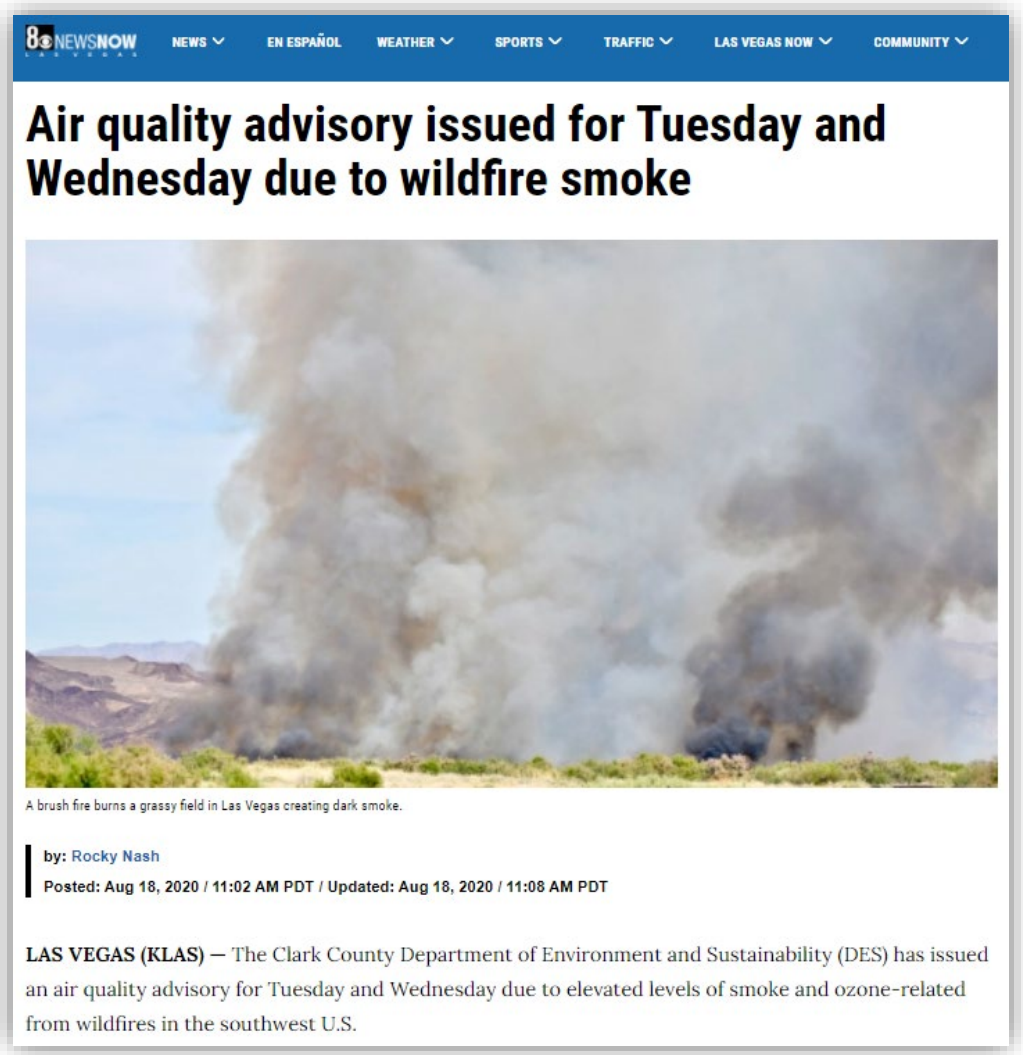
Appendix A. Supporting Media Coverage for Section 3.1.4

Images and links for media coverage of the August 18-21 exceptional event detailed in Section 3.1.4 of the main text is presented below in Figures A-1 through A-4.



8 NEWSNOW LAS VEGAS | NEWS | EN ESPAÑOL | WEATHER | SPORTS | TRAFFIC | LAS VEGAS NOW | COMMUNITY

Air quality advisory issued for Tuesday and Wednesday due to wildfire smoke

A brush fire burns a grassy field in Las Vegas creating dark smoke.

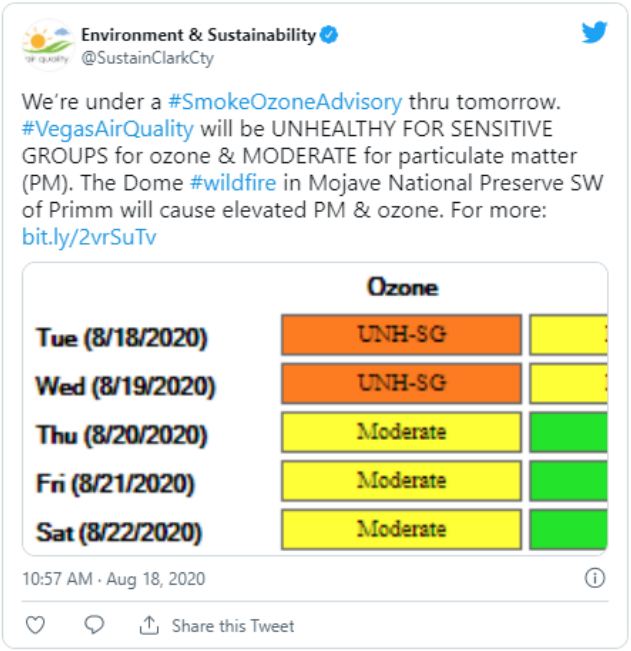
by: Rocky Nash

Posted: Aug 18, 2020 / 11:02 AM PDT / Updated: Aug 18, 2020 / 11:08 AM PDT

LAS VEGAS (KLAS) — The Clark County Department of Environment and Sustainability (DES) has issued an air quality advisory for Tuesday and Wednesday due to elevated levels of smoke and ozone-related from wildfires in the southwest U.S.

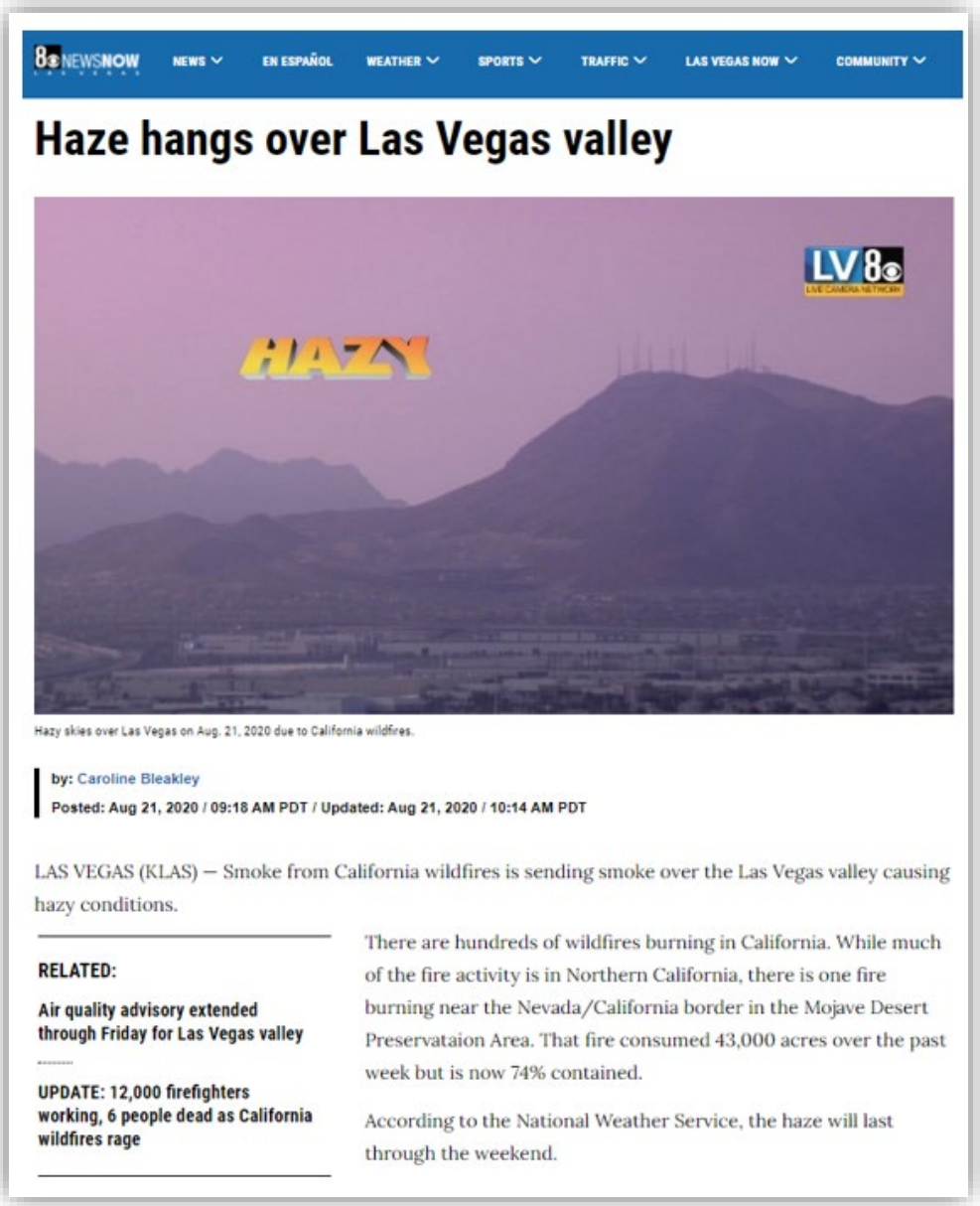
Figure A-1. Article entitled "Air quality advisory issued for Tuesday and Wednesday due to wildfire smoke" (https://www.8newsnow.com/news/local-news/air-quality-advisory-issued-for-tuesday-and-wednesday-due-to-wildfire-smoke/). Article released by 8NewsNow, a local Las Vegas news outlet, on August 18, 2020.

A seasonal ozone advisory is currently in effect.



DES Division of Air Quality officials says smoke is made of small dust particles and other pollutants that can aggravate respiratory diseases and contribute to ground-level ozone formation.

Figure A-1 (Cont). Article entitled "Air quality advisory issued for Tuesday and Wednesday due to wildfire smoke" (https://www.8newsnow.com/news/local-news/air-quality-advisory-issued-for-tuesday-and-wednesday-due-to-wildfire-smoke/). Article released by 8NewsNow, a local Las Vegas news outlet, on August 18, 2020.



8 NEWSNOW LAS VEGAS | NEWS | EN ESPAÑOL | WEATHER | SPORTS | TRAFFIC | LAS VEGAS NOW | COMMUNITY

Haze hangs over Las Vegas valley

Hazy skies over Las Vegas on Aug. 21, 2020 due to California wildfires.

by: Caroline Bleakley
Posted: Aug 21, 2020 / 09:18 AM PDT / Updated: Aug 21, 2020 / 10:14 AM PDT

LAS VEGAS (KLAS) — Smoke from California wildfires is sending smoke over the Las Vegas valley causing hazy conditions.

RELATED:

Air quality advisory extended through Friday for Las Vegas valley

UPDATE: 12,000 firefighters working, 6 people dead as California wildfires rage

There are hundreds of wildfires burning in California. While much of the fire activity is in Northern California, there is one fire burning near the Nevada/California border in the Mojave Desert Preservataion Area. That fire consumed 43,000 acres over the past week but is now 74% contained.

According to the National Weather Service, the haze will last through the weekend.

Figure A-2. Article entitled "Haze hangs over Las Vegas valley" (https://www.8newsnow.com/news/local-news/haze-hangs-over-las-vegas-valley/). Article released by 8NewsNow, a local Las Vegas news outlet, on August 21, 2020.

County Extends Smoke, Ozone Advisory Through The Weekend

Photo credit © Chris Caldwell / The Spectrum & Daily News via Imagn Content Services, LLC

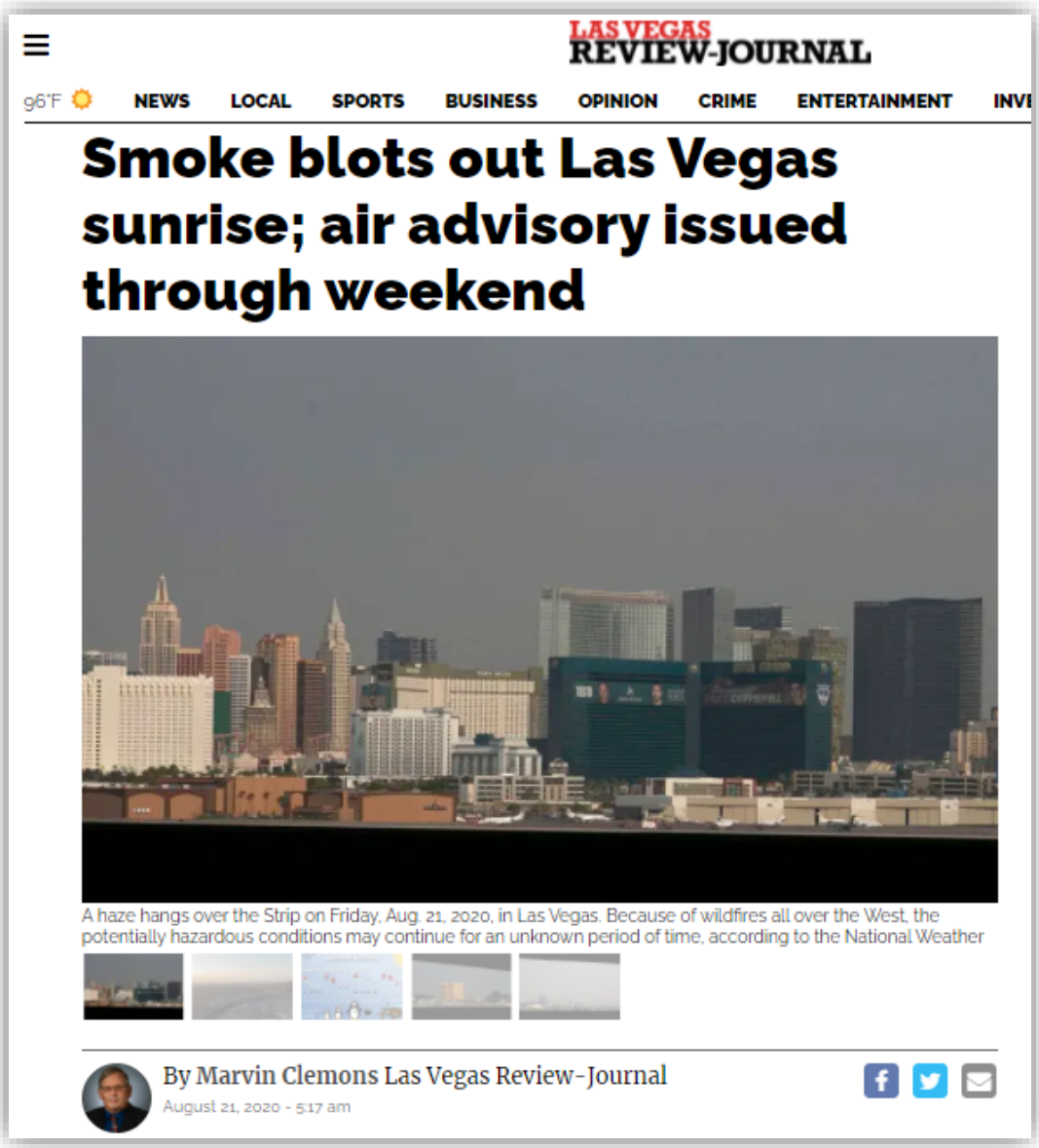
By Mitch Kelly,
News and Talk
Radio 840 AM

August 21, 2020
11:12 am

LAS VEGAS, NV (KXNT) - The Clark County Department of Environment and Sustainability (DES) is extending its advisory through Sunday for elevated levels of smoke and ozone due to the regional wildfires throughout the southwest U.S.

DES Division of Air Quality officials say smoke is made of small dust particles and other pollutants that can aggravate respiratory diseases and contribute to ground-level ozone formation.

Figure A-3. Article entitled "County Extends Smoke, Ozone Advisory Through the Weekend" (https://www.audacy.com/kxnt/articles/press-release/county-extends-smoke-ozone-advisory-through-the-weekend). Article released by KXNT, a local Las Vegas news outlet, on August 21, 2020.



LAS VEGAS REVIEW-JOURNAL

96°F NEWS LOCAL SPORTS BUSINESS OPINION CRIME ENTERTAINMENT INVI

Smoke blots out Las Vegas sunrise; air advisory issued through weekend

A haze hangs over the Strip on Friday, Aug. 21, 2020, in Las Vegas. Because of wildfires all over the West, the potentially hazardous conditions may continue for an unknown period of time, according to the National Weather

By Marvin Clemons Las Vegas Review-Journal

August 21, 2020 - 5:17 am

Figure A-4. Article entitled "Smoke blots out Las Vegas sunrise; air advisory issued through the weekend" (https://www.reviewjournal.com/local/weather/smoke-blots-out-las-vegas-sunrise-air-advisory-issued-through-weekend-2100432/). Article released by Las Vegas Review-Journal, a local Las Vegas newspaper, on August 21, 2020.

Shortly after sunrise, the sun was not visible in the Las Vegas sky because of extreme haze, smoke and ozone.

Because of wildfires all over the West, the potentially hazardous conditions may continue for an unknown period of time, according to the National Weather Service.

"It is just all the smoke" covering up the sun, meteorologist Clay Morgan said. "There is no liquid or ice crystals or water clouds.

"I'm not sure that any of this will flush out during the day," Morgan said. "It will probably get a little better, but not much. It's just a ridiculous amount of smoke over such a wide area."

The Clark County Department of Air Quality issued an air quality advisory through Sunday, saying effects of smoke from regional wildfires will put ozone quality in the Unhealthy for Sensitive Groups (USG) level and the air quality index will be moderate for particulates.

"While a return to breezy southwesterly afternoon winds will improve valley ventilation, we are continuing to monitor the fires causing the smoke impacts," the advisory stated.

Smoke is made of small particles and other pollutants that can aggravate respiratory diseases andcontribute to ground-level ozone formation. Exposure to ozone can induce coughing, wheezing and shortness of breath even in healthy people. A seasonal ozone advisory is in effect.

350-plus fires in California

More than 350 fires are burning in California, and the air quality in the state is currently the worst on Earth.

"It all depends on the direction of the wind and the progress of the firefighters," Morgan said. "For now, we have to take it day by day."

The haze may lower the Friday high temperature, expected to be 111. If reached, that would be a degree above the record for Aug. 21, set in 2009.

The high Thursday was 112, topping the 110 set in 1950. It was the 50th straight day with a high of 100 or more. The record is 66 days, set in 1944. It also was the seventh day with a high of 110 or higher. The record is 10 consecutive days in 1961.

The morning low was 88 just before 6 a.m. Friday and rose to 98 just before 11 a.m.

Figure A-4 (Cont). Article entitled "Smoke blots out Las Vegas sunrise; air advisory issued through the weekend" (https://www.reviewjournal.com/local/weather/smoke-blots-out-las-vegas-sunrise-air-advisory-issued-through-weekend-2100432/). Article released by Las Vegas Review-Journal, a local Las Vegas newspaper, on August 21, 2020.

Real-time air quality data, Air Quality Index (AQI) maps, daily air quality forecasts, and event notifications are available on the DES website (https://clarkcountynvairquality.meteostar.com/). Air quality forecasts and current data are also available through EPA's AirNow and EnviroFlash systems. DES issues air quality advisories and alerts to warn the public and regulated community if unhealthy levels of a regulated pollutant are anticipated, and to provide recommendations on reducing exposure and emissions. Advisories are issued when forecast conditions are favorable for pollutant levels to exceed the NAAQS (i.e., to reach the Unhealthy for Sensitive Groups [USG] level) on the AQI, or when public health and safety might be in danger. Alerts are issued when air quality levels have already reached the AQI USG level or are expected to reach that level. **Figures A-5 through A-8** provides the concentration and AQI values for all NAAQS pollutants in the Metropolitan/Non-Metropolitan and Greater Las Vegas Metro Area from August 18-21, 2020. This information was publicly available during the August 18-21 potential exceptional event. In addition to the near-real-time data available on the DES website, 5-day AQI forecasts were and are currently available for August 18-21, 2020, to the public here: https://aqportal.clarkcountynv.gov/DES_AQ_Forecast.

The Air Quality Advisory/News Release for the overall 2020 ozone season is shown in **Figure A-9**, for August 18-19, 2020, in **Figure A-10**, for August 20-21, 2020, in **Figure A-11**, and for August 22-23, 2020, in **Figure A-12**. Additional media coverage and publicly available AirNow AQI maps for the August 18-21 potential exceptional event dates are included in Section 3.1.2 and Section 3.1.4 of the main report.

Reporting for August 18, 2020 August 18 2020 Select a Different Date

Metropolitan Area or Non-Metropolitan County	Air Quality Rating	Critical Pollutant	Air Quality Index															
			Ozone				Carbon Monoxide		Sulfur Dioxide		Nitrogen Dioxide		PM-10 (Std Cond)		PM-2.5 (Lcl Acpt)		PM-2.5 (Lcl Cond)	
			1-Hour		8-Hour		8-Hour		1-Hour		1-Hour		24-Hour		24-Hour		24-Hour	
			AQI	ppb	AQI	ppb	AQI	ppm	AQI	ppb	AQI	ppb	AQI	µg/m³ (25° C)	AQI	µg/m³ LC	AQI	µg/m³ LC
Clark County -- Region 1																		
Apex	Good	Ozone	*	59	**50**	**54**												
Boulder City	Moderate	Ozone	*	63	**64**	**59**							48	51.70				
Greater Las Vegas	Unhealthy for sensitive groups	Ozone	*	96	**140**	**82**	8	0.668	1	1.0	41	43.8	60	72.38			62	17.83
Indian Springs	Good	Ozone	*	56	**49**	**53**												
Jean	Moderate	Ozone	*	69	**77**	**63**							51	54.28			60	16.60
Mesquite	Good	Ozone	*	51	**45**	**49**												

Monitoring Sites in the Greater Las Vegas Metro Area	Air Quality Rating	Critical Pollutant	Air Quality Index															
			Ozone				Carbon Monoxide		Sulfur Dioxide		Nitrogen Dioxide		PM-10 (Std Cond)		PM-2.5 (Lcl Acpt)		PM-2.5 (Lcl Cond)	
			1-Hour		8-Hour		8-Hour		1-Hour		1-Hour		24-Hour		24-Hour		24-Hour	
			AQI	ppb	AQI	ppb	AQI	ppm	AQI	ppb	AQI	ppb	AQI	µg/m³ (25° C)	AQI	µg/m³ LC	AQI	µg/m³ LC
Clark County	Unhealthy for sensitive groups	Ozone	*	96	**140**	**82**	8	0.668	1	1.0	41	43.8	60	72.38			62	17.83
Casino Center	Good	Nitrogen Dioxide									**38**	**40.7**						
Green Valley	Moderate	Ozone	*	85	**100**	**70**							60	72.38			58	15.96
Jerome Mack	Moderate	Ozone	*	74	**90**	**67**			1	1.0	34	36.0	58	68.30			61	17.15
Joe Neal	Unhealthy for sensitive groups	Ozone	*	88	**126**	**78**					12	12.3	51	55.19			54	14.01
Palo Verde	Moderate	Ozone	*	84	**100**	**70**							46	50.02				
Paul Meyer	Unhealthy for sensitive groups	Ozone	*	96	**129**	**79**							52	56.69			58	15.65
Rancho & Teddy	Moderate	PM-2.5					8	0.668			41	43.8					**61**	**17.19**
Sunrise Acres	Moderate	PM-2.5					6	0.523			38	40.5	59	70.92			**62**	**17.83**
Walter Johnson	Unhealthy for sensitive groups	Ozone	*	96	**140**	**82**							50	53.85			56	14.69

Figure A-5. AQI values reported by the Clark County Department of Environment and Sustainability on August 18, 2020.

Reporting for August 19, 2020 August 19 2020 Select a Different Date

Metropolitan Area or Non-Metropolitan County	Air Quality Rating	Critical Pollutant	Air Quality Index															
			Ozone				Carbon Monoxide		Sulfur Dioxide		Nitrogen Dioxide		PM-10 (Std Cond)		PM-2.5 (Lcl Acpt)		PM-2.5 (Lcl Cond)	
			1-Hour		8-Hour		8-Hour		1-Hour		1-Hour		24-Hour		24-Hour		24-Hour	
			AQI	ppb	AQI	ppb	AQI	ppm	AQI	ppb	AQI	ppb	AQI	µg/m³ (25° C)	AQI	µg/m³ LC	AQI	µg/m³ LC
Clark County -- Region 1																		
Apex	**Moderate**	Ozone	*	67	**67**	**60**												
Boulder City	**Moderate**	Ozone	*	72	**80**	**64**							45	48.33				
Greater Las Vegas	**Unhealthy for sensitive groups**	Ozone	*	93	**112**	**74**	5	0.475	1	1.0	43	45.9	66	84.88			62	17.83
Indian Springs	**Moderate**	Ozone	*	58	**51**	**55**												
Jean	**Moderate**	Ozone	*	65	**67**	**60**							46	50.02			50	12.28
Mesquite	**Good**	Ozone	*	54	**47**	**51**												

Monitoring Sites in the Greater Las Vegas Metro Area	Air Quality Rating	Critical Pollutant	Air Quality Index															
			Ozone				Carbon Monoxide		Sulfur Dioxide		Nitrogen Dioxide		PM-10 (Std Cond)		PM-2.5 (Lcl Acpt)		PM-2.5 (Lcl Cond)	
			1-Hour		8-Hour		8-Hour		1-Hour		1-Hour		24-Hour		24-Hour		24-Hour	
			AQI	ppb	AQI	ppb	AQI	ppm	AQI	ppb	AQI	ppb	AQI	µg/m³ (25° C)	AQI	µg/m³ LC	AQI	µg/m³ LC
Clark County	**Unhealthy for sensitive groups**	Ozone	*	93	**112**	**74**	5	0.475	1	1.0	43	45.9	66	84.88			62	17.83
Casino Center	**Good**	Nitrogen Dioxide									**43**	**45.9**						
Green Valley	**Unhealthy for sensitive groups**	Ozone	*	88	**101**	**71**							63	78.67			58	15.65
Jerome Mack	**Moderate**	Ozone	*	71	**80**	**64**			1	1.0	33	35.3	66	84.44			62	17.80
Joe Neal	**Unhealthy for sensitive groups**	Ozone	*	88	**108**	**73**					11	11.7	57	67.51			55	14.48
Palo Verde	**Moderate**	Ozone	*	75	**77**	**63**							49	53.04				
Paul Meyer	**Unhealthy for sensitive groups**	Ozone	*	90	**112**	**74**							59	70.40			61	17.07
Rancho & Teddy	**Moderate**	PM-2.5					5	0.475			36	38.5					**60**	**16.77**
Sunrise Acres	**Moderate**	PM-10					5	0.425			37	39.2	**66**	**84.88**			62	17.83
Walter Johnson	**Unhealthy for sensitive groups**	Ozone	*	93	**112**	**74**							56	65.63			57	15.21

Figure A-6. AQI values reported by the Clark County Department of Environment and Sustainability on August 19, 2020

Reporting for August 20, 2020 August 20 2020 Select a Different Date

Metropolitan Area or Non-Metropolitan County	Air Quality Rating	Critical Pollutant	Air Quality Index															
			Ozone				Carbon Monoxide		Sulfur Dioxide		Nitrogen Dioxide		PM-10 (Std Cond)		PM-2.5 (Lcl Acpt)		PM-2.5 (Lcl Cond)	
			1-Hour		8-Hour		8-Hour		1-Hour		1-Hour		24-Hour		24-Hour		24-Hour	
			AQI	ppb	AQI	ppb	AQI	ppm	AQI	ppb	AQI	ppb	AQI	µg/m³ (25° C)	AQI	µg/m³ LC	AQI	µg/m³ LC
Clark County -- Region 1																		
Apex	**Moderate**	Ozone	*	74	**90**	**67**												
Boulder City	**Moderate**	Ozone	*	71	**90**	**67**							44	47.39				
Greater Las Vegas	**Unhealthy for sensitive groups**	Ozone	*	87	**101**	**71**	7	0.605	1	1.0	46	48.9	52	57.85			66	19.67
Indian Springs	**Moderate**	Ozone	*	65	**74**	**62**												
Jean	**Moderate**	Ozone	*	71	**87**	**66**							44	47.51			62	17.60
Mesquite	**Moderate**	Ozone	*	60	**54**	**56**												

Monitoring Sites in the Greater Las Vegas Metro Area	Air Quality Rating	Critical Pollutant	Air Quality Index															
			Ozone				Carbon Monoxide		Sulfur Dioxide		Nitrogen Dioxide		PM-10 (Std Cond)		PM-2.5 (Lcl Acpt)		PM-2.5 (Lcl Cond)	
			1-Hour		8-Hour		8-Hour		1-Hour		1-Hour		24-Hour		24-Hour		24-Hour	
			AQI	ppb	AQI	ppb	AQI	ppm	AQI	ppb	AQI	ppb	AQI	µg/m³ (25° C)	AQI	µg/m³ LC	AQI	µg/m³ LC
Clark County	**Unhealthy for sensitive groups**	Ozone	*	87	**101**	**71**	7	0.605	1	1.0	46	48.9	52	57.85			66	19.67
Casino Center	**Good**	Nitrogen Dioxide									**43**	**45.2**						
Green Valley	**Moderate**	Ozone	*	72	**90**	**67**							47	50.67			61	17.19
Jerome Mack	**Moderate**	Ozone	*	74	**84**	**65**			1	1.0	36	38.5	52	57.15			66	19.66
Joe Neal	**Unhealthy for sensitive groups**	Ozone	*	87	**101**	**71**					10	10.3	47	50.85			58	15.69
Palo Verde	**Moderate**	Ozone	*	64	**64**	**59**							50	53.79				
Paul Meyer	**Moderate**	Ozone	*	73	**97**	**69**							44	47.79			61	17.21
Rancho & Teddy	**Moderate**	PM-2.5					7	0.605			46	48.9					**64**	**18.63**
Sunrise Acres	**Moderate**	PM-2.5					6	0.567			39	41.0	52	57.85			**66**	**19.67**
Walter Johnson	**Moderate**	Ozone	*	80	**93**	**68**							46	49.34			60	16.57

Figure A-7. AQI values reported by the Clark County Department of Environment and Sustainability on August 20, 2020.

Reporting for August 21, 2020 August 21 2020 Select a Different Date

Metropolitan Area or Non-Metropolitan County	Air Quality Rating	Critical Pollutant	Air Quality Index															
			Ozone				Carbon Monoxide		Sulfur Dioxide		Nitrogen Dioxide		PM-10 (Std Cond)		PM-2.5 (Lcl Acpt)		PM-2.5 (Lcl Cond)	
			1-Hour		8-Hour		8-Hour		1-Hour		1-Hour		24-Hour		24-Hour		24-Hour	
			AQI	ppb	AQI	ppb	AQI	ppm	AQI	ppb	AQI	ppb	AQI	µg/m³ (25° C)	AQI	µg/m³ LC	AQI	µg/m³ LC
Clark County -- Region 1																		
Apex	**Moderate**	Ozone	*	66	**71**	**61**												
Boulder City	**Moderate**	PM-10	*	62	50	54							**52**	**57.03**				
Greater Las Vegas	**Unhealthy for sensitive groups**	Ozone	*	82	**101**	**71**	9	0.774	1	1.0	48	50.9	63	79.31			81	26.70
Indian Springs	**Moderate**	Ozone	*	77	**93**	**68**												
Jean	**Moderate**	Ozone	*	76	**100**	**70**							56	64.44			95	33.16
Mesquite	**Moderate**	Ozone	*	76	**84**	**65**												

Monitoring Sites in the Greater Las Vegas Metro Area	Air Quality Rating	Critical Pollutant	Air Quality Index															
			Ozone				Carbon Monoxide		Sulfur Dioxide		Nitrogen Dioxide		PM-10 (Std Cond)		PM-2.5 (Lcl Acpt)		PM-2.5 (Lcl Cond)	
			1-Hour		8-Hour		8-Hour		1-Hour		1-Hour		24-Hour		24-Hour		24-Hour	
			AQI	ppb	AQI	ppb	AQI	ppm	AQI	ppb	AQI	ppb	AQI	µg/m³ (25° C)	AQI	µg/m³ LC	AQI	µg/m³ LC
Clark County	**Unhealthy for sensitive groups**	Ozone	*	82	**101**	**71**	9	0.774	1	1.0	48	50.9	63	79.31			81	26.70
Casino Center	**Good**	Nitrogen Dioxide									**48**	**50.9**						
Green Valley	**Moderate**	PM-2.5	*	66	64	59							63	79.31			**77**	**24.44**
Jerome Mack	**Moderate**	PM-2.5	*	57	44	48			1	1.0	42	44.0	60	72.18			**76**	**24.00**
Joe Neal	**Moderate**	Ozone	*	79	**87**	**66**					13	13.4	58	68.75			71	21.73
Palo Verde	**Moderate**	Ozone	*	80	**87**	**66**							54	61.51				
Paul Meyer	**Unhealthy for sensitive groups**	Ozone	*	82	**101**	**71**							55	62.99			81	26.70
Rancho & Teddy	**Moderate**	PM-2.5					9	0.774			45	48.1					**79**	**25.52**
Sunrise Acres	**Moderate**	PM-2.5					6	0.536			42	44.1	61	74.34			**79**	**25.39**
Walter Johnson	**Moderate**	Ozone	*	81	**100**	**70**							56	64.60			78	25.04

Figure A-8. AQI values reported by the Clark County Department of Environment and Sustainability on August 21, 2020.

News Release

County Commission:
Marilyn Kirkpatrick, Chairman
Lawrence Weekly, Vice Chairman
Larry Brown
James B. Gibson
Justin Jones
Michael Naft
Tick Segerblom

Yolanda King, County Manager

Office of Public Communications • (702) 455-3546 • FAX (702) 455-3558 • www.ClarkCountyNV.gov

Contact: Kevin J MacDonald
Public Information Officer

Phone: (702) 455-6131
Mobile: (702) 232-0931
E-mail: kevmac@ClarkCountyNV.gov

For Immediate Release **Tuesday, March 31, 2020**

Seasonal Ozone Advisory Issued Through September

The Clark County Department of Environment and Sustainability issued a season-long advisory for ground-level ozone pollution today that will be in effect from Wednesday, April 1 – Wednesday, Sept. 30.

Ozone is a colorless gas that exists naturally in the Earth's upper atmosphere. At ground level, ozone is a key ingredient of urban smog that can build up during the day in the hottest months of the year because of strong sunlight, hot temperatures, gasoline and chemical vapors, and pollutants from automobiles, wildfires and regional transport. Exposure to ozone can irritate your respiratory system and cause coughing, a sore throat, chest pain and shortness of breath even in healthy people, according to the EPA.

"Even though we're continuing to Stay Home for Nevada as we and the rest of the country work through the COVID-19 pandemic, it is important to remind the community that ozone increases during the warmer months," said Department of Environment and Sustainability Director Marci Henson. "Our Air Quality Division continues to be an essential service to Clark County by enforcing federal, health-based standards. We also remind people they play an important role in helping reduce ground-level ozone."

HELPFUL TIPS TO REDUCE OZONE

Because cars, trucks and other vehicles are major contributors to ozone, people can follow these helpful, everyday tips to reduce ozone:

- Reduce driving – combine errands into one trip.
- Don't idle your car engine unnecessarily.
- Use mass transit or carpool.
- Fill up your gas tank after sunset. Try not to spill gasoline when filling up and don't top off your tank.
- Keep your car well maintained.
- Consider landscaping that uses less water and gas-powered equipment to maintain.
- Turn off lights and electronics when not in use. Less fuel burned at power plants means cleaner air.

[more]

Clark County news releases may be found at www.ClarkCountyNV.gov.
You may also follow the County on more than 40 social media sites, including
Facebook, Twitter, Instagram, LinkedIn, NextDoor, Pinterest and **YouTube.**

Figure A-9. Seasonal Ozone Advisory issued by the Clark County Office of Public Communication on March 31, 2020, for the 2020 Ozone Season (April 1 to September 30, 2020).

News Release

Environment and Sustainability Seasonal Ozone Advisory, cont.

Also, if you have respiratory issues or other health concerns, consider these tips during ozone season:

- Reduce the time you are active outdoors when ozone levels are elevated, especially if you are engaged in a strenuous activity or have a respiratory disease.
- Schedule activities for the morning or evening when ozone levels are usually lower.
- Substitute a less intense activity – walking instead of jogging, for example.
- Always consult your doctor first for medical advice.

STAY UP TO DATE WITH AIR QUALITY INFORMATION

The Department of Environment and Sustainability monitors air pollution through a network of monitoring sites throughout the Las Vegas Valley. Data is collected from these sites and reported at our monitoring website: AirQuality.ClarkCountyNV.gov. People can stay informed through a couple channels:

- Twitter and Facebook: Read air quality updates in your Facebook news feed or tweets. On Facebook: www.facebook.com/SustainClarkCounty and Twitter: @SustainClarkCty.
- EnviroFlash: Receive daily text or email messages with the latest air quality information. Learn more at www.enviroflash.org. The Dept. of Environment and Sustainability also issues advisories and alerts for ozone and other pollutants such as dust, smoke and other particulate matters.
- AIRNow: Check air quality forecasts, current conditions and the Air Quality Index (AQI) for Clark County at AIRNow's website.

###

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Figure A-9 (cont.). Seasonal Ozone Advisory issued by the Clark County Office of Public Communication on March 31, 2020, for the 2020 Ozone Season (April 1 to September 30, 2020).

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Yolanda King, County Manager

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For Immediate Release **Tuesday, Aug. 18, 2020**

Smoke, Ozone Advisory Issued for Tuesday and Wednesday Due to Wildfire Smoke

The Clark County Department of Environment and Sustainability (DES) is issuing an **advisory for Tuesday, Aug. 18 – Wednesday, Aug. 19** for elevated levels of smoke and ozone due to the regional wildfires in the southwest U.S. DES Division of Air Quality officials say smoke is made of small dust particles and other pollutants that can aggravate respiratory diseases and contribute to ground-level ozone formation.

According to the U.S. Environmental Protection Agency, people who may be most sensitive to elevated levels of particulates and ozone include individuals with respiratory problems, cardiac disease, young children or senior citizens. Consult your physician if you have a medical condition that makes you sensitive to air quality conditions.

Smoke is made of small particles and other pollutants that can aggravate respiratory diseases and contribute to ground-level ozone formation. Exposure to ozone can induce coughing, wheezing and shortness of breath even in healthy people. A seasonal ozone advisory is currently in effect.

SMOKE AND OZONE TIPS

- Stay indoors when you smell or see smoke.
- Limit outdoor activity and exertion when ozone levels are elevated – exercise makes you breathe heavier and increases the amount of particulates you may inhale.
- Keep windows and doors closed. Run your air conditioner inside your house and car. Air conditioning filters out smoke and particles.
- Change your indoor air filters if they are dirty.
- Schedule activities for the morning or evening when ozone levels are usually lower.
- Substitute a less intense activity – walk instead of jog, for example.
- Reduce driving – combine errands into one trip.
- Don't idle your car engine unnecessarily.

[more]

Air Quality Smoke, Ozone Advisory Issued for Tuesday and Wednesday, cont.

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Figure A-10. Smoke and Ozone Advisory issued by the Clark County Office of Public Communication on August 18, 2020, for August 18-19, 2020.

News Release

SMOKE AND OZONE TIPS, cont.

- Use mass transit or carpool.
- Fill up your gas tank after sunset. Try not to spill gasoline when filling up, and don't top off your tank.
- Keep your car well maintained.
- Consider landscaping that uses less water and gas-powered equipment to maintain.
- Turn off lights and electronics when not in use. Less fuel burned at power plants means cleaner air.

STAY UP TO DATE WITH AIR QUALITY INFORMATION

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- EnviroFlash: Receive daily text or email messages with the latest air quality information. Learn more at www.enviroflash.org. The Dept. of Environment and Sustainability also issues advisories and alerts for ozone and other pollutants such as dust, smoke and other particulate matters.
- AIRNow: Check air quality forecasts, current conditions and the Air Quality Index (AQI) for Clark County at AIRNow's website.

About the Department of Environment and Sustainability

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###

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Figure A-10 (cont.). Smoke and Ozone Advisory issued by the Clark County Office of Public Communication on August 18, 2020, for August 18-19, 2020.

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For Immediate Release **Thursday, Aug. 20, 2020**

Smoke, Ozone Advisory Extended Through Friday Due to Wildfire Smoke

The Clark County Department of Environment and Sustainability (DES) is extending its **advisory to include Thursday, Aug. 20 – Friday, Aug. 21** for elevated levels of smoke and ozone due to the regional wildfires throughout the southwest U.S. DES Division of Air Quality officials say smoke is made of small dust particles and other pollutants that can aggravate respiratory diseases and contribute to ground-level ozone formation.

According to the U.S. Environmental Protection Agency, people who may be most sensitive to elevated levels of particulates and ozone include individuals with respiratory problems, cardiac disease, young children or senior citizens. Consult your physician if you have a medical condition that makes you sensitive to air quality conditions.

Smoke is made of small particles and other pollutants that can aggravate respiratory diseases and contribute to ground-level ozone formation. Exposure to ozone can induce coughing, wheezing and shortness of breath even in healthy people. A seasonal ozone advisory is currently in effect.

