

Avoiding Wildfires & Smoke During Aviation Operations

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Overview

- Wildfire Impacts on Aviation:
 - Smoke,
 - Produces aviation weather hazards.
- How to avoid wildfires and smoke:
 - Understand diurnal evolution of wildfires and smoke,
 - Online resources.



Hermit's Peak Fire, NM
Viewed from the Northwest, Looking Southeast
April 29, 2022

© Jim O'Donnell

Smoke Impacts on Aviation

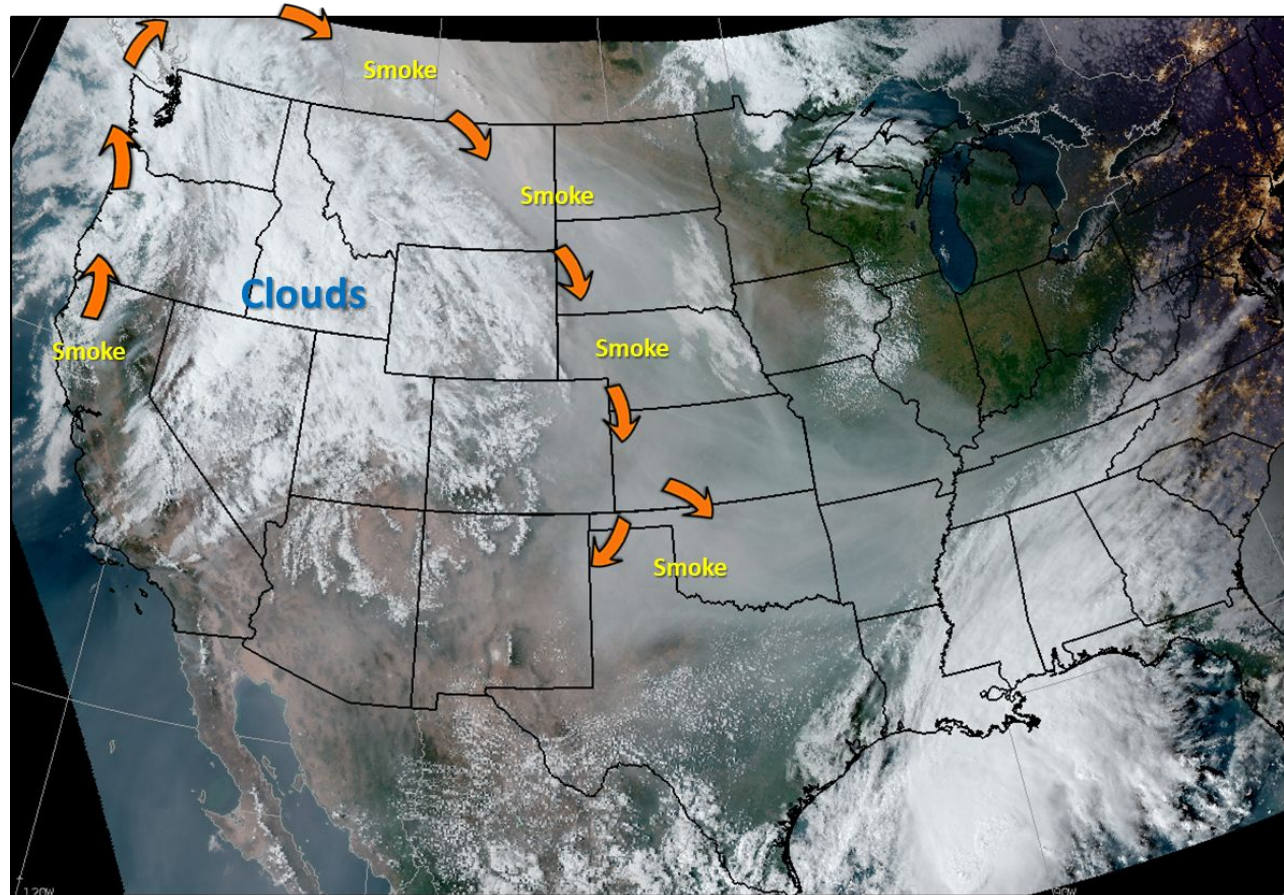


Trigo Fire, NM; April 30, 2008; © Stephanie

- Obstructs visibility on ground and in flight,
- Creates a ceiling,
- Impacts efficiency of air traffic operations,
- Can damage aircraft,
- Health risk for flight crews, passengers, and airfield ground personnel.

Long Distance Smoke

- Smoke can travel thousands of miles with far reaching impacts.
- Smoky haze can decrease slant range visibility enough to form a ceiling when landing into the rising or setting sun.



