National Weather Service - Medford, Oregon

Fall 2022
Volume 11, Issue 3

The Crater Chronicle

Fall began September 22nd at 5:03 pm PDT.

Daylight Savings Time ends November 6th!

Remember to set your clocks back one hour!

Inside This Issue

2022-2023 Wet Season Outlook

Brett Lutz, *Lead Forecaster*

A rare, third consecutive La Niña winter is predicted for 2022-23. The Climate Prediction Center is continuing a La Niña Advisory indicating that "La Niña is favored to continue through the Northern Hemisphere Winter of 2022-23, with a 91% chance in September-November, decreasing to a 54% chance in January-March 2023." February-April 2023 odds tilt toward ENSO neutral conditions, so neither La Niña nor El Niño. What does this mean for SW Oregon and northern California?

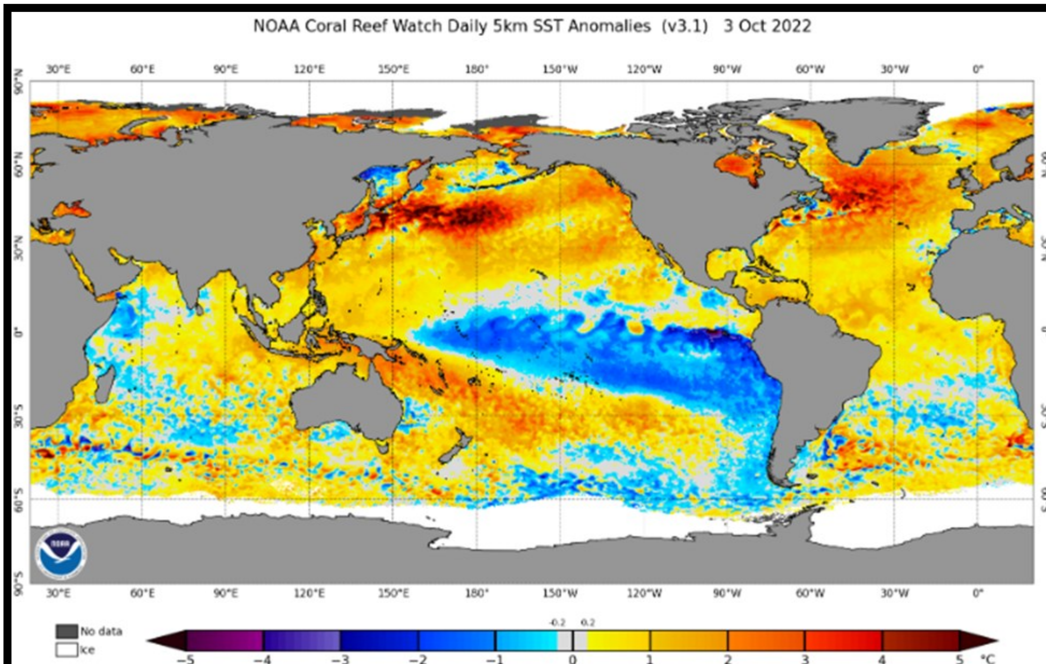


Figure 1: Sea Surface Temperature (SST) anomalies, as of October 3rd, 2022. A rare, third consecutive year of La Niña is expected and indicated by the colder than normal blue hued colors west of South America. The North Pacific is also notably unusually warm, noted by the red hued colors.

Average Conditions During La Niña Winters:

All La Niña winter are not the same, of course. Impacts from them vary based on how strong they are in the equatorial Pacific, the location and timing of SST anomalies associated with them, and all of the other factors that affect seasonal weather. In recent years, lesser sea ice in polar regions due to a warming planet has been a significant factor affecting climate. On longer time scales, variation in SSTs across the Pacific known as the Pacific Decadal Oscillation also play a role, though seasonal impacts are not well understood.

As Figure 2 indicates, the average of all La Niña winters since 1950 is for wetter than normal conditions in our forecast area and colder than normal conditions over parts of it. However, this is only an average. There have been dry winters with La Niña, as well. Just looking at the December through March time period, the 2020-21 brought near normal temperatures to all areas (+/- 2 degrees Fahrenheit), near normal precipitation west of a north-south oriented line extending from the western border of Jackson County, and below normal precipitation (25-85% of normal) elsewhere. The 2021-22 La Niña, for that same time period, brought inversion conditions with near normal temperatures in some valleys, but above normal temperatures, especially in our mountainous areas. Precipitation was 25-85% of normal, with the driest locations in about the same area as occurred during the preceding winter period. So, we see that, even just with the past two years of La Niña, conditions did not represent the average of all of them since 1950. So, what's the forecast for this year?