SMOKE AND OZONE TIPS

- Stay indoors when you smell or see smoke.
- Limit outdoor activity and exertion when ozone levels are elevated – exercise makes you breathe heavier and increases the amount of particulates you may inhale.
- Keep windows and doors closed. Run your air conditioner inside your house and car. Air conditioning filters out smoke and particles.
- Change your indoor air filters if they are dirty.
- Schedule activities for the morning or evening when ozone levels are usually lower.
- Substitute a less intense activity – walk instead of jog, for example.
- Reduce driving – combine errands into one trip.
- Don't idle your car engine unnecessarily.

[more]

Air Quality Smoke, Ozone Advisory Issued for Tuesday and Wednesday, cont.

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Figure A-11. Smoke and Ozone Advisory issued by the Clark County Office of Public Communication on August 20, 2020, for August 20-21, 2020.

News Release

SMOKE AND OZONE TIPS, cont.

- Use mass transit or carpool.
- Fill up your gas tank after sunset. Try not to spill gasoline when filling up, and don't top off your tank.
- Keep your car well maintained.
- Consider landscaping that uses less water and gas-powered equipment to maintain.
- Turn off lights and electronics when not in use. Less fuel burned at power plants means cleaner air.

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Figure A-11 (cont.). Smoke and Ozone Advisory issued by the Clark County Office of Public Communication on August 20, 2020, for August 20-21, 2020.

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For Immediate Release **Friday, Aug. 21, 2020**

Smoke, Ozone Advisory Extended Through Weekend Due to Wildfire Smoke

The Clark County Department of Environment and Sustainability (DES) is extending its current **advisory to include Saturday, Aug. 22 and Sunday, Aug. 23** for elevated levels of smoke and ozone due to the regional wildfires throughout the southwest U.S. DES Division of Air Quality officials say smoke is made of small dust particles and other pollutants that can aggravate respiratory diseases and contribute to ground-level ozone formation.

According to the U.S. Environmental Protection Agency, people who may be most sensitive to elevated levels of particulates and ozone include individuals with respiratory problems, cardiac disease, young children or senior citizens. Consult your physician if you have a medical condition that makes you sensitive to air quality conditions.

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[more]

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Figure A-12. Smoke and Ozone Advisory issued by the Clark County Office of Public Communication on August 21, 2020, for August 22-23, 2020.

News Release

Air Quality Smoke, Ozone Advisory Issued for Tuesday and Wednesday, cont.

SMOKE AND OZONE TIPS, cont.

- Use mass transit or carpool.
- Fill up your gas tank after sunset. Try not to spill gasoline when filling up, and don't top off your tank.
- Keep your car well maintained.
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Figure A-12 (cont.). Smoke and Ozone Advisory issued by the Clark County Office of Public Communication on August 21, 2020, for August 22-23, 2020.

Appendix B. Extended Emissions Transport Analysis

To further investigate the transport of emissions from the fires identified in this demonstration, an extended analysis was conducted to investigate emissions and the transport of smoke from fires over more than 24 hours. This extended analysis is similar to the analysis presented in Section 3.2.1, Key Factor #1 is the Q/d Analysis, but with the transport of wildfire smoke emissions for additional days (August 16 and 17) prior to the first exceedance event on August 18 included. This extended analysis was conducted because HYSPLIT modeling, presented in Section 3.1.3, suggests smoke transport from additional fires over a period of more than 24 hours. We refer to the resulting value calculated using the 48-hour back trajectories and emissions estimates from prior days as "Extended Q/d" to distinguish these results with the Q/d calculated in accordance with EPA guidance. The Extended Q/d and Q/d are unlikely to be directly comparable to one another due to differences in ozone photochemistry over varying time scales (Jaffe and Wigder, 2012).

The 72-hour HYSPLIT back trajectories and their uncertainty buffers show that transport likely occurred from all identified fires to the exceeding monitors in Clark County (**Figures B-1 through B-4**). The total emissions from a subset of fires examined were significant on August 17 (**Table B-1**) and August 16 (**Table B-2**). These extended analyses provide evidence that wildfires emitted ozone precursors in the days leading up to August 18, 2020, and these emissions were transport to Clark County, Nevada.

Automated Smoke Exceptional Event Screening for Fire Report for August 18, 2020
LasVegasNevada

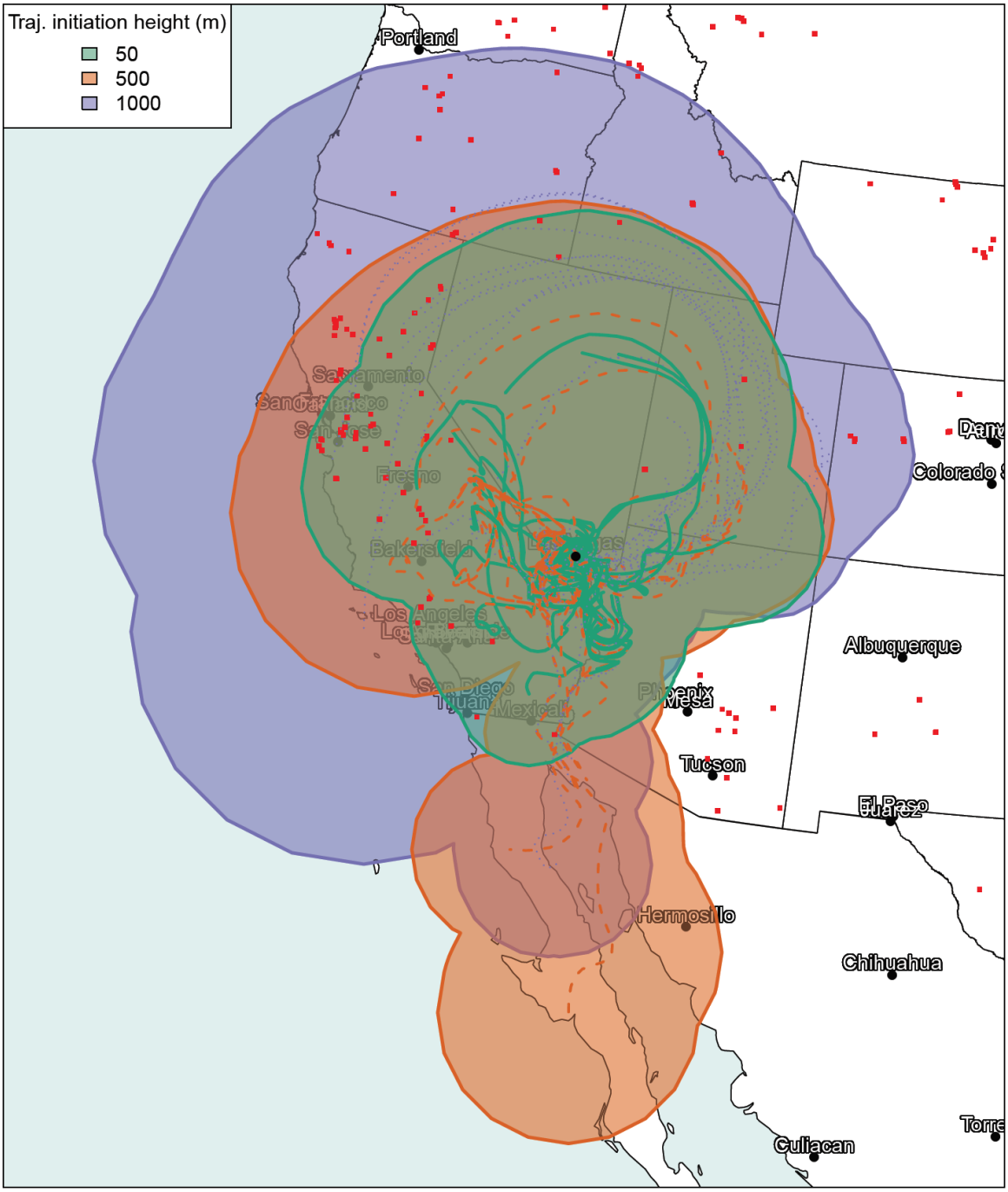


Figure B-1. 72-hour back trajectories for August 18, 2020. Trajectories are shown as solid or dotted lines. The starting height of the back trajectory is indicated by the color. Uncertainty buffers, calculated as 25% of the distance traveled by the trajectory, are shown in colored polygons. Active fires on August 18 are shown as red squares. Fires falling within one or more uncertainty buffer(s) were used to calculate individual and aggregate emissions impact values.

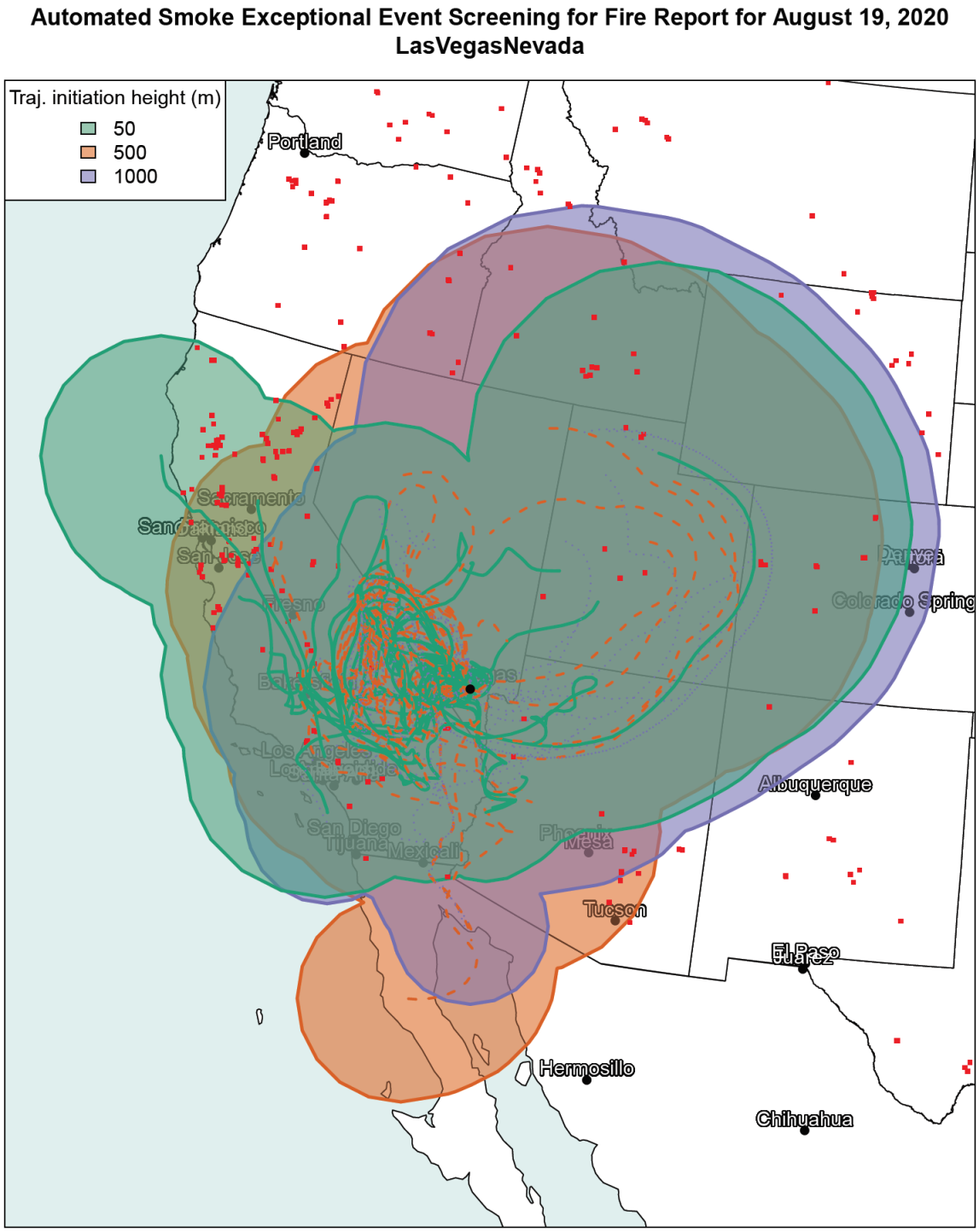


Figure B-2. 72-hour back trajectories for August 19, 2020. Trajectories are shown as solid or dotted lines. The starting height of the back trajectory is indicated by the color. Uncertainty buffers, calculated as 25% of the distance traveled by the trajectory, are shown in colored polygons. Active fires on August 19 are shown as red squares. Fires falling within one or more uncertainty buffer(s) were used to calculate individual and aggregate emissions impact values.

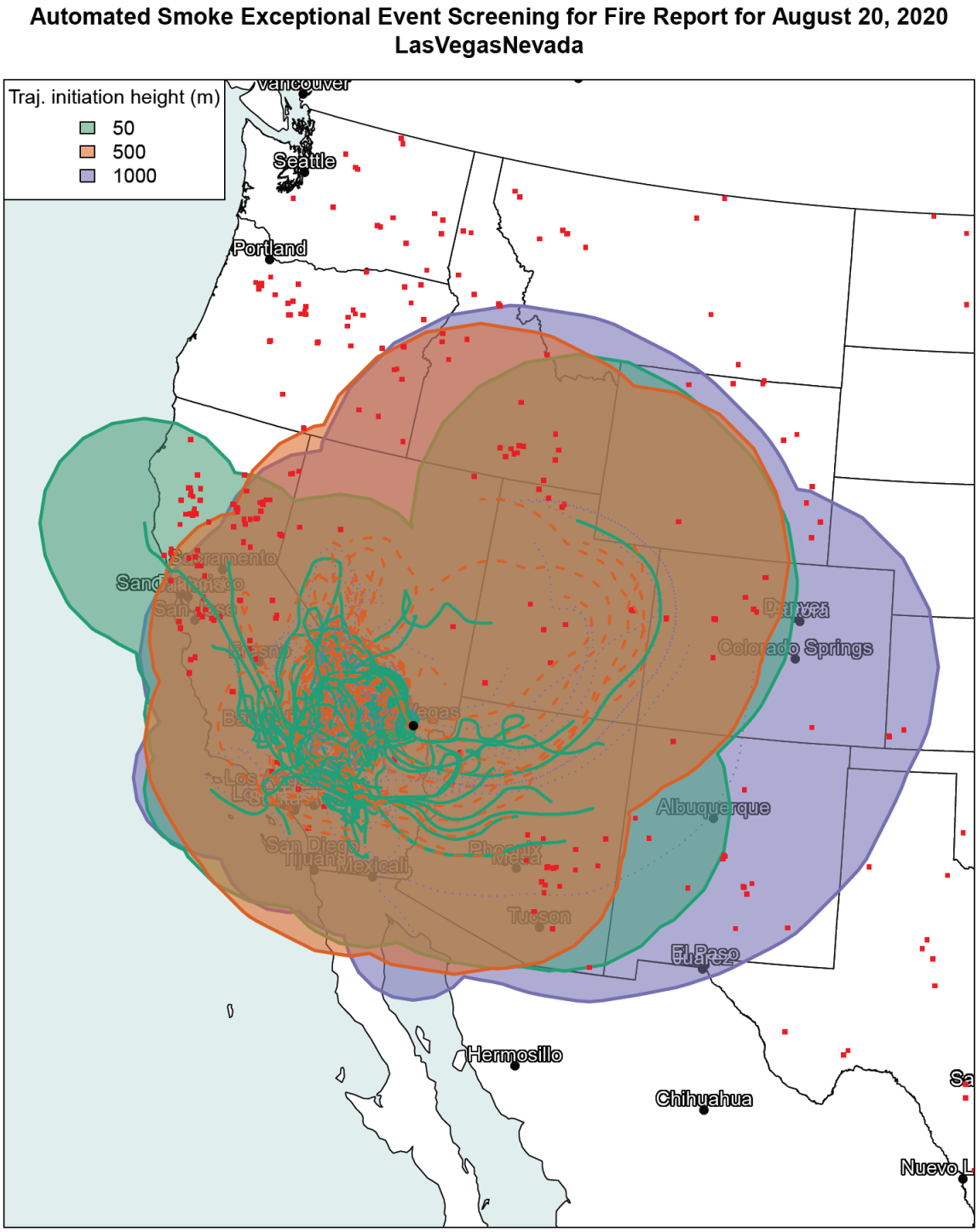


Figure B-3. 72-hour back trajectories for August 20, 2020. Trajectories are shown as solid or dotted lines. The starting height of the back trajectory is indicated by the color. Uncertainty buffers, calculated as 25% of the distance traveled by the trajectory, are shown in colored polygons. Active fires on August 20 are shown as red squares. Fires falling within one or more uncertainty buffer(s) were used to calculate individual and aggregate emissions impact values.

Automated Smoke Exceptional Event Screening for Fire Report for August 21, 2020
LasVegasNevada

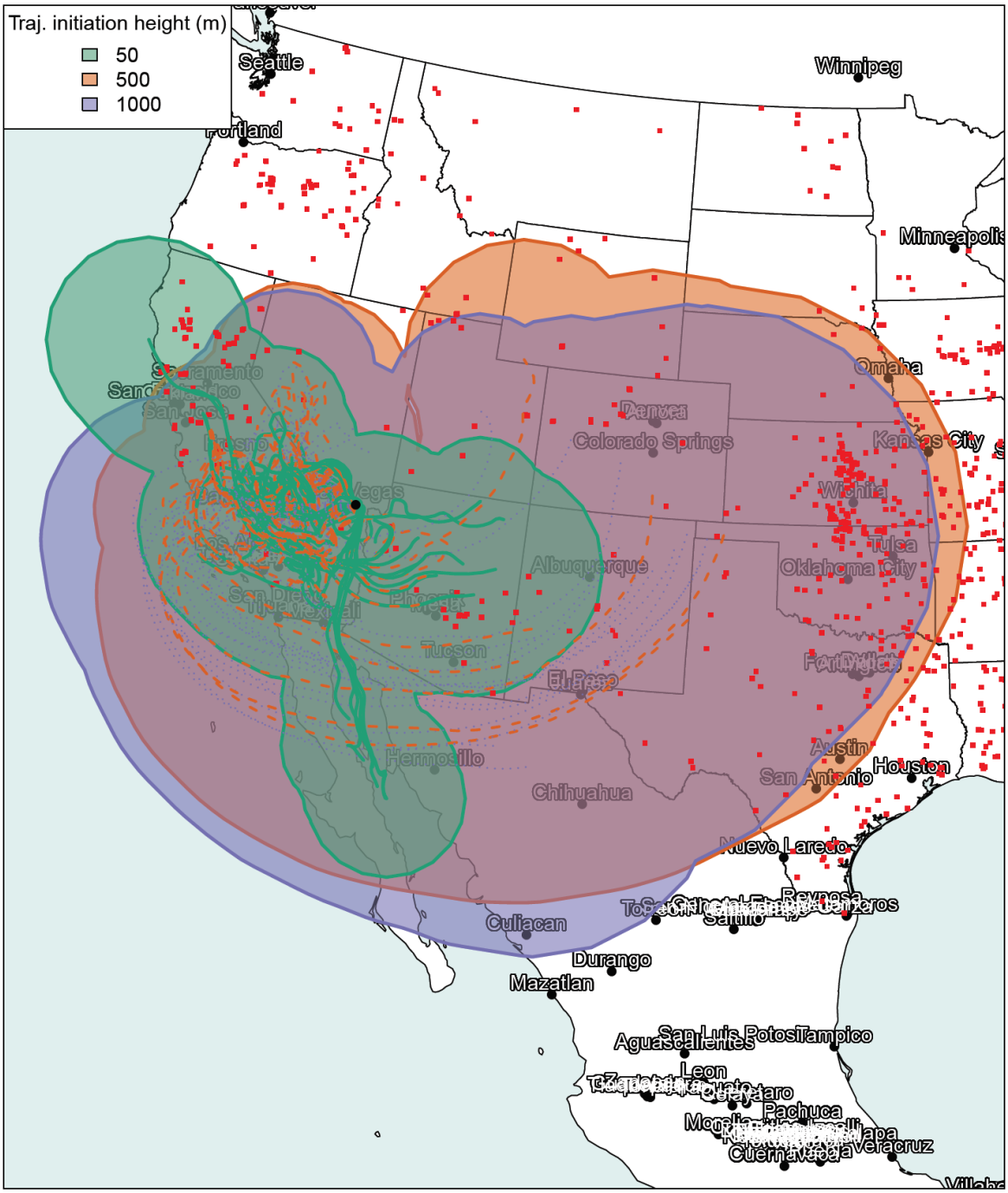


Figure B-4. 72-hour back trajectories for August 21, 2020. Trajectories are shown as solid or dotted lines. The starting height of the back trajectory is indicated by the color. Uncertainty buffers, calculated as 25% of the distance traveled by the trajectory, are shown in colored polygons. Active fires on August 21 are shown as red squares. Fires falling within one or more uncertainty buffer(s) were used to calculate individual and aggregate emissions impact values.

Table B-1. Daily growth, daily emissions associated with the daily growth in area burned, and Q/d for the fires with potential smoke contribution on August 17, 2020. Total area burned represents the cumulative area burned across the entire history of the fire up to and including August 17. Growth for all dates shown were obtained from agency estimates available from the Incident Information System (InciWeb) or satellite estimates of growth. Aggregate Q/d calculated for all fires shown is 12. Column "E (Tons)" represents the sum of NO_x and Reactive VOC emissions.

Fire Name	Total Area Burned (Acres)	Daily Growth (Acres)	NO_x (Tons)	VOCs (Tons)	Reactive VOCs (Tons)	E (Tons)	Distance (Km)	Q/d (Tons/km)	Fuel Loading	Fire size data source
North Range Fire	NA	NA	NA	NA	NA	NA	NA	NA	Creosote bush shrubland	NA
Dome Fire	20,621	4,621	17.09	89.8	54	71	65	1.1	Creosote bush shrubland	MODIS hotspot estimate
Lake Fire	21,115	2,589	83.59	438.9	263	347	210	1.7	California live oak-blue oak woodland	https://inciweb.nwcg.gov/incident/6953/
Red Salmon Complex	15,129	2,273	73.39	2128.4	1,277	1,350	910	1.5	Douglas fir madrone tanoak forest	https://inciweb.nwcg.gov/incident/6891/
August Complex Fire	825	825	16.92	543.0	326	343	780	0.4	Jeffrey pine ponderosa pine Douglas fir California black oak forest	https://inciweb.nwcg.gov/incident/article/6983/53307/
LNU Lightning Complex Fire	12,000	12,000	270.49	2027.3	1,216	1,487	700	2.1	California live oak blue oak woodland	https://www.sfchronicle.com/california-wildfires/article/Whatever-anyone-can-spare-How-lightning-in-15538666.php
SCU Lightning Complex Fire	16,998	13,652	4.92	24.6	15	20	570	0.0	Wheatgrass cheatgrass grassland	MODIS hotspot estimate

Fire Name	Total Area Burned (Acres)	Daily Growth (Acres)	NO_x (Tons)	VOCs (Tons)	Reactive VOCs (Tons)	E (Tons)	Distance (Km)	Q/d (Tons/km)	Fuel Loading	Fire size data source
Cold Springs Fire	NA	NA	NA	NA	NA	NA	NA	NA	Sagebrush Shrubland	NA
River Fire	NA	NA	NA	NA	NA	NA	NA	NA	California live oak-blue oak woodland	NA
Dolan Fire	NA	NA	NA	NA	NA	NA	NA	NA	California live oak-blue oak woodland	NA
North Complex Fire	NA	NA	NA	NA	NA	NA	NA	NA	Douglas fir sugar pine tanoak forest	NA
Loyalton Fire	44,147	7852	185.85	6713.3	4027.98	4,214	590	7.1	Ponderosa pine Jeffrey pine forest	https://inciweb.nwcg.gov/incident/news/6975/
CZU Lightning Complex Fire	NA	NA	NA	NA	NA	NA	NA	NA	Redwood tanoak forest	NA
Carmel Fire	NA	NA	NA	NA	NA	NA	NA	NA	California live oak blue oak woodland	NA

Table B-2. Daily growth, daily emissions associated with the daily growth in area burned, and Q/d for the fires with potential smoke contribution on August 16, 2020. Total area burned represents the cumulative area burned across the entire history of the fire up to and including August 16. Growth for all dates shown were obtained from agency estimates available from the Incident Information System (InciWeb) or satellite estimates of growth. Aggregate Q/d calculated for all fires shown is 34. Column "E (Tons)" represents the sum of NO_x and Reactive VOC emissions.

Fire Name	Total Area Burned (Acres)	Daily Growth (Acres)	NO_x (Tons)	VOCs (Tons)	Reactive VOCs (Tons)	E (Tons)	Distance (Km)	Q/d (Tons/km)	Fuel Loading	Fire size data source
North Range Fire	NA	NA	NA	NA	NA	NA	NA	NA	Creosote bush shrubland	NA
Dome Fire	16,000	10,224	37.82	198.7	119	157	65	2.4	Creosote bush shrubland	https://www.nps.gov/moja/learn/nature/dome-fire.htm
Lake Fire	18,526	664	20.79	109.2	65	86	210	0.4	California live oak-blue oak woodland	https://inciweb.nwcg.gov/incident/article/6953/53254/
Red Salmon Complex	12,856	755	24.38	707.0	424	449	910	0.5	Douglas fir madrone tanoak forest	https://inciweb.nwcg.gov/incident/6891/
August Complex Fire	NA	NA	NA	NA	NA	NA	NA	NA	Jeffrey pine ponderosa pine Douglas fir California black oak forest	NA
LNU Lightning Complex Fire	NA	NA	NA	NA	NA	NA	NA	NA	California live oak blue oak woodland	NA

Fire Name	Total Area Burned (Acres)	Daily Growth (Acres)	NO_x (Tons)	VOCs (Tons)	Reactive VOCs (Tons)	E (Tons)	Distance (Km)	Q/d (Tons/km)	Fuel Loading	Fire size data source
SCU Lightning Complex Fire	3,345	3,345	1.2	6.0	4	5	570	0.0	Wheatgrass cheatgrass grassland	MODIS hotspot estimate
Cold Springs Fire	NA	NA	NA	NA	NA	NA	NA	NA	Sagebrush shrubland	NA
River Fire	NA	NA	NA	NA	NA	NA	NA	NA	California live oak-blue oak woodland	NA
Dolan Fire	NA	NA	NA	NA	NA	NA	NA	NA	California live oak-blue oak woodland	NA
North Complex Fire	NA	NA	NA	NA	NA	NA	NA	NA	Douglas fir sugar pine tanoak forest	NA
Loyalton Fire	36295	36295	859.1	31031.5	18618.9	19,478	590	33	Ponderosa pine Jeffrey pine forest	https://inciweb.nwcg.gov/incident/news/6975/
CZU Lightning Complex Fire	NA	NA	NA	NA	NA	NA	NA	NA	Redwood tanoak forest	NA
Carmel Fire	NA	NA	NA	NA	NA	NA	NA	NA	California live oak blue oak woodland	NA

Reference

Jaffe D.A. and Wigder N.L. (2012) Ozone production from wildfires: a critical review. *Atmospheric Environment*, 51, 1-10, May. Available at https://www.sciencedirect.com/science/article/pii/S1352231011012507.

Appendix C. Satellite Retrievals of Pollutant Concentrations from Section 3.2.3

CO retrievals from the Measurements of Pollution in the Troposphere (MOPITT) instrument onboard the Terra satellite were only available for August 19 and 21, 2020. The August 21, 2020, image is included in the main text in Section 3.2.3. However, Figure C-1 shows a limb retrieval of CO over Las Vegas and does not provide CO concentrations for most of the Clark County area. Therefore, the August 19, 2020, MOPITT CO retrieval is considered inconclusive for the August 18-21 exceptional event. Additionally, CO measurements from the Atmospheric Infrared Sounder (AIRS) satellite were unavailable from August 18-21.

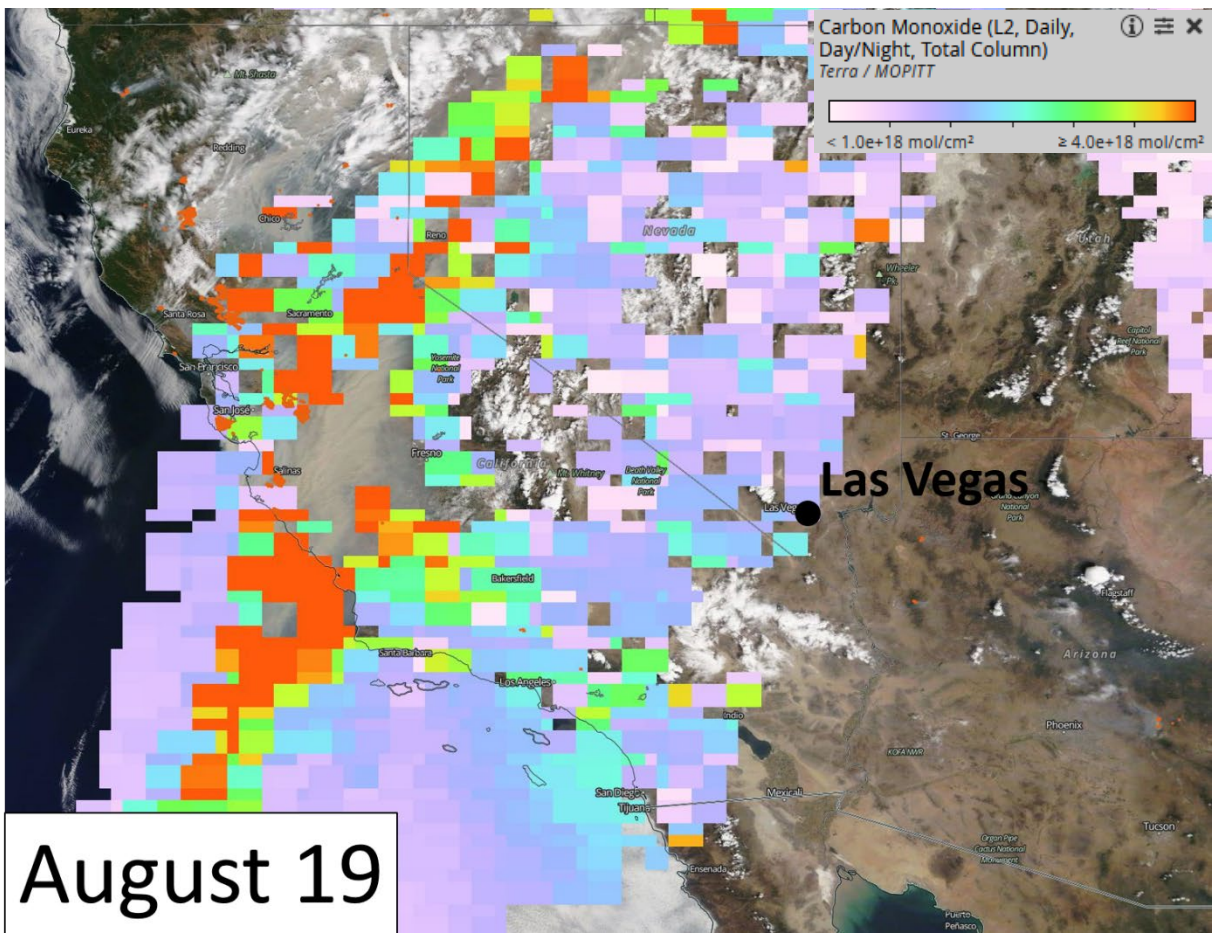


Figure C-1. A zoomed-in view (over Clark County and the fires in California) of the Aqua MOPITT CO retrieval during the EE on August 19, 2020.

Appendix D. Supporting Figures and Documents for Section 3.2.4

The ratio of $PM_{10}/PM_{2.5}$ is examined at each event site where $PM_{2.5}$ and PM_{10} data is available in Figures D-1 through D-4 to determine if a dust event had a significant contribution to abnormal $PM_{2.5}$ concentrations in Clark County during the event period. Elevated $PM_{2.5}$ concentrations that are caused by a dust event can be identified by an even greater increase in PM_{10}. In other words, there should be an accompanying increase in the $PM_{10}/PM_{2.5}$ ratio. Contributions to $PM_{2.5}$ concentrations due to a dust event could confound the assertion that wildfire influence in Clark County can be identified by elevated or abnormal levels of $PM_{2.5}$. Four years of $PM_{10}/PM_{2.5}$ data is available from Paul Meyer, one year from Walter Johnson, three years from Joe Neal, and five years from Green Valley. As seen in the following figures, the periods with the highest $PM_{2.5}$ concentrations, between August 20 and 21, were not accompanied by a marked increase in the $PM_{10}/PM_{2.5}$ ratio at any site. $PM_{10}/PM_{2.5}$ hover at or below the diurnal average at each site for most of the event period. This demonstrates that a dust event did not significantly contribute to the abnormal $PM_{2.5}$ concentrations measured in Clark County between August 18 through 21, lending evidence to the assertion that these abnormalities were related to the presence of wildfire smoke at the surface.

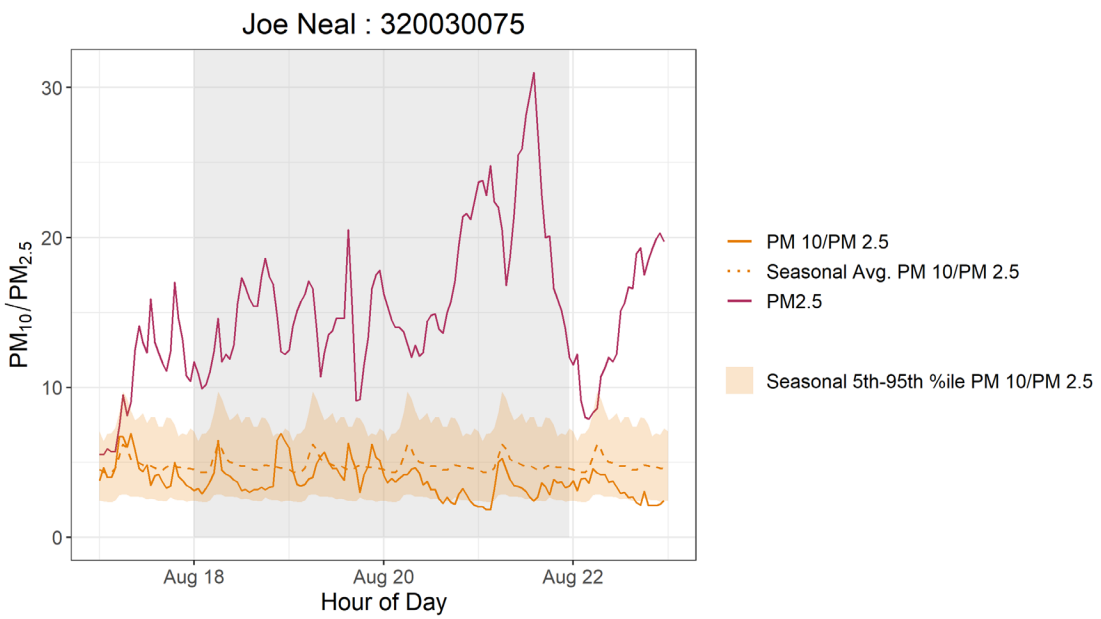


Figure D-1. $PM_{10}/PM_{2.5}$ ratio (yellow) and $PM_{2.5}$ (maroon) concentrations at Joe Neal during the August 18-21, 2020, event period. The seasonal average $PM_{10}/PM_{2.5}$ ratio is shown as a dashed line, and the 5th-95th percentile $PM_{10}/PM_{2.5}$ ratio is shaded in yellow. The gray bar highlights August 18-21, 2020.

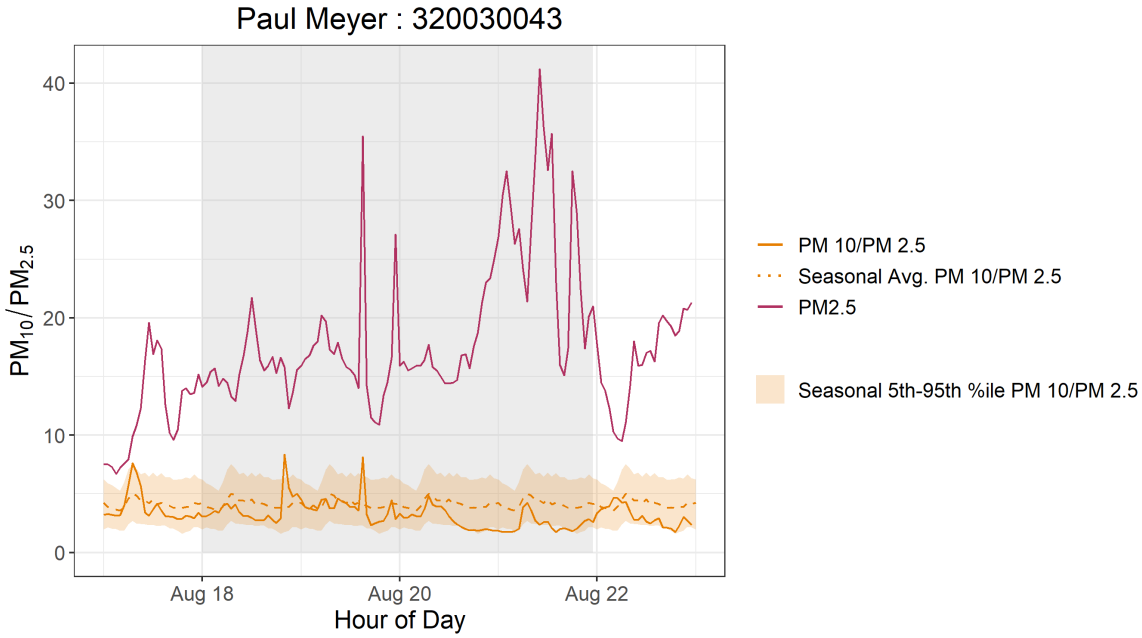


Figure D-2. $PM_{10}/PM_{2.5}$ ratio (yellow) and $PM_{2.5}$ (maroon) concentrations at Paul Meyer during the August 18-21, 2020, event period. The seasonal average $PM_{10}/PM_{2.5}$ ratio is shown as a dashed line, and the 5th-95th percentile $PM_{10}/PM_{2.5}$ ratio is shaded in yellow. The gray bar highlights August 18-21, 2020.

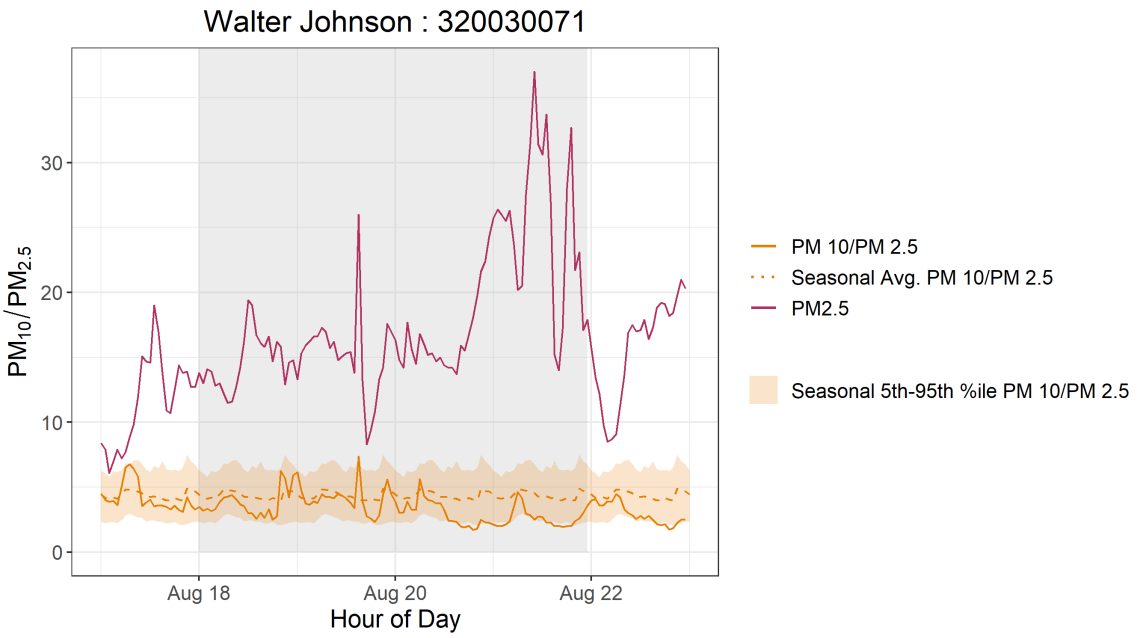


Figure D-3. $PM_{10}/PM_{2.5}$ ratio (yellow) and $PM_{2.5}$ (maroon) concentrations at Walter Johnson during the August 18-21, 2020, event period. The seasonal average $PM_{10}/PM_{2.5}$ ratio is shown as a dashed line, and the 5th-95th percentile $PM_{10}/PM_{2.5}$ ratio is shaded in yellow. The gray bar highlights August 18-21, 2020.