GOES CONUS GeoColor

Reduction in Slant Range Visibility



Haze Vs. Non-haze View of the Same Landscape

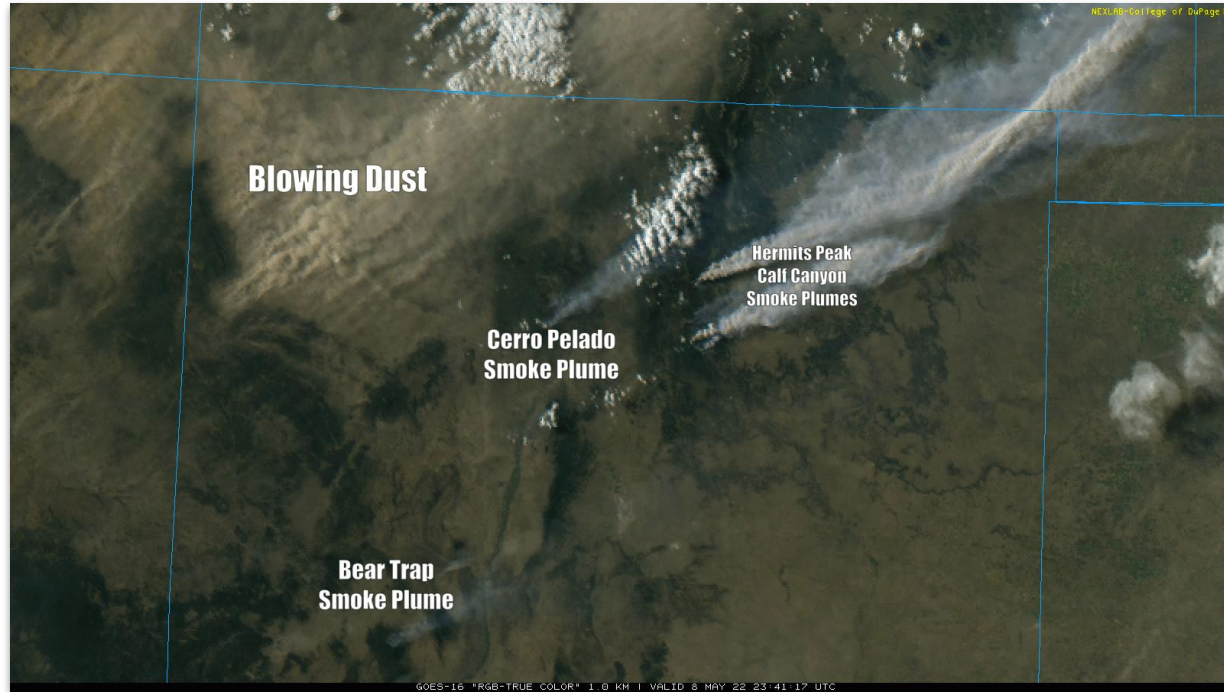
From “Evaluating the Impacts of Haze on Air Traffic Operations” by R. Lee, C. Craun, M. Robinson, and M. Phaneuf; AvMet Applications, Inc.

“From a planning perspective, aircraft flying into airports under the influence of wildfire smoke should anticipate delays in arrival... . Even if the METAR or ATIS reports good visibility, a prudent flight crew should anticipate the reduction in slant range visibility from the cockpit. **Preparation for utilizing an ILS and/or asking to utilize a runway that isn’t approaching into the sun would be options to consider.**”

- Dr Patrick Veillette (experienced Smokejumper Aircraft Pilot) in “Wildfires Effect on Aviation, Part 1”; Aviation Week Network; August 4, 2021.

Smoke Plumes

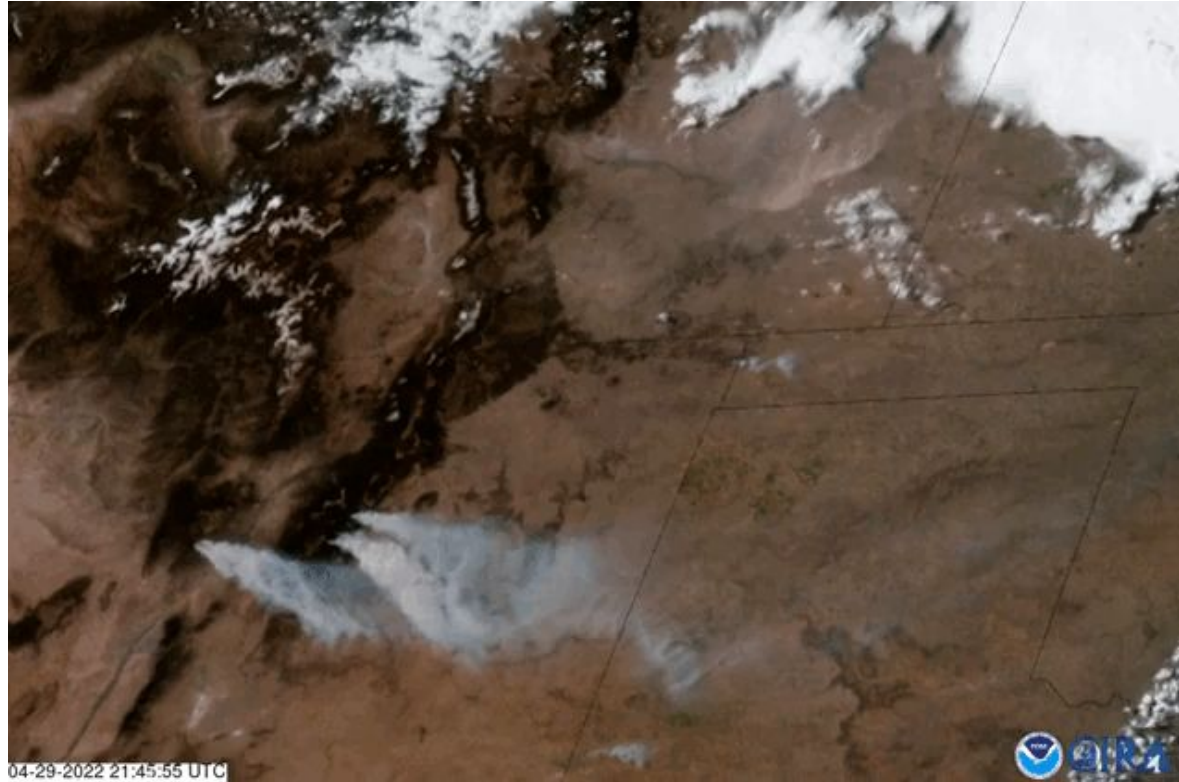
- Concentrated smoke plumes are the most hazardous.
- Less concentrated smoke plumes can quickly become more concentrated due to:
 - Strengthening winds,
 - Fire entering more susceptible fuels like old growth forests.



