National Weather Service - Medford, Oregon

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The Crater Chronicle

Fall Began September 22nd at 1:02 pm PDT.

Daylight Savings Time Ends November 5th! -

Remember to Set Your Clocks Back One Hour!

Inside This Issue

Wildfire Smoke and Weather

John Lovegrove, *Meteorologist In Charge*

Smoke from wildfires affected many areas of the West this past summer, including southern Oregon and northern California. The smoke varied from dense and choking to high, thin wisps. We know that the smoke can affect people on the ground but how can it affect the weather? It can do so in many ways.

Weather and wildfires are closely intertwined. It is the weather that determines when an area is susceptible to burning and how intensely it burns. High temperatures, low humidity and strong winds favor fire growth and spread. Lightning from thunderstorms bring the spark that lights the fire. Thunderstorms do also bring rain but many lightning strikes fall outside of the rain shaft.

As with many parts of weather, there is a feedback mechanism at work. Weather affects the fire and the fire affects the weather. The visible and troublesome feedback is when dense smoke is trapped in valleys. This happens when there is a temperature inversion. Normally, the air temperature decreases as altitude increases. But in an inversion, temperature rises as altitude increases. This can be caused by cooler air draining into valleys at night. This inversion makes the atmosphere very stable with little, if any, mixing. No mixing means that the smoke coming with the cool air flowing into the valleys will stay there. The only way this can change is to bring something along that stirs up the air. To do this we need a thunderstorm, a front or just a different type of air mass that is more unstable. Basically, something that can bring wind to the surface and break the inversion. Then the wind can carry the smoke away (as long the fire is located upwind).

Smoke plume on the Eclipse Complex (2017). Photo taken by Tallac Hotshots, retrieved from InciWeb

Another way an inversion can form is by a plume of dense smoke covering an area and blocking the sun. Just as with clouds or an eclipse, if the sun's energy is blocked the surface will cool. This will cause the daily high temperatures to not reach what it could without smoke. It is very tricky to forecast high temperatures around fires. If the plume is over a place, it will be cooler but the question is: by how much? That depends on how far away the fire is, how much smoke is being produced and what direction the wind is blowing. That is a lot of variables to tackle.

The lower temperatures cause the humidity to be a bit higher (warm air can hold more water so lower temperatures equal higher humidity). The higher humidity can slow the growth of fires since the burning environment is not as favorable. The smoke plume that can affect a fire may come from a neighboring fire. We saw this affect this year when smoke from the Chetco Bar Fire shaded fires in the Applegate and Siskiyou County.

The temperature inversions can also be strengthened by dense smoke in valleys. The sun shines on the top of the smoke and raises the temperature of that air. This way, the surface gets cooler and the top of the smoke is warmer. So once the smoke is trapped in the valley, it gets hard to scour it out.

The smoke we see is made up of tiny particles. Particles from smoke tend to be very small - less than one micrometer in diameter. For purposes of comparison, a human hair is about 60 micrometers (or 0.0023 inch) in diameter. Particulate matter in wood smoke has a size range near the wavelength of visible light (0.4 – 0.7 micrometers). A cloud is made up of countless tiny water droplets and these droplets need a small particle (a cloud condensation nuclei) to seed their growth. The smaller smoke particles make great cloud condensation nuclei. If there is sufficient humidity in the air, the smoke particles can help cloud formation along which can lead to rain. The smoke itself won't make a cloud or thunderstorm develop because the big driver is humidity, but smoke can help increase development.

Pyrocumulus on the Spruce Creek Fire, located northwest of Crater Lake, 9/5/2017. Image: Incident Meteorologist, Jason Clapp

Pyrocumulus are the clouds that form on the smoke columns of very active fires. The pyrocumulus are not formed so much by the smoke but by the intense heat and updrafts formed by the fire.