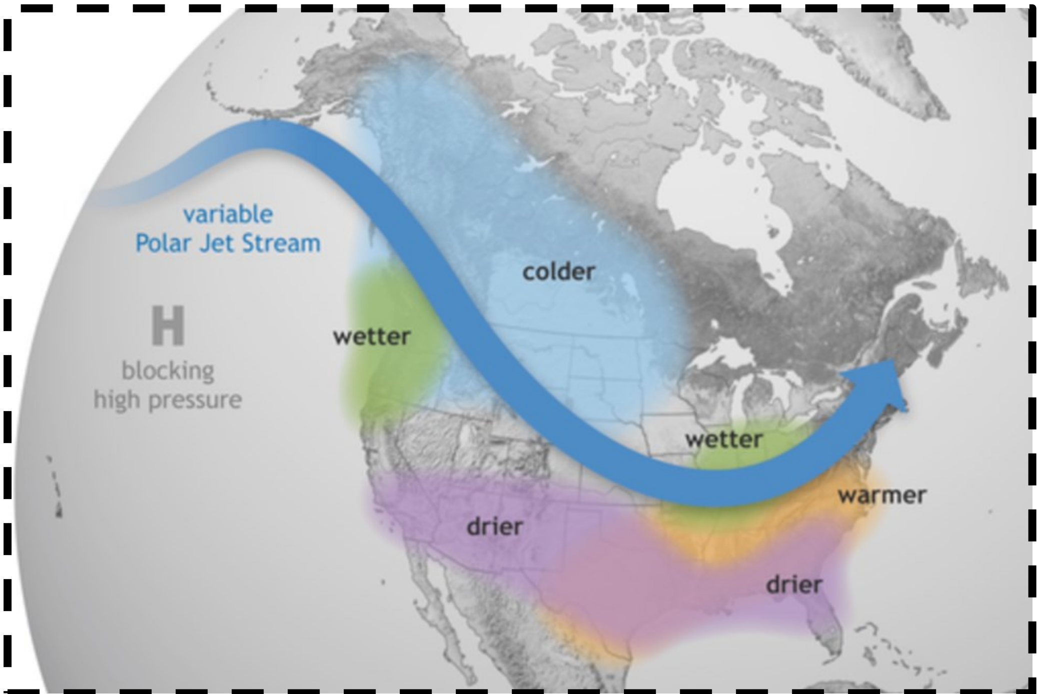


Figure 2: Average of all conditions compared to normal for all La Niña winters since 1950.

2022-23 Winter Forecast:

The official forecast from the Climate Prediction Center (CPC) for December 2022 through March of 2023 is for slightly enhanced chances of below average temperatures across mainly Coos and Douglas counties and equal chances of below, near, and above normal temperatures elsewhere. For precipitation, CPC is predicting equal chances for below, near, and above normal precipitation over most Oregon areas for Dec-Feb and slightly increased chances for below normal precipitation for most California areas away from the Oregon-California border. For Feb-Apr, the prediction is for slightly increased chances of below normal precipitation across most of the forecast area. For further details and graphics depicting the above information, please go to: ***https://www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=3***

Analogous Years:

Going back to 1950, there have only been 3 years prior to this one that have been the third La Niña year in a row. These are 1956-57, 1975-76, and 2000-01. However, since this year's La Niña is forecast to weaken in the spring, we see three more years in the climate record that appear quite similar, two of which are more recent and, therefore, more closely aligned with other climate change related factors. These are 1985-86, 2008-09, and 2011-12. Using the WestWide Drought Tracker to query this data, we see a common theme in the data:

- The Oregon Cascades, Umpqua, and Coquille Basin regions usually received near to above normal precipitation.

- Areas from the Oregon Cascades westward usually observed near to below normal temperatures.

- Areas east of the Cascades and across northeastern California usually received below normal precipitation.

- It should be noted that 2000-01 was different, with only 25-75% of normal precipitation across the entire forecast area.