NM Smoke Plumes of Varying Concentration
GOES 16 True Color RGB
May 8, 2022

Smoke Plumes

- Smoke plumes become most vigorous and far reaching on windy, dry, and warm days.
- Smoke and ash may not reach downstream airports until late in the afternoon or evening.



**Northern NM Smoke Plumes
with Vigorous Cold Front and Haboob on the High Plains
April 29, 2022; 2145-0045Z**

Fire Produced Aviation Weather Hazards

- Hot smoke towers can initiate atmospheric convection forming clouds and thunderstorms (if enough moisture present) with lightning and downburst winds.
- Billowing smoke towers create wind shear and turbulence.
- Strong inflow winds reached 40 KT with the Station Fire, CA, August 2009, while prevailing winds were light.
- Fire whirls, like the famous Carr Fire, CA, 'firenado' in August 2018.
- Smoke can shade the ground making TAF wind forecasts less reliable.



Leah Robertson

Smoke Induced Pyrocumulonimbus Cloud

Las Conchas Fire, NM

June 11, 2013

Fire Produced Aviation Weather Hazards

- For every hot column that rises, air must converge underneath creating potentially gusty and erratic winds.
- The higher and more vigorously the smoke plume billows, the stronger the winds it can induce.

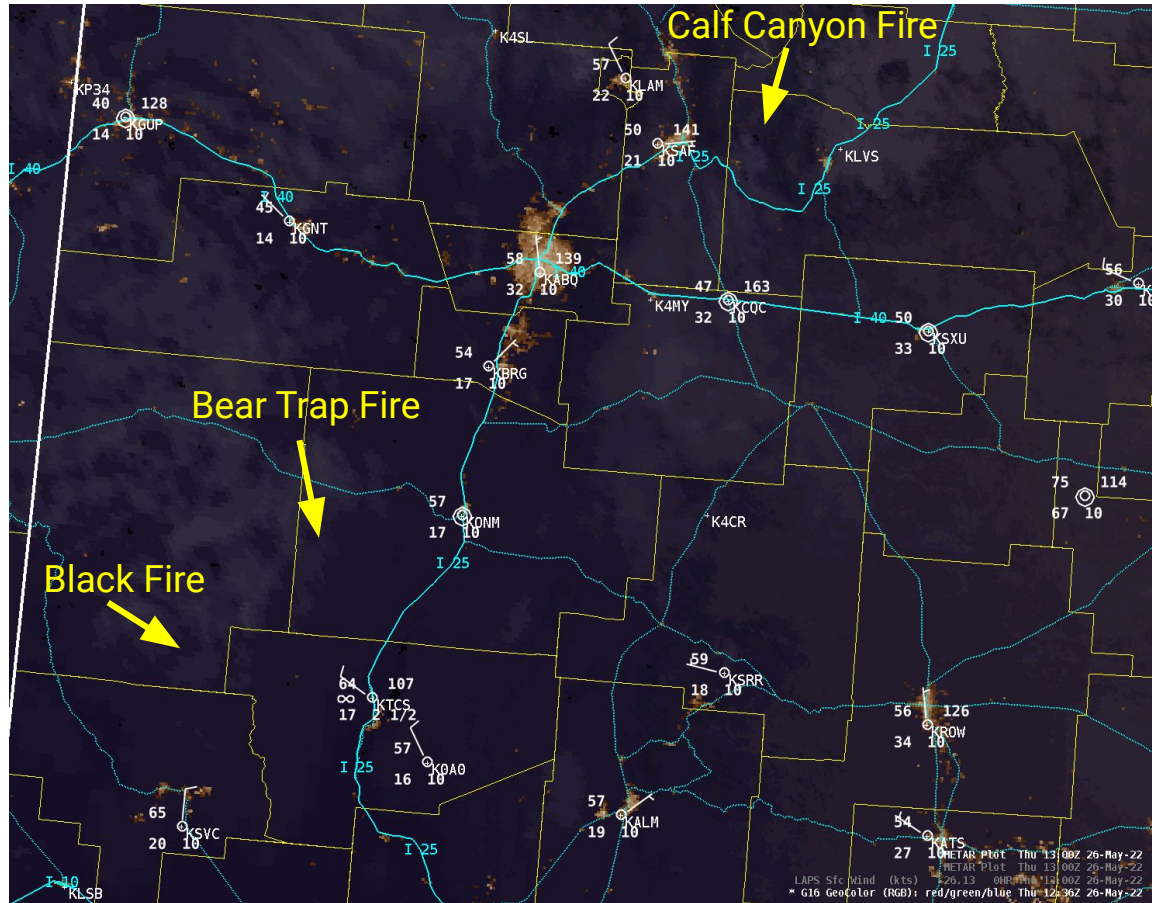


Jim O'Donnell

Hermit's Peak Fire, NM

Viewed from the Northwest, Looking Southeast
April 29, 2022

Smoke Evolution: Late Night and Early Morning



NM Fires on May 26, 2022, Early Morning

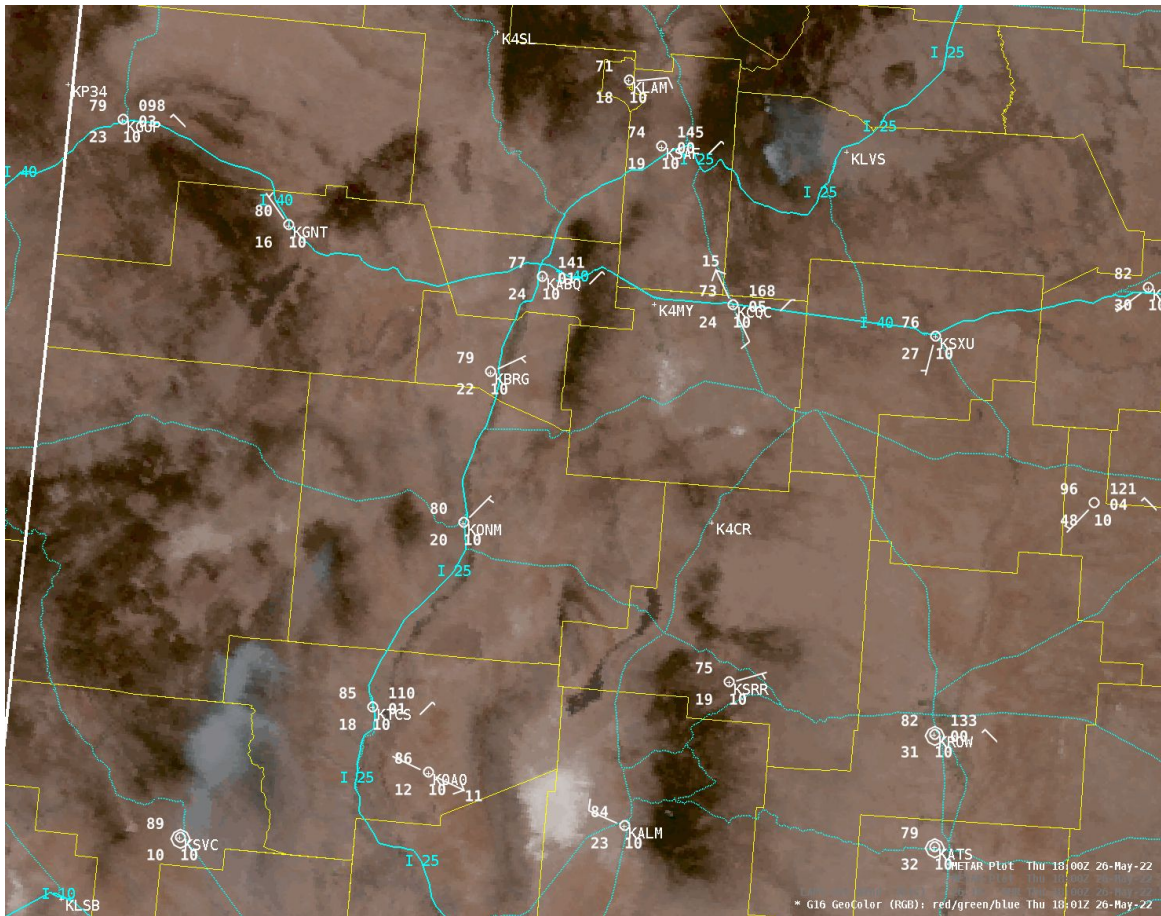
- Trapped at low elevations under temperature inversion,
- Drains into valleys with cool/dense air currents,
- Impacts limited to near and downslope from fire.



Elephant Butte Res., NM, May 27, 2022, Dave DuBois

Smoke Evolution: Late Morning to Early Afternoon

- Temperature inversion breaks,
- Surface winds begin to gust,
- Smoke begins to loft and form a plume,
- Plume direction shifts,
- Flows downwind with an increasing rate of speed.