I have mainly covered the affects of dense smoke near the ground so far. Thinner, lighter smoke can also affect the weather. The changes in this case are more subtle. A thin layer of smoke aloft will mainly cut into the amount of sun shine reaching the ground. This will cut the afternoon high temperatures by a couple of degrees - it all depends upon how dense the smoke layer is. Other than a red sunrise/sunset, that is about the limit of the affects of a thin layer of smoke.

Traveling during Changing Seasons

Misty Firmin, *Meteorologist*

As we transition from the hot, dry fire season to the cooler, wet season, it's important to know the forecast and road conditions before venturing out into the wilderness. During the fall months, it's not out of the ordinary for a system to quickly change the weather from warm and dry to much cooler and wet in just a few hours. This could catch some people off-guard by either making road conditions hazardous for travel or for those camping overnight waking up to chilly conditions with a few inches of snow on the ground. Before making outdoor and/or travel plans, be sure to check the local forecast and road conditions. There's a really awesome recreation specific forecast page available where you can select from different recreation activities to get a spot specific forecast for that area of interest. Click the icons below for the forecast or road conditions.

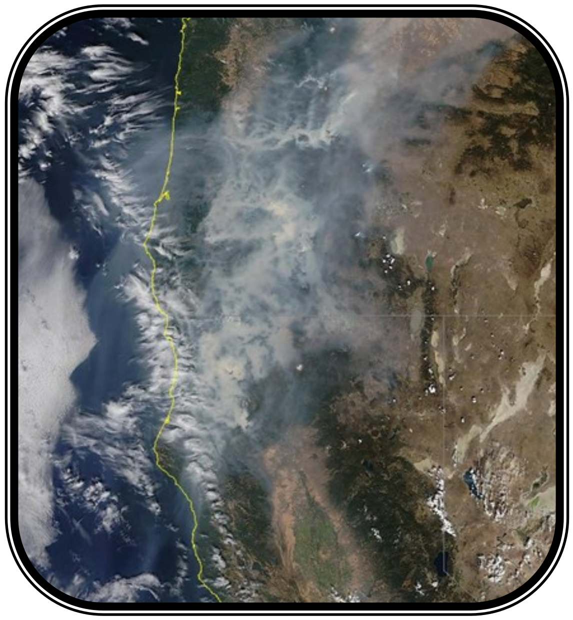
Recreation Safety Forecast

Trip Check www.tripcheck.com

Caltrans

The Curious Lightning Event of September 6th, 2017

Brad Schaaf, *Meteorologist*



MODIS Visible Satellite Image on September 3, 2017

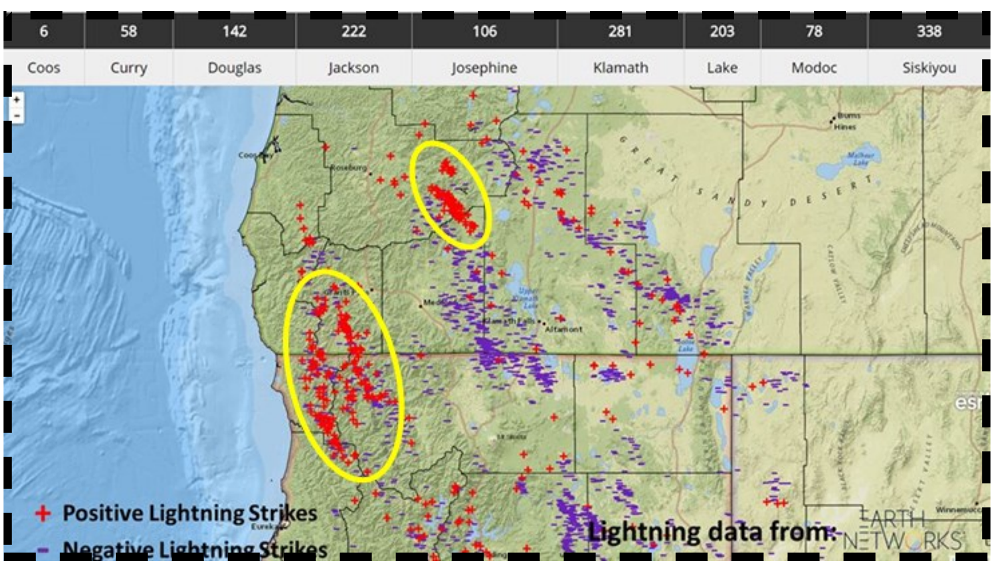
The beginning of September was marked by a period of dry weather, hot temperatures, and unhealthy air quality due to thick smoke. In fact, the smoke had become so thick across southern Oregon and northern California that visibility was reduced to less than a mile in several places. This was due to the dry and unstable conditions around the area allowing the fires to produce a significant amount of smoke, loft that smoke in the air and carry it quite a distance away from the fires. This smoke created big changes to our weather—most notably a decrease in temperatures. On the 1st and 2nd, highs surpassed the century mark. Beginning on September 3rd, afternoon high temperatures dropped by 8 degrees in the Medford area.