The Realm of Possibilities:

Although we have reviewed La Niña averages, the Dec-Mar values for 2020-21 and 2021-22, the official CPC Dec-Mar forecast, and conditions observed in years with analogous ENSO conditions since 1950, we still can't say for sure, what will happen this winter season. However, most of the time, reviewing commonalities in the data will tell us what's most likely to occur. Looking at the law of averages from the last two La Niña years would suggest that we're due for a wetter winter. In fact, the European Seasonal Model indicates near to slightly above normal temperatures and above normal precipitation for the Dec-Mar 2022-23 time period. The Europeans are renowned for having the best weather modeling in the world. A reality check tells us that we live in a highly variable climatic region and time in terms of year to year temperature variation, precipitation, and mountain snowpack. So, while recent trends have been mostly toward warmer and drier than normal, of late, the range of possibilities for this winter is many. Overall, La Niña favors increased chances of wetter and cooler than normal conditions from the Oregon Cascades westward.

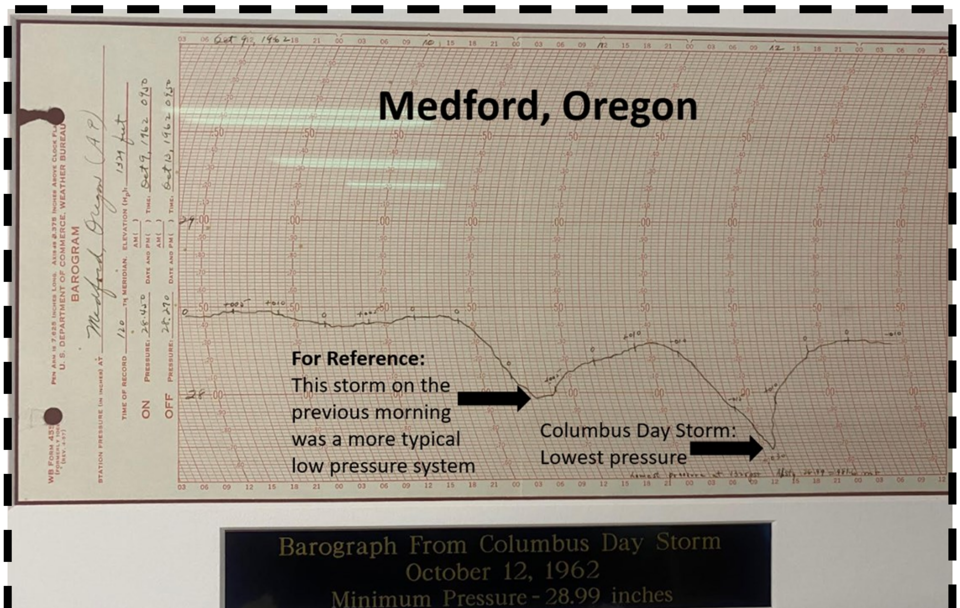
The Diamond Anniversary of the Columbus Day Storm

Ryan Sandler, *Warning Coordination Meteorologist*

October 12th, 2022, marks the 60th anniversary of the Columbus Day Storm. This was the most powerful windstorm to strike the Pacific Northwest during the 20th century. Although the Pacific Northwest's offshore and coastal waters are much too cold to support a hurricane, this storm packed a hurricane force punch. This storm rapidly strengthened as it approached from the southwest and moved up the coast from northern California to southern British Columbia.

Our office "museum" paying tribute to the 1962 Columbus Day Storm.

What adds to the mystique of this powerful storm is how early in the season it occurred. Typically, our biggest windstorms occur from November through January, but this storm occurred during the relatively tranquil weather period of early October. In Oregon, the most damage occurred in the Willamette Valley where the most people and infrastructure existed. However, southern Oregon and far northern California also suffered through damaging winds. Peak winds blew at 145+ mph at Cape Blanco (the "plus" because the wind equipment was destroyed). Coos Bay and Brookings saw peak gusts exceeding 80 mph. For Roseburg, Medford, Klamath Falls, and Mt. Shasta City the peak winds ranged between 58 and 66 mph.



Barograph reading from NWS Medford station during the 1962 Columbus Day Storm.

Anyone alive today may never see a storm as powerful as the 1962 Columbus Day Storm because it was believed to range from a 1 in a 100-year windstorm to a 1 in a 1,000-year windstorm. How do we know that it could have been a 1 in a 1,000-year storm? Well, there were a large number of 1,000-year-old trees blown down suggesting that it could have been the wind event of the millennium! Keep in mind that in any given year there is still a very small chance of a similar storm happening. In other words, to quote one of my favorite scenes in the movie Dumb and Dumber "so you're telling me there's a chance."

Flash Flood, During a Wildfire?

Tom Wright, *Observation Program Leader*

In addition to my day job as the Observation Program Leader at NWS Medford, I am also an Incident Meteorologist, or IMET for short. In that capacity, I am deployed to help Incident Management Teams in their efforts. While this could be any kind of incident or event (IMETs have been deployed to events ranging from Hurricanes to Superbowls to 9/11), this most often means supporting wildfires. I was the IMET deployed to the McKinney fire west of Yreka when something rather unusual, to say the least, happened: a flash flood!