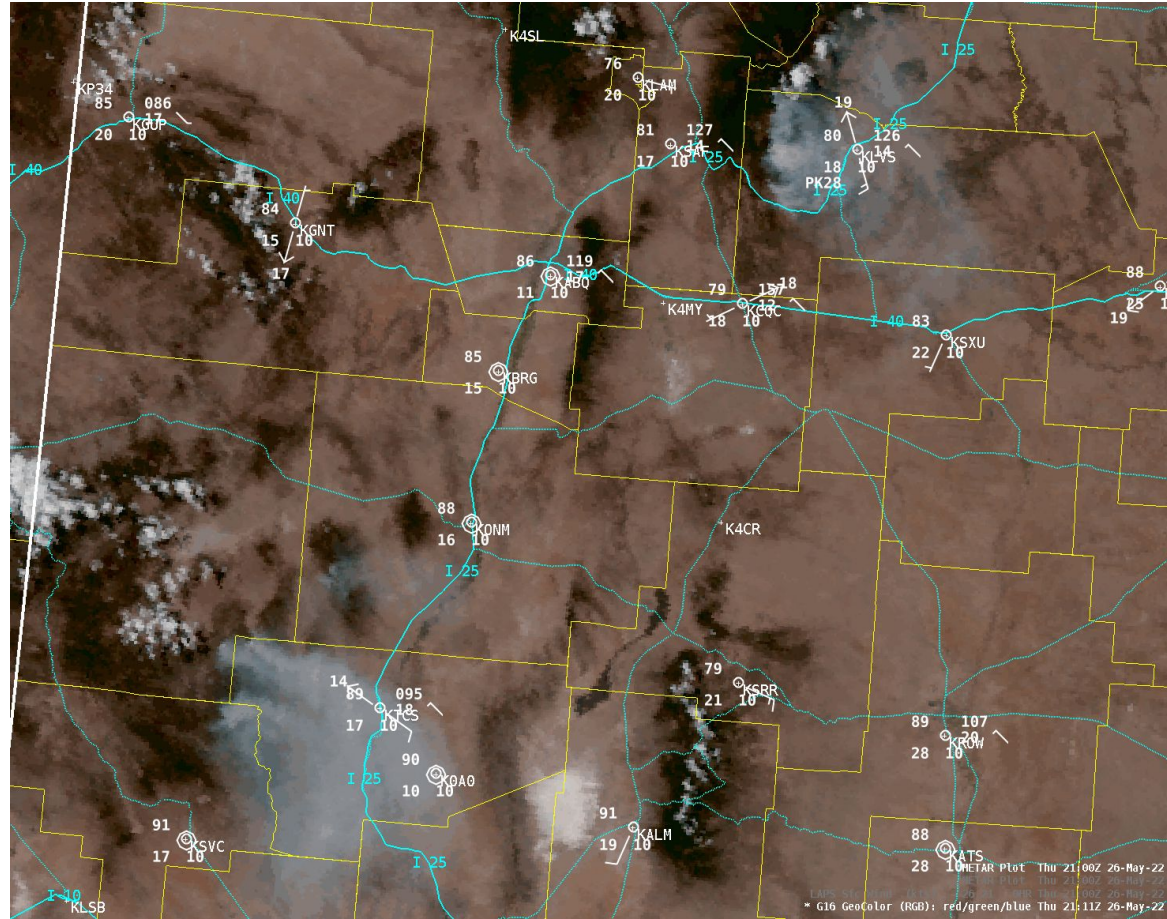
NM Fires on May 26, 2022, Late Morning to Early Afternoon



Trigo Fire, NM, April 22, 2008, Stephanie Shope-McDaniel

Smoke Evolution: Late Afternoon

- Plume volume increases dramatically as wind peaks,
- Smoke rises highest,
- Impacts spread downwind,
- Influences weather patterns the most.



NM Fires on May 26, 2022, Late Afternoon



Las Conchas Fire, June 29, 2011, Leah Robertson

Online Resources for Pilots

1. Terminal Aerodrome Forecast (TAF)
2. Aviation Forecast Discussion,
3. NWS Graphiccasts,
4. High Resolution Rapid Refresh (HRRR) Model smoke forecasts,
5. AirNow Fire & Smoke Map.



Hermit's Peak Wildfire, NM

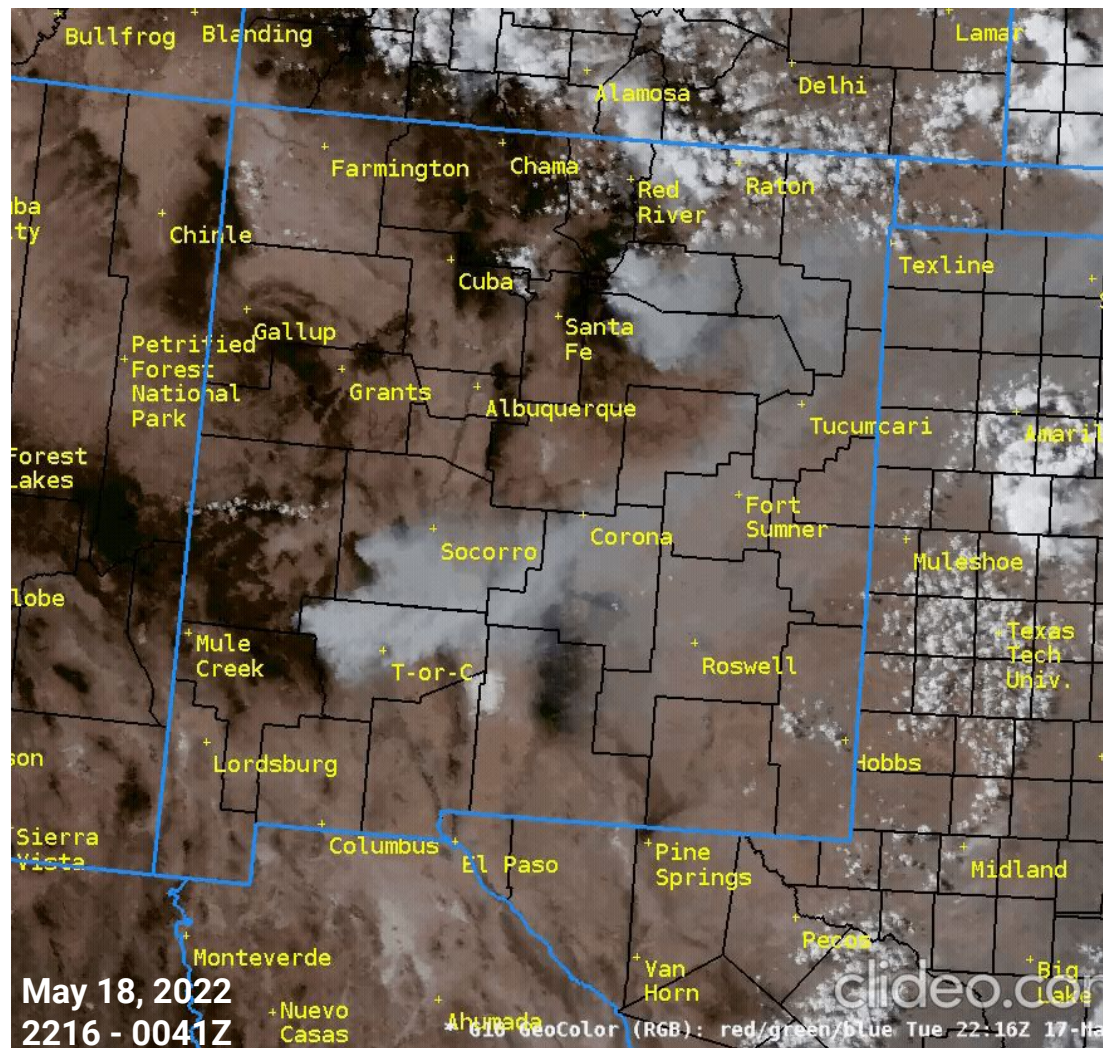
May 15, 2022. View from El Prado/Taos.