Then on the 6th, moisture from the remnants of hurricane Lidia wafted into the area and brought the first measureable rain in a few weeks. This moisture, combined with a low pressure system west of San Francisco, generated thunderstorms over portions of northern California and southern Oregon. Overall, the Medford forecast area received nearly 1,500 lightning strikes.

One thing that struck me as odd was that the vast majority of lightning strikes that occurred across western Siskiyou and Del Norte County in California as well as Josephine County were positive strikes. Additionally, a second set of unusually positive strikes occurred across the border of Jackson and Douglas Counties over the High Cascades and Umpqua North complexes. This was unusual since the majority of lightning strikes in nature have a negative charge.

So I set out to find the answer to this question. On my quest, I found that the answer was a bit more difficult to answer than I had originally thought. To start out with, I had to look at the theories of how lightning is created.

To generate lightning, you need a cloud. Clouds are made of liquid and solid water. When the ice crystals (snow) and graupel (sleet) crash into things, an electrical charge builds. It is theorized that the different charge types—either positive or negative—occur depending on what is colliding in the cloud. For instance, when snow and sleet crash into each other, a negative charge builds. When snow crystals collide, a positive charge tends to occur (Smith et al., 2003). Once enough charge is built up, energy will be transferred through a lightning strike. This further explains why positive charges are usually a bit more uncommon. Positive charges tend to build at the tops of clouds (where water is more likely to be in the solid form) and the negative charges build at the bottoms of clouds (more likely to be liquid). Since there is a greater distance between the top of the cloud and the ground, it takes more charge to link the cloud top to the ground.



Spatial plot of lightning strikes on September 6, 2017. Red plus signs indicate positive strikes, and blue minus signs indicate negative strikes.

That begged the question, "what caused so many of the lightning strikes to become positive?" Some studies have hypothesized that smoke or other aerosols—particulates in the atmosphere—could be a factor in changing the amount of lightning (Rosenfeld et al., 2008). Other studies have shown that there may not be a direct link to smoke and lightning in thunderstorms (Smith et al., 2003). Unfortunately, seeing studies with opposite findings happens quite often in meteorology.

The question still remained, however: What caused the abundance of positive strikes? New research as of this year has come out to suggest a possible role that smoke plays for this very question. Pawar et al. (2017) studied 32 thunderstorms and found that 10 of them switched the electrical structure. This means that the positive charges collected at the bottom of the cloud and that the negative charges collected at the top of the cloud. This research had to take the previous studies into consideration, and found that while the smoke could indeed cause thunderstorms to produce an abundance of positive lightning strikes, scientists cannot rule out that thunderstorms also need to occur in a place where low humidity occurred with high temperatures.