When a very hot fire burns over an area, the soil can become hydrophobic – meaning it doesn't absorb water – so the water just runs off and washes everything in its path down with it. Flash floods and the resulting debris flows are not usual in areas that have been burned over, but they usually occur during the following winter(s) when heavy rains hit slopes that have been long abandoned by firefighting crews.

On August 2, 2022, it happened on the McKinney fire when they were all still there. I knew trouble was brewing that morning. Precipitable water (PWAT, a measure of water content of the atmosphere) was at an all-time record – not just for that date, but for ANY date, and we were expecting thunderstorms near the fire. It is the nature of convection that you can't always tell where they are going to form ahead of time. But if storms came over our fire, it was going to be a problem, because the slopes had been badly burned – or "nuked" as we call it – which means that soils were likely hydrophobic, and all the resulting debris was primed to be washed off the hills if it rained hard enough.

Thunderstorms rumbled all around the fire through the afternoon and into the evening, but none hit the fire directly. Then at around 6:30 PM, a very large storm took aim at us. The storm had already produced flooding to our south, so I knew it would be bad if it moved over us. I issued a warning to the firefighters of what was to come. The NWS office in Medford followed suit shortly thereafter with a flash flood warning for the fire.

Two to three inches of rain fell over the eastern side of the fire between approximately 7:30 and 8:30 PM – much of it in a single drainage: Humbug Creek. At 8:00 PM, the report we feared came over the radio: flash flooding and debris flows on Humbug Creek. A vehicle was swept off the road and the driver trapped in the flood waters. The driver was eventually rescued but not until after nearly drowning and sustaining significant injuries.

I surveyed the scene the next day and found that road had been completely washed away. The truck that got caught in the flood was a total loss (pictured above). Debris (ash and dirt in particular) filled many of the drainages to a depth of several feet (pictured below). Much of the silt and ash washed down into the Klamath River and turned it brown. Later, videos emerged on social media showing many vehicles stranded in the flood, including large fire trucks. Several crews were stranded behind the flood and had to spend the night on the hill.

All of this serves to remind us a few things:

1. Anything can occur on a wildfire, including floods.
2. When you encounter a flood, NEVER try to cross it. You have no idea what is under there or, more importantly, what is NOT under there, like the road! It's better to spend the night in your vehicle waiting for water to recede than to risk your life trying to cross it.
3. There is tremendous power in moving water. Water weighs over 8 pounds per gallon, and large, very heavy fire engines with skilled drivers were unable to safely cross just a foot or two of fast-moving water.

Post Fire Hazards, Part II

Spencer Higginson, *Service Hydrologist*

Helicopter flight to hand plot burn area on a map - Swan Lake Fire, Alaska

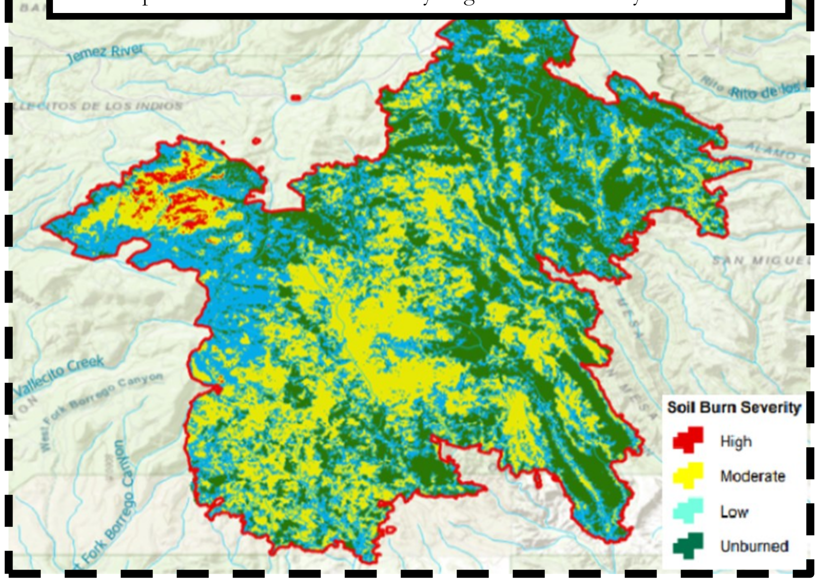
In the last issue of the Crater Chronicle, I talked about the dangers that remain after a wildfire is out. This article will focus on the next step in dealing with the post-fire environment.