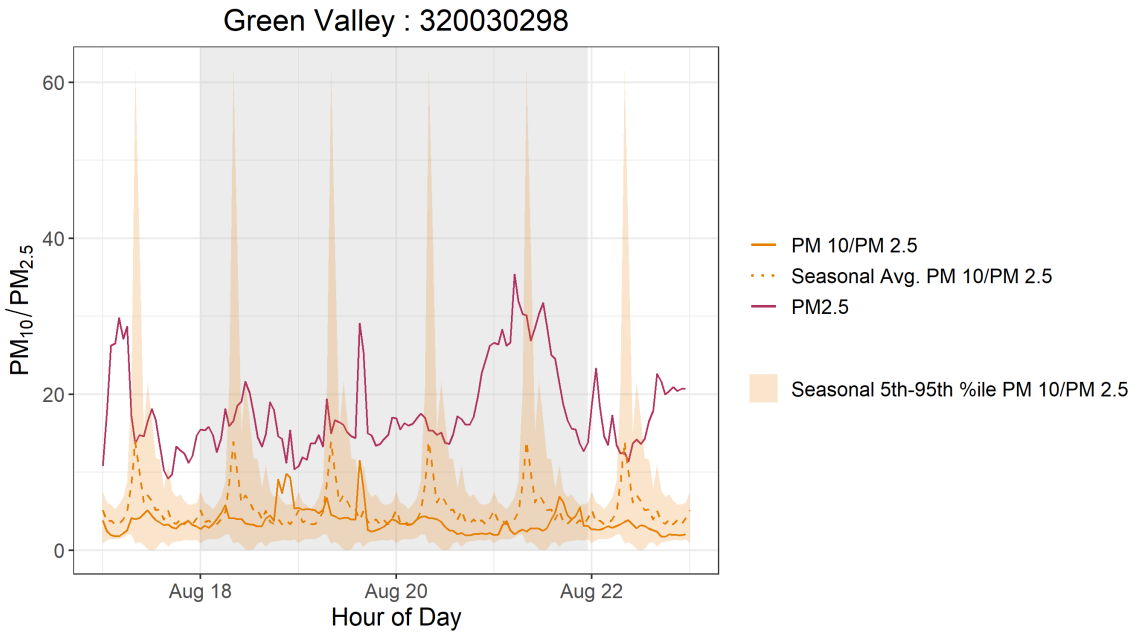


Figure D-4. $PM_{10}/PM_{2.5}$ ratio (yellow) and $PM_{2.5}$ (maroon) concentrations at Green Valley during the August 18-21, 2020, event period. The seasonal average $PM_{10}/PM_{2.5}$ ratio is shown as a dashed line, and the 5th-95th percentile $PM_{10}/PM_{2.5}$ ratio is shaded in yellow. The gray bar highlights August 18-21, 2020.

Diurnal profiles of ozone and CO on August 18-21 are included in Figures D-5 and D-6 below. CO data is available only for the Joe Neal (two years of data) and Green Valley (one year of data) event sites. CO concentrations reached magnitudes comparable to the 95th percentile value at each of these sites during the event period, but generally followed the expected diurnal pattern.

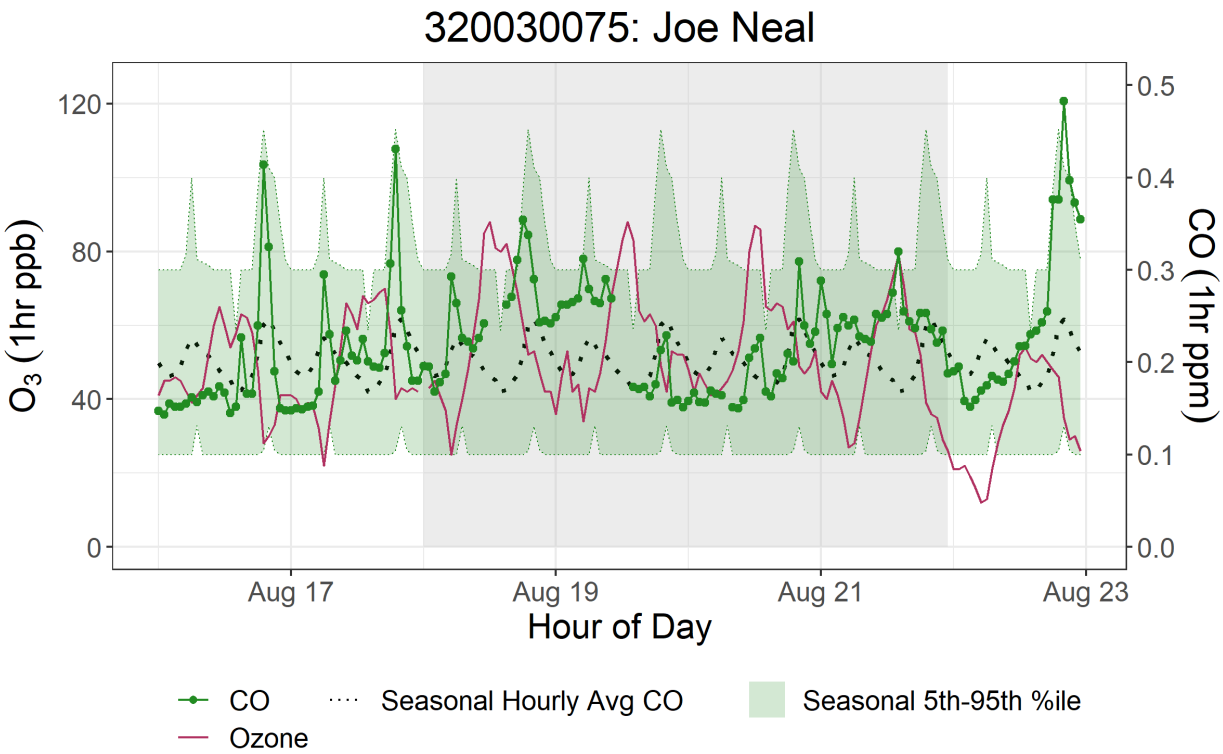


Figure D-5. CO (green) and ozone (maroon) concentrations at Joe Neal during the August 18-21, 2020, event period. The seasonal average CO ratio is shown as a dashed line, and the 5th-95th percentile CO concentrations is shaded in green. The gray bar highlights August 18-21, 2020.

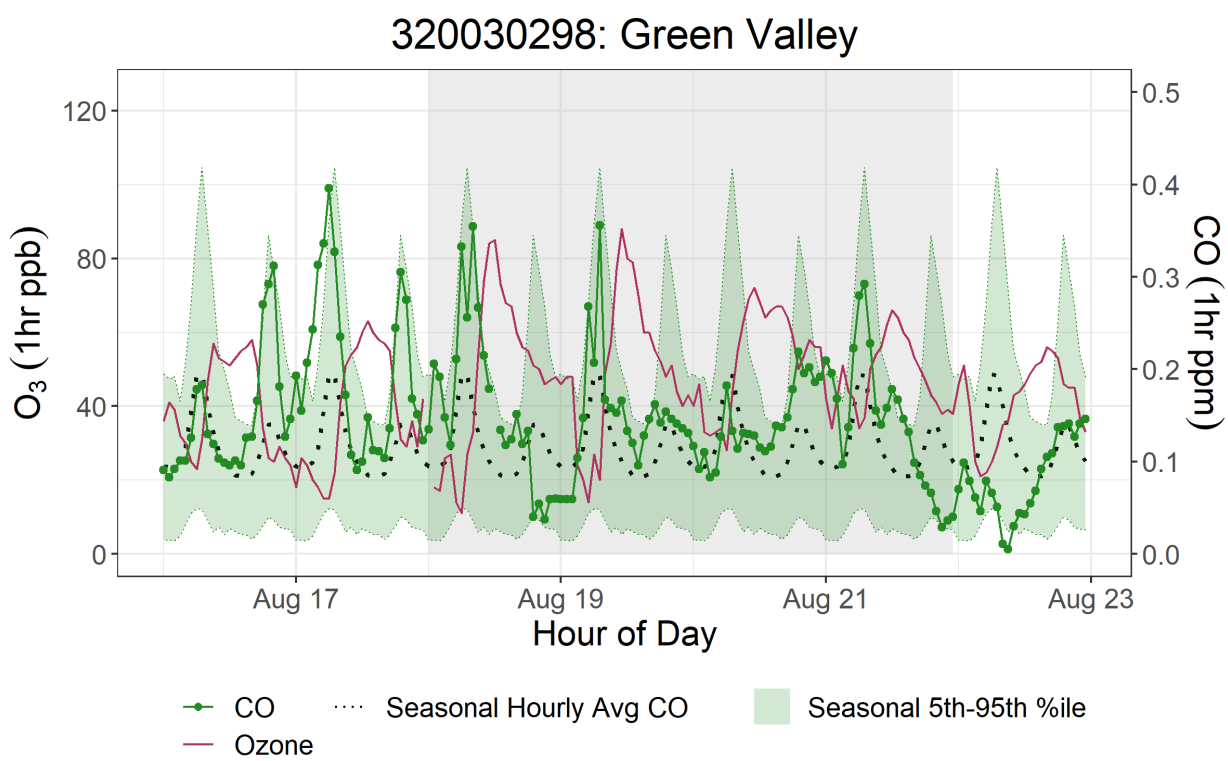


Figure D-6. CO (green) and ozone (maroon) concentrations at Green Valley during the August 18-21, 2020, event period. The seasonal average CO ratio is shown as a dashed line, and the 5th-95th percentile CO concentrations is shaded in green. The gray bar highlights August 18-21, 2020.

Concentrations of NO_x were examined for each day in the August 18-21 event in Clark County (see Figures D-7 through D-9). NO data are available only at the NCore reference site, Jerome Mack (five years of data), and NO_2 data are available only from Joe Neal (five years of data) and Jerome Mack (four years of data). The daily NO_x trends did not deviate markedly from expected diurnal patterns during the event period, though peak concentrations of both NO and NO_2 at Jerome Mack were above average on each date.

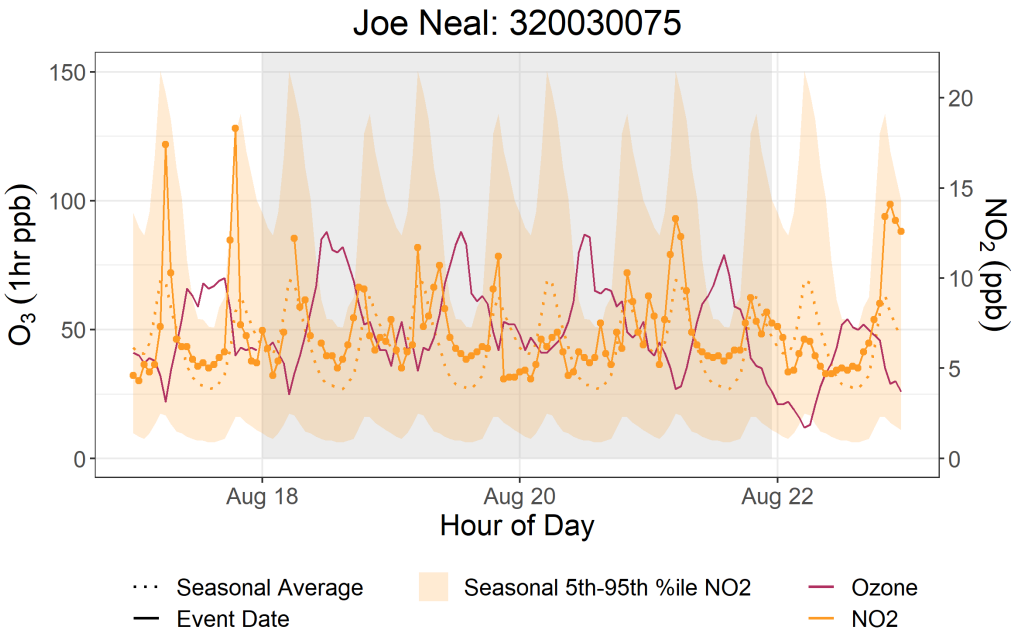


Figure D-7. NO_2 (yellow) and ozone (maroon) concentrations at Joe Neal during the August 18-21, 2020, event period. The seasonal average NO_2 ratio is shown as a dashed line, and the 5th-95th percentile NO_2 concentrations is shaded in yellow. The gray bar highlights August 18-21, 2020.

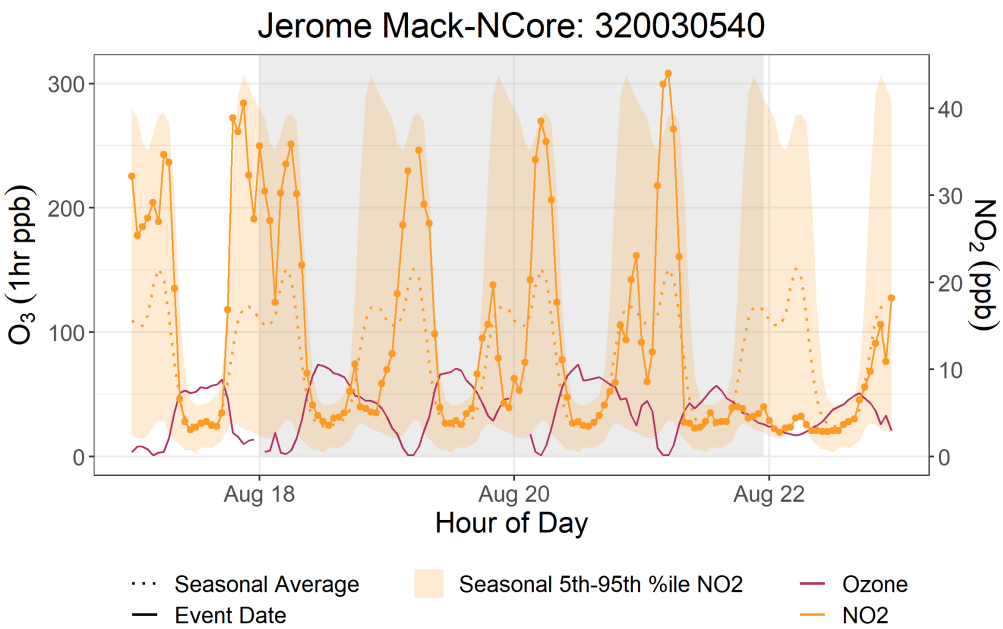


Figure D-8. NO_2 (yellow) and ozone (maroon) concentrations at Jerome Mack during the August 18-21, 2020, event period. The seasonal average NO_2 ratio is shown as a dashed line, and the 5th-95th percentile NO_2 concentrations is shaded in yellow. The gray bar highlights August 18-21, 2020.

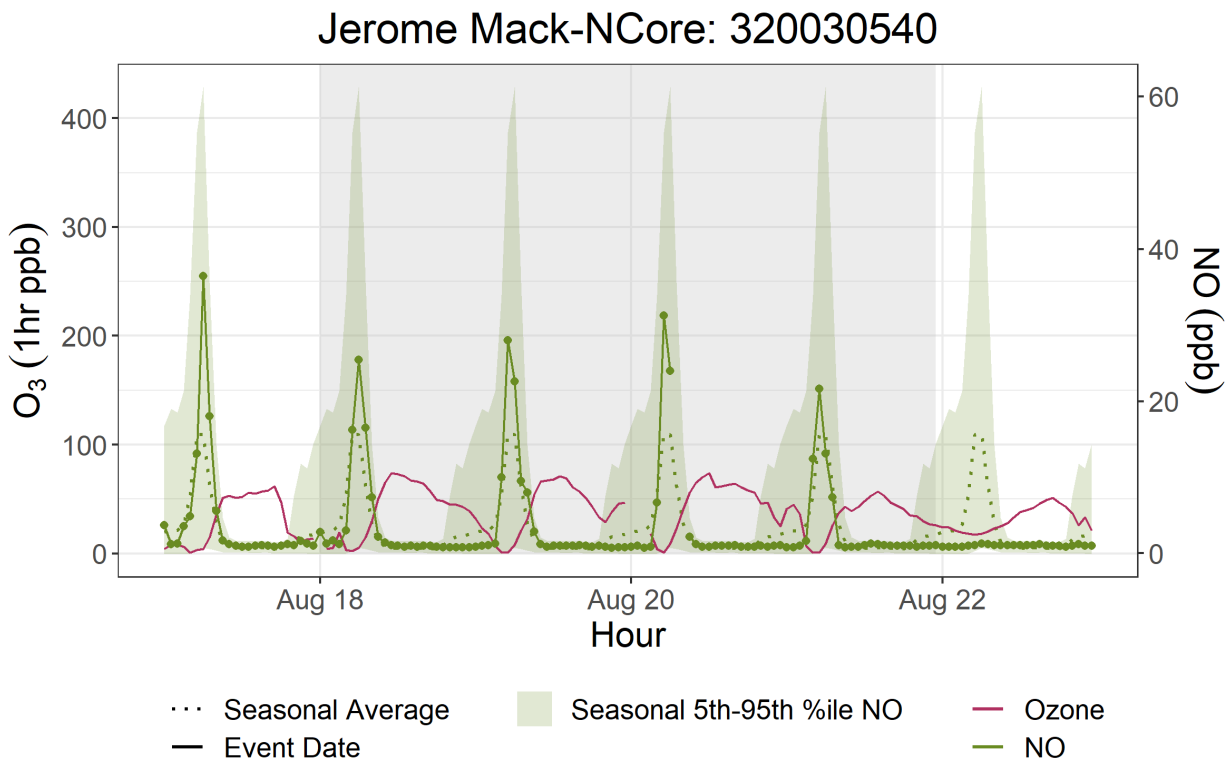


Figure D-9. NO (green) and ozone (maroon) concentrations at Jerome Mack during the August 18-21, 2020, event period. The seasonal average NO ratio is shown as a dashed line, and the 5th-95th percentile NO concentrations is shaded in yellow. The gray bar highlights August 18-21, 2020.

Appendix E. Supporting Figures and Documents for Section 3.3.2

The full subset of matching meteorologically similar days to August 19, 20, and 21, 2020 included August 31, 2018, July 7, 2017, and June 23, 2015, respectively. Though none of these three dates is formally identified as a date with wildfire influence, examination of NOAA's HMS Smoke Product indicates that wildfire smoke was likely present in Clark County on these dates. **Figures E-1 through E-3** show the HMS Smoke and Fire products on each date. The HMS Smoke Product on August 31, 2018, (Figure E-1) shows Clark County surrounded by smoke plumes to the north, west, and south. HYSPLIT back-trajectories ending at 18:00 UTC on August 31, 2018, show that transport paths towards Clark County intersected smoke plumes from more than one source at the 500 and 1,000 m levels. The HMS Smoke product on July 7, 2017, (Figure E-2) shows a smoke plume within the eastern boundary of Clark County. Further, HYSPLIT back-trajectories ending at 18:00 UTC on July 7, 2017, show transport across a different smoke plume in southern California towards Clark County. Lastly, on June 23, 2015, (Figure E-3), wildfire smoke is widely present in the southwestern region of the United States, resulting from fires in California and Arizona. HYPLIT back-trajectories overlaid in this figure ending at 18:00 UTC on June 23, 2015, show transport across a smoke plume toward Clark County at 50 m and 1,000 m. Due to this evidence that wildfire smoke may have influenced ozone concentrations in Clark County on August 31, 2018, July 7, 2017, and June 23, 2015, these meteorologically similar days have been omitted from the similar days analysis for August 19, 20, and 21, 2020, respectively.

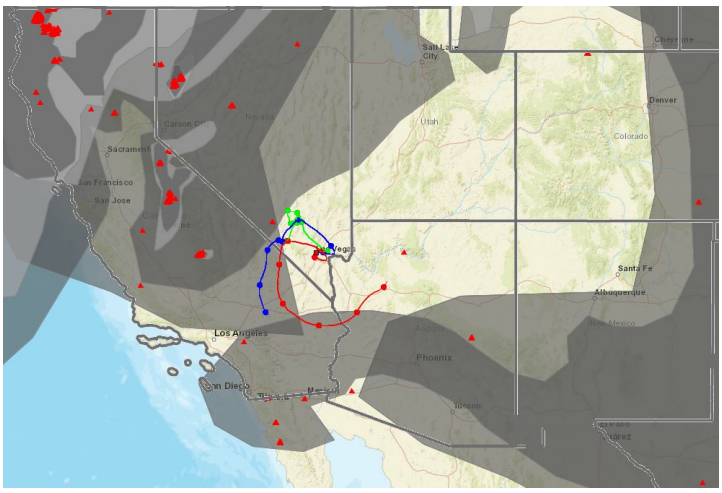


Figure E-1. HMS Smoke and Fire Products on August 31, 2018. Active fires are marked by red triangles, and smoke extent is shaded in gray. 50 m (green), 500 m (blue) and 1,000 m (red) HYSPLIT back-trajectories ending on August 31, 2018, at 18:00 UTC are overlaid. HYSPLIT trajectories use 40-km NAM meteorology.

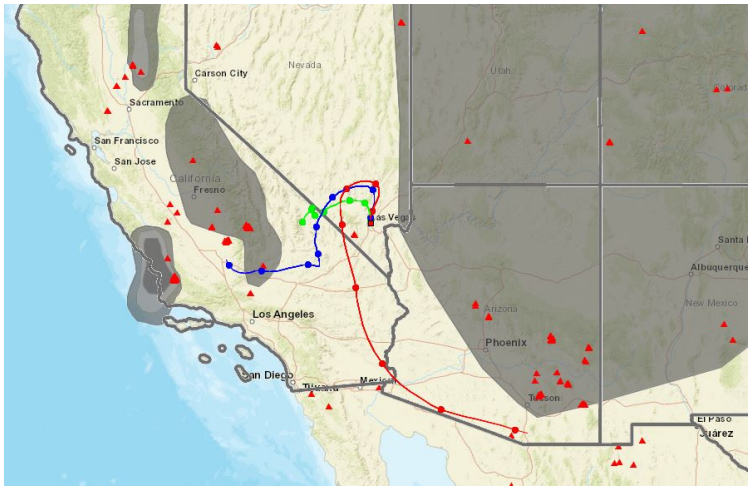


Figure E-2. HMS Smoke and Fire Products on July 7, 2017. Active fires are marked by red triangles, and smoke extent is shaded in gray. 50 m (green), 500 m (blue) and 1,000 m (red) HYSPLIT back-trajectories ending on July 7, 2017, at 18:00 UTC are overlaid. HYSPLIT trajectories use 40-km NAM meteorology.

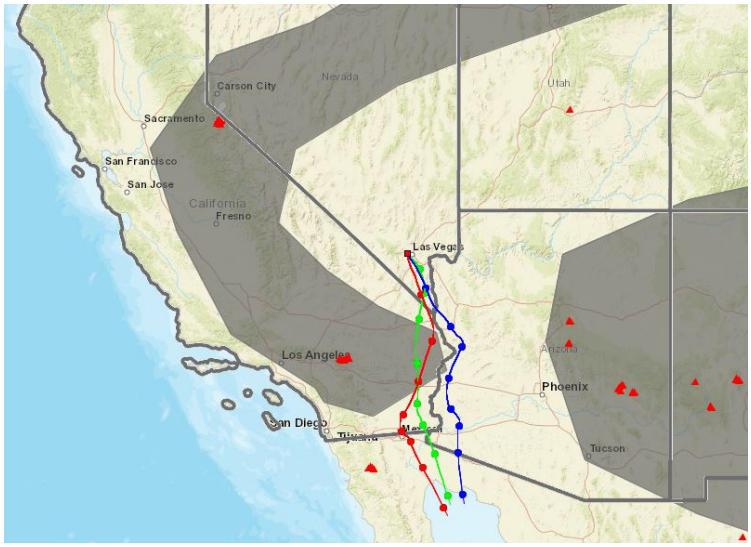


Figure E-3. HMS Smoke and Fire Products on June 23, 2015. Active fires are marked by red triangles, and smoke extent is shaded in gray. 50 m (green), 500 m (blue) and 1,000 m (red) HYSPLIT back-trajectories ending on June 23, 2015, at 18:00 UTC are overlaid. HYSPLIT trajectories use 40-km NAM meteorology.

Identification of matching meteorologically similar days includes a comparison of meteorology maps between each of August 18, 19, 20, and 21, 2020, and each date subset from candidate matching days. Surface and upper-level maps for August 18, 19, 20, and 21, and all meteorologically similar dates listed in Tables 3-18 through 3-21 (see Section 3.3.2), show highly consistent conditions. All dates show a surface low pressure system over Clark County, and most also show a surface high to the east. Surface maps for August 18, 2020, and each date in Table 3-18 are shown in Figures E-4 through E-10. Surface maps for August 19, 2020, and each date in Table 3-19 are shown in

Figures E-18 through E-29. Surface maps for August 20, 2020, and each date in Table 3-20 are shown in Figures E-42 through E-60. Surface maps for August 21, 2020, and each date in Table 3-21 are shown in Figures E-80 through E-93.

Upper-level maps show low-gradient high pressure at 500 mb over Clark County. 500 mb maps for August 18, 2020, and each date in Table 3-18 are shown in Figure E-11 through E-17. 500 mb maps for August 19, 2020, and each date in Table 3-19 are shown in Figure E-30 through E-41. 500 mb maps for August 20, 2020, and each date in Table 3-20 are shown in Figure E-61 through E-79. 500 mb maps for August 21, 2020, and each date in Table 3-21 are shown in Figure E-94 through E-107.

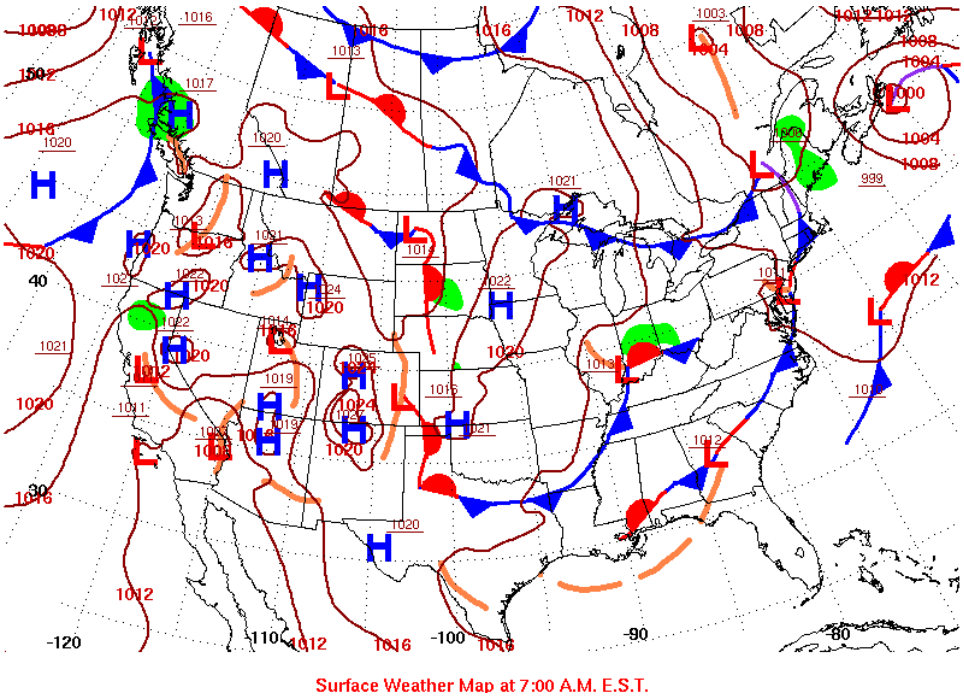


Figure E-4. Surface meteorology map on August 18, 2020 (event date).

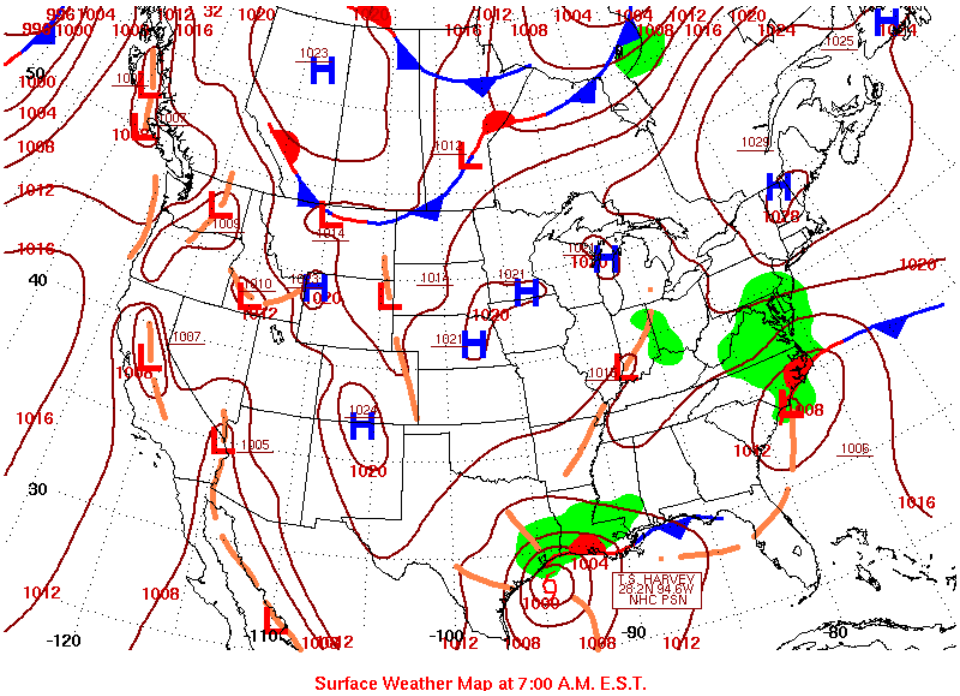


Figure E-5. Surface meteorology map on August 29, 2017.

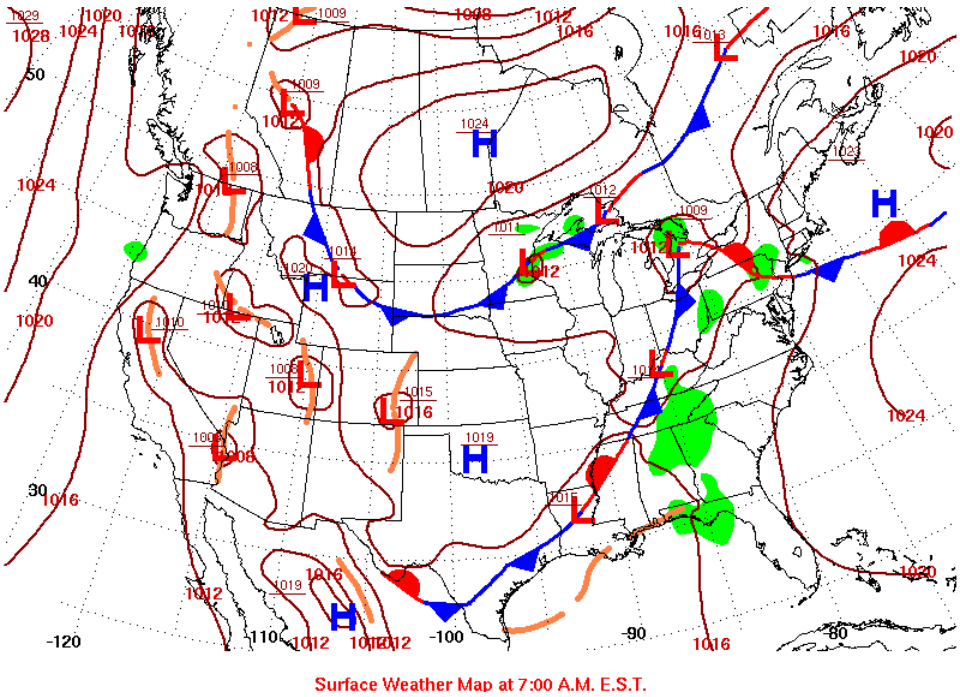


Figure E-6. Surface meteorology map on August 1, 2018.

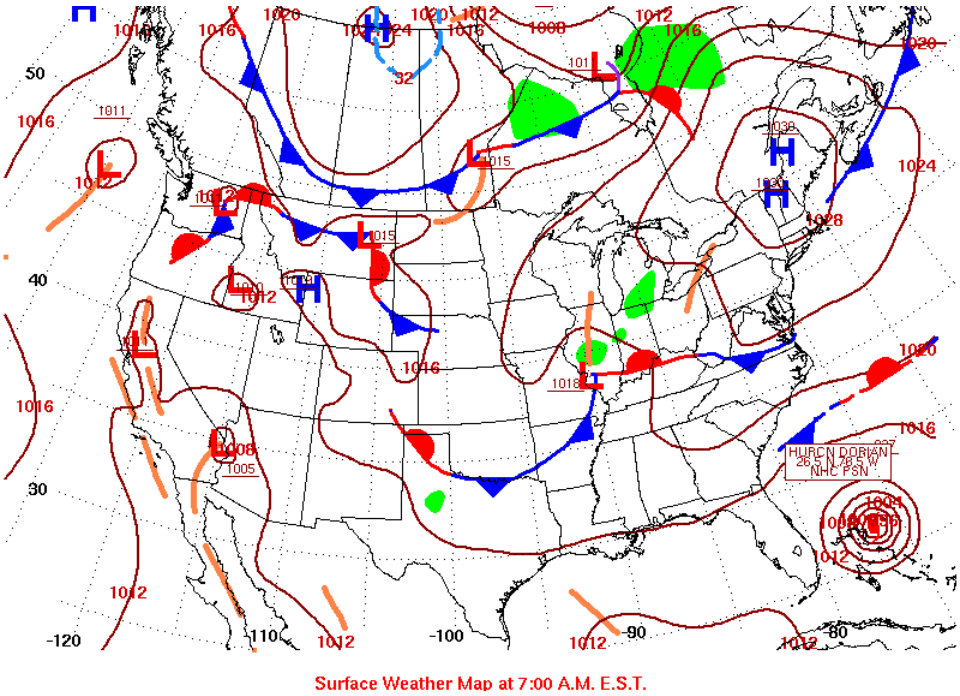


Figure E-7. Surface meteorology map on September 1, 2019.

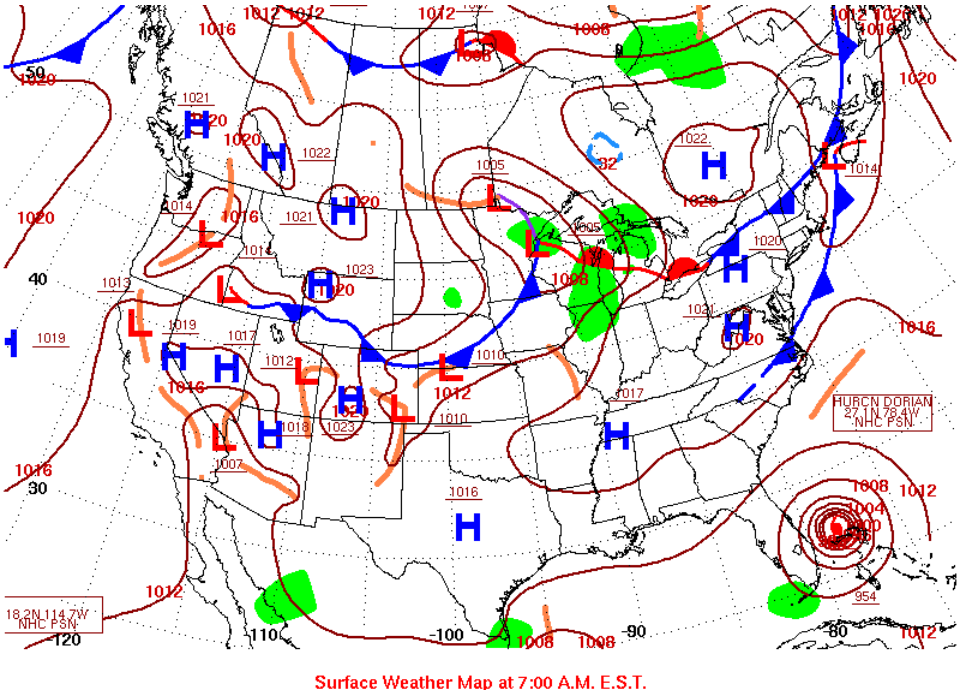


Figure E-8. Surface meteorology map on September 3, 2019.

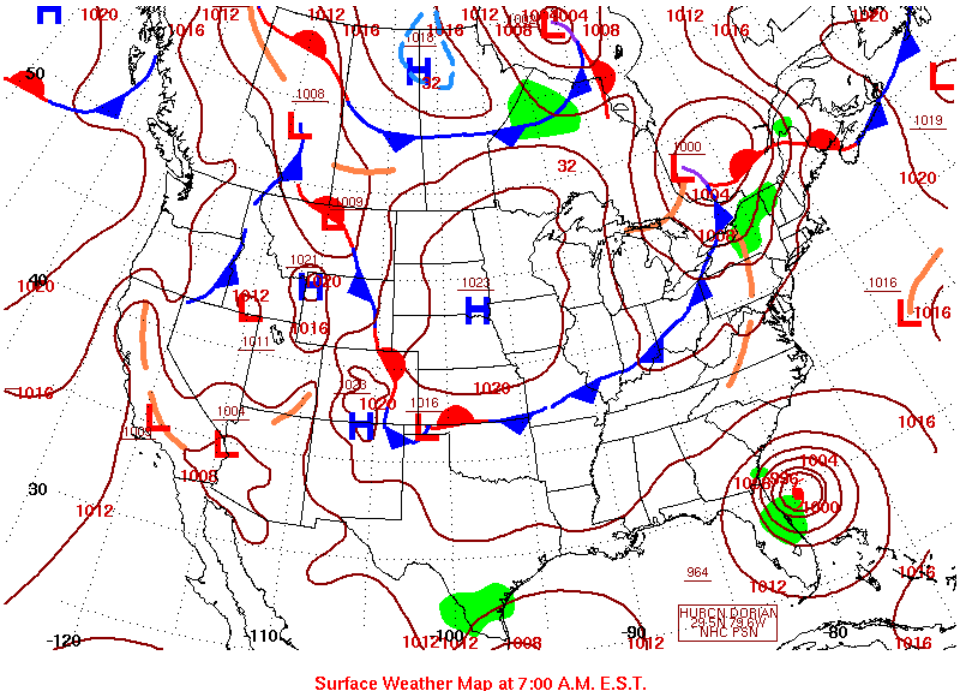


Figure E-9. Surface meteorology map on September 4, 2019.

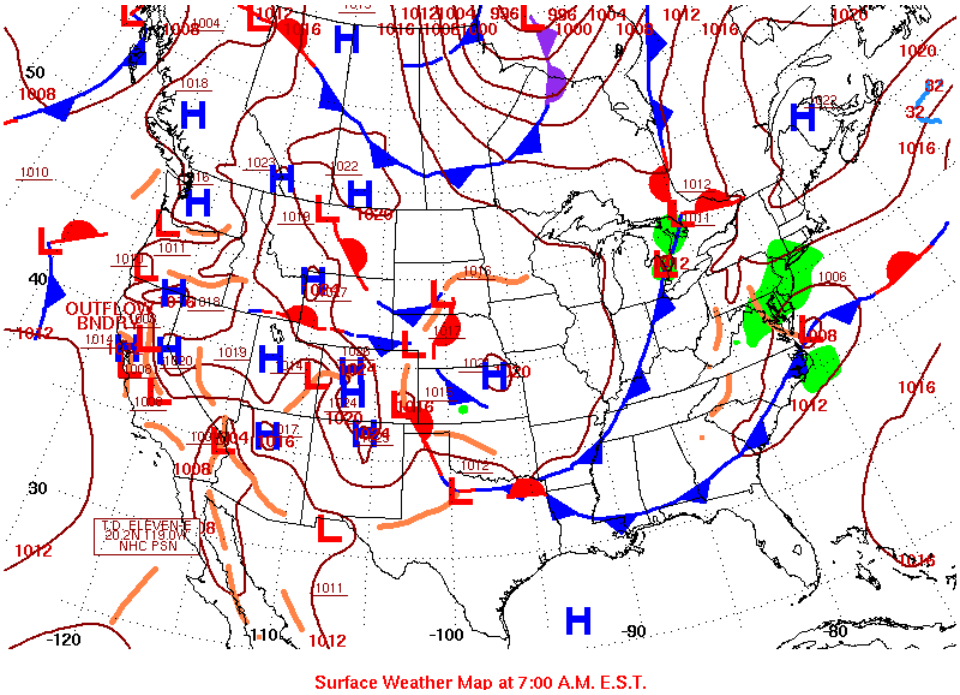


Figure E-10. Surface meteorology map on August 16, 2020.

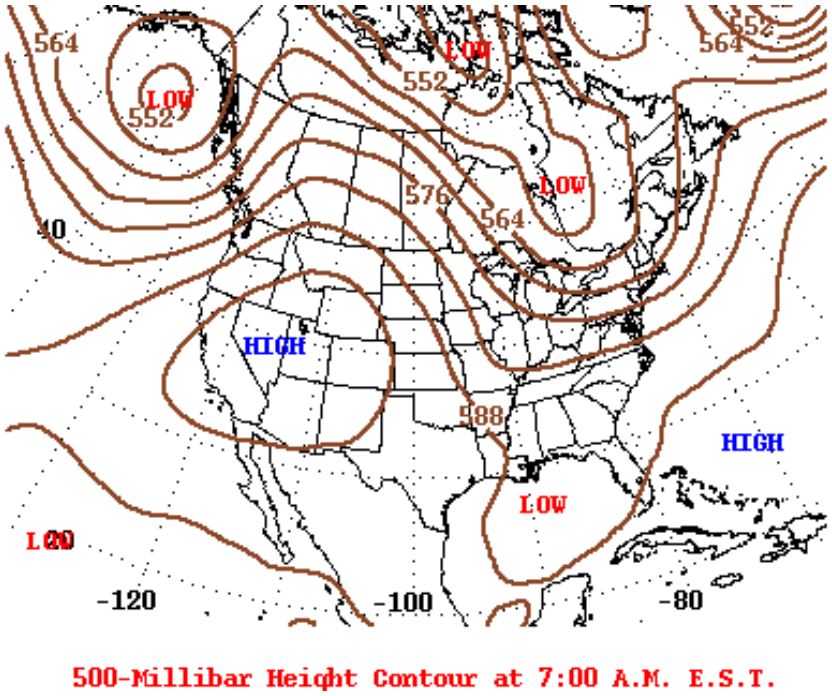


Figure E-11. 500 mb meteorology map on August 18, 2020 (the event date).