Photo Courtesy of Kristina (@elementalmama).

TAF Smoke Forecast

- Based on smoke model guidance and timing of previous day's smoke ceiling and visibility obstruction.
- NWS ABQ closely coordinates with US Forest Service on smoke impacts and timing.
- Sample:

TAF KTCC 101730Z 1018/11118 23015G25KT P6SM SKC
FM102000 23018G28KT P6SM SCT150
FM110200 24011KT **6SM FU BKN020**
TEMPO 1103/1106 **1SM FU OVC020**
FM110700 VRB06KT **6SM FU SCT020**
FM111200 VRB06KT P6SM SKC



Aviation Forecast Discussion

- Forecaster's reasoning behind the TAF;
- Updated by 00Z, 06Z, 12Z, & 18Z;
- <https://www.aviationweather.gov/fcstdisc>;
- Sample:

Area Forecast Discussion...UPDATED
National Weather Service Albuquerque NM
1200 PM MDT Thu May 26 2022

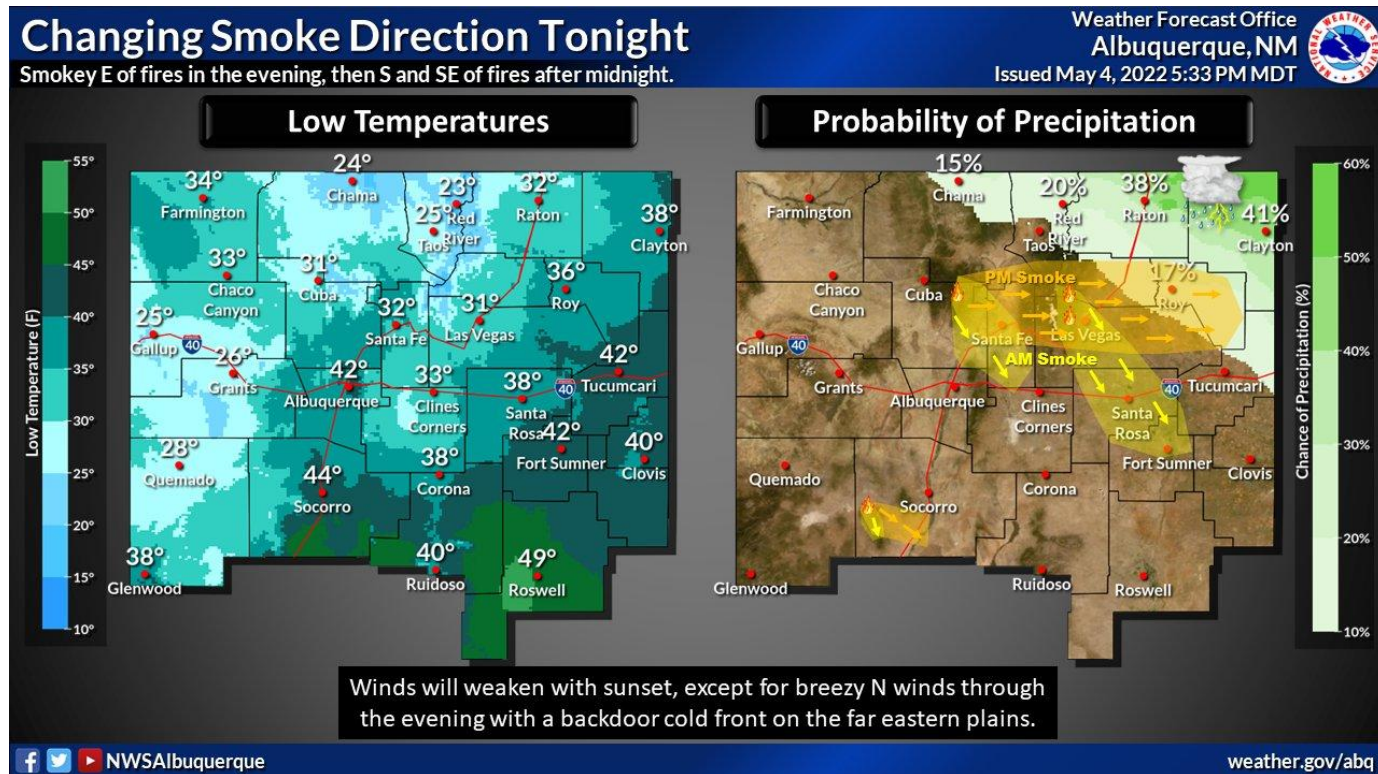
.AVIATION...
18Z TAF CYCLE
Smoke will drift to the east today, then to the northeast tonight. High resolution smoke forecast loops depict a broad area of smoke drifting from the Bear Trap and Black Fires northeastward across central areas late tonight into Friday morning potentially impacting KAEG, KABQ, and KSAF with modest visibility reduction. Southwest winds will become gusty areawide on Friday with better developed smoke plumes. Isolated and gusty virga showers, and maybe a few dry thunderstorms, will be possible across west central, central, northeast, and east central areas Friday afternoon and early evening.