Going back to our storms, this seemed to fit the bill. According to the research, the smoke seemed to be a factor, as well as relatively low humidity in the area near the fires. Furthermore, the study having only found 30% of thunderstorms in a limited sample size can explain why we only saw a couple of our thunderstorms put out the abundance of positive lightning strikes despite a widespread area of dense smoke. So to answer the question simply, the smoke may have been a factor; but the atmosphere is very complex, and there likely are other unknown factors that contributed to the phenomena.

References:

S.D. Pawar, V. Gopalakrishnan, P. Murugavel, N.E. Veremey, A.A. Sinkevich, 2017, Possible role of aerosols in the charge structure of isolated thunderstorms, *J. Atmospheric Research*, Volume 183, 331-340.

Rosenfeld, D., Williams, E., MO, A., Freud, E., Poschl, U., NO, R., 2012, Flood or drought: how do aerosols affect precipitation? *Science* 321, 1309.

Smith, J.A., Baker, M.B, Weinman, J.A., 2003. Do forest fires effect lighting? *Q. J. Roy. Meteorol. Soc.* 129, 2651-2670.

Building a Weather-Ready Nation

Ryan Sandler, *Warning Coordination Meteorologist*

In 2012 the National Weather Service (NWS) released its Weather-Ready Nation Roadmap recognizing that nearly 98% of all presidential disaster declarations are weather and flood related. Weather-Ready Nation is about building community resilience in the face of increasing vulnerability to extreme weather and water events.

Back in the 1990s the NWS was focused on technology and training. We were brought into the 21st century with automated weather observing systems, automated NOAA Weather Radio voices, Doppler radar, more advanced supercomputers and satellites, and a much more advanced computer forecast display system in all 122 NWS offices. It took 4 ½ billion dollars to bring us into the 21st century of technology, but this great leap in technology lacked any real advances in communication between meteorologists and the end users of our forecasts.

We now have nearly 9 out of 10 Americans using the internet, 8 out of 10 own a smartphone, and 7 out of 10 use social media. We have communication tools we never dreamed of in the 1990s and we must leverage these tools to provide the best service possible.

This shift toward focusing on communication and providing decision-support services to our users is an even bigger challenge than what we faced in the 1990s. While new technology is still important, we are emphasizing a cultural change where nearly all of our meteorologists and hydrologists are expected to provide decision support services, in addition to weather and water forecasting.

During potentially hazardous weather, our forecasts and warnings may be enhanced by social media posts, graphical weather stories, email weather briefings, live weather briefings, spot forecasts, on-site emergency operations support, and media interviews.

We used all of these communication methods during this past wet, snowy, and icy Oregon winter. We have a great working relationship with the Oregon Department of Transportation with a common goal of keeping travelers as safe as possible during hazardous weather.

The best example of our decision support services began over 100 years ago in Medford with the fire weather program. Nationwide, there are 74 Incident Meteorologists specially trained to go on-site to wildfires and provide weather briefings and forecasts to incident responders and command staff. Their forecasts ensure the safety of operations, allowing responders to take into account the most changeable aspects of any incident—the weather.

The NWS has a number of programs helping to form and build relationships with our partners. StormReady and TsunamiReady, which began around the year 2000, have been successful. There are a total of 35 StormReady and TsunamiReady sites in Oregon including 7 counties and 28 communities. There are also 10 StormReady/TsunamiReady Supporters and one Indian Nation.

The Weather-Ready Nation Ambassador initiative began in 2014 and there are now 48 Weather-Ready Nation Ambassadors in Oregon. This initiative is a tool to help us strengthen existing relationships, build new relationships, formally recognize partners for their efforts in preparedness, readiness, and building resiliency, and, to most importantly, build a Weather-Ready Nation.

Together with Weather-Ready Nation Ambassadors, the NWS strives to communicate the importance of being prepared for extreme weather, but it takes all of us, working together, to build a Weather-Ready Nation.