Some of the damage done by a wildfire creates life and safety issues while some damage just means it will be difficult for the area to return to its pre-fire condition. Federal land management agencies have a process to deal with this to alleviate the danger and in some cases, to speed up the recovery. The process is called Burned Area Emergency response; BAER for short. Pronounced like "bear", the BAER Team rapidly assesses the damage done by a wildfire, determines what threats exist due to that damage, and prescribes treatments to mitigate the threats. The prescribed treatments are then put in place by the land management unit responsible for the burned area using emergency funding.

A BAER Team is requested anytime the local unit feels that the size and scope of the fire is too large for them to handle on their own. A BAER Team Leader will discuss the concerns of the local unit to determine which resource areas need attention. For example, if there is widespread damage to roads or culverts, an engineer is requested. If there is concern about flash flooding, a hydrologist is requested. If there is a known archeological site within the burn scar, an archeologist or cultural specialist is called. The most common resource specialists requested are: biologist, botanist, archeologist/cultural specialist, forester, soil scientist, hydrologist, and GIS specialist. Each of these resource specialists will assess the fire's impacts on their respective resource and will plan the path forward for recovery.

The BEAR Team starts by talking to the local unit and finding out what their concerns are. The local unit will come up with a list of values (roads, buildings, campgrounds, critical habitat, etc) that they want the BAER Team to assess. As the BAER Team is assembling, they will request a special map called a BARC map to guide the field work. The BARC map (Burned Area Reflectance Classification) is made by comparing pre- and post-fire satellite images of the burned area. This shows the change in land cover (mostly vegetation) caused by the fire. The map then breaks the fire down into 4 categories: Low, Moderate, and High Severity and then Unburned.

SBS Map that shows Soil Burn Severity to guide field work by BAER Team



There have been instances where cloud or smoke cover prevented the satellite from getting a good post-fire picture in order to create a BARC map. In these cases, it is often necessary to map the fire by flying in a helicopter and, with markers, plotting on a map the areas that look moderate and severe. The helicopter flight can also give the team members a better feel for the scope of the fire and the lay of the land as they move forward with their assessments.

Sometimes the BARC map is very accurate and doesn't need adjustment at all. Other times the BARC map is skewed and needs to be corrected. The BAER Team will ground-truth the BARC map to verify that it is a good indication of post-fire conditions. Once the BARC map has been adjusted and finalized, it is called a Soil Burn Severity (SBS) map (pictured right).

The SBS map is what all of the BAER Team's findings and recommendations are based on. For that reason, it is im-

Assessing ash depth and soil conditions - High Cascades Fire, Crater Lake NP

portant to make it as accurate as possible in the limited time the team has. So what goes into ground-truthing the BARC map to make the SBS map?

All members of the team will assist in the ground-truthing process of the BARC map. Team members, typically in groups of 2 or 3, will visit as many parts of the fire as possible in order to increase the accuracy of their findings. They pay special attention to the areas mapped as moderate and high severity because those are the areas that will have the greatest bearing on post-fire impacts.

The team will look at the type of vegetation that was in the area pre-fire, the amount of trees and shrubs that has been consumed, the amount of remaining ground cover (live and dead vegetation, rocks, etc), the amount of the duff layer (years of built up organic material like leaves) that has been consumed, the depth of the ash layer, and the condition of the soil. There is a lot that a team member can learn from these variables. Looking at the amount of ash, the amount of vegetation that was consumed, and the vegetation that remains allows the team member to estimate how hot and for how long the fire burned in the area. That fire residence time gives clues as to how much damage has been done to the soil.

The reason it is so important to know the amount of damage that was done to the soil is because soil burn severity is a major determining factor in how quickly the area will recover from the fire and how the burn scar will respond to significant weather events.

The duff layer and the soil contain everything a forest needs to regenerate; the seeds, the roots and starts, the nutrients, the structure, etc. The regeneration will take much longer if the duff layer is consumed, and longer still if the soil is burned. If the fire is severe enough to burn the soil layer, the seed bank and the organic material will be consumed and there will be nothing to start new growth and nothing to hold the soil together. The soil will turn to dust and sand where it is susceptible to wind and water erosion and will not be able to store water or support the weight of the forest. Luckily, total consumption of the soil like this is fairly rare and localized but when it occurs, it can take decades to recover without help. Usually, what the team finds is a mosaic pattern with some moderate and high severity mixed in with in with some low severity and unburned areas.