<https://www.aviationweather.gov/fcstdisc>

Graphiccasts

- Updated early morning and late afternoon daily.
- Huge variety of graphics.
- For southern CA:
 - Weather.Gov/SGX,
 - Weather.Gov/LOX,
 - Weather.Gov/VEF,
 - Weather.Gov/PSR.

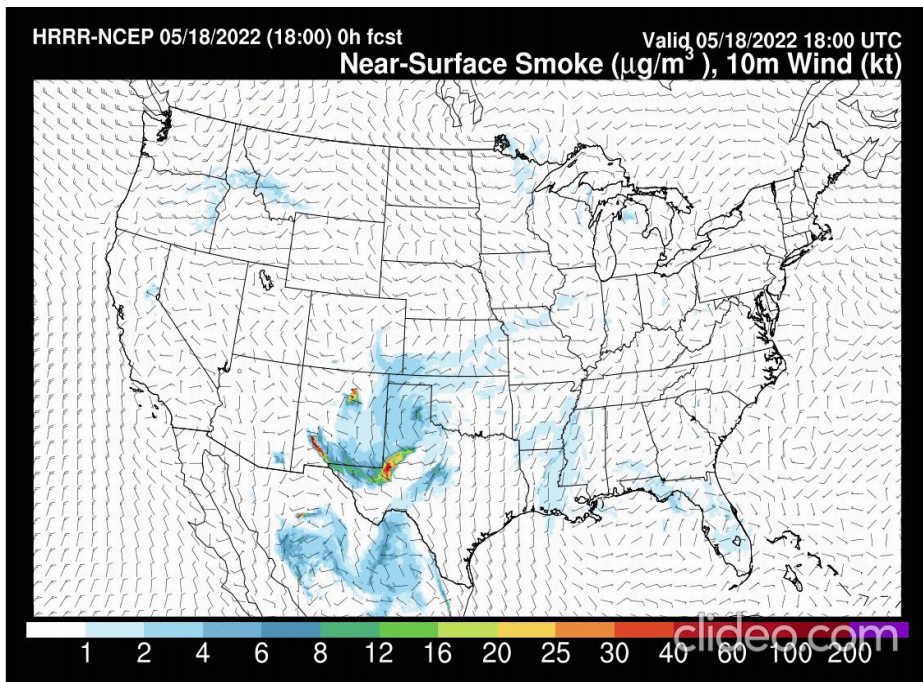


Graphiccast from Weather.Gov/ABQ

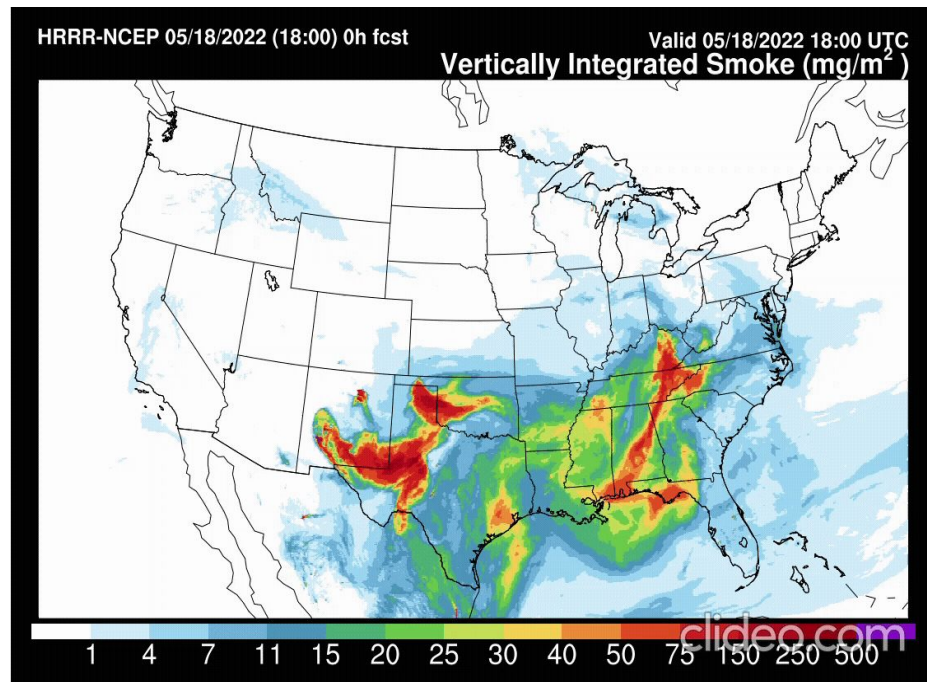
May 4, 2022, 5:33 PM

HRRR Smoke

<https://rapidrefresh.noaa.gov/hrrr/HRRRsmoke/>

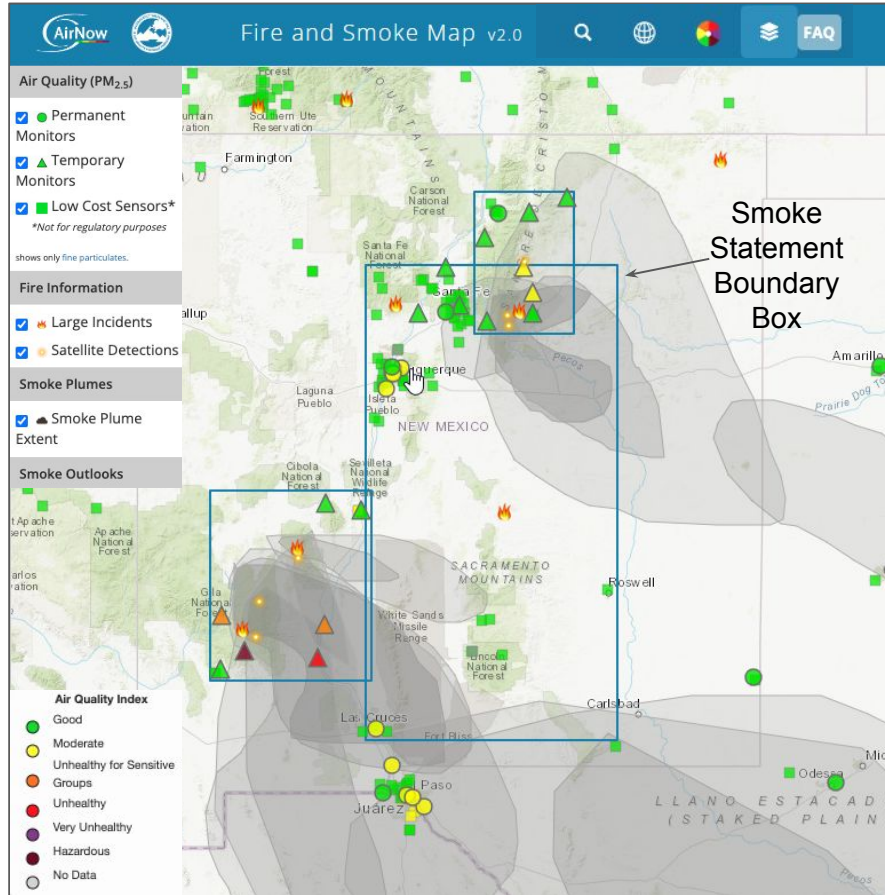


Near-Surface Smoke Forecast
May 18 (18Z) to May 20 (18Z), 2022
Smoke about 26 feet off the ground.




Vertically Integrated Smoke Forecast
May 18 (18Z) to May 20 (18Z), 2022
All of the smoke in a vertical column, including
smoke high in the atmosphere.

AirNow Fire & Smoke Map



<https://fire.airnow.gov/>

- Smoke plume map with air quality sensors.
 - Sensors mainly from EPA and USFS.
 - Smoke plumes from NOAA Hazard Mapping System using a combination of satellite and human analysis.
- Click  to set your location, then scroll to zoom in from CONUS view.
- Smoke plumes updated every few hours.
- Verify smoke shading using visible or GeoColor satellite loop.

Summary

- Wildfire Impacts on Aviation:
 - Smoke,
 - Produces aviation weather hazards.
- How to avoid wildfires and smoke:
 - Understand diurnal evolution of wildfires and smoke,
 - Online resources.



<https://inciweb.nwcg.gov/>

Cerro Pelado Fire, NM
May 2, 2022


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Questions?

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Handout–Smoke Resources Online