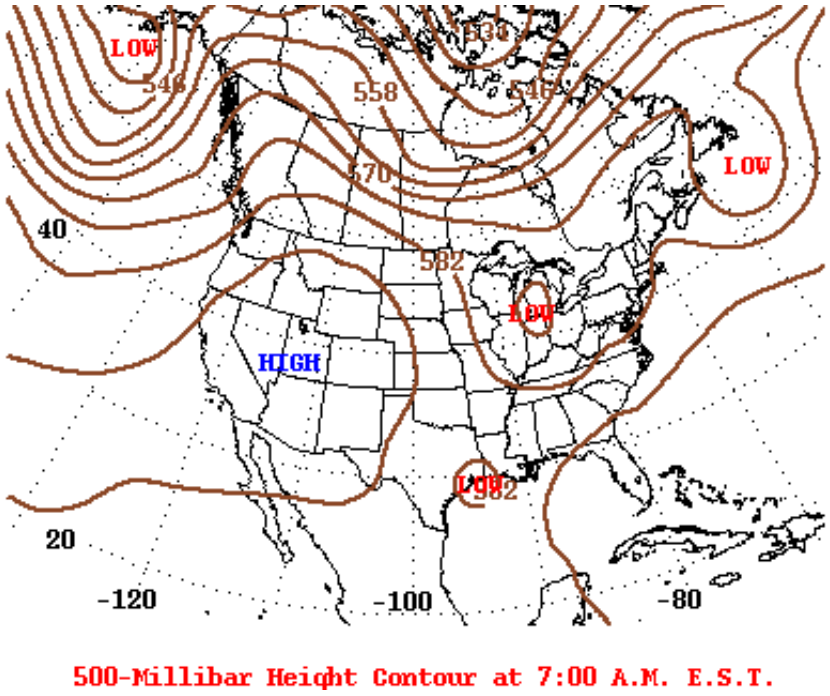


Figure E-12. 500 mb meteorology map on August 29, 2017.

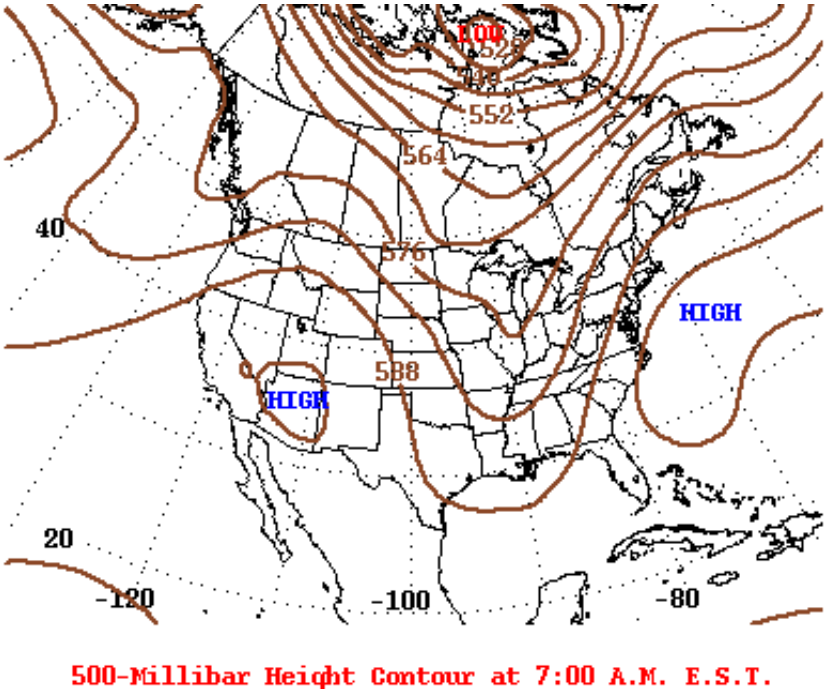


Figure E-13. 500 mb meteorology map on August 1, 2018.

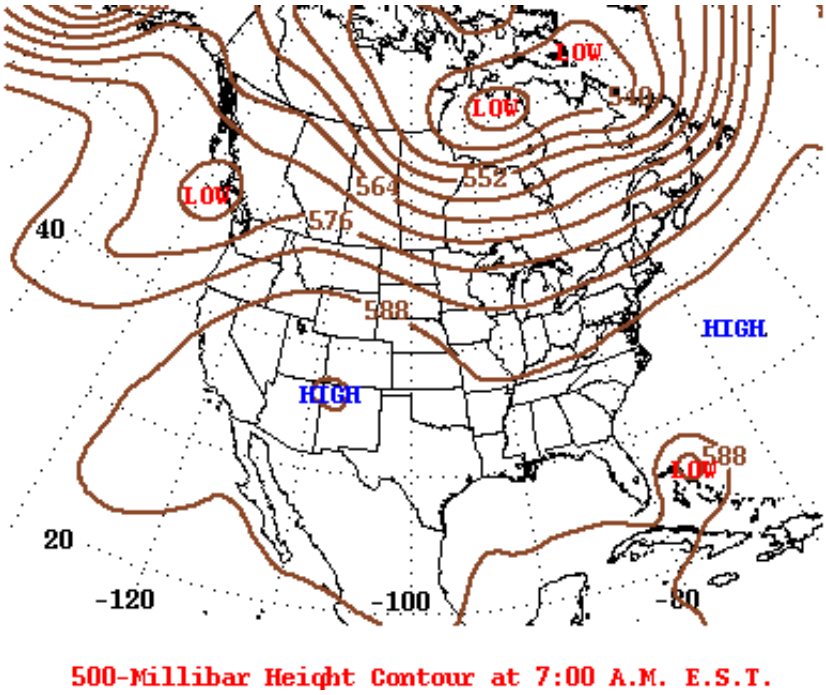


Figure E-14. 500 mb meteorology map on September 1, 2019.

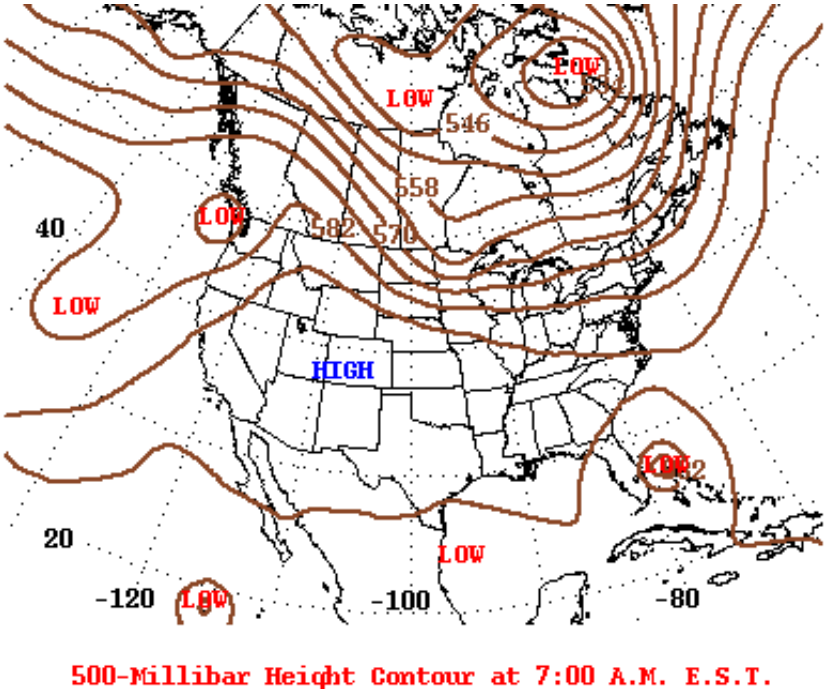


Figure E-15. 500 mb meteorology map on September 3, 2019.

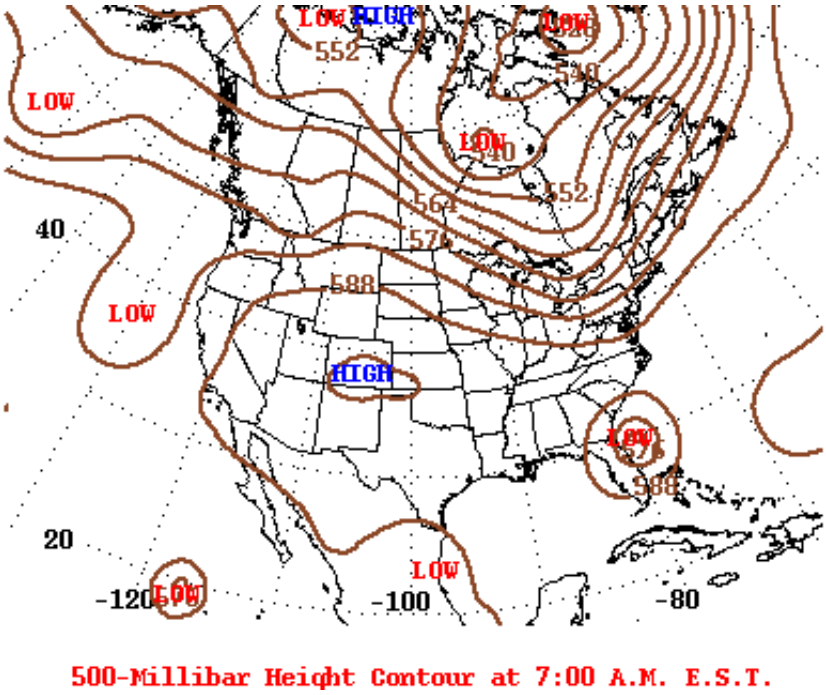


Figure E-16. 500 mb meteorology map on September 4, 2019.

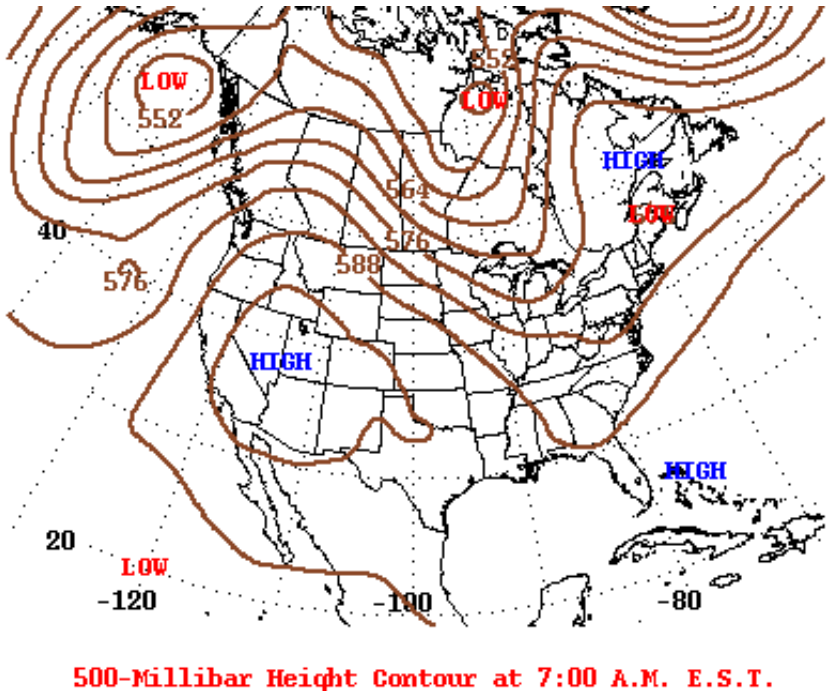


Figure E-17. 500 mb meteorology map on August 16, 2020.

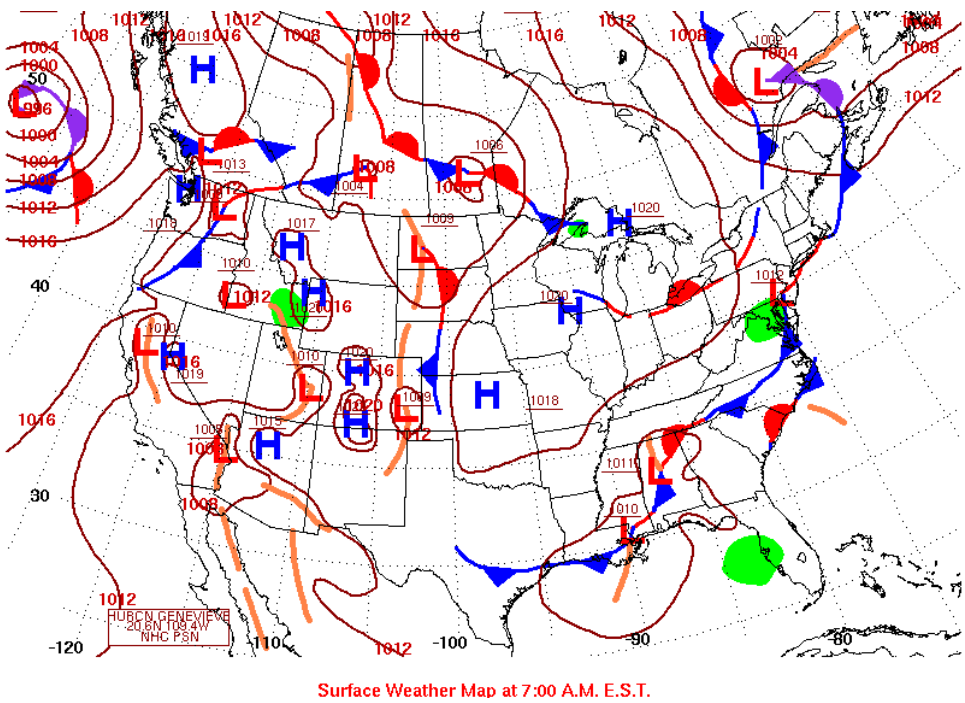


Figure E-18. Surface meteorology map on August 19, 2020 (event date).

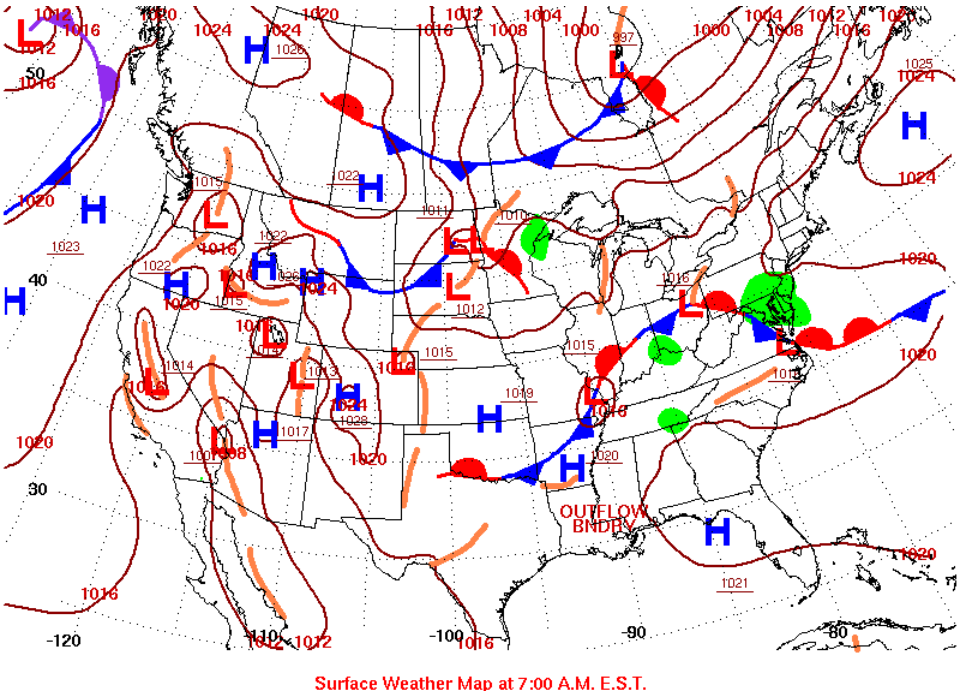


Figure E-19. Surface meteorology map on July 6, 2017.

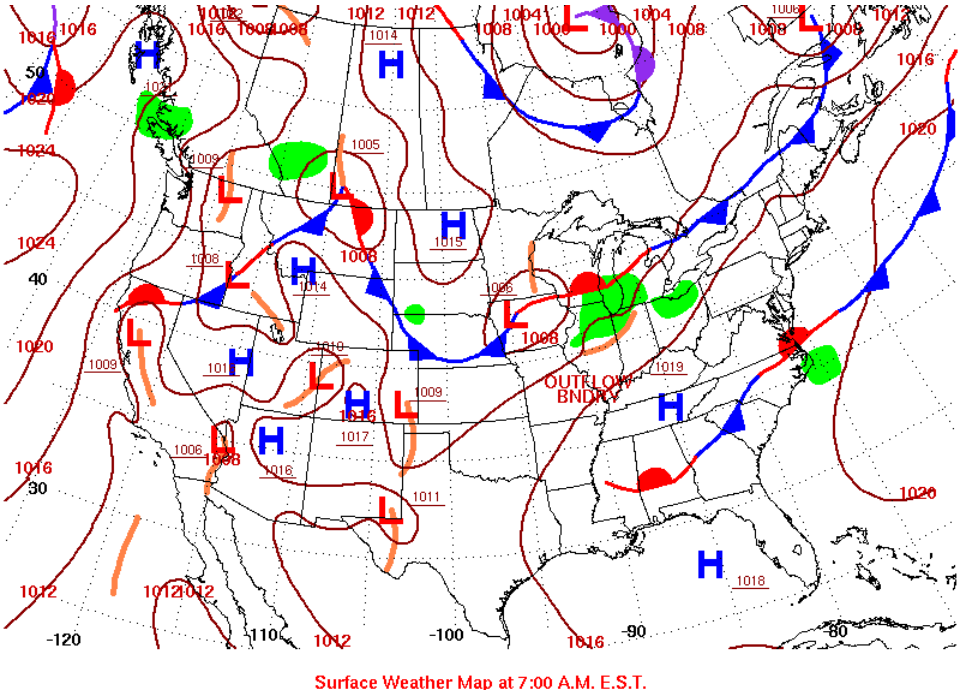


Figure E-20. Surface meteorology map on July 10, 2017.

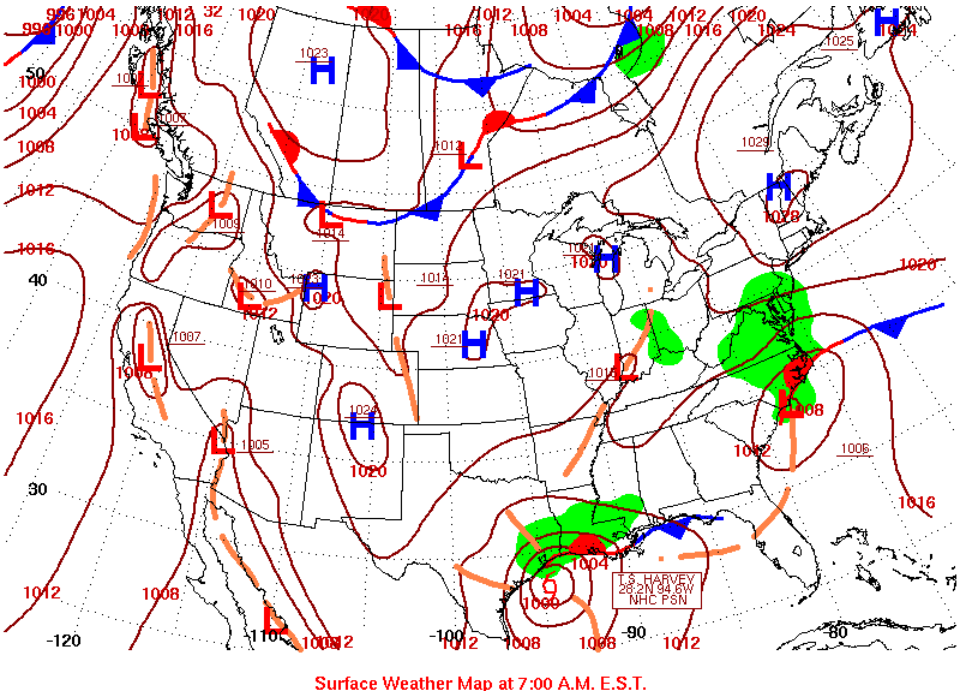


Figure E-21. Surface meteorology map on August 29, 2017.

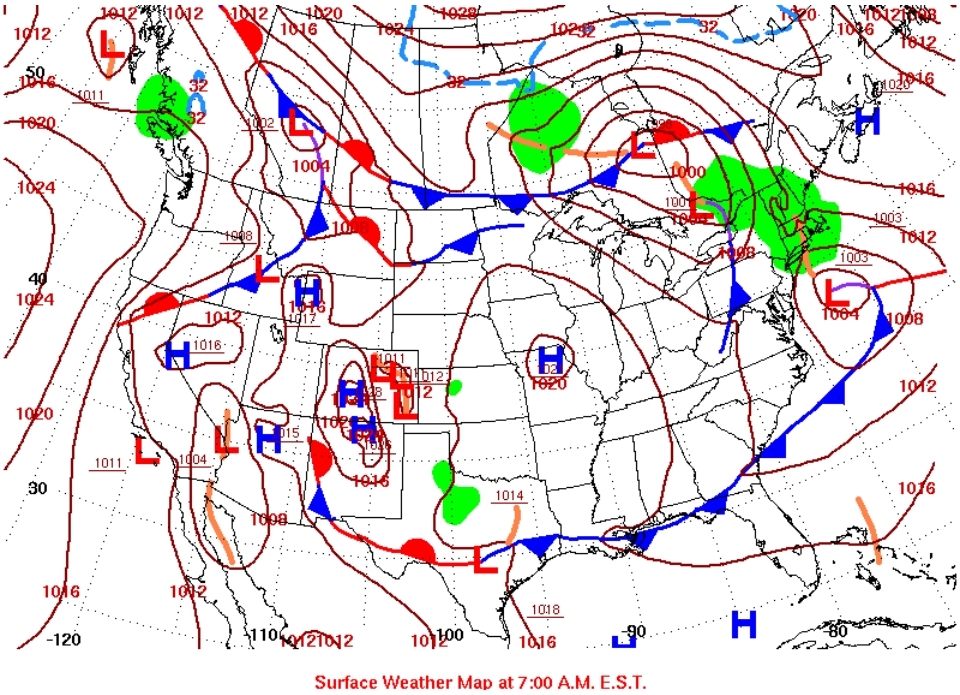


Figure E-22. Surface meteorology map on June 4, 2018.

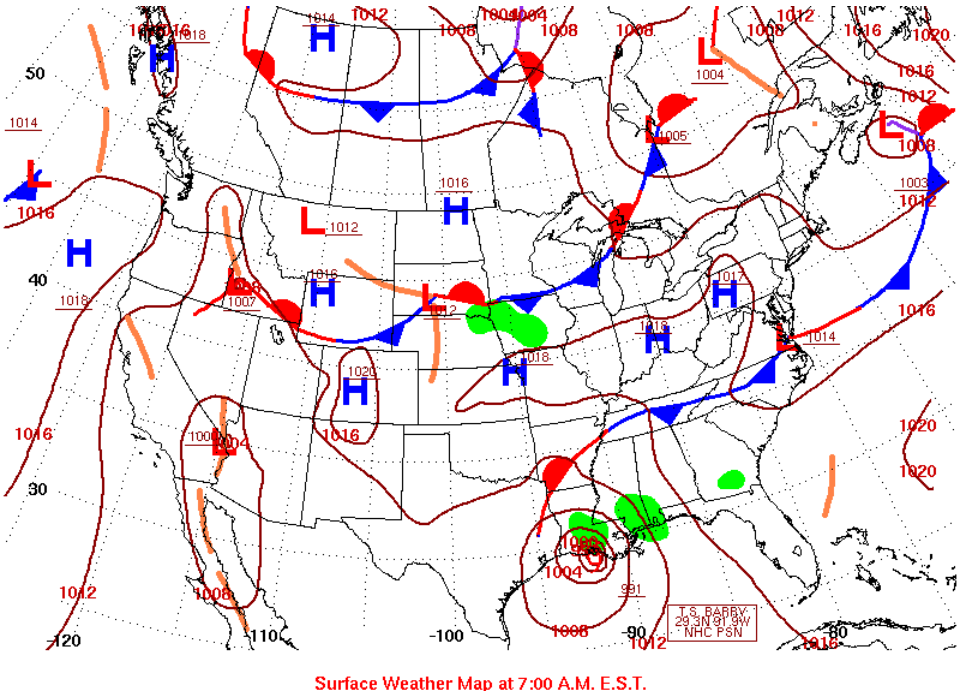


Figure E-23. Surface meteorology map on July 13, 2019.

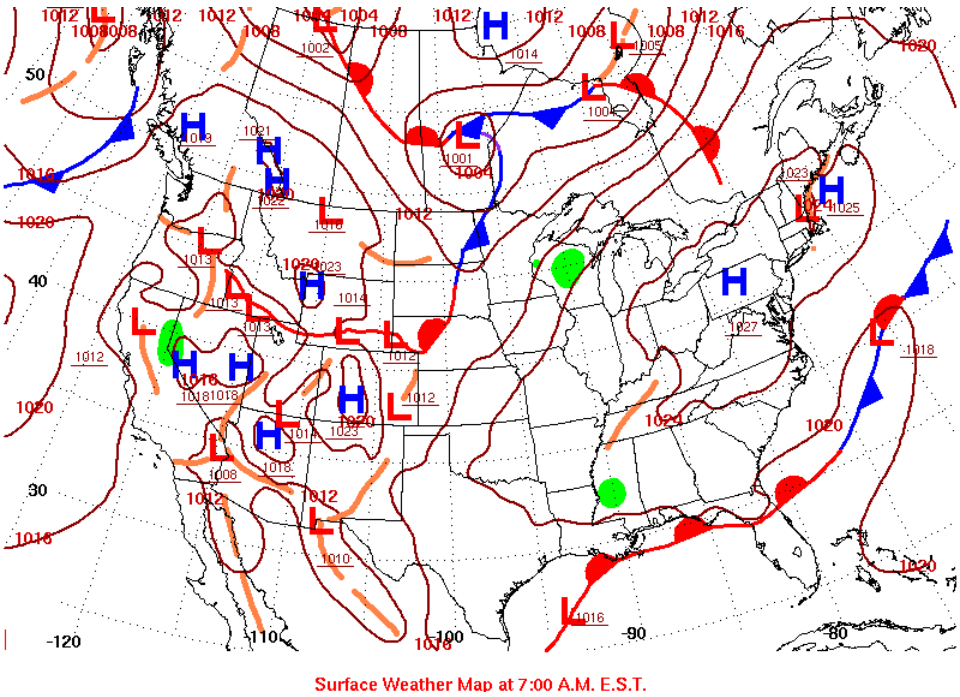


Figure E-24. Surface meteorology map on July 26, 2019.

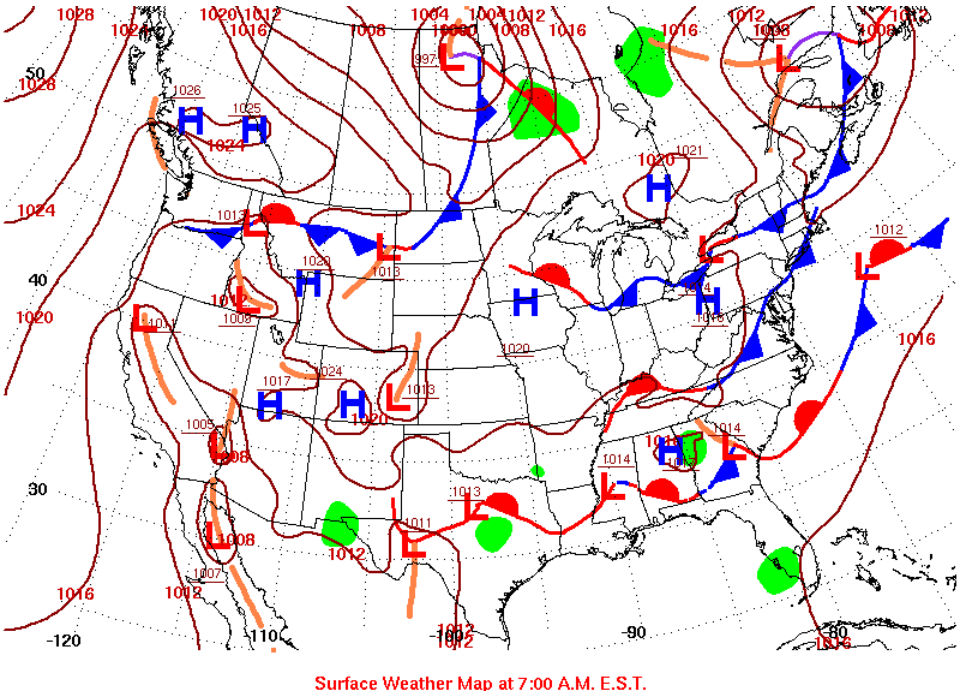


Figure E-25. Surface meteorology map on August 4, 2019.

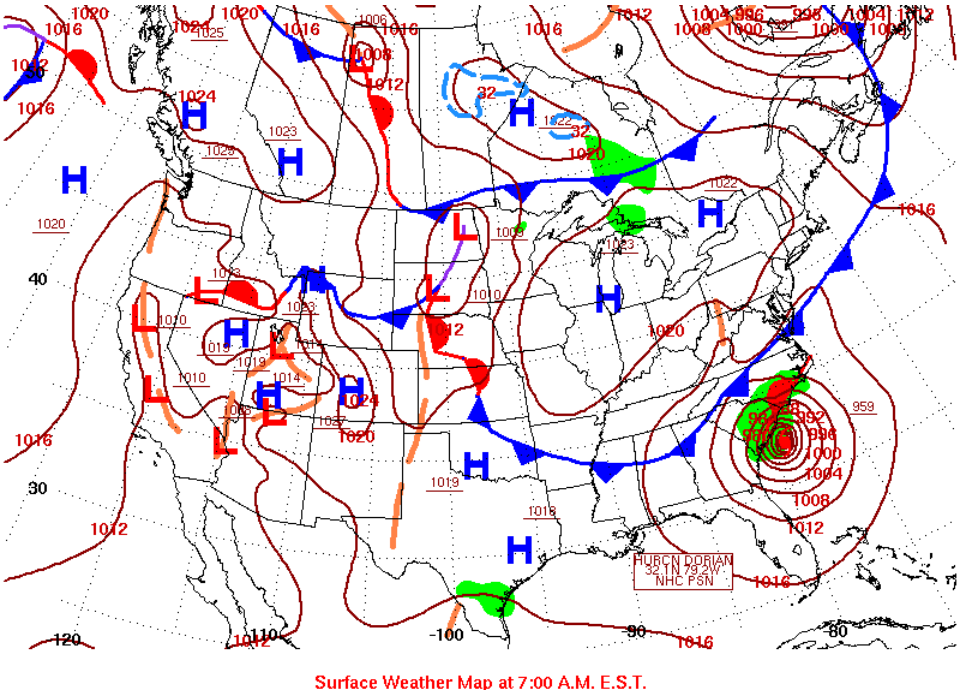


Figure E-26. Surface meteorology map on September 5, 2019.

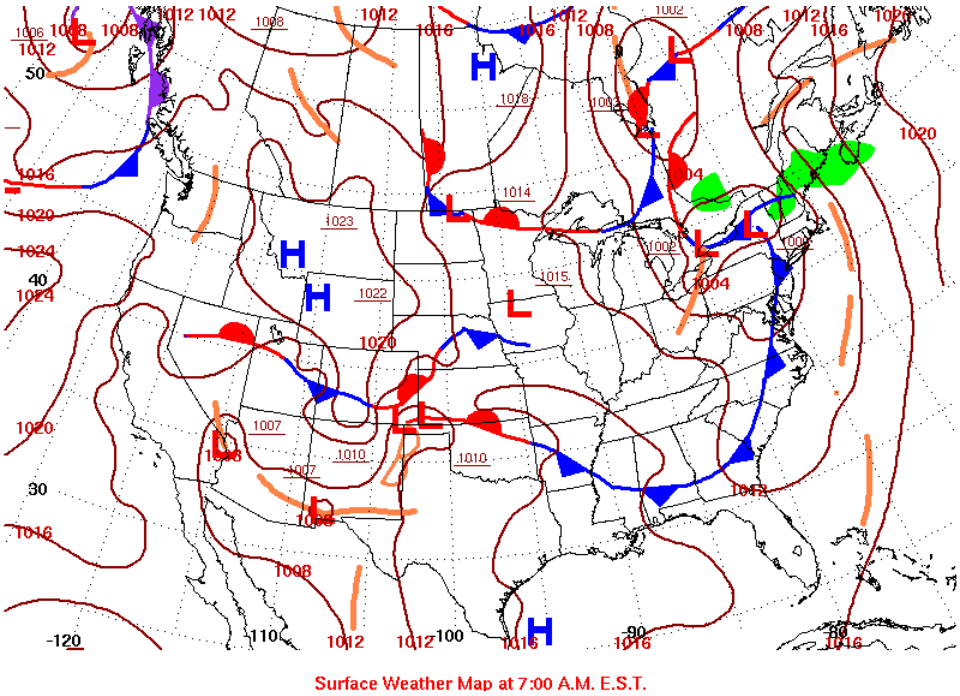


Figure E-27. Surface meteorology map on July 11, 2020.

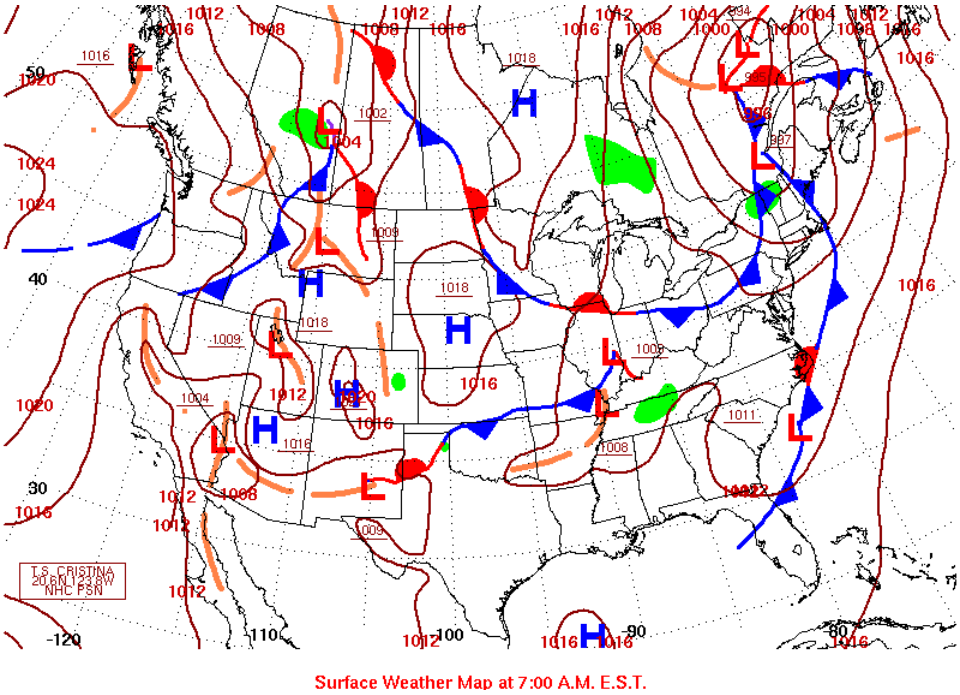


Figure E-28. Surface meteorology map on July 12, 2020.

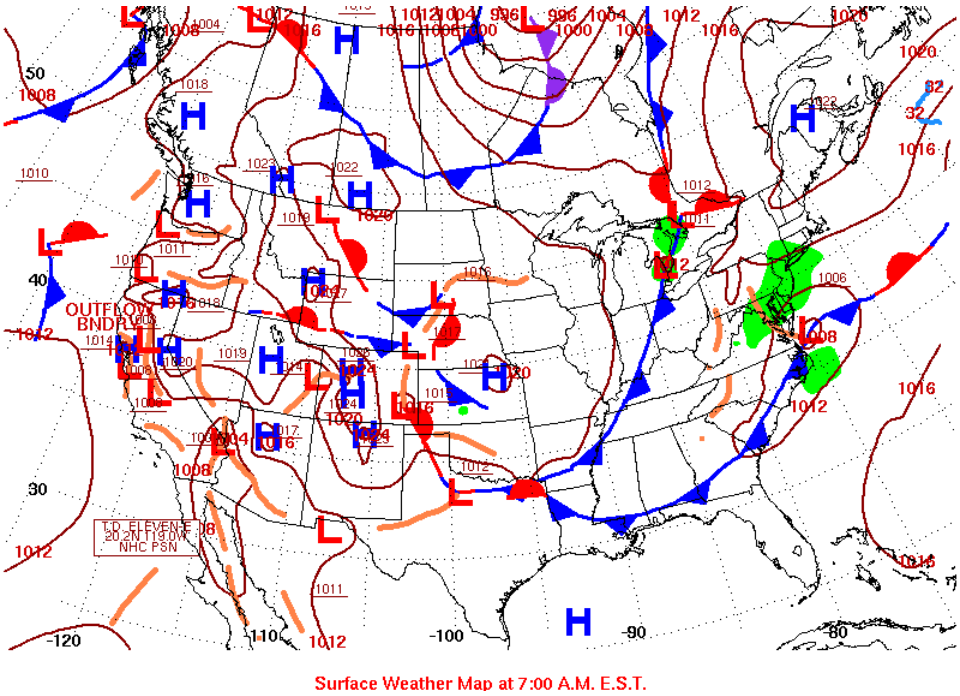


Figure E-29. Surface meteorology map on August 16, 2020.

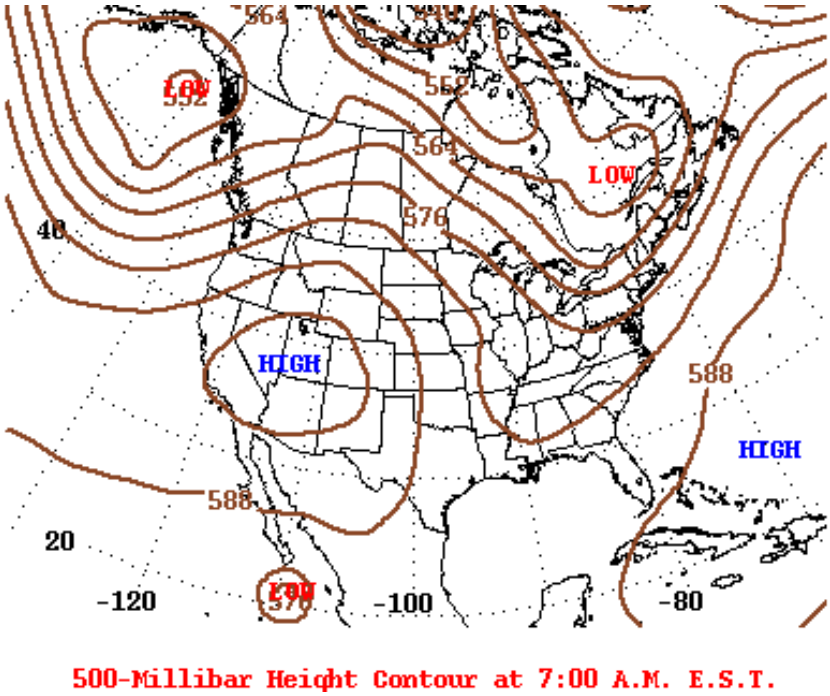


Figure E-30. 500 mb meteorology map on August 19, 2020 (event date).

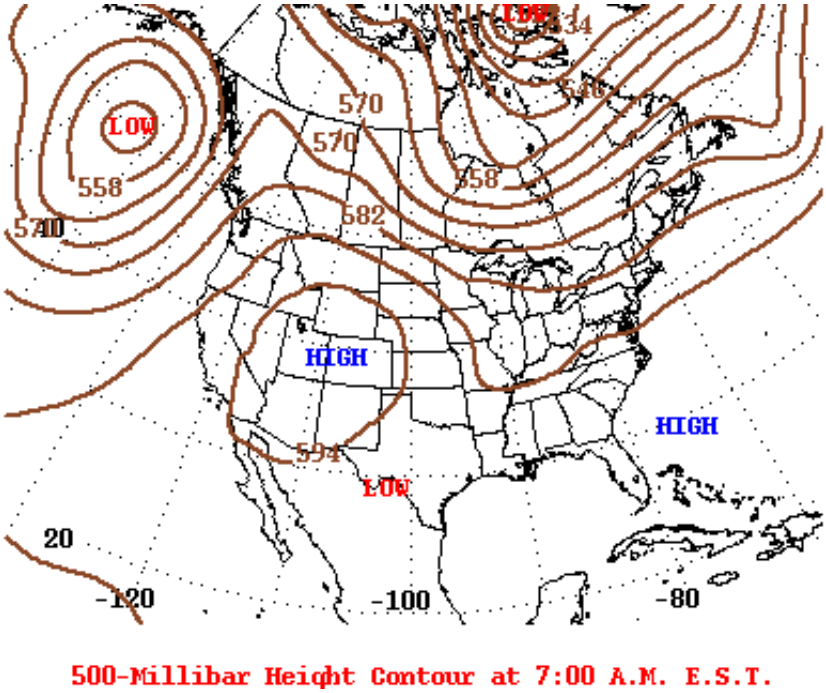


Figure E-31. 500 mb meteorology map on July 6, 2017.