One phenomenon found in soils is hydrophobicity. Hydrophobicity is when the soil has a layer (or multiple layers) that water can only pass through very slowly or cannot pass through at all. Many areas have some degree of natural hydrophobicity from the clay content in the soils or from the decay of organic material. In a wildfire, hydrophobicity can increase; significantly in some cases. In a wildfire, the heat can vaporize a waxy substance found in the organic material. The hotter the fire burns and the longer the heat is present, the deeper the vapor is pushed into the soil. Once the fire is out and the soil cools, the vapor also cools and solidifies into a waxy, hydrophobic layer in the soil. The depth of the layer can also give clues to the heat and residence time of the fire.

All of these factors I have discussed, from soil to vegetation to ground cover, are used to determine the accuracy of the BARC map. If the team finds that the BARC map is over or underestimating moderate or severe burn severity, they will work with the GIS specialist to adjust the thresholds in the map to increase or decrease the amount shown of each category so that it more accurately reflects what they are seeing on the ground. Once the SBS map is finalized, each team member can prioritize their field work to make the most of their time during the rapid assessment. They can finally begin assessing their resource area and find the best way to move forward.

In the next article we'll look at how each resource area is impacted by wildfire and what the specialist can do to help with the post-fire recovery.

A drop of water on a hydrophobic layer in the soil.

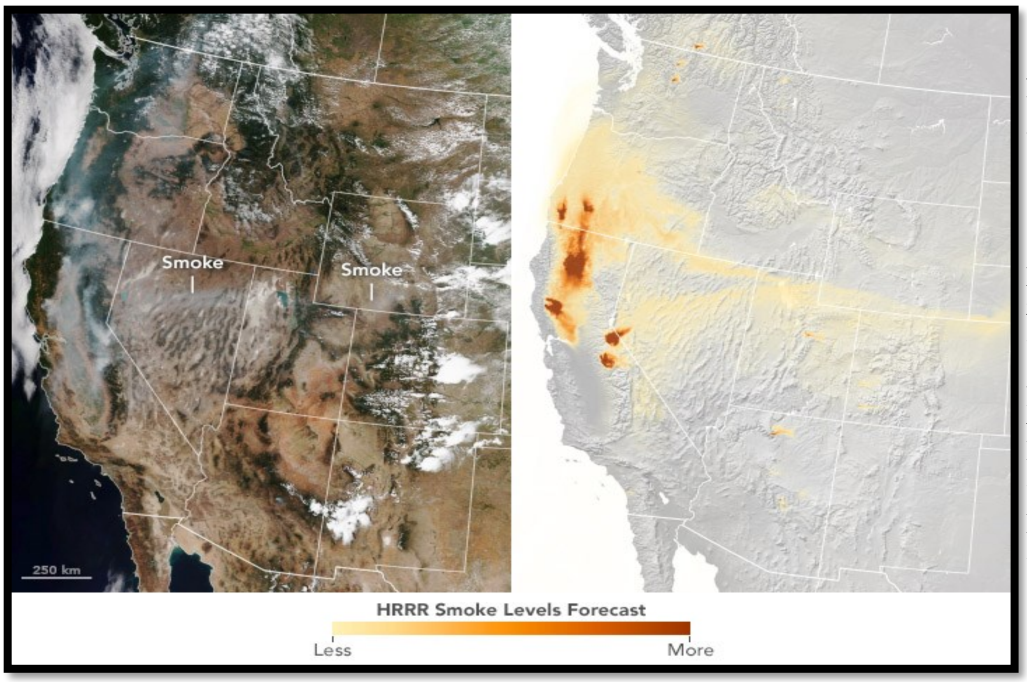
HRRR Smoke Model

Roberta Thornton, *Administrative Services Assistant*

Every year, from June to October, the American West experiences forest fires that disperse heavy concentrations of smoke across the region. Smoke has a profound impact on public health, regional commerce, and transportation routes. It is critical that the general public, health professionals, and firefighter crews have accurate and real time information about the location and concentration of wildfire smoke.

Meteorologists from the NWS working in field offices and on assignment at wildfire incident command posts are tasked with disseminating important public health guidance about wildfire smoke. *Forecasting* smoke is significantly more important than simply *observing* smoke. Even though smoke can't be prevented, by forecasting it, meteorologists can assist firefighters and communities in planning for its effects. The NWS has a powerful tool in this mission: the High Resolution Rapid Refresh Smoke Model (HRRR-Smoke).

