHS)

by CoCoRaHS Coordinator Vickie Stephenson

What a busy winter we had in south central and southeast Montana, with record cold and snowfall across the area. Yes, many records were broken this season between cold temperatures and snowfall. If you would like to become a part of our Precipitation Reporting Network, check out this web site <http://www.cocorahs.org> and feel free to contact me @ vickie.stephenson@noaa.gov.

I wish to thank you all very much for your tireless efforts in measuring our record snowfall. Billings' snowfall as of April 6th has measured 102.4 inches this season, and we are slowly closing in on our record season of 103.5 inches.

Who uses CoCoRaHS Observations?



YES, IT REALLY IS TRUE! Your data are used every day!

No matter how many times we repeat this, the question just keeps coming up "who cares about and who uses the observations from CoCoRaHS volunteers?" It must be hard to fathom that precipitation data is so useful and that backyard rain gauges have a place of importance in national and global climate monitoring in the 21st Century. But the fact is, it's true. Your rainfall reports -- including your reports of **ZERO precipitation** -- are very valuable and are being used EVERY DAY. Every morning many organizations pull data from the CoCoRaHS database at least every hour to get all the latest reports as they come in, hoping all CoCoRaHS reports are submitted right away.

Your reports of hail or heavy rain may trigger the National Weather Service (NWS) to issue severe thunderstorm or flash flood warnings. In cases of extreme localized storms, your local report could help save lives.

Don't let all this "importance" frighten you. The weight is not all on observers shoulders. The real value comes from having thousands of volunteers reporting from all over the country. So keep up the good work, and go out and find more weather enthusiasts to help measure, map and track the amazingly variable patterns of precipitation.

A key reason that CoCoRaHS data are so useful is because the rain gauge used by CoCoRaHS volunteers -- the 4-inch diameter, 11.30" capacity clear plastic rain gauge is very good. Under most circumstances, this type of gauge performs as well as the official National Weather Service Standard Rain Gauge that has been used for over 120 years, documenting our nation's climate. Most CoCoRaHS volunteers have found representative locations to mount their gauge to get very high quality readings. The CoCoRaHS gauge, if installed and used properly, provides very accurate readings. CoCoRaHS volunteers tend to be very interested and very committed to careful and high-quality observations. As a result, the data are usually excellent for a wide range of uses. Below are just a few of our many users, there are probably many others. The most obvious ones that come to mind are:

**Weather Forecasters
Researchers
Insurance Industry**

**Hydrologists
Agriculture
Engineering**

**Water management
Climatologists
Recreation**



Are You “Weather-Ready”?

by Warning Coordination Meteorologist Tom Frieders & Forecaster Kurt Hooley



Here are some things you can do to ensure you are Weather-Ready:

- * **Know Your Risk:** Don't leave home without knowing the forecast. Check our [website](#) each and every morning.
- * **Take Action:** Have an [emergency supply kit](#). This includes a 72 hour supply of food and water. Also, develop a plan to ensure family and friends know how they can reach you in an emergency. This plan would include meeting places and alternate ways to communicate in case of an emergency.
- * **Be A Force of Nature:** Inspire others by sharing your preparedness activities with family and friends.

For more information, visit our severe weather preparedness website at: <http://goo.gl/xbljh>

Severe Thunderstorms produce:

- * **Tornadoes**
- * **Hail one inch in diameter or larger**
- * **Damaging winds in excess of 60 mph**

Know the difference:

Funnel Cloud: A funnel-shaped cloud, extended outward or downward from a thunderstorm, that corresponds to a rotating column of air. If the rotation is violent and reaches the ground, the funnel cloud is associated with a tornado.

Tornado: A violently rotating column of air, in contact with the ground, that extends from the base of a thunderstorm to the ground. This is often visible as a funnel cloud with swirling dust or debris near the surface.

Know the difference:

Watch: The potential exists for severe weather to occur within the next hours but the exact location and timing is not known. Action can be taken to protect property such as putting your vehicle in the garage, putting away patio furniture, etc.

Warning: Severe weather either is occurring or will be shortly. Immediate action should be taken to protect yourself by going to the lowest portion of a sturdy building, or into a closet, hallway or room without windows.



Information Stop

by Warning Coordination Meteorologist Tom Frieders

Stay Informed during Hazardous or Severe Weather

Severe Weather Preparedness:

<http://www.nws.noaa.gov/om/thunderstorm/>

Lighting Safety:

<http://www.lightningsafety.noaa.gov/>

Flood Safety:

<http://www.nws.noaa.gov/floodsafety/>

Advanced Hydrologic Prediction Services (Rivers and Lakes):

<http://water.weather.gov/>

Owlie - NWS Education

<https://www.weather.gov/owlie/>

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