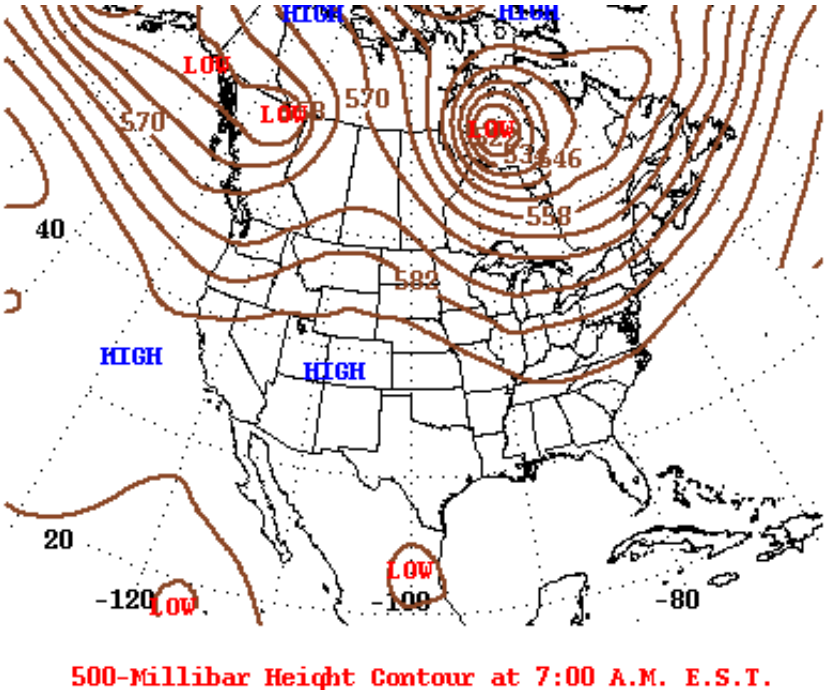


Figure E-32. 500 mb meteorology map on July 10, 2017.

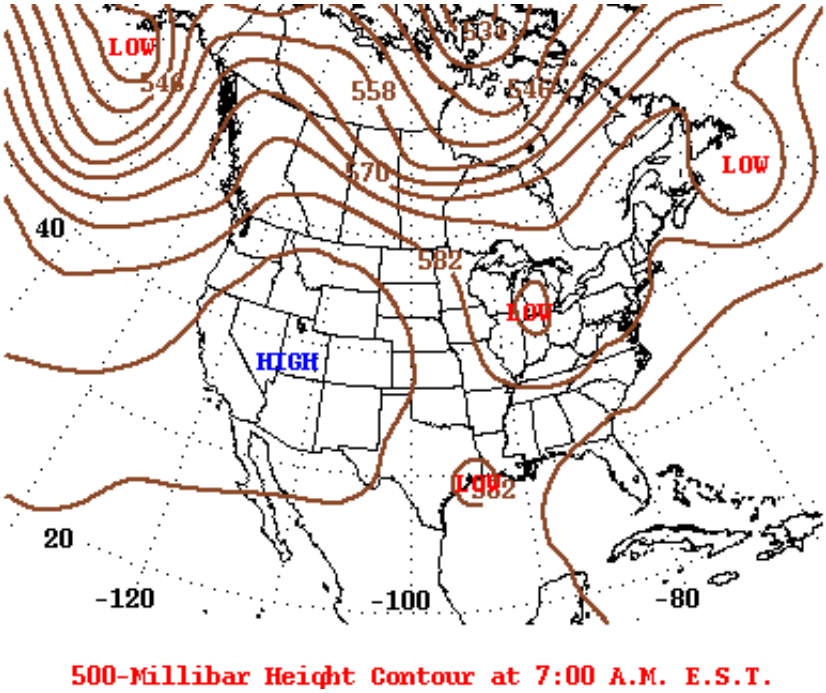


Figure E-33. 500 mb meteorology map on August 29, 2017.

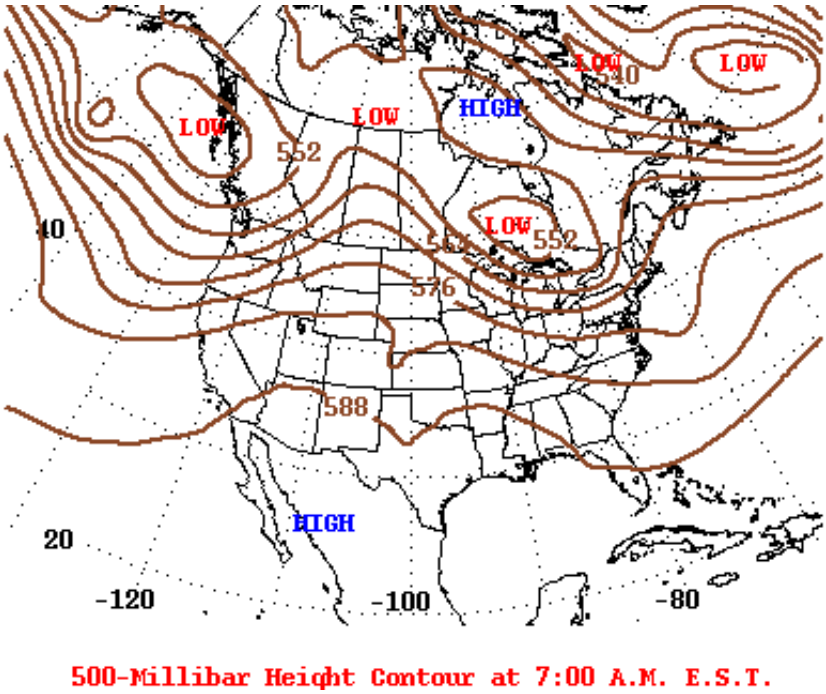


Figure E-34. 500 mb meteorology map on June 4, 2018.

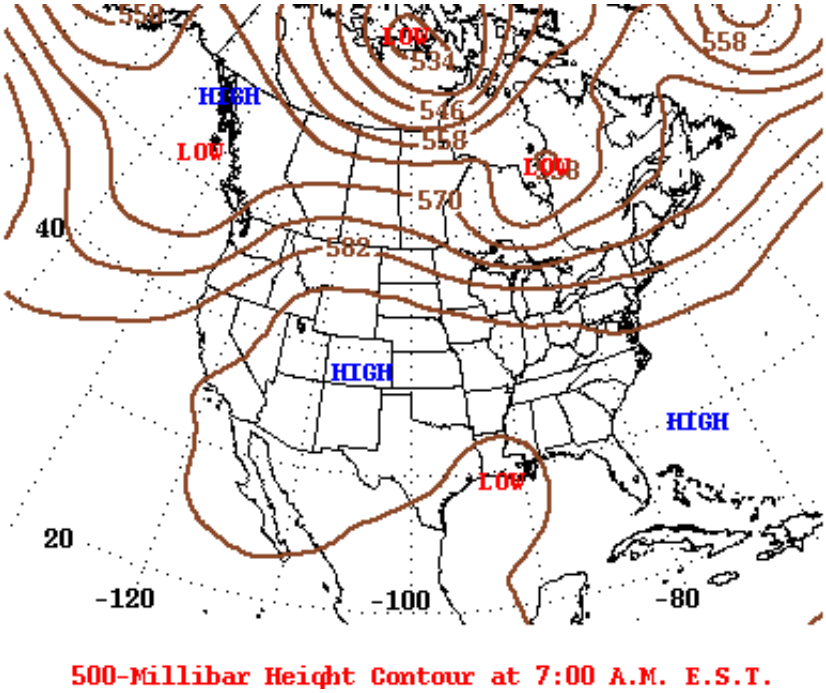


Figure E-35. 500 mb meteorology map on July 13, 2019.

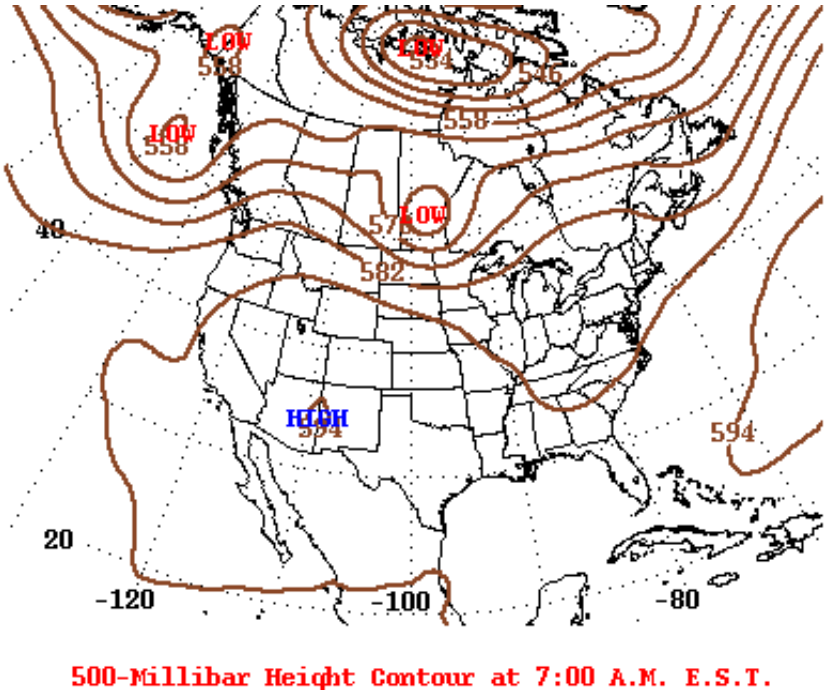


Figure E-36. 500 mb meteorology map on July 26, 2019.

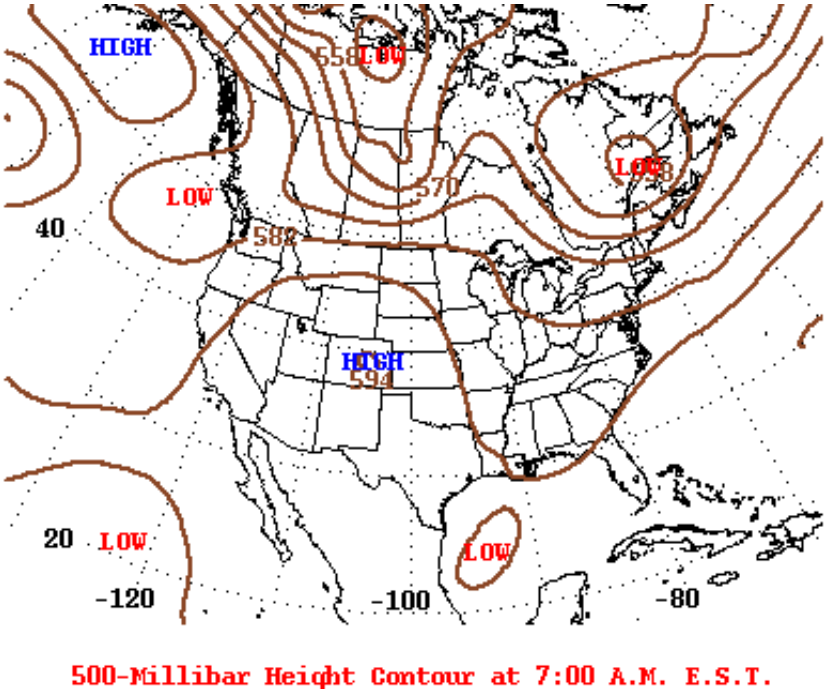


Figure E-37. 500 mb meteorology map on August 4, 2019.

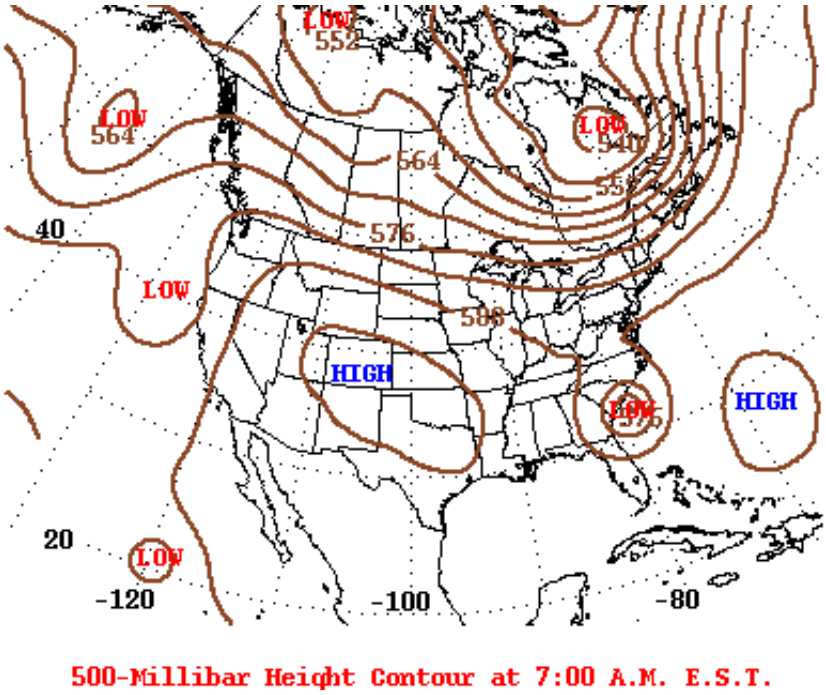


Figure E-38. 500 mb meteorology map on September 5, 2019.

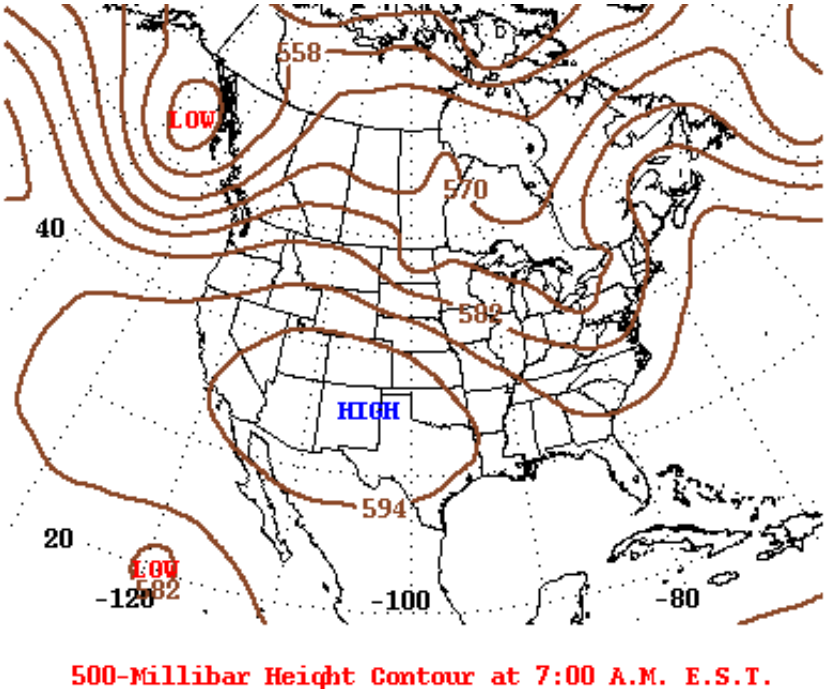


Figure E-39. 500 mb meteorology map on July 11, 2020.

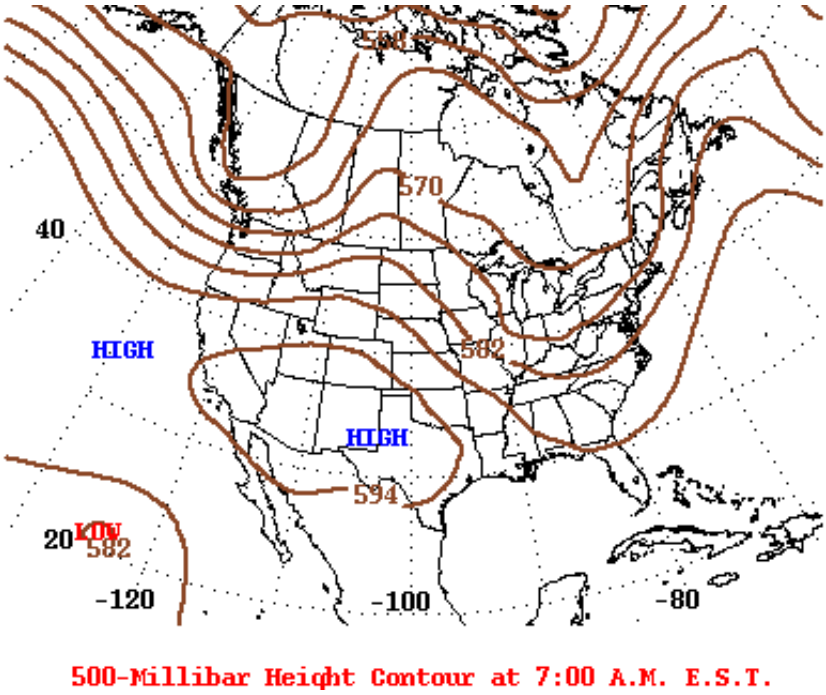


Figure E-40. 500 mb meteorology map on July 12, 2020.

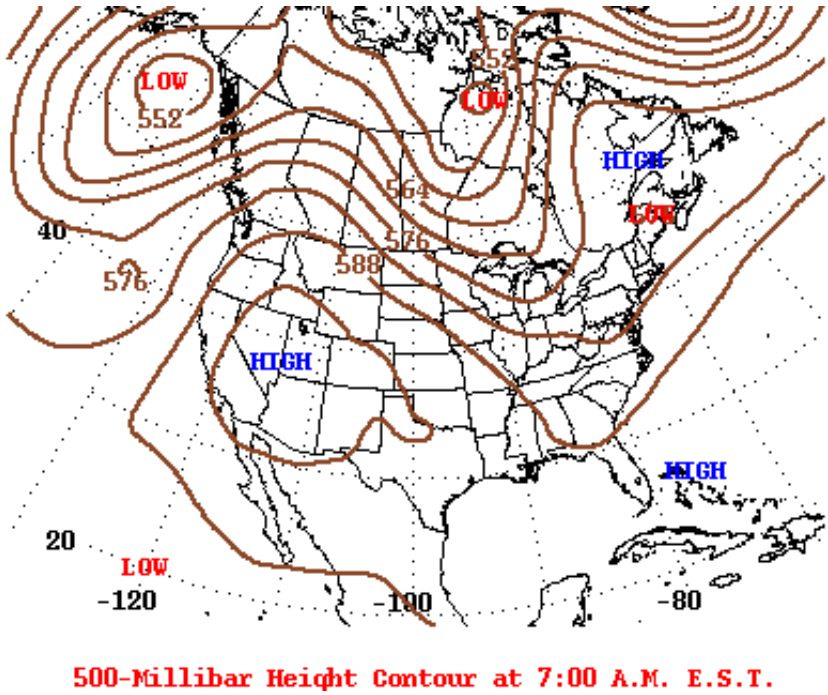


Figure E-41. 500 mb meteorology map on August 16, 2020.

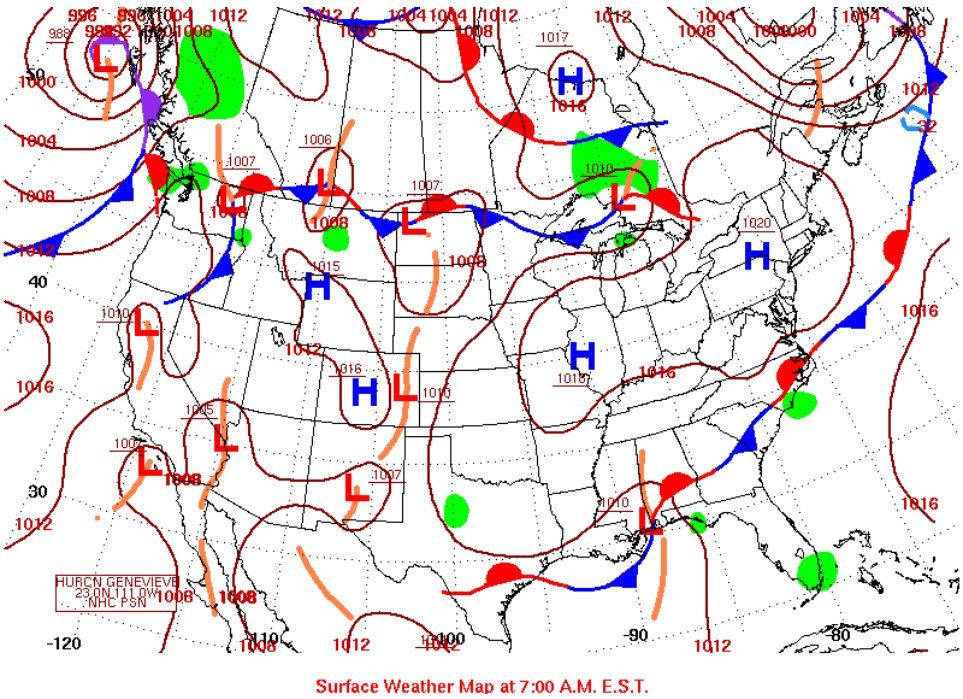


Figure E-42. Surface meteorology map on August 20, 2020 (event date).

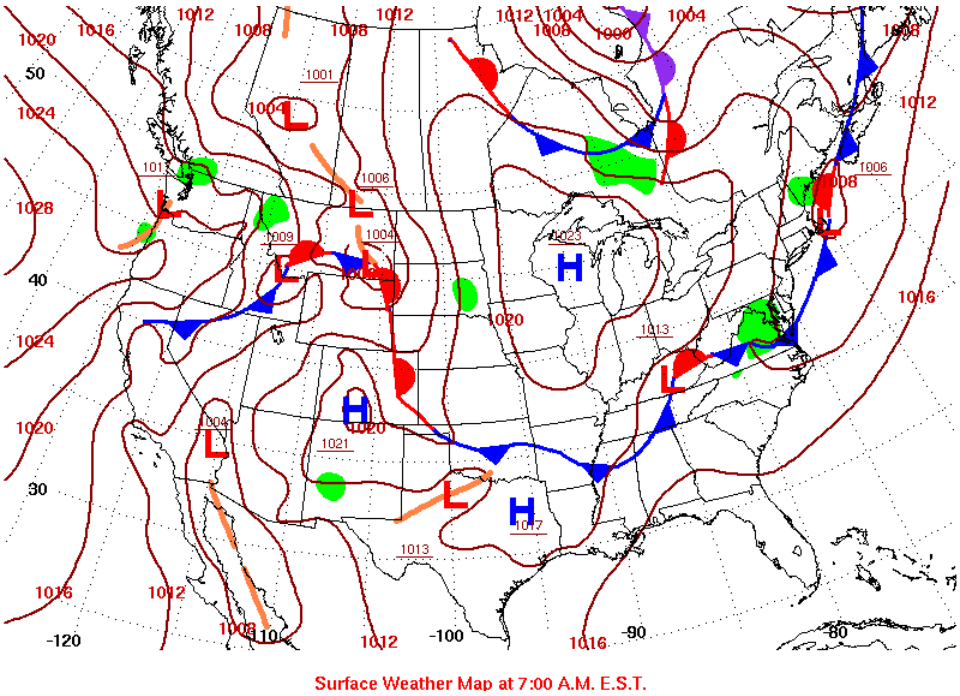


Figure E-43. Surface meteorology map on July 24, 2014.

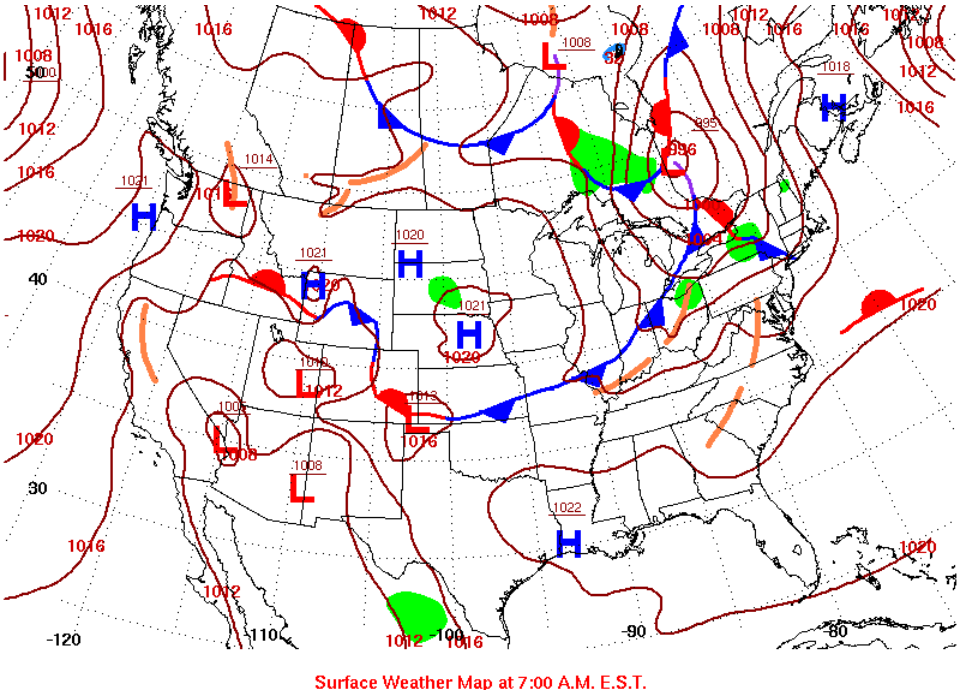


Figure E-44. Surface meteorology map on June 23, 2015.

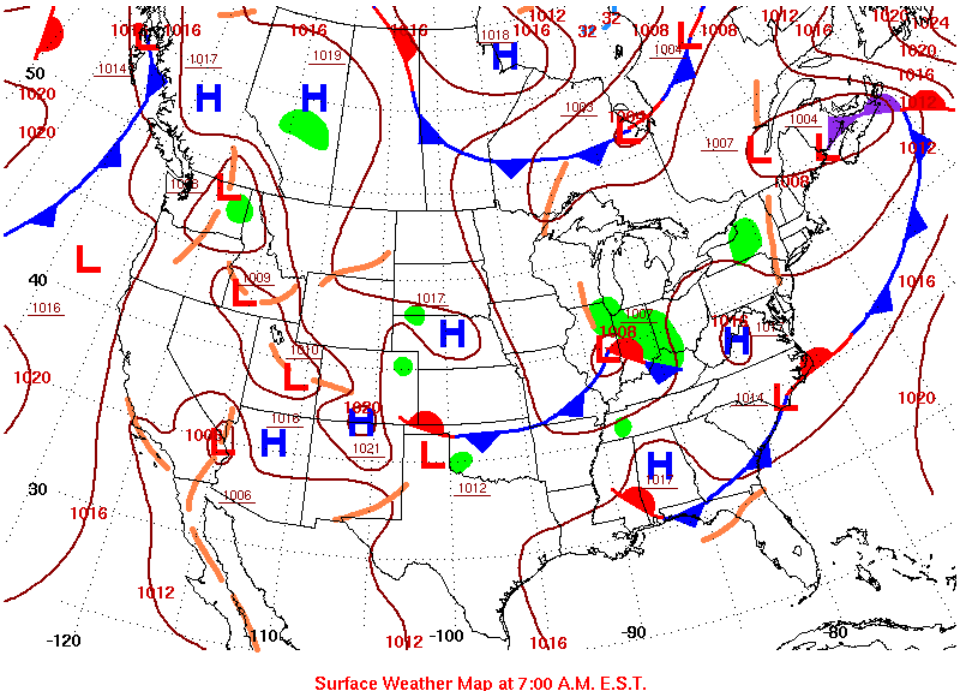


Figure E-45. Surface meteorology map on June 29, 2015.

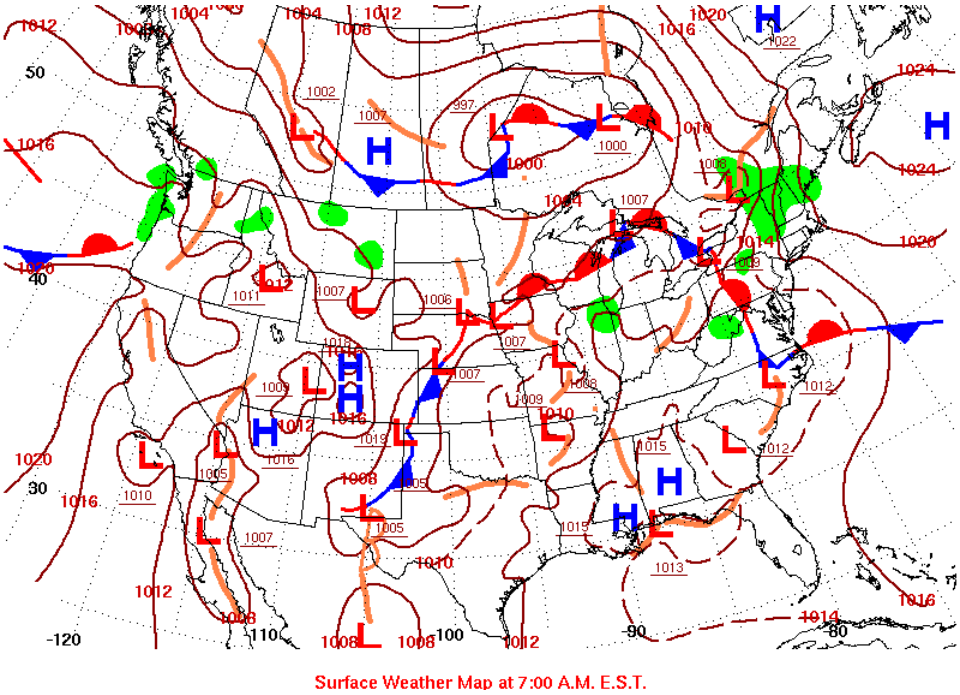


Figure E-46. Surface meteorology map on June 16, 2017.

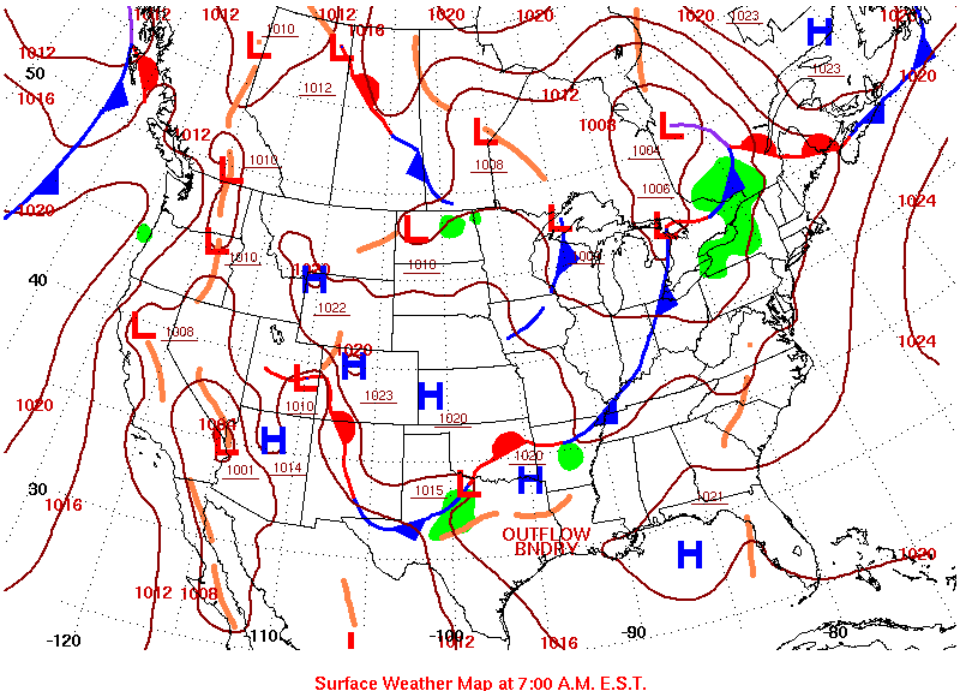


Figure E-47. Surface meteorology map on July 1, 2017.

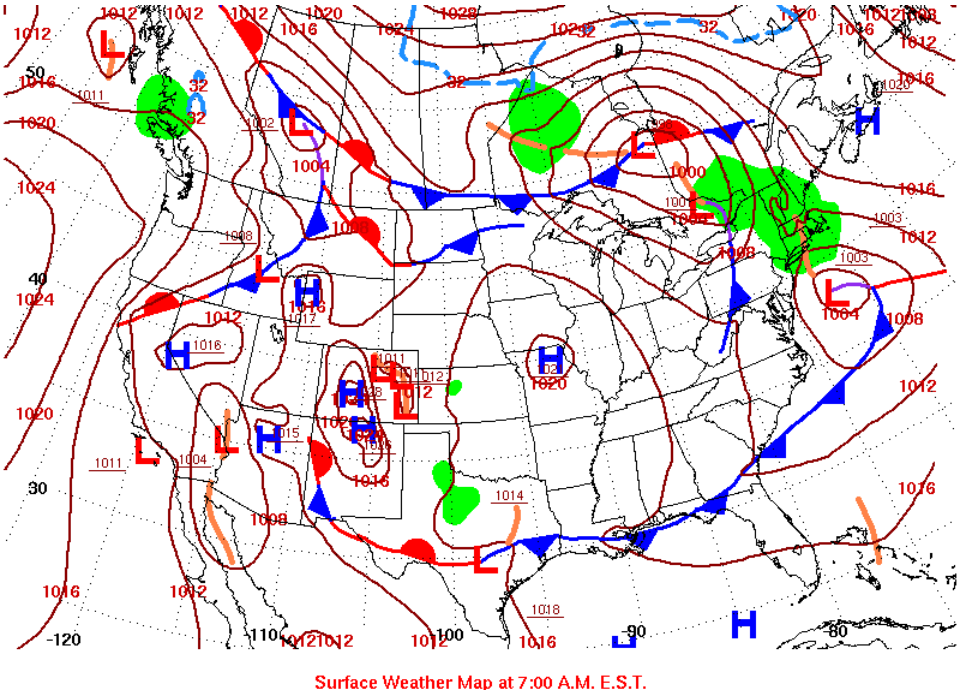


Figure E-48. Surface meteorology map on June 4, 2018.

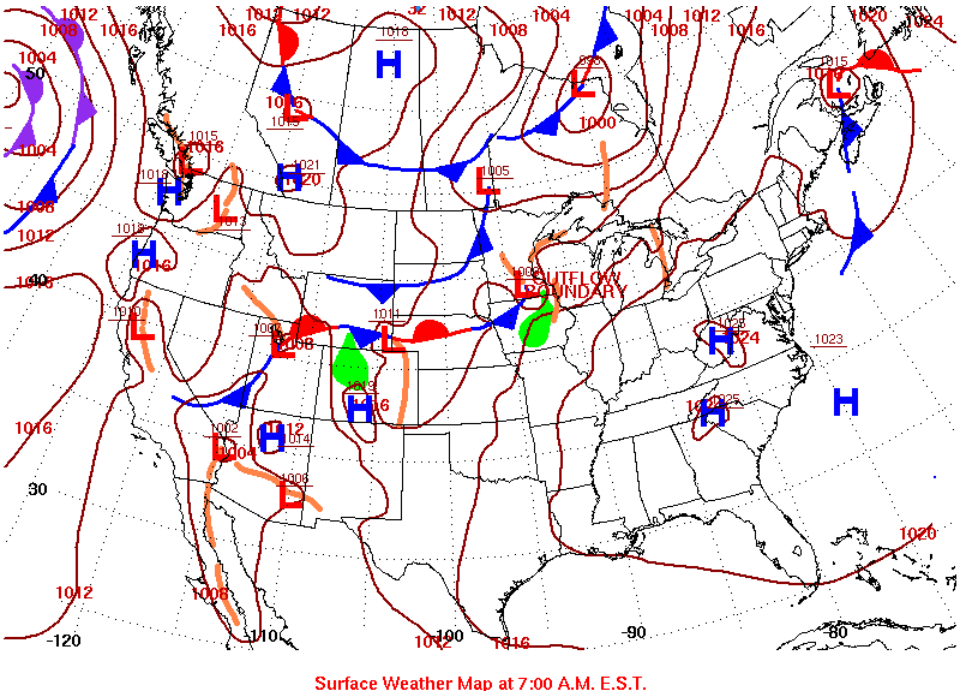


Figure E-49. Surface meteorology map on August 5, 2018.

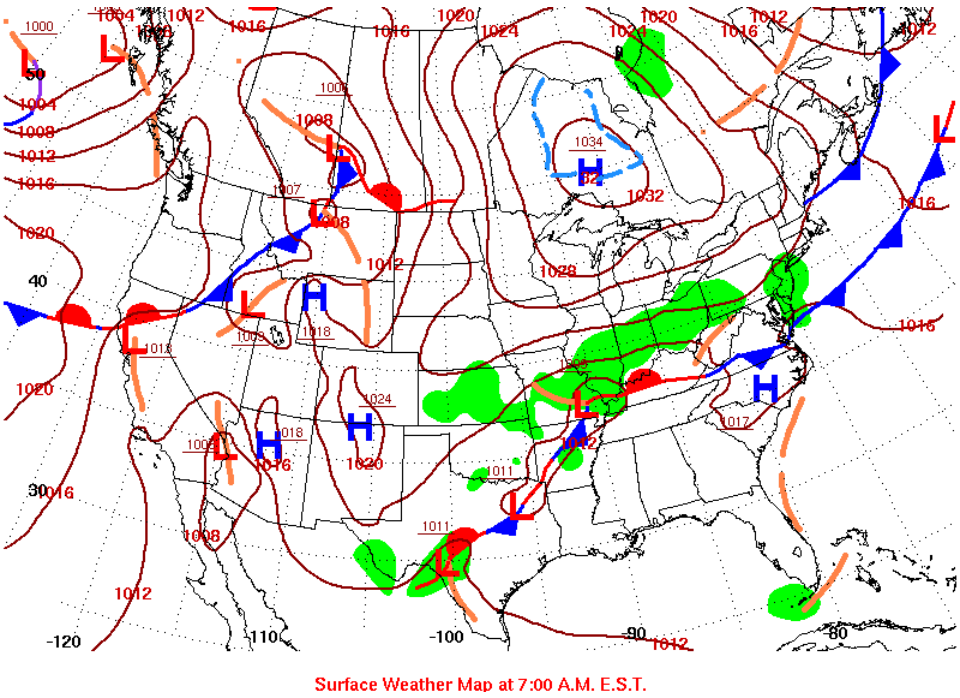


Figure E-50. Surface meteorology map on September 8, 2018.

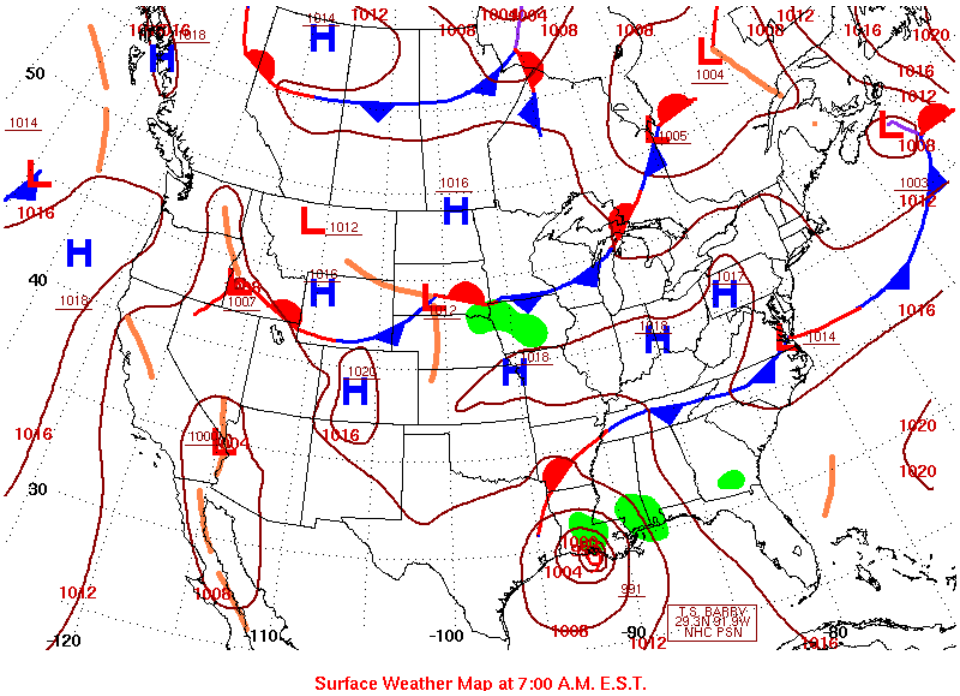


Figure E-51. Surface meteorology map on July 13, 2019.