HRRR-Smoke is what forecasters call an *atmospheric model*, a predictive tool utilizing high resolution satellite images that are able to detect large fires (the source of smoke), compute wind forecasts to determine wind direction and speed (where the smoke is going, how fast the smoke is moving), and how much mixing will occur in the atmosphere. The smoke model then takes all of the information and combines the data with advanced knowledge of chemistry and physics, resulting in highly accurate smoke forecasts for up to 36 hours. The model forecasts the accumulation of very small smoke particles, the type of which can be inhaled and lodged deep within the lungs.



NWS meteorologists rely on the HRRR-Smoke model, which is updated hourly, to improve the forecast. Smoke can be added to the short-term forecast along with temperature adjustments. For example, in areas of dense smoke the daytime highs are cooler and the nighttime lows are warmer. On large fires, U.S. Forest Service Air Resource Advisors work with multiple agencies to address public health concerns, smoke risk to transportation safety, and firefighter exposure.

Smoke forecasts are crucial for decision making, especially for those most vulnerable to smoke related health impacts. Hospitals, nursing homes, and the Veterans Administration use smoke forecasts to decide whether to relocate patients. Outdoor venues use smoke forecasts to make determinations regarding outdoor performances and sporting events. Departments of Transportation determine road closures impacting the transportation of goods. Schools use the data to plan indoor recess. Private citizens use the information to make decisions regarding the purchase of smoke filtering masks and a host of other activities from crop harvesting to outdoor weddings.

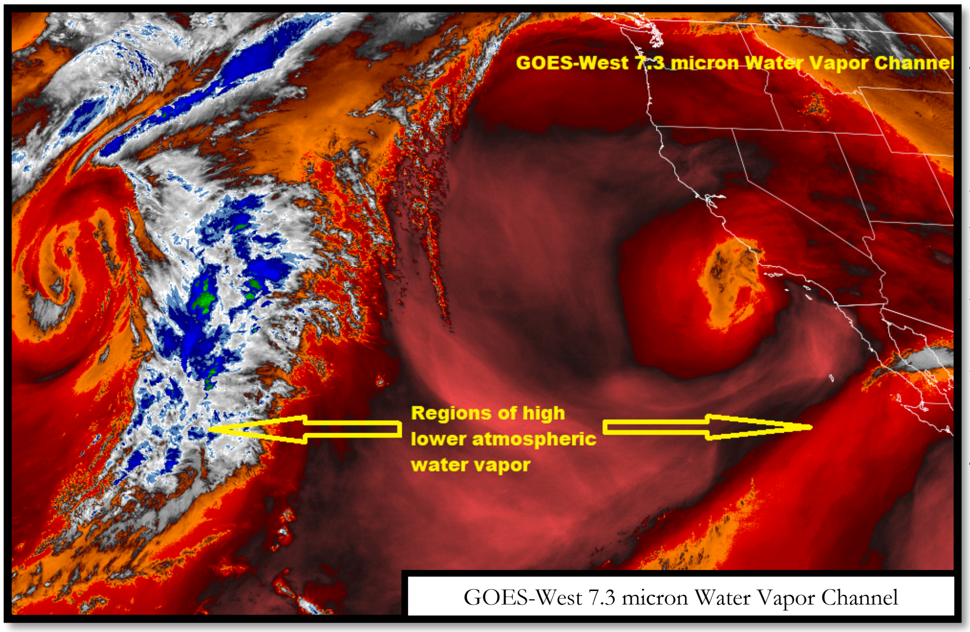
Because HRRR-smoke has the ability to provide accurate information about wildfire smoke density at both the surface and high in the atmosphere, NWS forecasters are able to advise regional airports so they can make proactive decisions to divert air traffic and mitigate inconvenience to travelers.

NWS meteorologists ensure the broadest communication of smoke forecasts by working with partner agencies, broadcast and news media, and posting on social media, to name a few. This allows for the most accurate and timely information regarding what is occurring with the smoke forecasts.

The Value of the New GOES-R Satellites in Monitoring Atmospheric Rivers

Mike Stavish, *Science Operations Officer*

On average, cool-season atmospheric river events bring 30 to 50 percent of the total yearly precipitation in the west. Many of these events also contribute to dangerous winter storms and flooding. Thus, monitoring the existence and evolution of atmospheric rivers has become increasingly important. Atmospheric rivers (ARs) are narrow, lower-atmospheric corridors of moisture transport that carry higher moisture content from the lower latitudes poleward. Throughout the course of the cool season, meteorologists have become accustomed to identifying atmospheric river events which will bring significant amounts of rain and snow to parts of the west. One way we're going about this is by utilizing the capabilities of new environmental satellites including the new geostationary satellite, GOES-West.