- Avoiding Wildfires & Smoke During Aviation Operations, SAWS X Presentation: <https://www.weather.gov/media/abq/Aviation/SAWSX/AvoidingWildfires&Smoke.pdf>
- Timelapse of Hermit’s Peak Fire, NM; by Jim O’Donnell; April 29, 2022: https://www.weather.gov/media/abq/Aviation/SAWSX/HPCC_JimODonnell.mov.
- Terminal Aerodrome Forecasts: <https://aviationweather.gov/taf>.
- Graphiccasts for southern CA: Weather.Gov/SGX, Weather.Gov/LOX, Weather.Gov/VEF, Weather.Gov/PSR.
- Aviation Forecast Discussion: Forecaster’s reasoning behind the TAF:
 - Generally updated with each TAF cycle.
 - <https://www.aviationweather.gov/fcstdisc>.
- HRRR Smoke: <https://rapidrefresh.noaa.gov/hrrr/HRRRsmoke/>.
 - “Vertically Integrated Smoke” depicts all smoke in the vertical column including smoke high in atmosphere. Example timelapse: https://www.weather.gov/media/abq/Aviation/SAWSX/HRRR_VIS_18Z_18May22.mp4.
 - “Near Surface Smoke” depicts smoke about 26 feet off the ground. Example timelapse: https://www.weather.gov/media/abq/Aviation/SAWSX/HRRR_Nr_Sfc_18Z_18May22.mp4.
 - Tutorial for optimal use (for CA choose SW not NW): https://www.weather.gov/mfr/HRRR_smoke_tutorial.
- Smoke plumes with map of air quality sensors: <https://fire.airnow.gov/>.
 - Click  to set your location, then scroll to zoom in from CONUS view.
 - Smoke plumes updated every few hours.
 - Verify smoke shading using GeoColor satellite loop (smoke not visible at night): https://www.star.nesdis.noaa.gov/GOES/conus_band.php?sat=G16&band=GEOCOLOR&length=24.