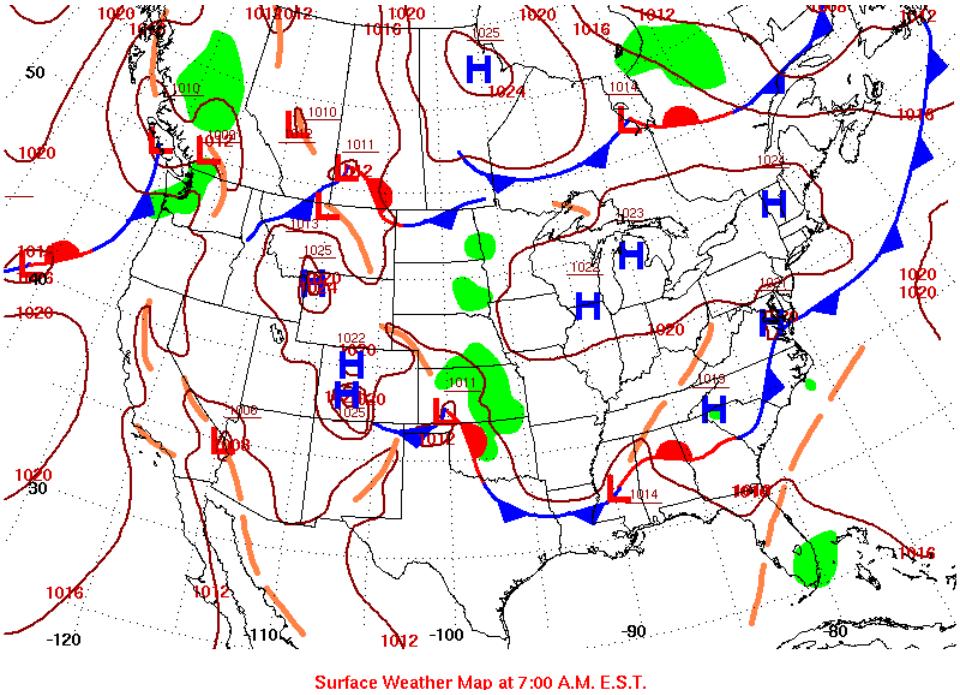


Figure E-52. Surface meteorology map on August 2, 2019.

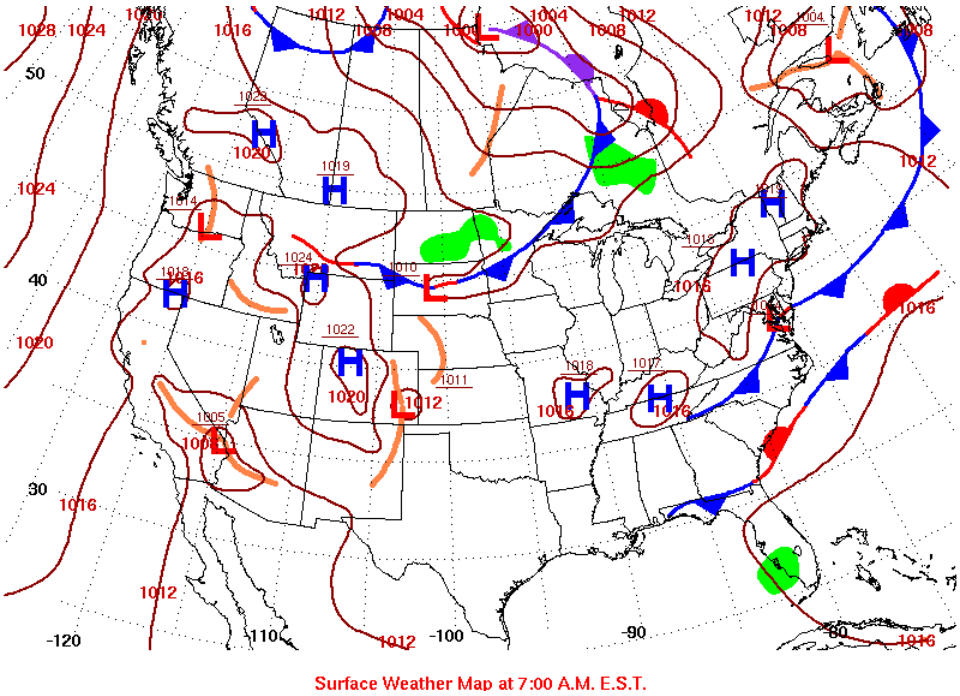


Figure E-53. Surface meteorology map on August 5, 2019.

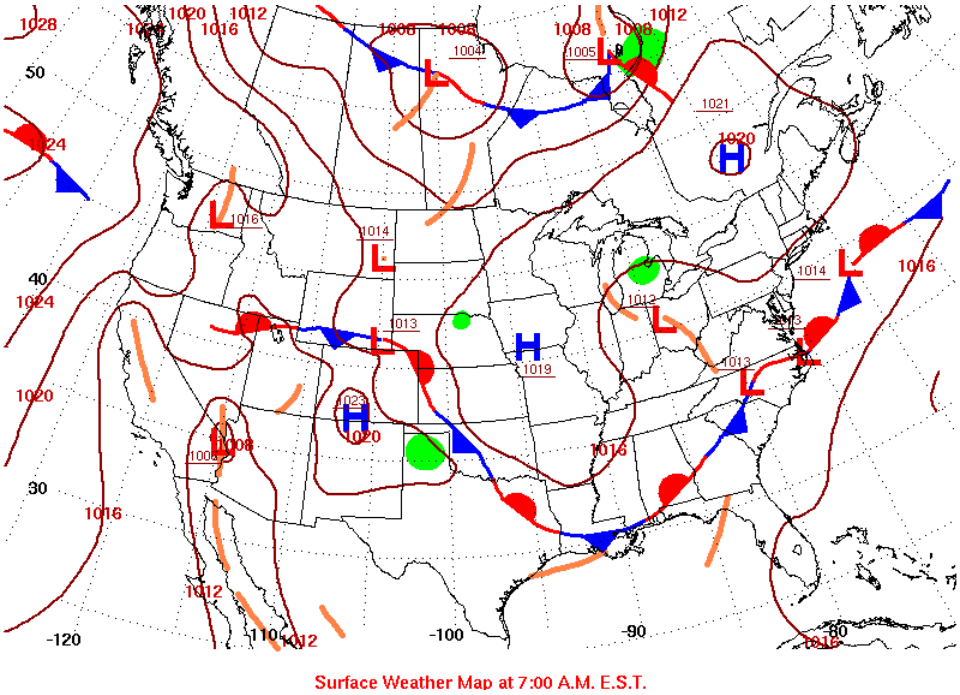


Figure E-54. Surface meteorology map on August 15, 2019.

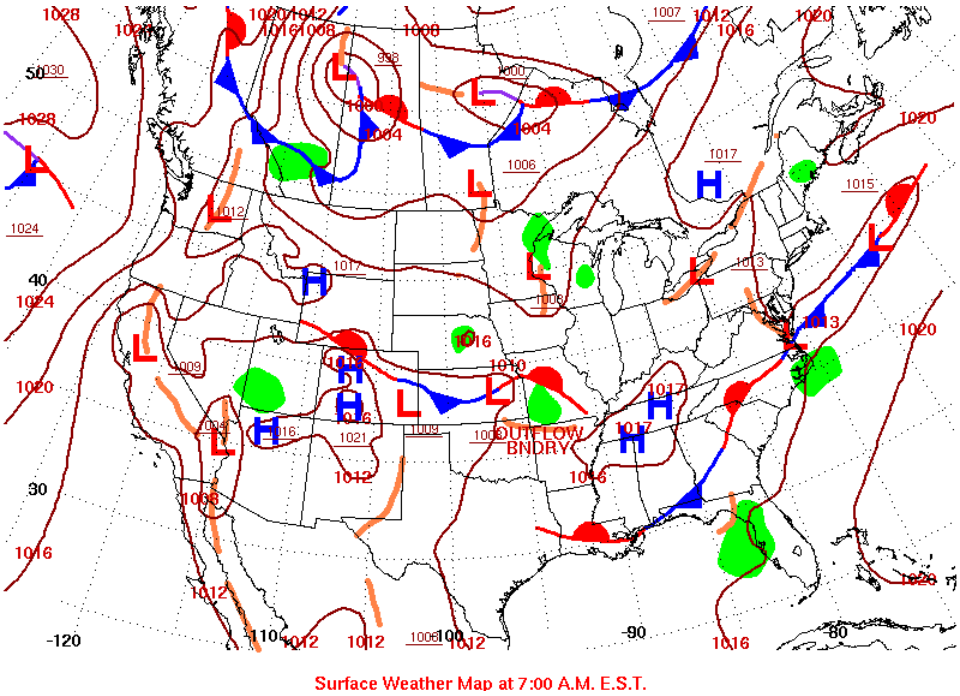


Figure E-55. Surface meteorology map on August 16, 2019.

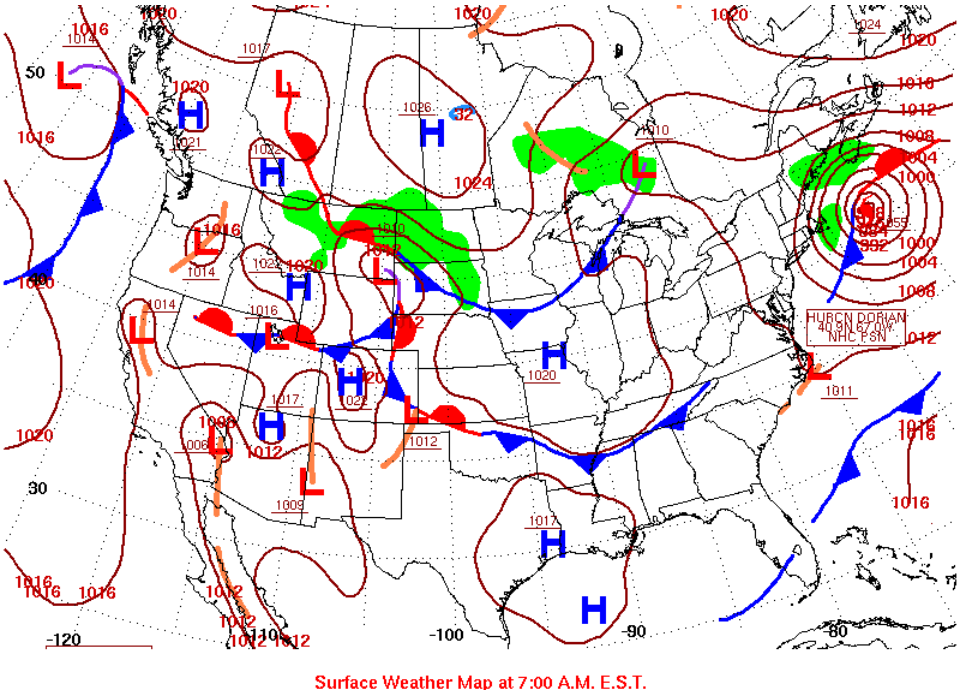


Figure E-56. Surface meteorology map on September 7, 2019.

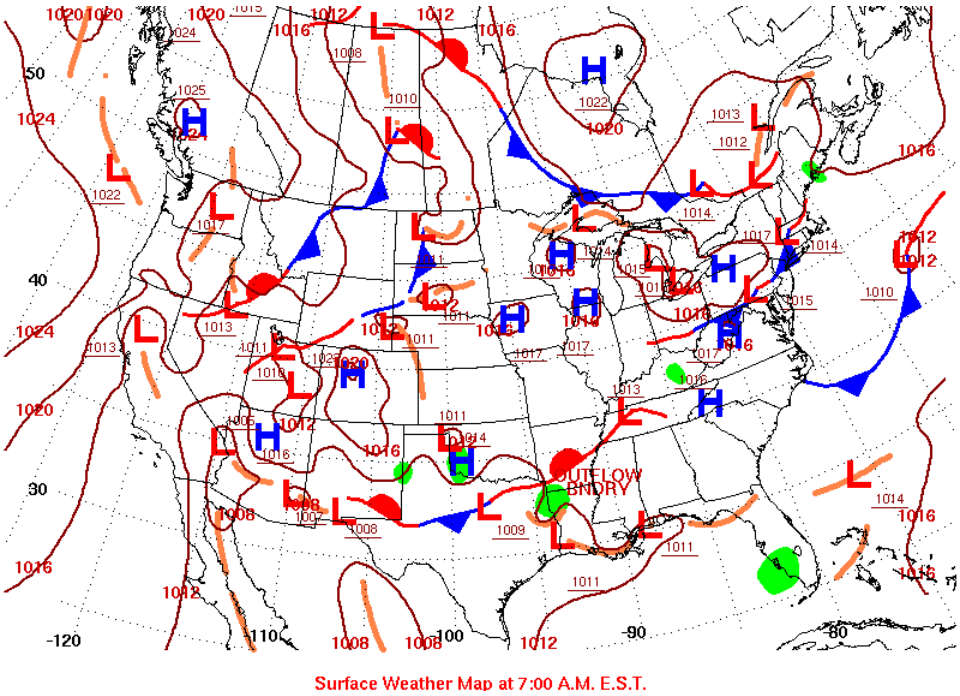


Figure E-57. Surface meteorology map on July 5, 2020.

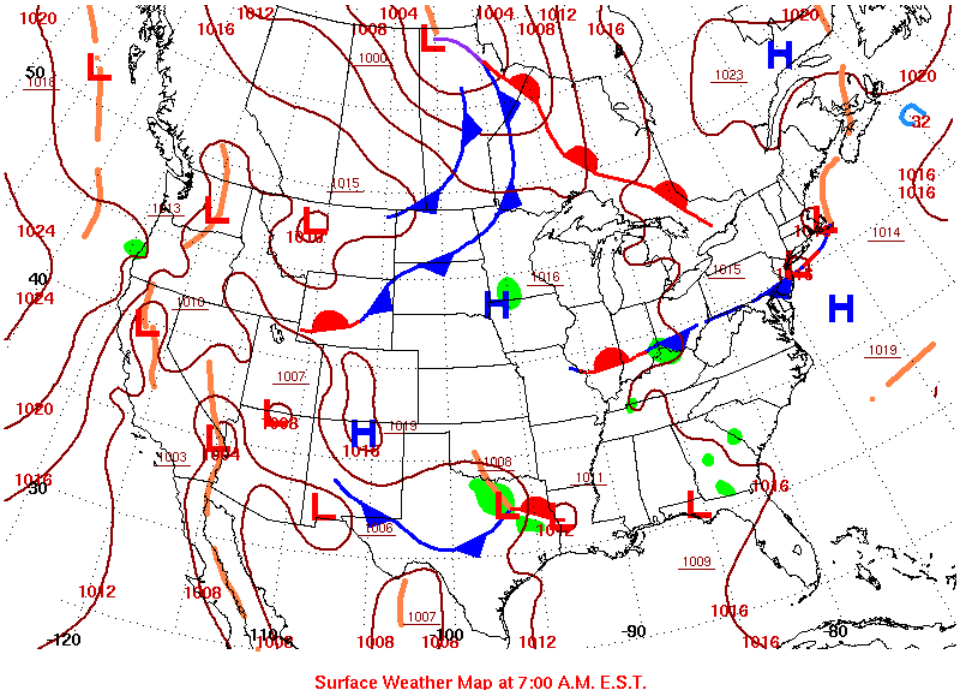


Figure E-58. Surface meteorology map on July 6, 2020.

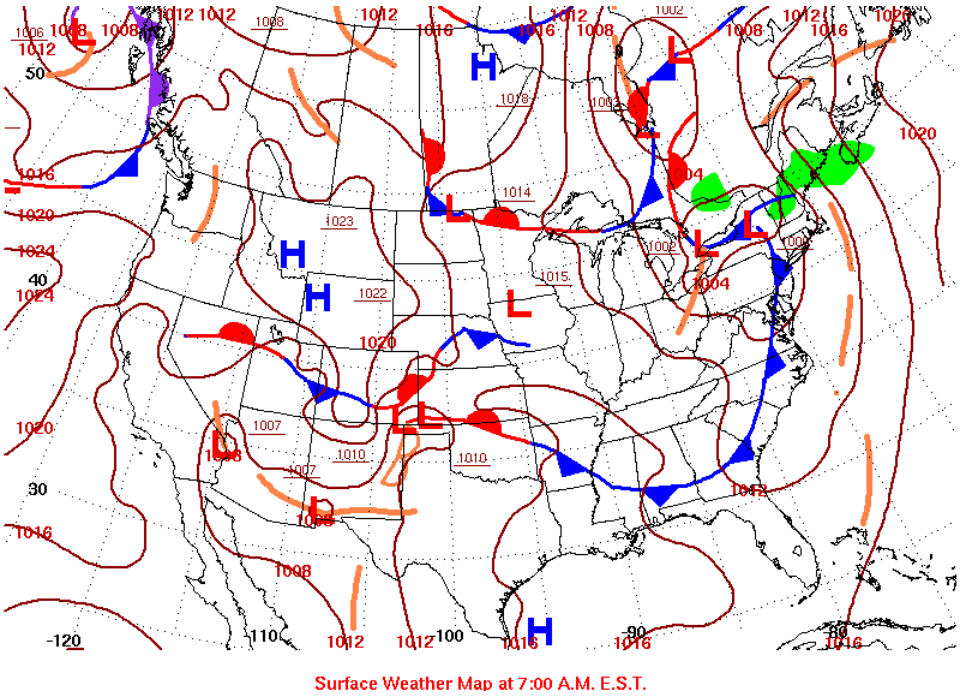


Figure E-59. Surface meteorology map on July 11, 2020.

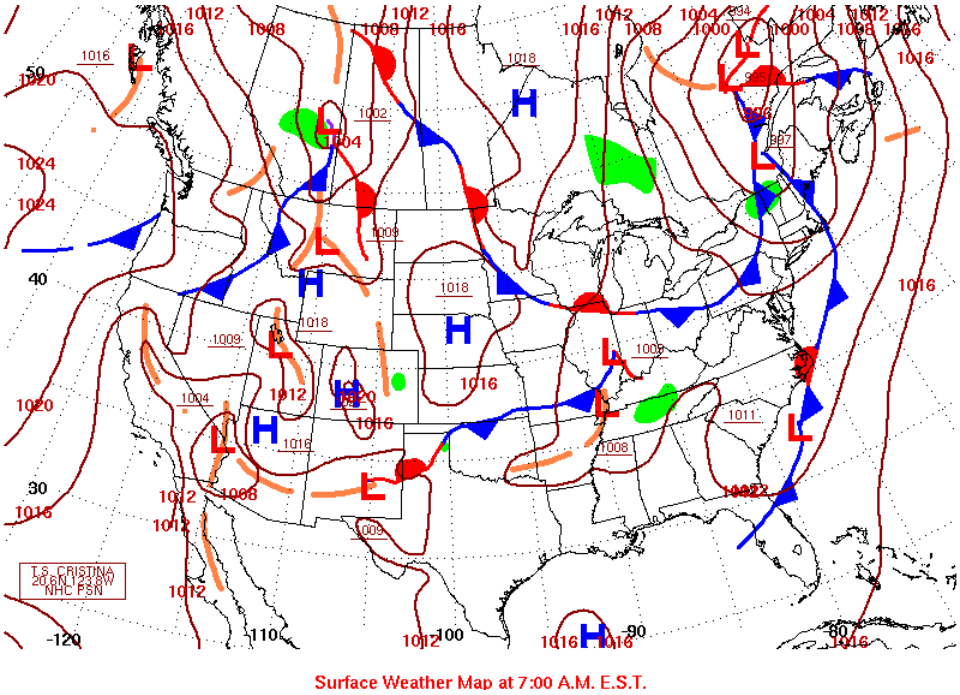


Figure E-60. Surface meteorology map on July 12, 2020.

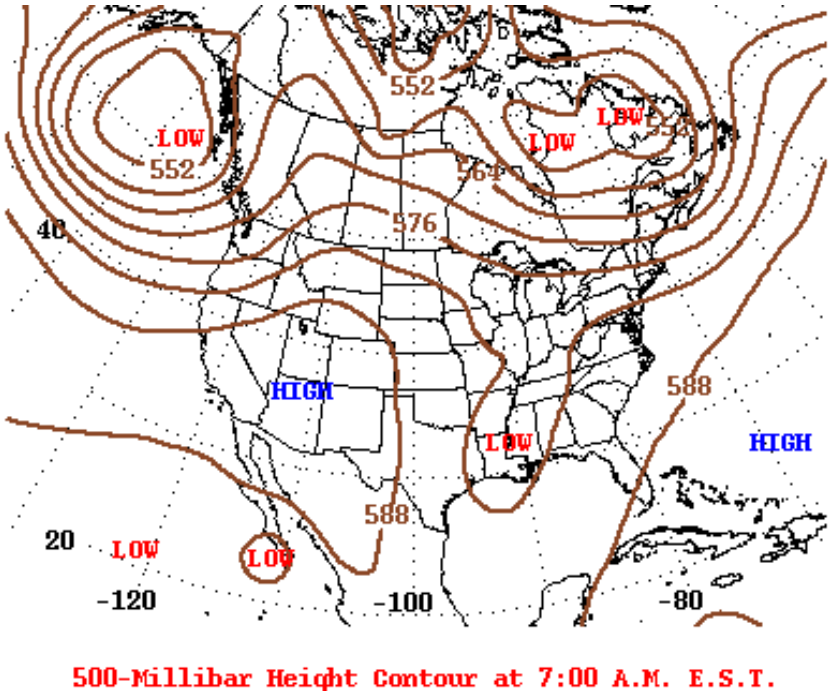


Figure E-61. 500 mb meteorology map on August 20, 2020 (event date).

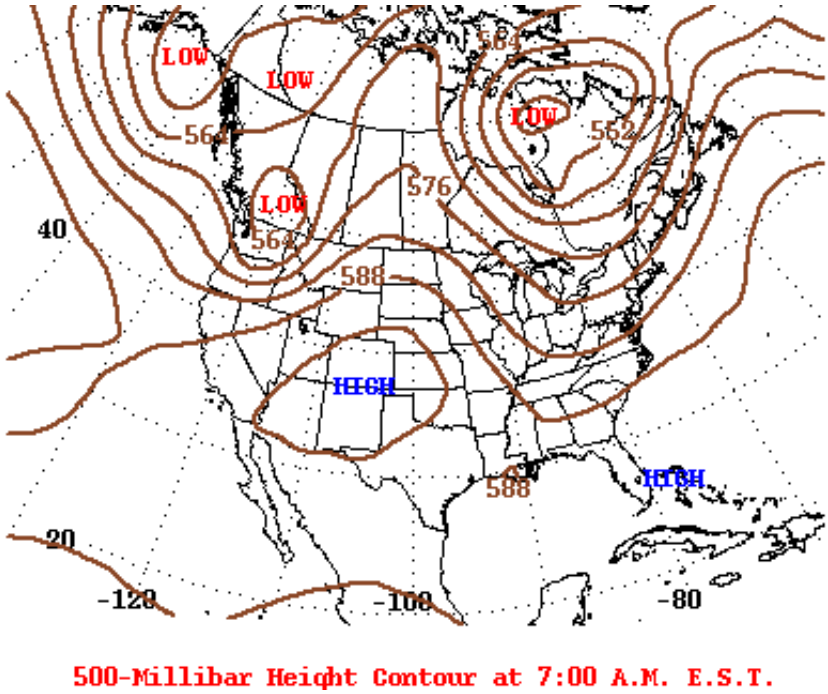


Figure E-62. 500 mb meteorology map on July 24, 2014.

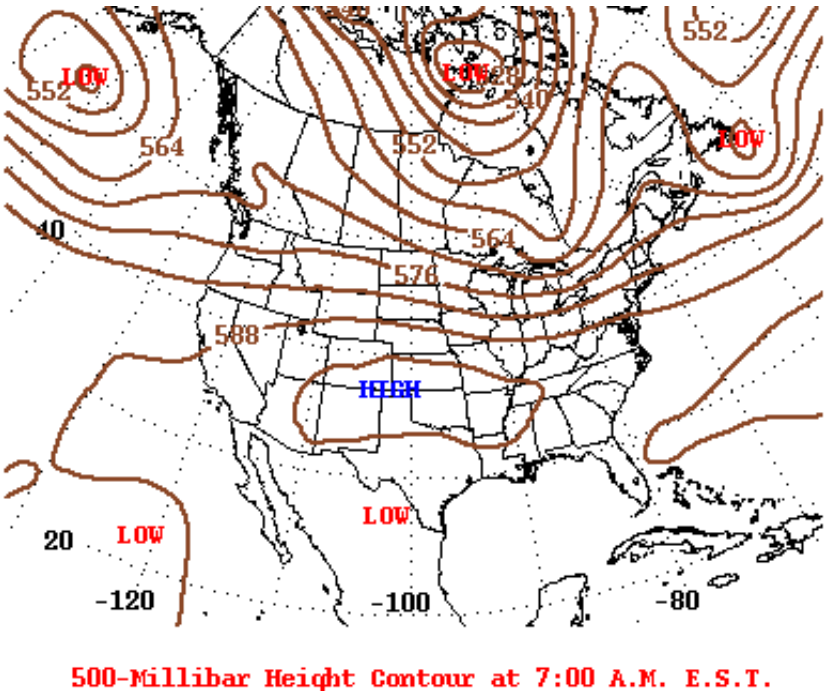


Figure E-63. 500 mb meteorology map on June 23, 2015.

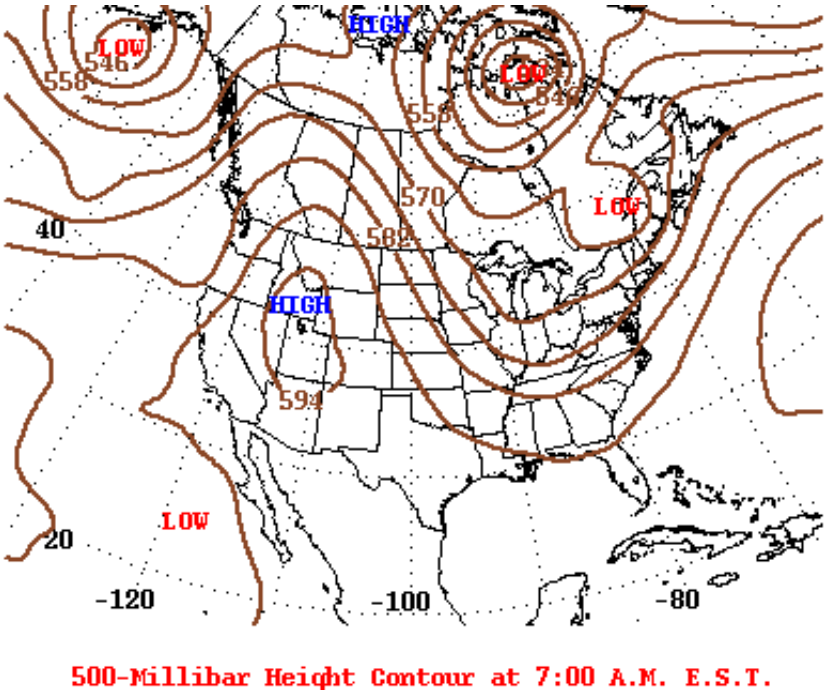


Figure E-64. 500 mb meteorology map on June 29, 2015.

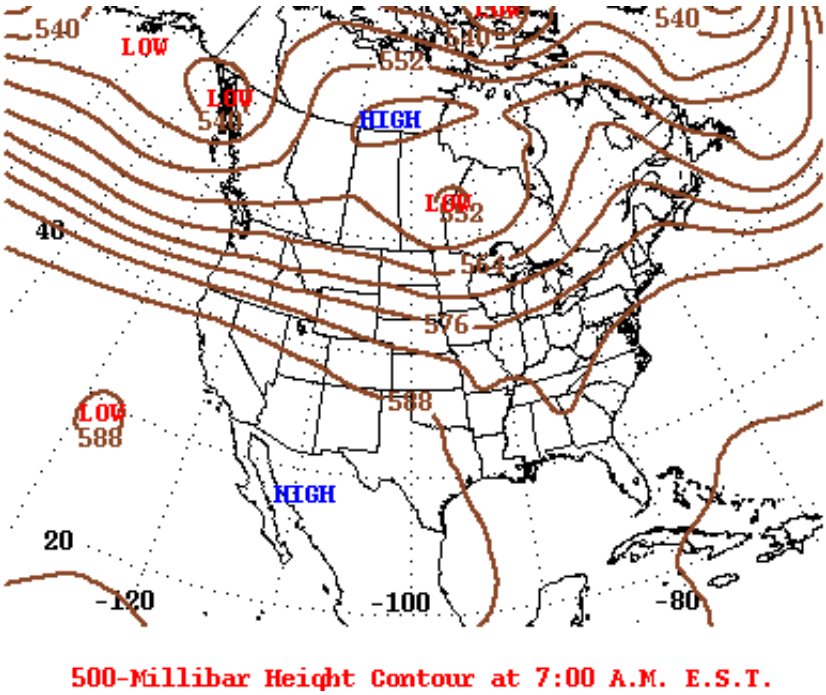


Figure E-65. 500 mb meteorology map on June 16, 2017.

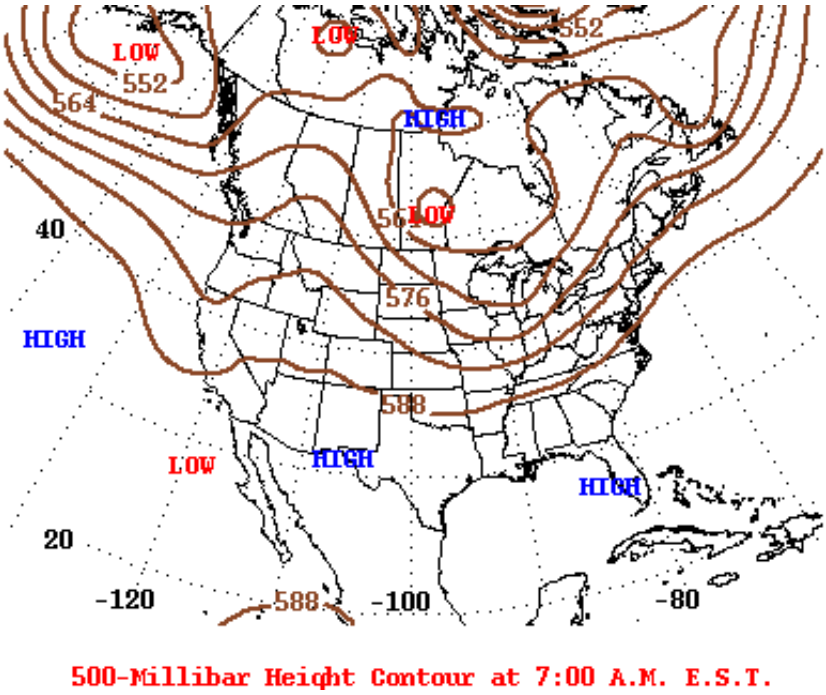


Figure E-66. 500 mb meteorology map on July 1, 2017.

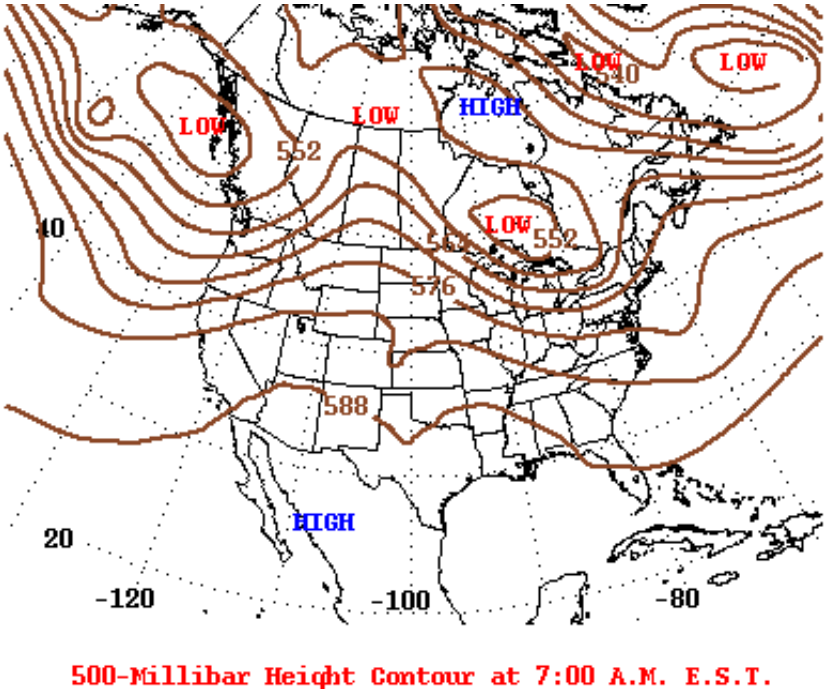


Figure E-67. 500 mb meteorology map on June 4, 2018.

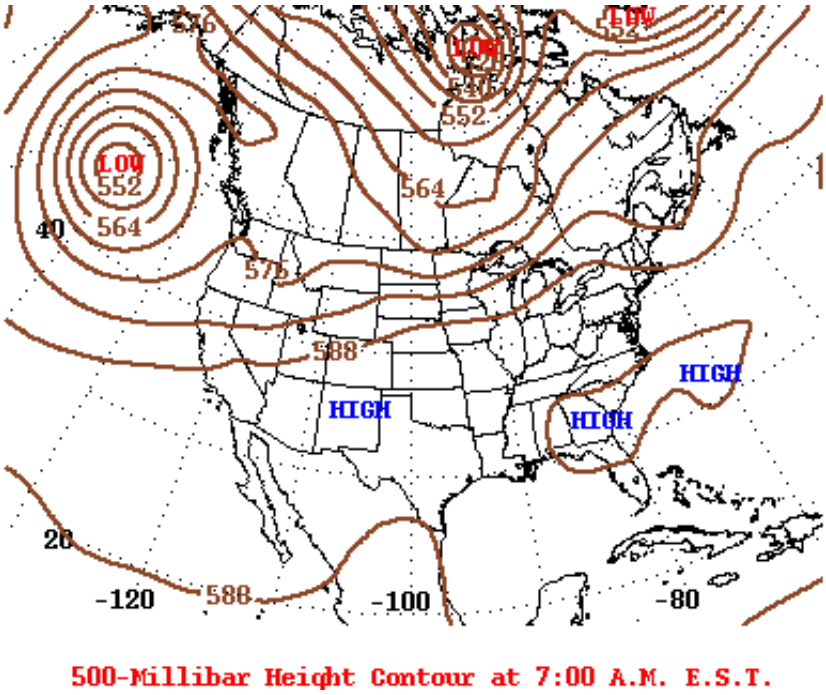


Figure E-68. 500 mb meteorology map on August 5, 2018.

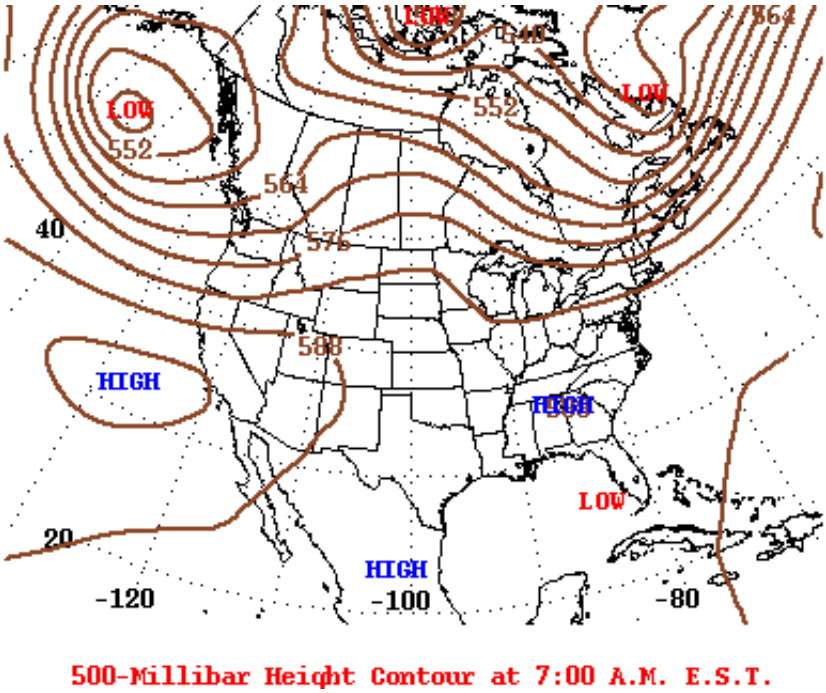


Figure E-69. 500 mb meteorology map on September 8, 2018.

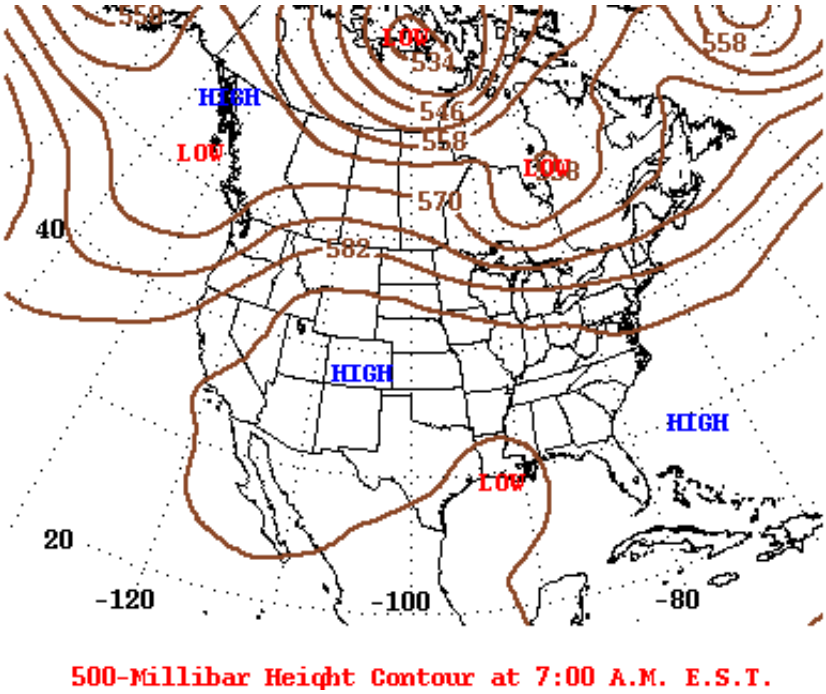


Figure E-70. 500 mb meteorology map on July 13, 2019.

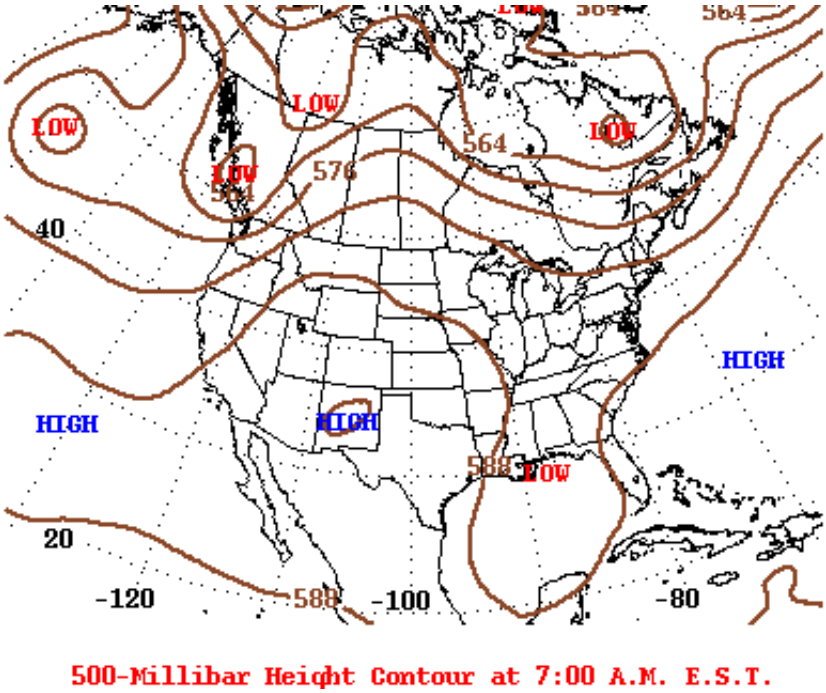


Figure E-71. 500 mb meteorology map on August 2, 2019.

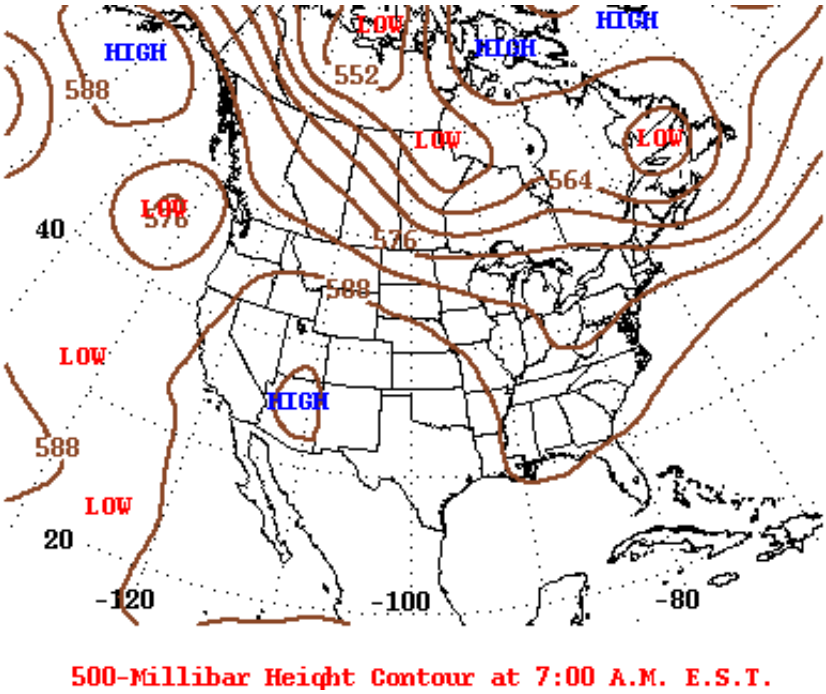


Figure E-72. 500 mb meteorology map on August 5, 2019.