August Heat Wave that Challenged All-Time Record Highs

Misty Firmin, *Meteorologist*

In early August 2017, a strong ridge resided over the area bringing multiple days of record breaking temperatures. Temperatures came very close to all-time record highs for many locations across the forecast area. Not only did high temperatures challenge all-time records, the number of consecutive days with very hot temperatures was challenged as well. For some places, the number of consecutive days would likely have been broken if it had not been for high level clouds that kept temperatures down by a few degrees on the 4th.

Heat like this, and for this long, had not been experienced in the Medford area since 1981. The table to the right shows the highest temperature recorded during the heat wave and it's overall rank for the all-time warmest temperature.

	Peak temp	All-Time Rank	All-time Record high temp (Date)
Roseburg	108°	2nd	109 (7/20/1946)
Medford	112°	3rd	115° (7/20/1946)
Klamath Falls	99°	9th	101° (7/02/2013)
Montague	107°	2nd	109° (7/11/2002)
Mt Shasta City	101°	8th	105° (8/7/1981)
Alturas	100°	26th	107° (7/11/2002)

Astronomy Highlights

Misty Firmin, *Meteorologist*

Meteor Showers Remaining in 2017

	Draconids	Orionids	South Taurids	North Taurids	Leonids	Geminids
Active Period	Oct. 6th – Oct. 10th	Oct. 4th – Nov. 14th	Sept. 7th – Nov. 19th	Oct. 19th – Dec. 10th	Nov. 5th – Nov. 30th	Dec. 4th – Dec. 16th
Peak Date	Oct. 7th & 8th	Oct. 21st	Nov. 5th	Nov 11th & Nov. 12th	Nov 17th & Nov 18th	Dec 13th & 14th
Best time to view	After sunset—just after nightfall	After midnight—just before dawn	After midnight—until dawn of the 5th	Late night on the 11th until dawn of the 12th	After midnight—just before dawn	Mid-evening Dec 13th—dawn of Dec 14th
# meteors per hour	~20… sometimes hundreds	~10 to 20	~5-10	~5-10	~10-15…can be many more	~50-100… rivaling the Perseids
Moon Phase	Waning Gibbous	Waxing Crescent	Nearly Full	Waning Crescent	New	Waning Crescent
Comet of Origin	Giacobini-Zinner	Halley	Encke	Encke	Tempel-Tuttle	Phaethon
Constellation of Origin/Radiant	Draco, near Eltanin & Rastaban	Orion, north of Betelgeuse	Taurus	Taurus	Leo	Gemini, near Castor & Pollox
Direction to Look	Northwest	Southeast	South	South	East	East