GOES-West 7.3 micron Water Vapor Channel

The new GOES-West geostationary satellite has 3 water vapor channels, as opposed to only 1 from the previous GOES-West. The 3 channels focus on the lower, middle, and upper atmospheric moisture, and focusing on the lower atmospheric (7.3 micron channel), can illuminate the current location and development of ARs. Using the low-level water vapor in combination with the middle and upper level imagery can help us to understand spatial characteristics of AR storms.

While the 7.3 micron imagery (shown above) provides a qualitative representation of high atmospheric water vapor, the new GOES data is also translated into "atmospheric profile" data which can be represented as "total precipitable water vapor (TPW)." Total precipitable water vapor is only available where skies are clear, so there are data gaps within ARs, but specific values of moisture can be displayed, which aid forecasters in assessing how impactful landfalling ARs may be.

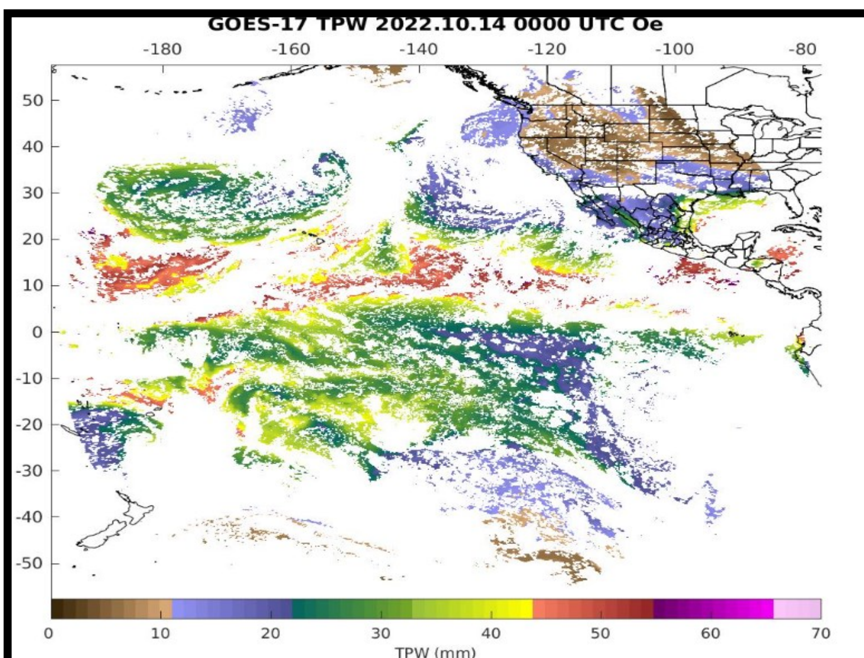


Image showing GOES-17 Derived Total Precipitable Water Vapor.

While imagery from the new GOES satellites does not serve all needs of forecasting ARs, it contributes to a growing ensemble of data and forecast tools within the emerging science. In combination with weather models, polar satellite data, and observations from land-based stations and aircraft, meteorologists have a robust toolbox for providing detailed forecast and warning information for AR events.

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Our Vision

Professionals focusing on science, teamwork, and customer service to design and deliver the best decision-support information to our community.

Our Mission

Our team at the National Weather Service Office in Medford strives to deliver the best observational, forecast, and warning information through exceptional customer service, extensive training and education, maintaining quality electronic systems, and relying upon an outstanding team of weather spotters and cooperative observers. We do this within the overall mission of the NWS to build a Weather-Ready Nation:

To provide weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community.

Our Values

Trust, Integrity, Professionalism, Service, Teamwork, Ingenuity, Expertise, and Enthusiasm.

About Us

The Weather Forecast Office in Medford, Oregon, is one of more than 120 field offices of the National Weather Service, an agency under the National Oceanic and Atmospheric Administration and the United States Department of Commerce. The Weather Forecast Office in Medford serves 7 counties in southwestern Oregon and 2 counties in northern California, providing weather and water information to more than a half-million citizens. We are also responsible for the coastal waters of the Pacific Ocean from Florence, Oregon, to Point St. George, California, extending 60 miles offshore. The office is staffed 24 hours a day, 7 days a week, and 365 days a year by a team of 26 meteorologists, hydrologists, electronic technicians, hydro-meteorological technicians, and administrative assistants, under the direction of the Meteorologist-In-Charge, Christine Riley.