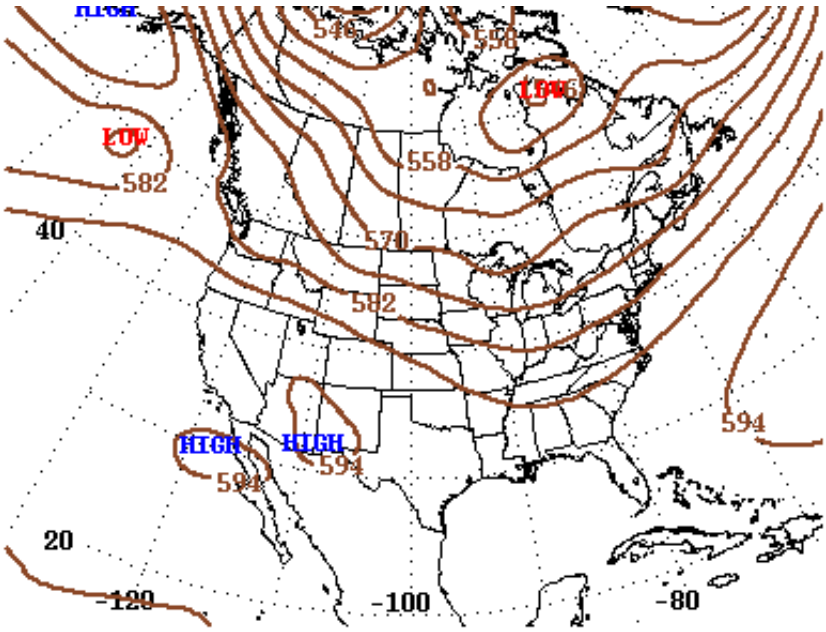


Figure E-73. 500 mb meteorology map on August 15, 2019.

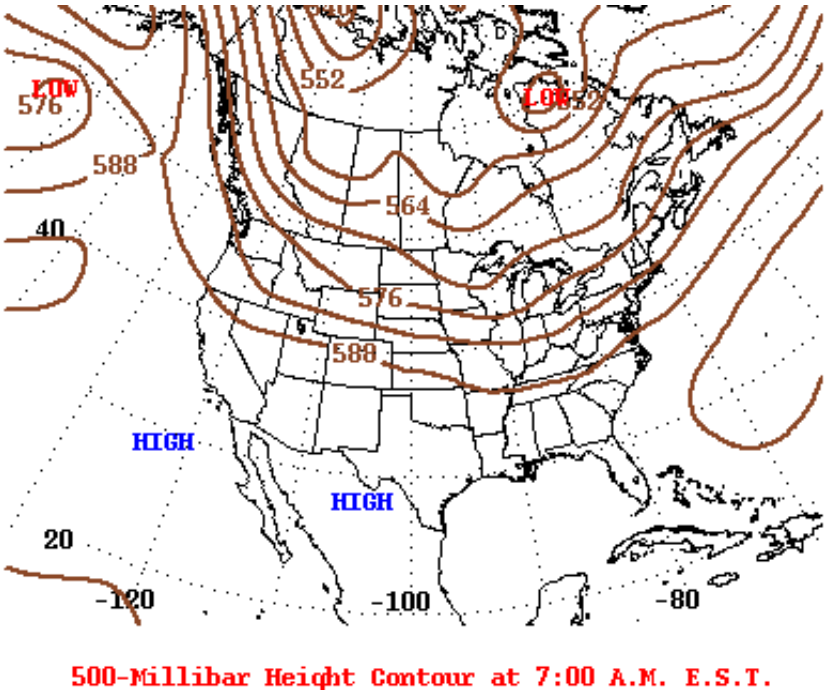


Figure E-74. 500 mb meteorology map on August 16, 2019.

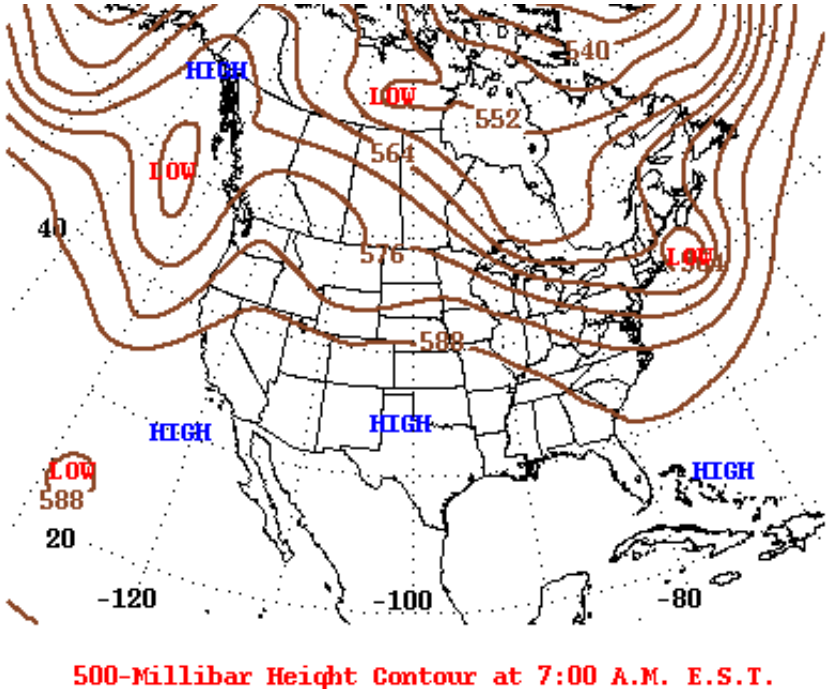


Figure E-75. 500 mb meteorology map on September 7, 2019.

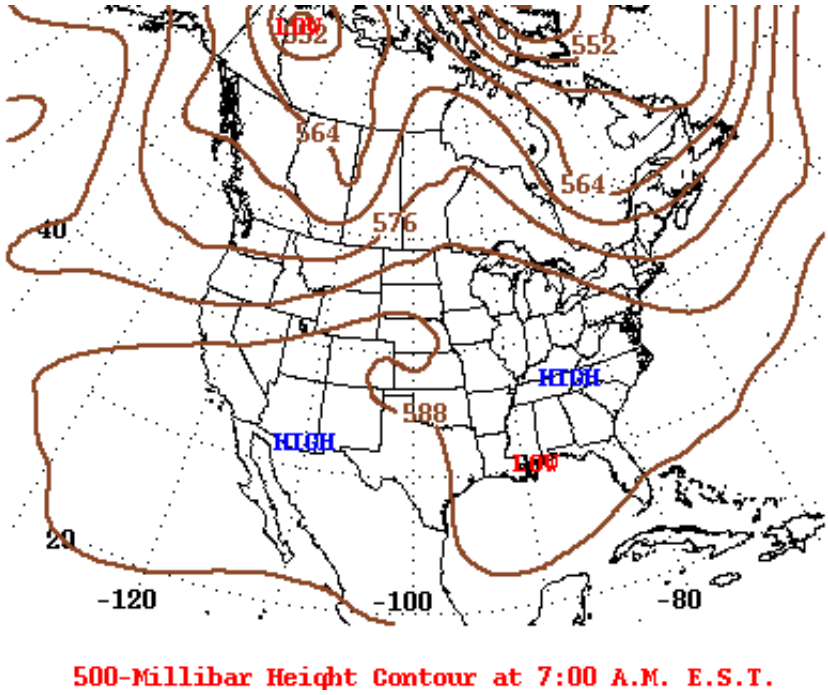


Figure E-76. 500 mb meteorology map on July 5, 2020.

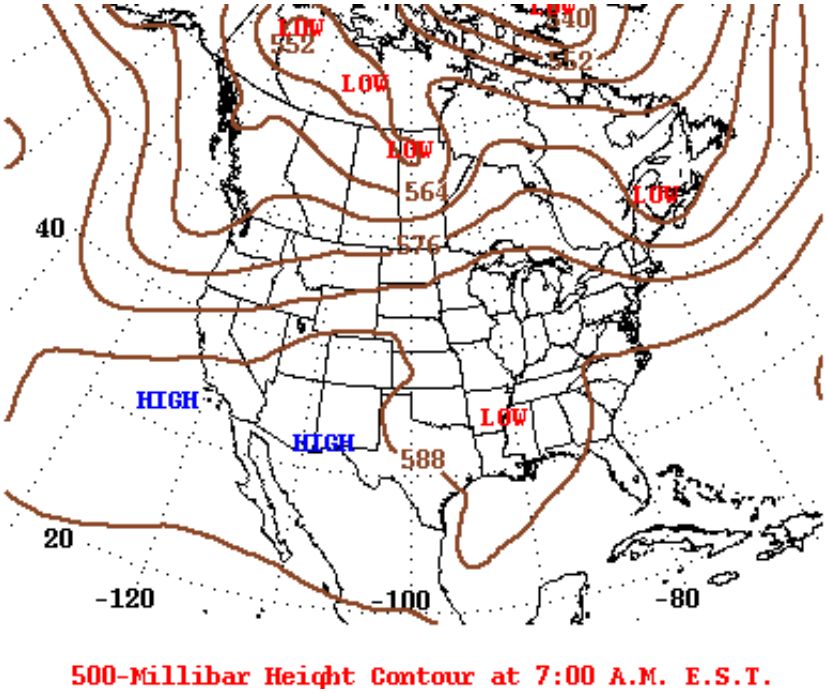


Figure E-77. 500 mb meteorology map on July 6, 2020.

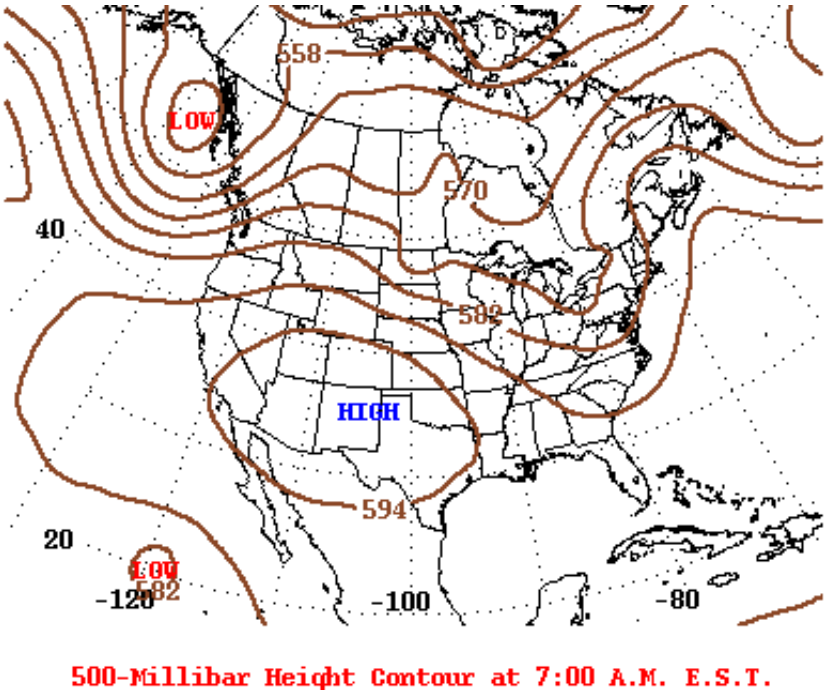


Figure E-78. 500 mb meteorology map on July 11, 2020.

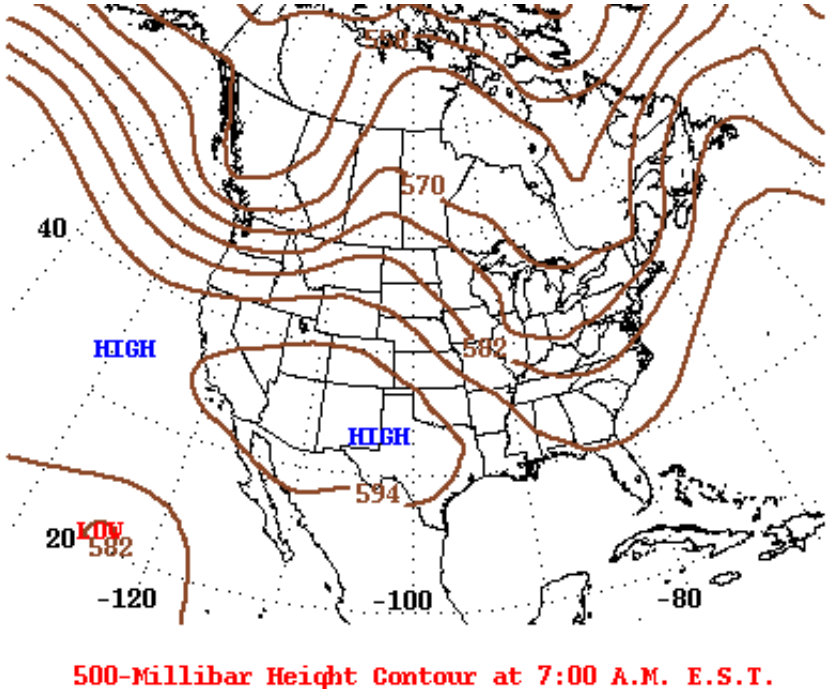


Figure E-79. 500 mb meteorology map on July 12, 2020.

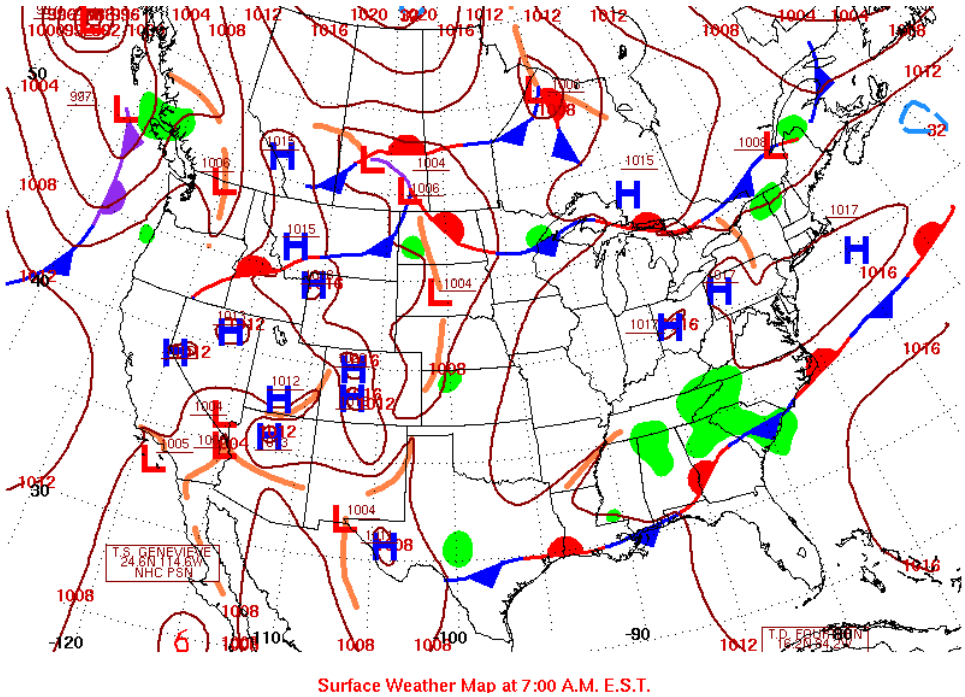


Figure E-80. Surface meteorology map on August 21, 2020 (event date).

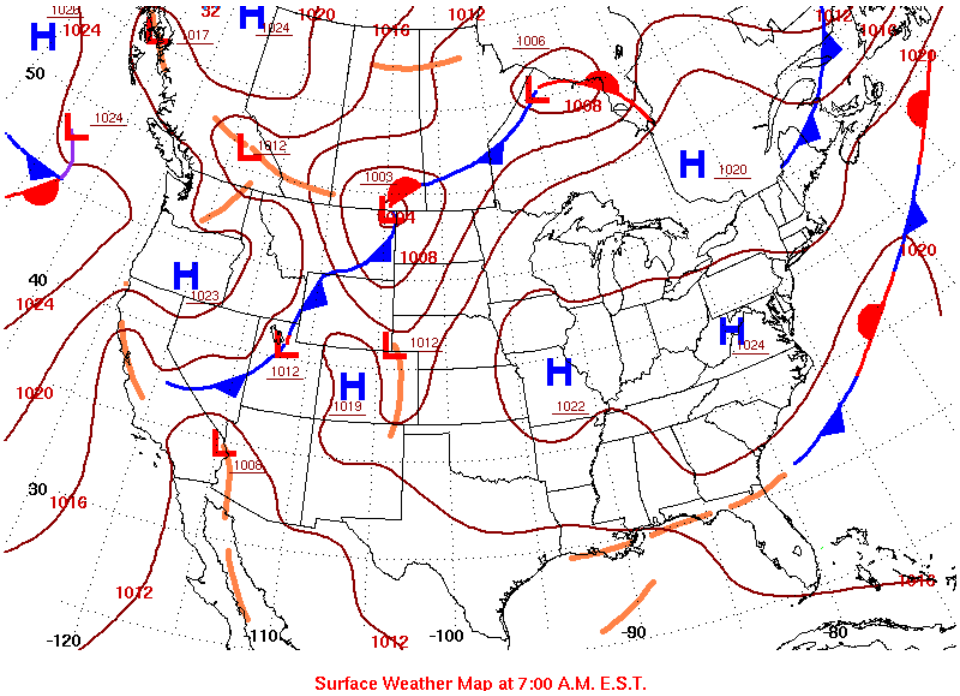


Figure E-81. Surface meteorology map on August 15, 2015.

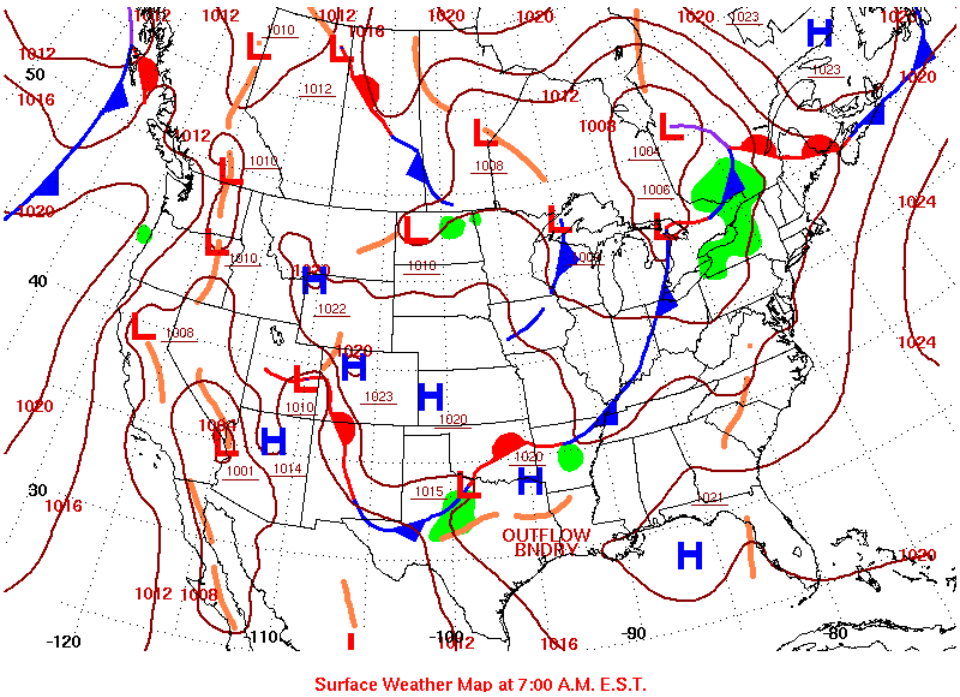


Figure E-82. Surface meteorology map on July 1, 2017.

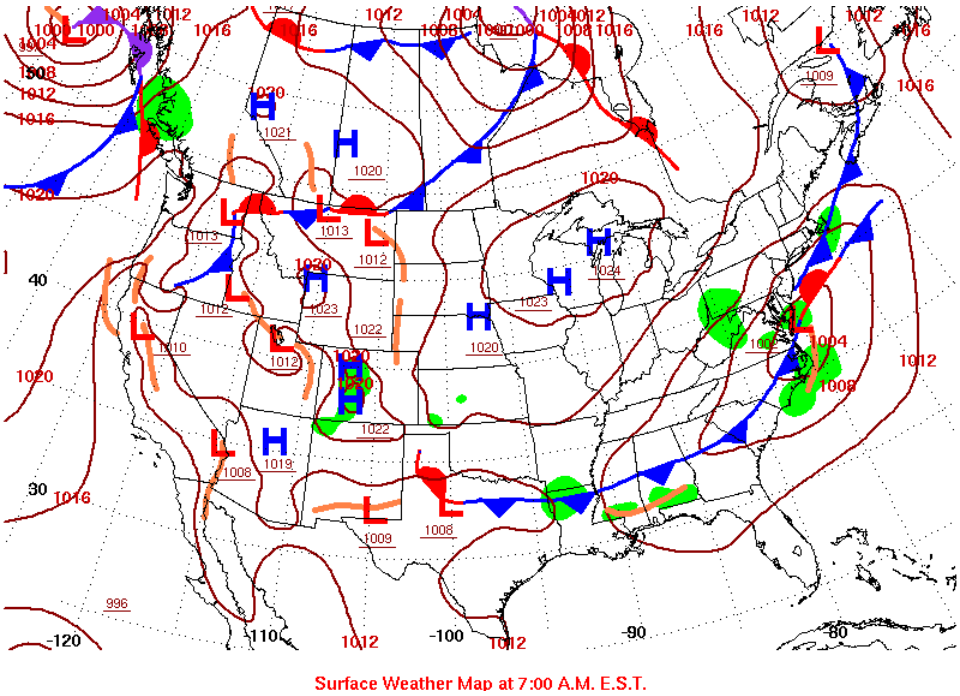


Figure E-83. Surface meteorology map on July 29, 2017.

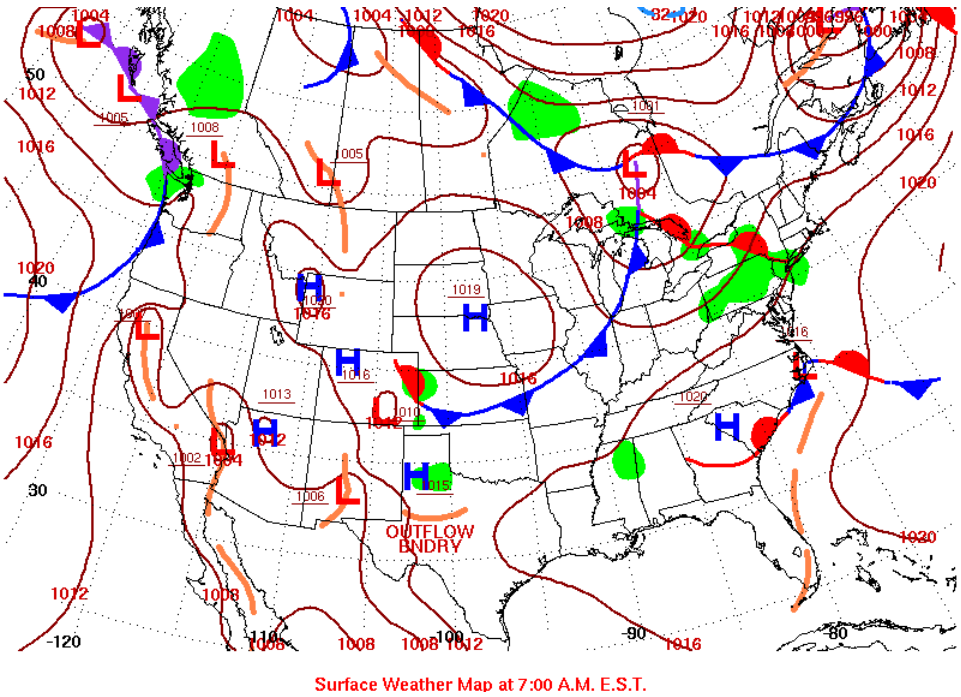


Figure E-84. Surface meteorology map on June 13, 2018.

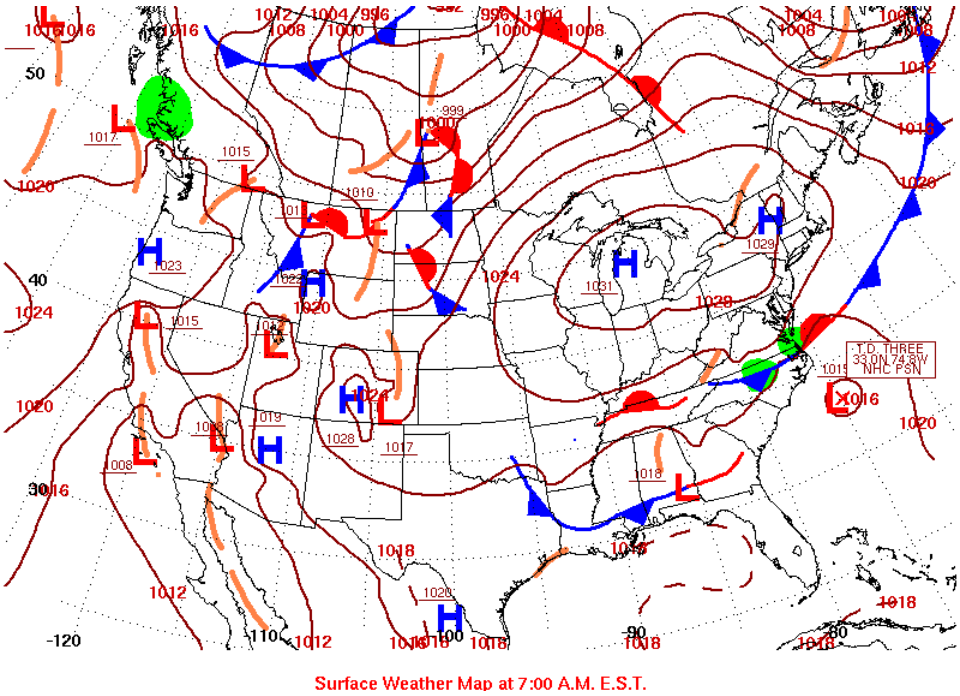


Figure E-85. Surface meteorology map on July 7, 2018.

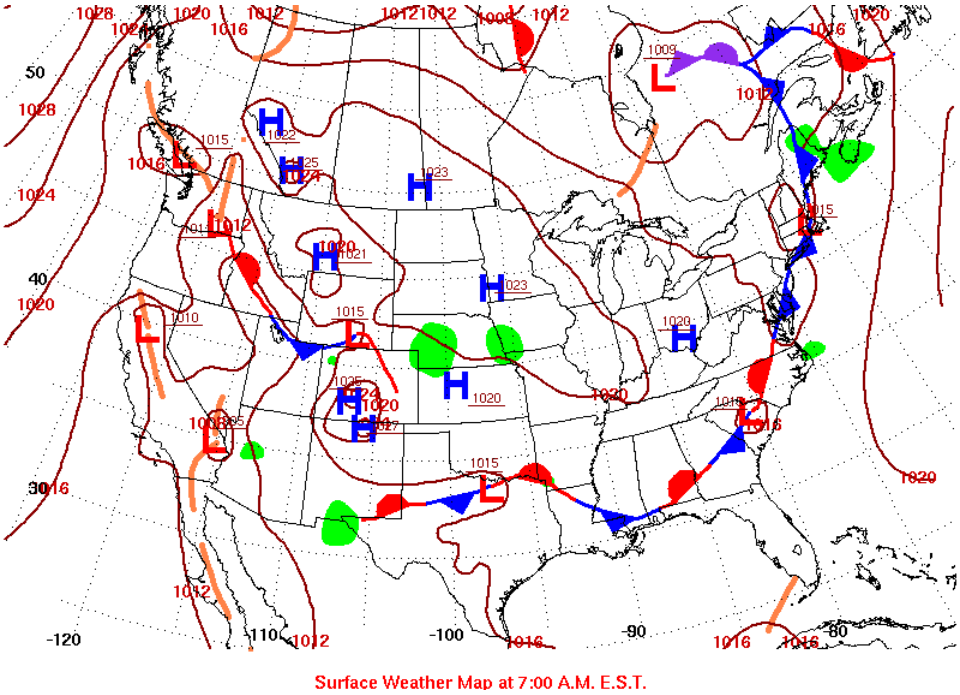


Figure E-86. Surface meteorology map on July 28, 2018.

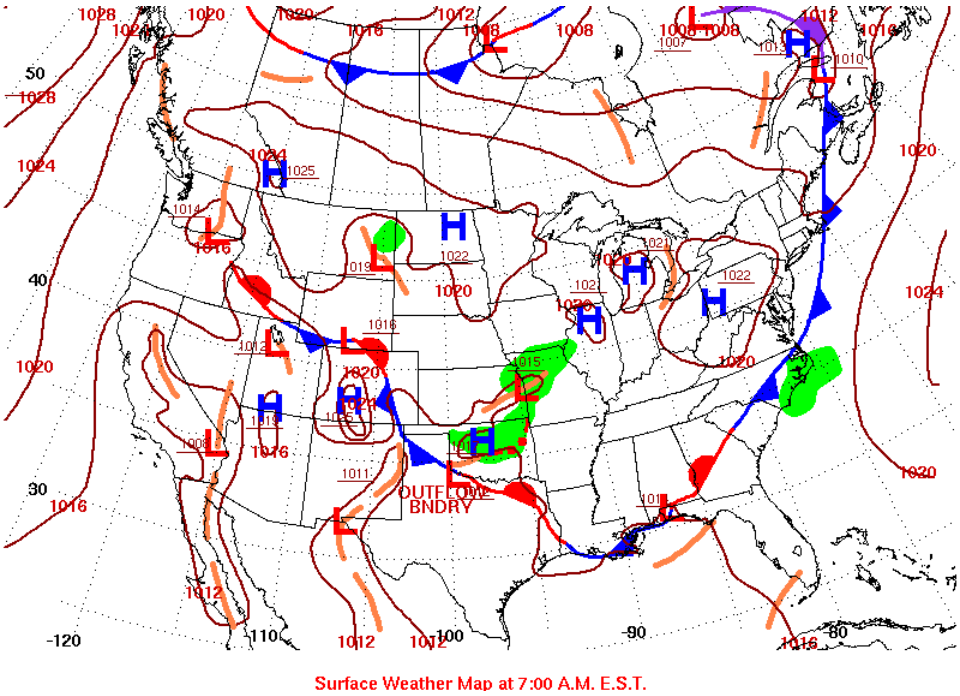


Figure E-87. Surface meteorology map on July 29, 2018.

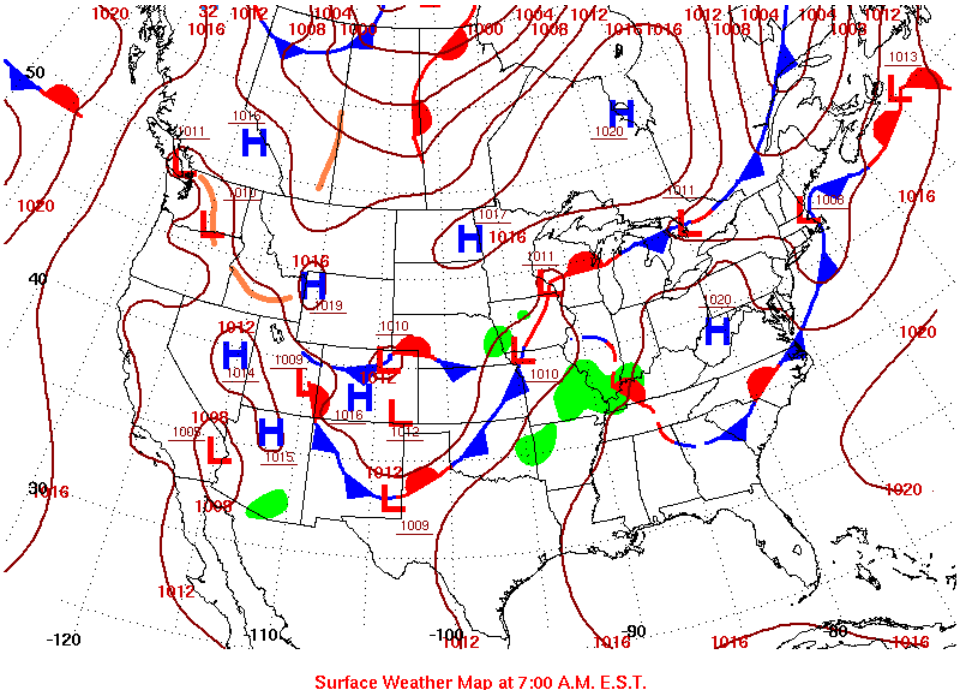


Figure E-88. Surface meteorology map on August 15, 2018.

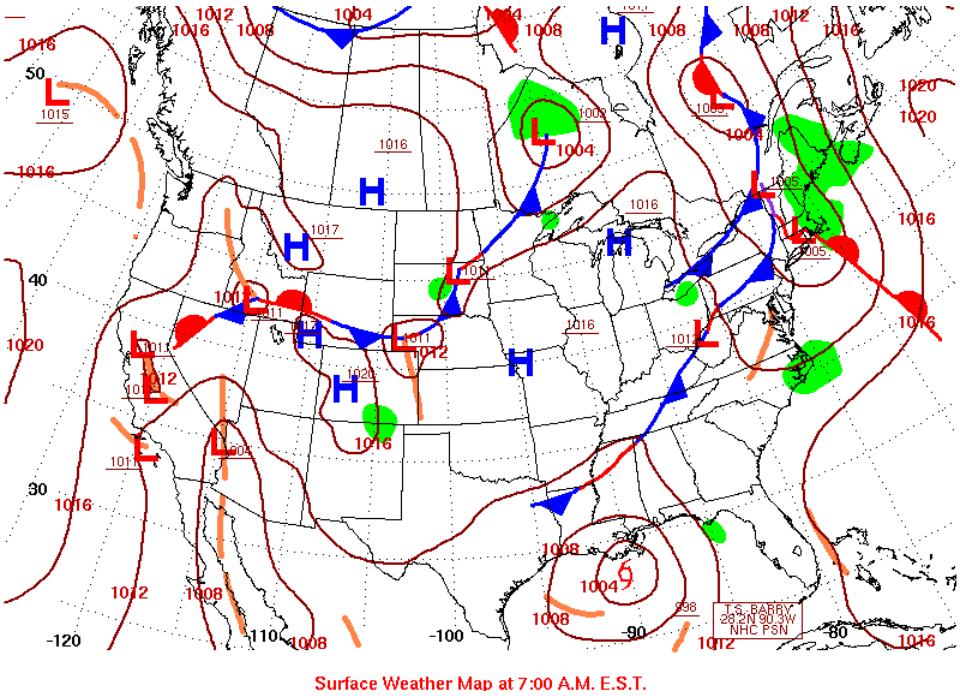


Figure E-89. Surface meteorology map on July 12, 2019.

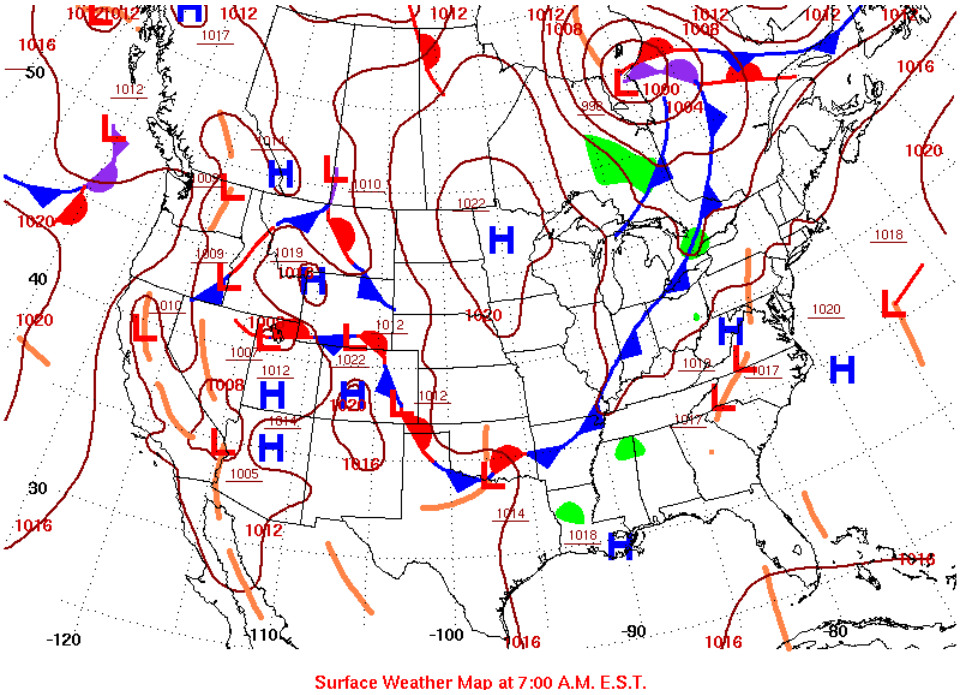


Figure E-90. Surface meteorology map on July 30, 2019.

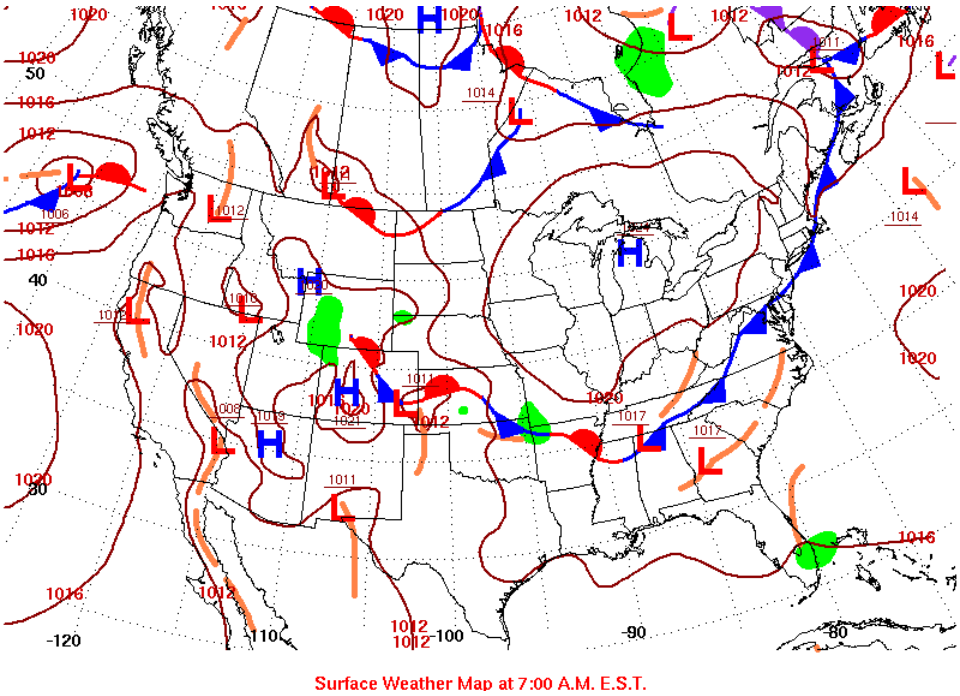


Figure E-91. Surface meteorology map on August 1, 2019.

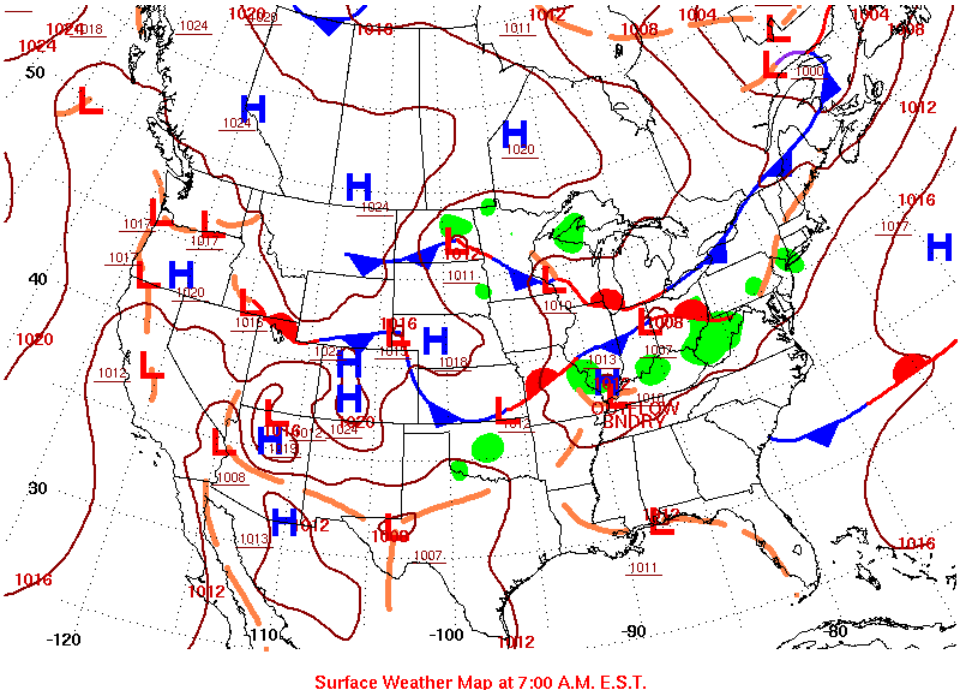


Figure E-92. Surface meteorology map on August 13, 2019.