Wildfires of 2017

Misty Firmin, *Meteorologist*

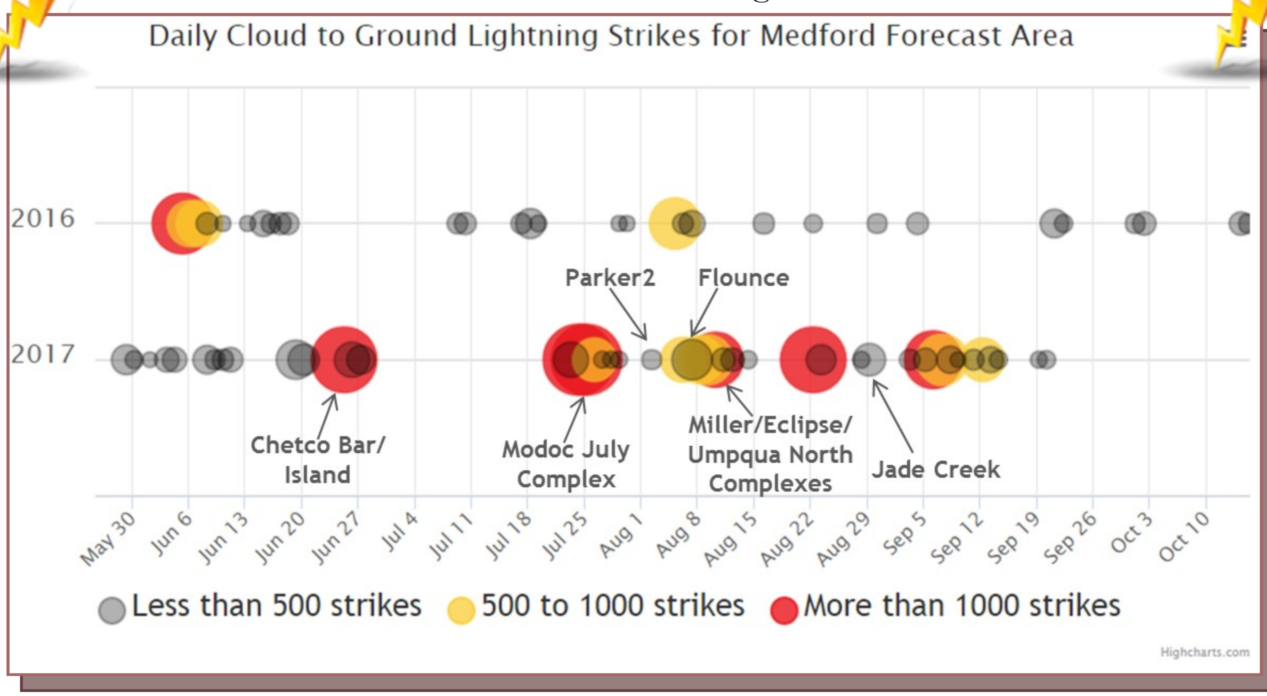
Summer 2017 was a very active fire season with multiple lightning outbreaks that sparked numerous wildfires across the forecast area. The most troublesome wildfires were started by a lightning outbreak that occurred around the middle of August. I say these were the most troublesome because the smoke produced from these fires created very unhealthy air quality in the valleys west of the Cascades and in western portions of Siskiyou county due to thick smoke. Visibilities and air quality were both severely degraded for an extended period of time as prime weather conditions allowed for ample growth of the fires which in turn, greatly increased smoke production. Reprieve from the dense smoke finally came in the middle of September when the first fall-like system moved through the area. Not only did this system help scour out the smoke that plagued the area for weeks on end, but it also brought between one to three inches of rain over a 5 day period that significantly reduced fire activity and resultant smoke production.

Acres Burned & %Containment are current as of 9/25/2017

Fire Name	Acres Burned	% Containment	County/Location	Date of Origin
Chetco Bar	191,067	97%	Kalmiopsis Wilderness, Chetco River Corridor, Illinois River Valley, OR	7/12/2017
High Cascades Complex	79,870	32%	Rogue River-Sikiyou NF, Umpqua NF, Tiller RD, Fremon-Winema NF, Klamath RD & Crater Lake National Park	8/13/2017
Umpqua North Complex	43,140	60%	50 miles E of Roseburg, OR	8/11/2017
Salmon August Complex	65,875	75%	Marble Mtn Wilderness & Klamath NF side of Trinity Alps Wilderness	8/13/2017
Eclipse Complex	69,462	51%	5 miles W of Happy Camp & 11 miles SE of Gasquet CA	8/15/2017
Miller Complex	36,496	70%	20 miles W of Ashland, OR	8/14/2017
Modoc July Complex	83,120	100%	Modoc County, CA	7/24/2017

Lightning Outbreaks & Wildfire Origins

Shad Keene, *Meteorologist*



There were significantly more wildfires in our 9-county forecast area this summer compared to 2016. The graphic above shows that there were 6 events of at least one thousand lightning strikes, in the heart of fire season, compared to a single thousand-strike lightning event last summer, which occurred at the beginning of fire season. In total, there have been about 2.5 times the amount of cloud to ground lightning strikes in 2017 compared to 2016. Additionally, the graphic shows which lightning events started which fires in 2017. Over the winter we will be further trying to identify a correlation value between lightning strike counts and the number of large fires.

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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 Meteorologist-In-Charge John Lovegrove.