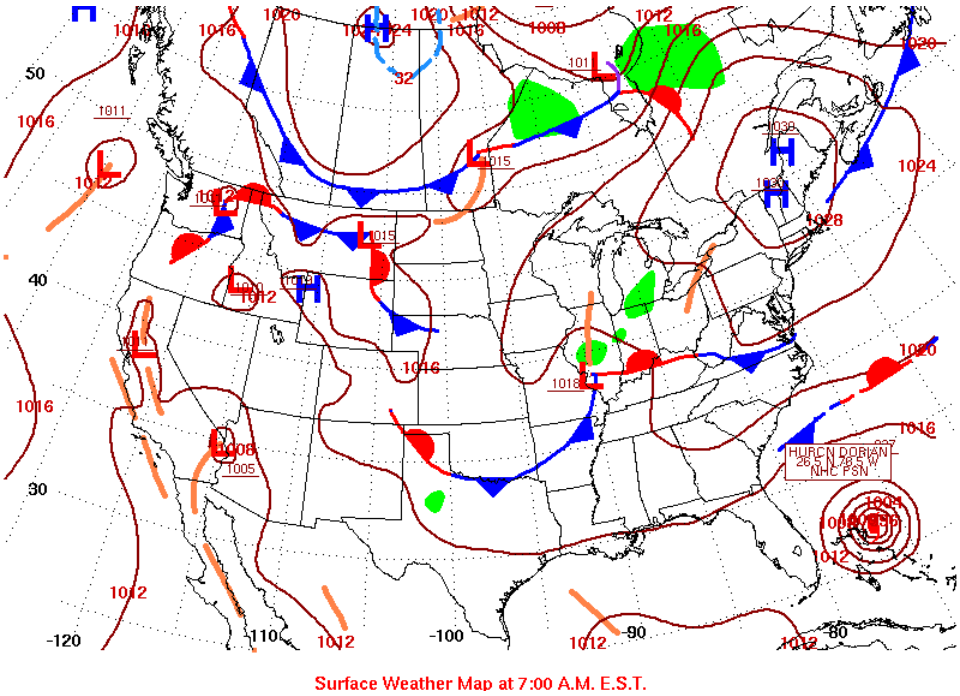


Figure E-93. Surface meteorology map on September 1, 2019.

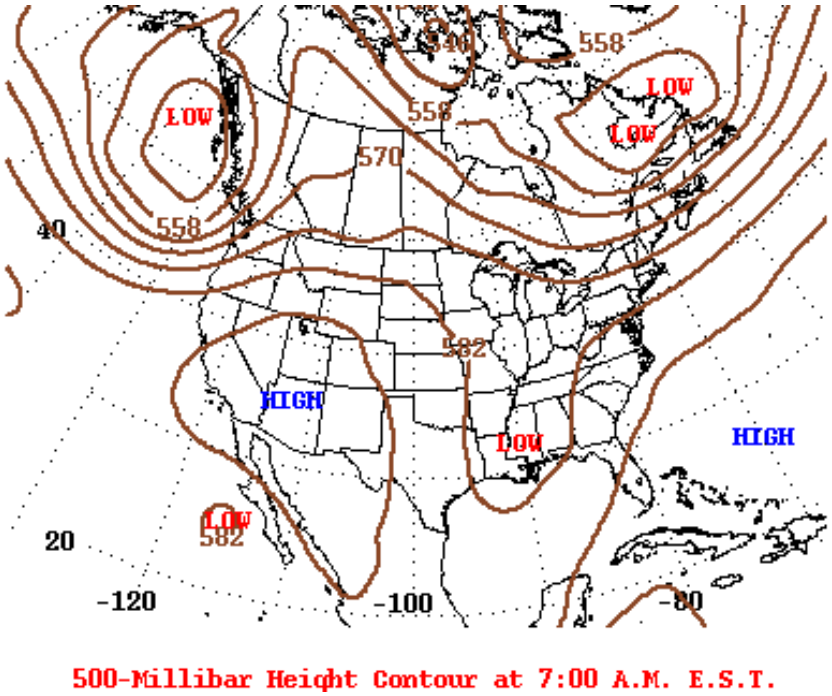


Figure E-94. 500 mb meteorology map on August 21, 2020 (event date).

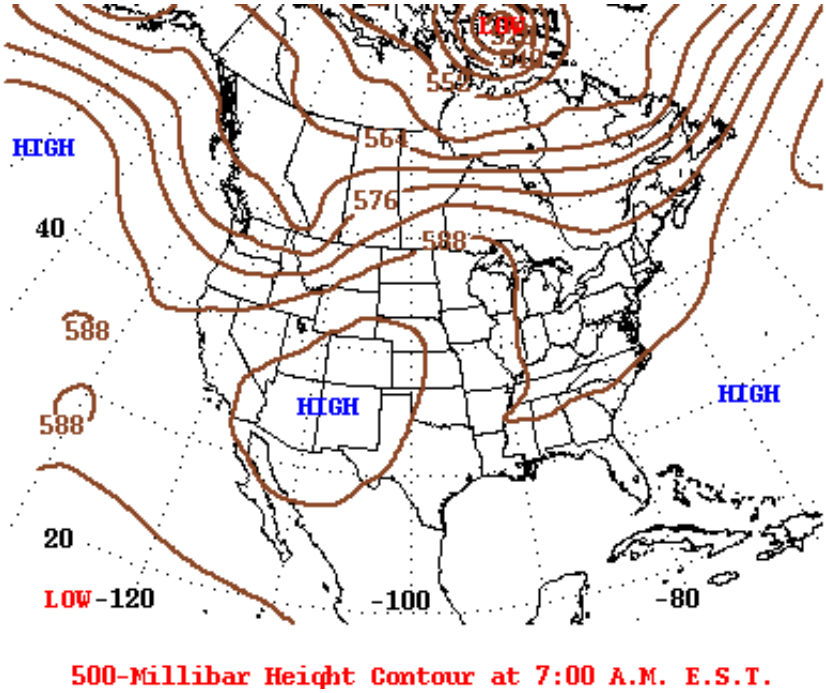


Figure E-95. 500 mb meteorology map on August 15, 2015.

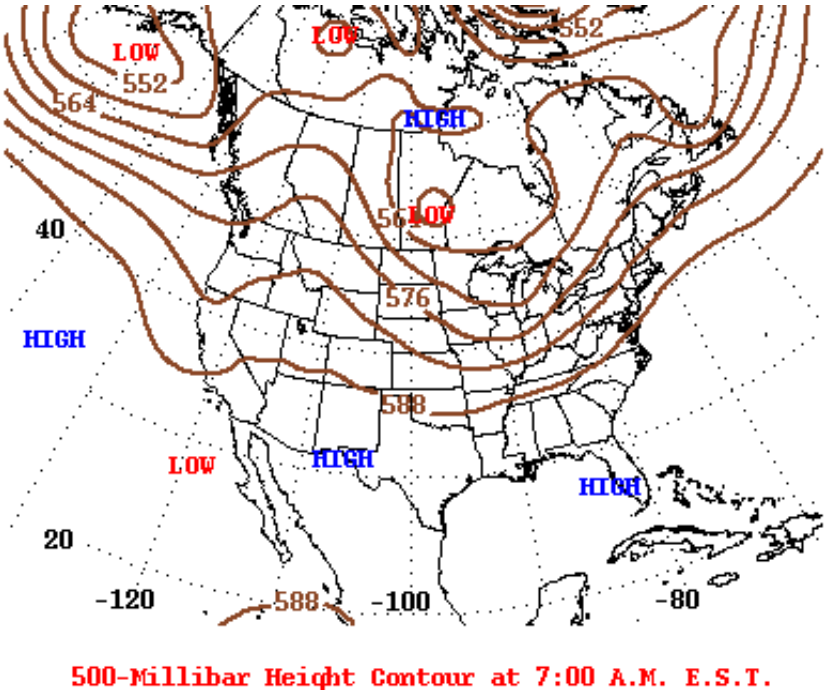


Figure E-96. 500 mb meteorology map on July 1, 2017.

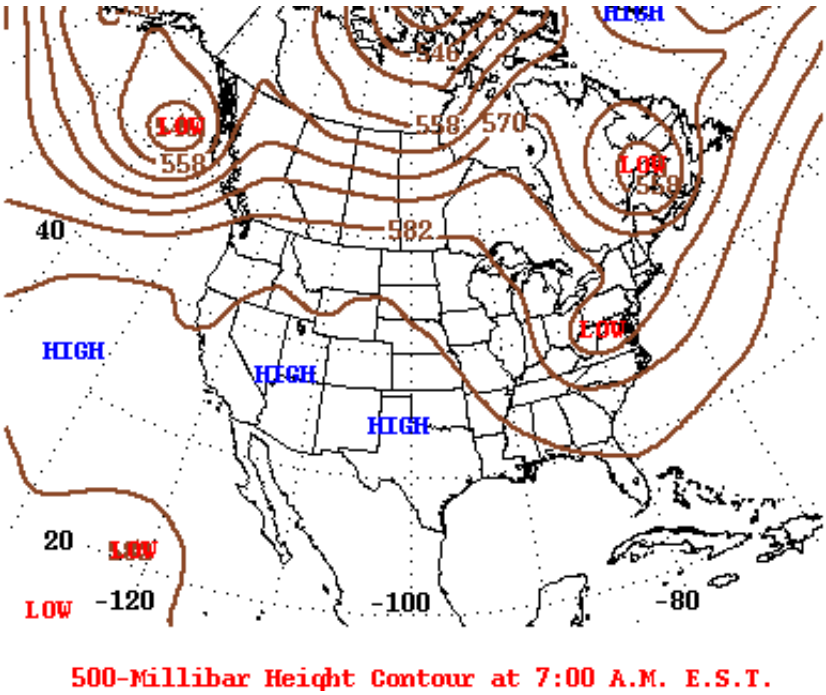


Figure E-97. 500 mb meteorology map on July 29, 2017.

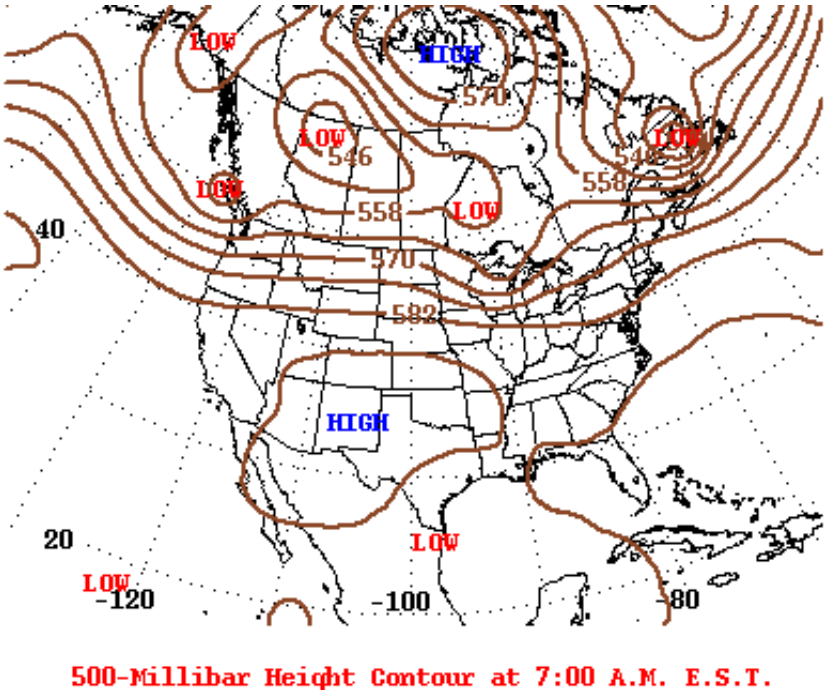


Figure E-98. 500 mb meteorology map on June 13, 2018.

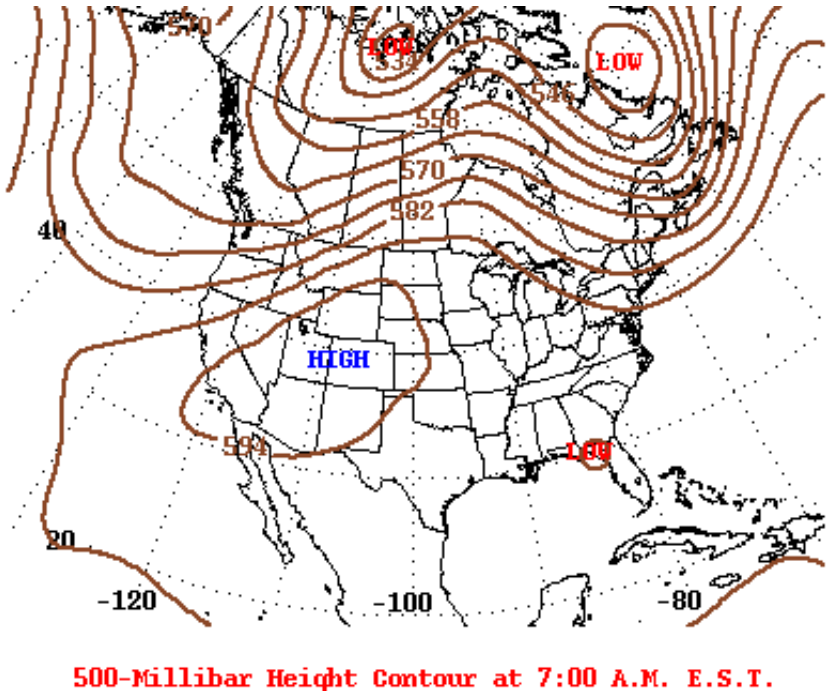


Figure E-99. 500 mb meteorology map on July 7, 2018.

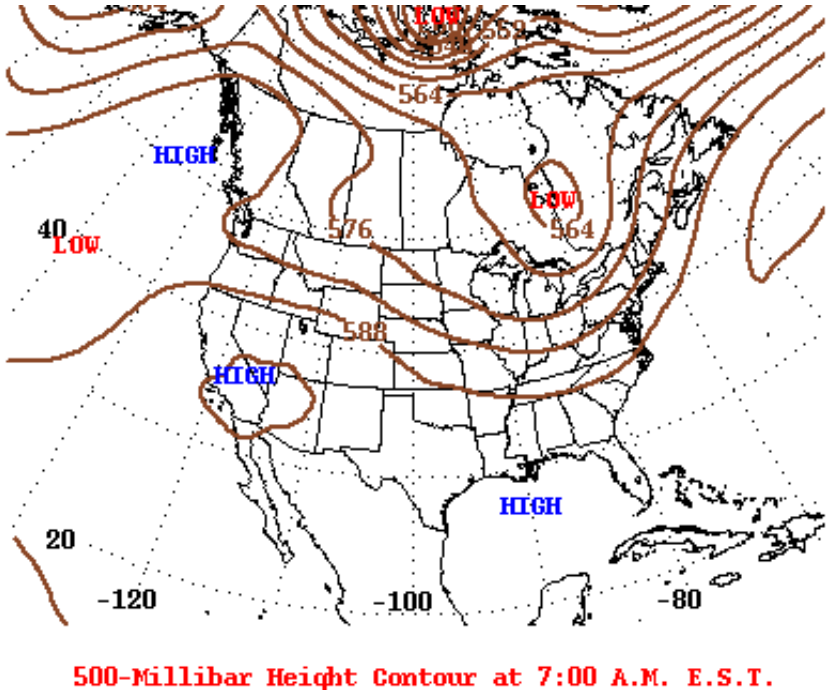


Figure E-100. 500 mb meteorology map on July 28, 2018.

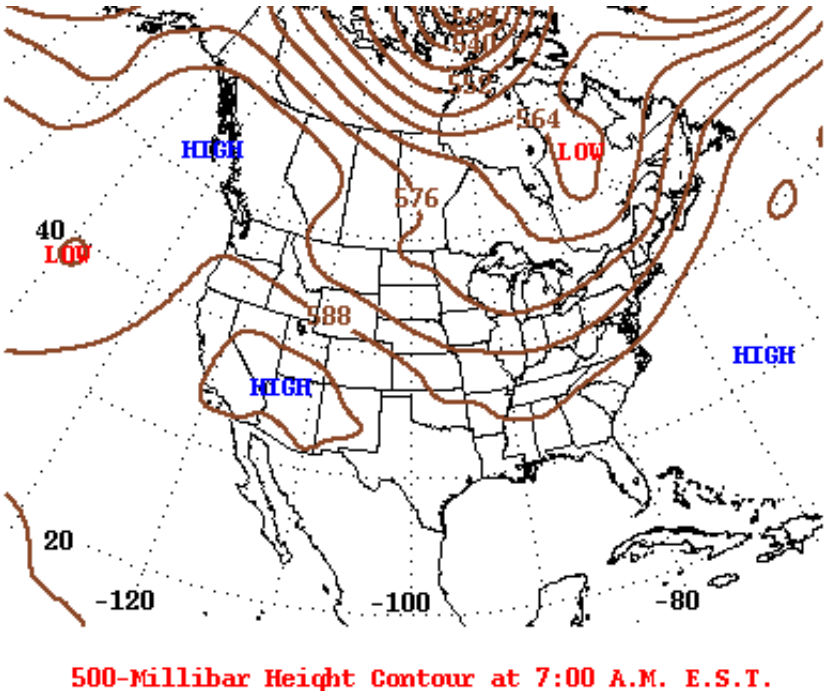


Figure E-101. 500 mb meteorology map on July 29, 2018.

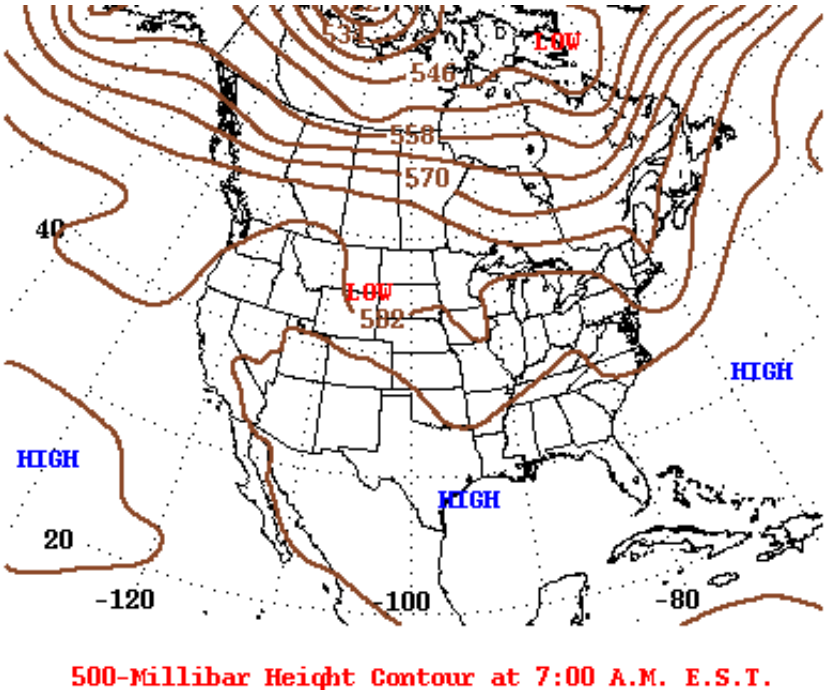


Figure E-102. 500 mb meteorology map on August 15, 2018.

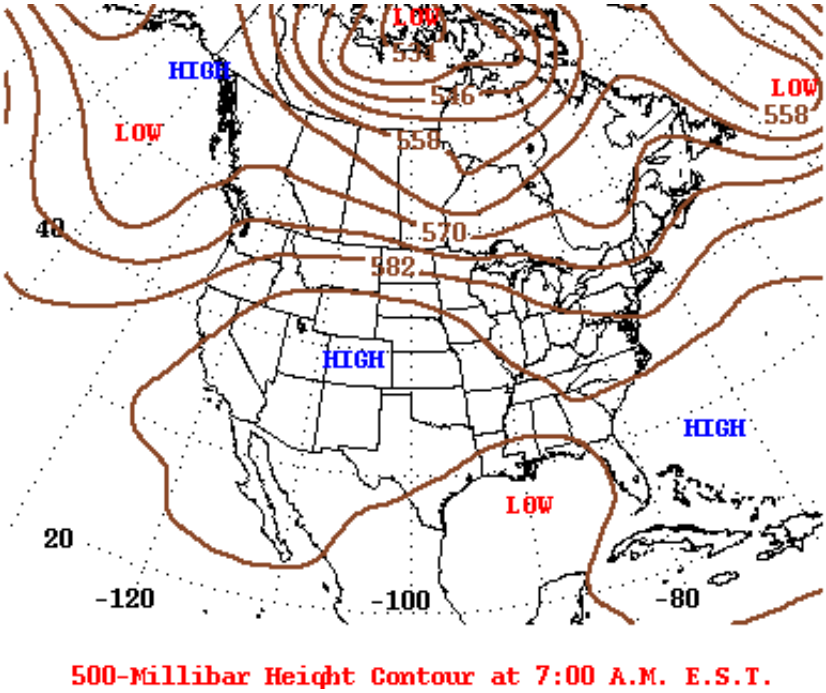


Figure E-103. 500 mb meteorology map on July 12, 2019.

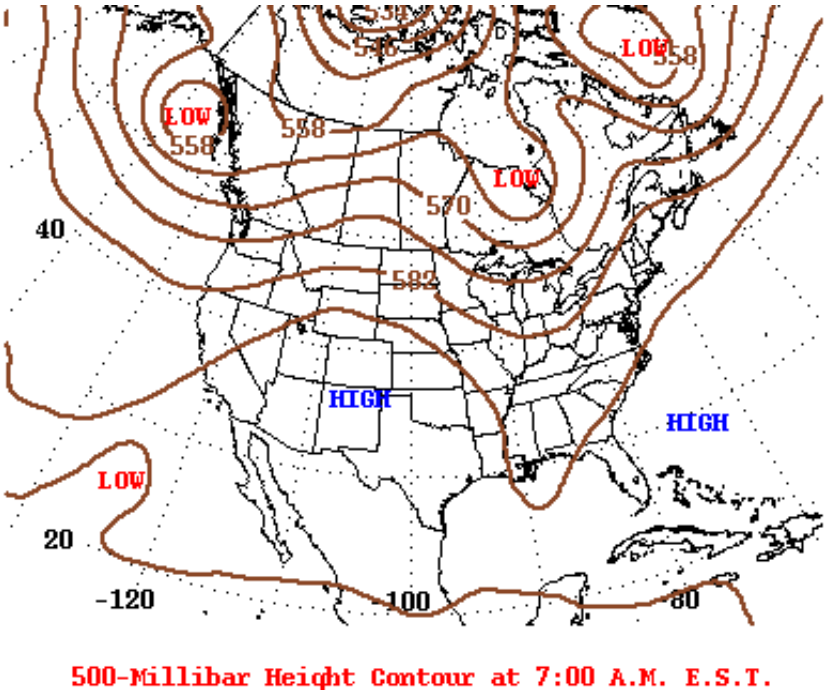


Figure E-104. 500 mb meteorology map on July 30, 2019.

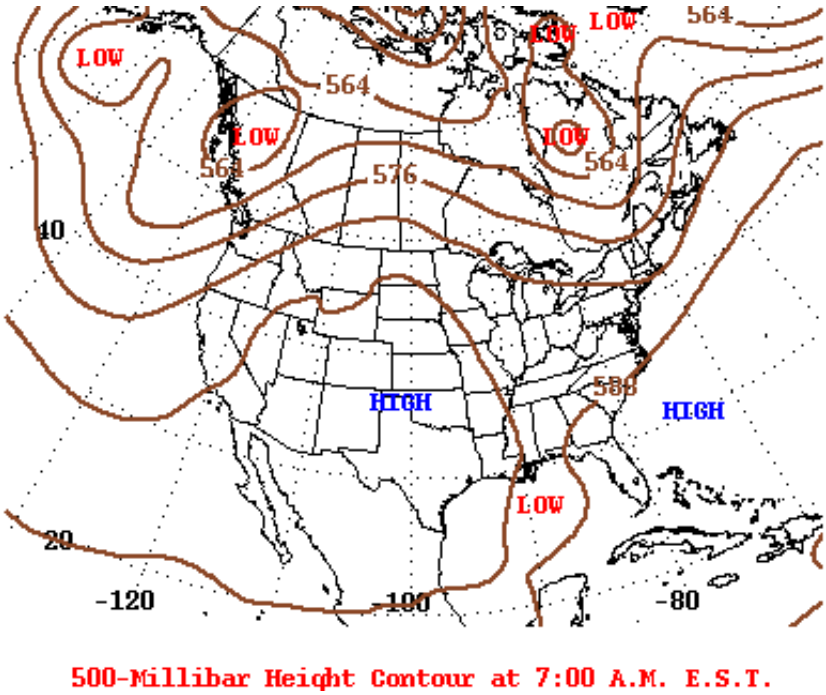


Figure E-105. 500 mb meteorology map on August 1, 2019.

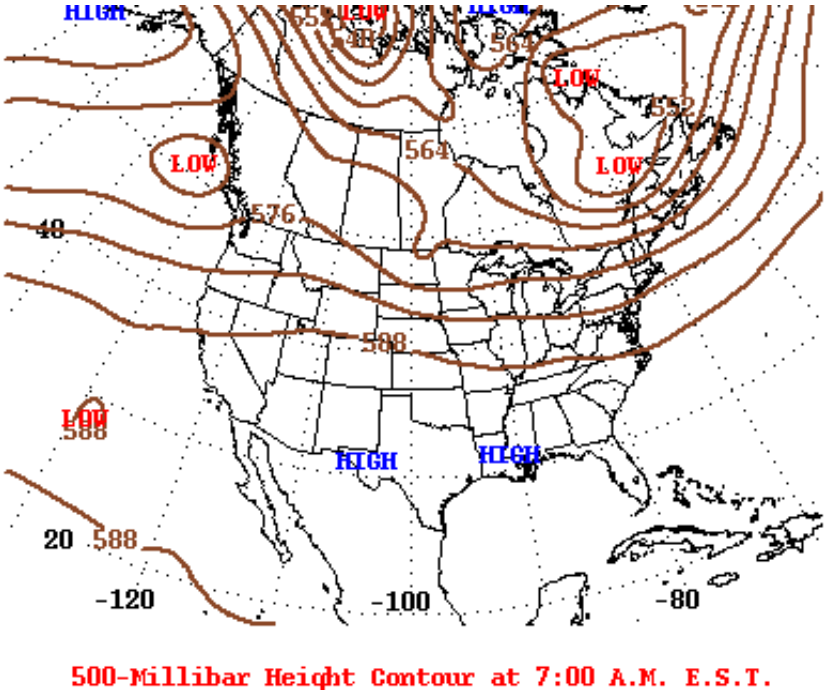


Figure E-106. 500 mb meteorology map on August 13, 2019.

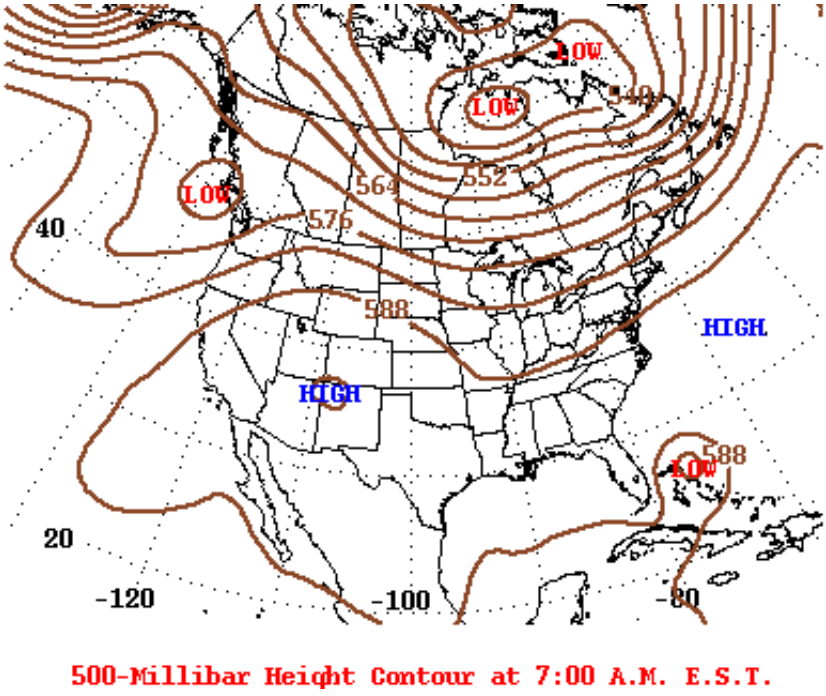


Figure E-107. 500 mb meteorology map on September 1, 2019.

Appendix F. GAM Residual Histograms and Scatter Plots from Concurred Exceptional Event Demonstrations

The following are GAM residual histograms and scatter plots from the concurred Arizona Department of Environmental Quality demonstration (Arizona Department of Environmental Quality 2016) and the submitted Texas Commission on Environmental Quality demonstration (Texas Commission on Environmental Quality 2021) for comparison with our GAM residual analysis. The figures in this Appendix show the good residual results from concurred and currently submitted exceptional events demonstrations to which we compared our results. Based on this comparison, we suggest that our GAM results show a well-fit, unbiased model. A well-fit GAM model should show a normal distribution of residuals at all sites modeled (ADEQ example in **Figure F-1**) and show no pattern or bias between GAM residuals and predicted values (TCEQ example in **Figure F-2**). These figures compare well with our GAM results in Section 3.3.3 of the main report.

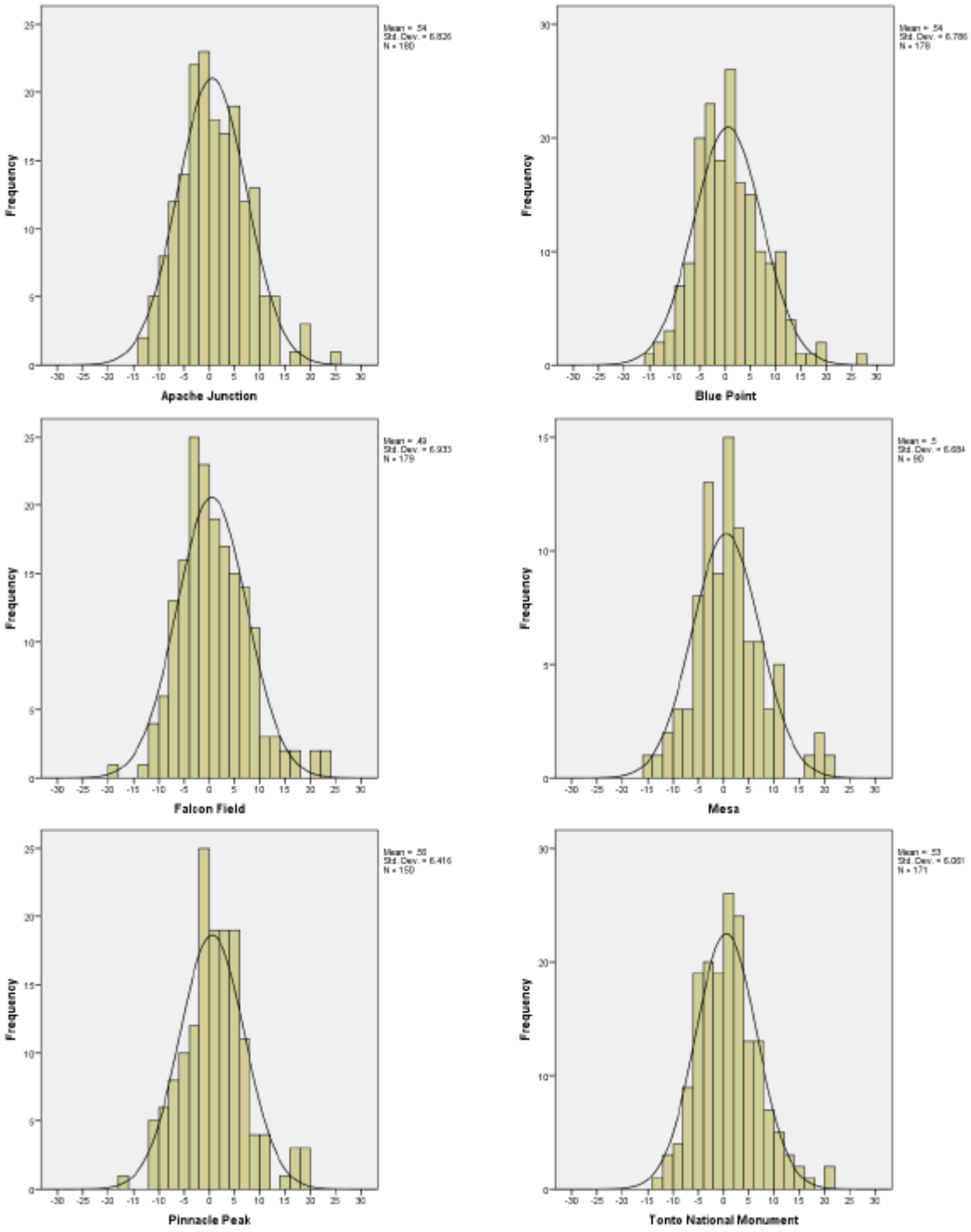


Figure F-1. Histograms of residuals results at each monitoring site from the Arizona DEQ GAM Analysis (Arizona Department of Environmental Quality 2016).

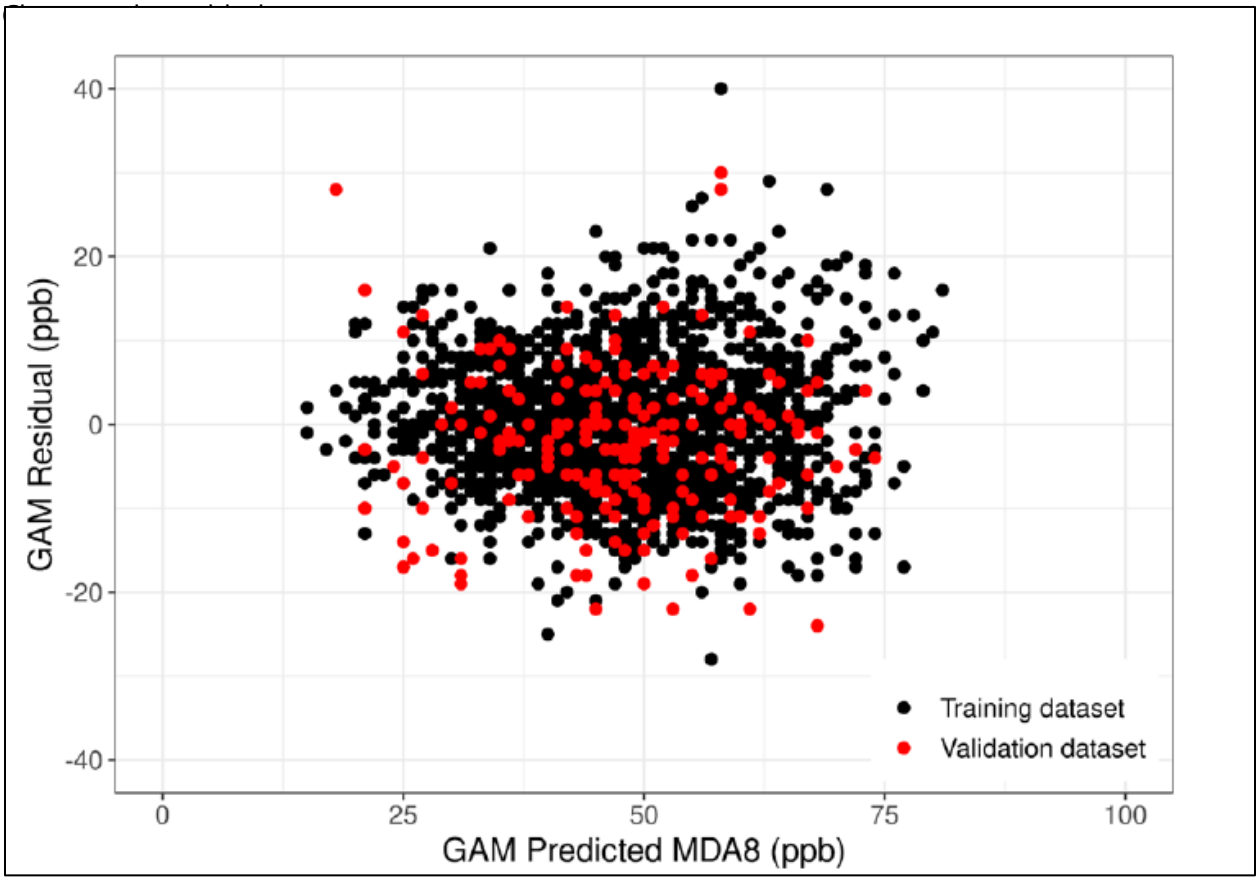


Figure F-2. Scatter plot of GAM residuals (observed – GAM predicted MDA8 ozone) vs. GAM predicted MDA8 ozone from the TCEQ submitted GAM analysis. Training data is shown in black and validation data is shown in red (Texas Commission on Environmental Quality 2021).

References

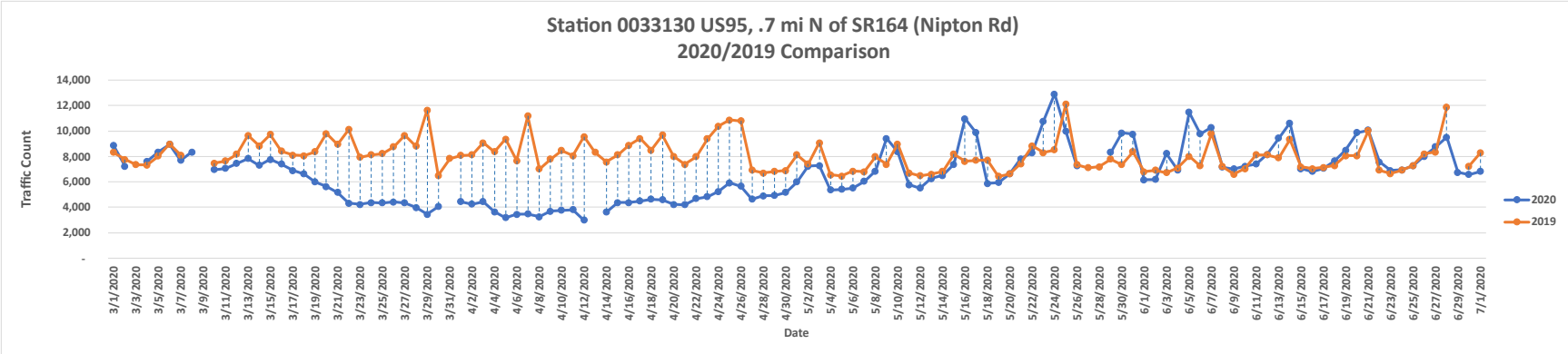
Arizona Department of Environmental Quality (2016) State of Arizona exceptional event documentation for wildfire-caused ozone exceedances on June 20, 2015 in the Maricopa nonattainment area. Final report, September. Available at https://static.azdeq.gov/pn/1609_ee_report.pdf.

Texas Commission on Environmental Quality (2021) Dallas-Fort Worth area exceptional event demonstration for ozone on August 16, 17, and 21, 2020. April. Available at https://www.tceq.texas.gov/assets/public/airquality/airmod/docs/ozoneExceptionalEvent/2020-DFW-EE-Ozone.pdf.

Appendix G. Analysis of COVID Restrictions on Ozone

Mobile emission sources decreased throughout the U.S. during the mobility restrictions for the COVID-19 pandemic beginning in mid-March 2020. Because decreases in nitrogen oxides (NO_x) emissions from mobile sources could result in higher ozone concentrations, we evaluated the potential contribution and sensitivity of the COVID-19 shutdown effects on ozone concentrations and MDA8 ozone on exceptional event (EE) days. Ozone production has non-linear dependence on precursor emissions of NO_x and volatile organic compounds (VOCs), as well as meteorological conditions. Changes in precursors also shift photochemical regimes. Thus, the effects of COVID-induced NO_x emission changes on ozone are complex and uncertain (Kroll et al., 2020). Recent studies have found variable ozone responses during lockdowns across countries, with responses ranging from −2 to +10% (Venter et al., 2020). Park et al., 2020 found spatially disparate effects of higher ozone concentrations downwind of Los Angeles and lower concentrations in the western LA basin. To evaluate the potential influence of COVID-19 shutdown precursor emission decreases or increases in MDA8 ozone, we compared ozone concentrations in May 2020 to the historical climatology, and compared the GAM residuals from May 2020 with those for the same historical record.

Based on 2017 emission inventories in Las Vegas, on-road mobile sources comprise 40% of NO_x emissions and total mobile (vehicle + aviation) emissions comprise 88% of total NO_x emissions for typical ozone season weekday (SIP Plan Revision, Clark County 2015). In contrast, only 11% of VOC emissions originate from on-road mobile sources. The effects of decreased mobility due to COVID restrictions has a significant effect on total NOx emissions, but minimal effect on VOC emissions. To determine the time period for these effects, we compared 2020 daily traffic count data from the Nevada Department of Transportation with that from 2019 across 10 monitoring sites (two examples in **Figure G-1**). On-road traffic activity was significantly reduced from mid-March through early-June 2020 in Clark County compared with 2019. Although aviation activity remained lower than pre-pandemic levels for a longer duration of 2020, commercial aviation represents only 12% of NO_x emissions in Clark County. Thus, the reduced aviation activity had a minimal influence on the precursors available for ozone formation from mid-June 2020 onwards. In this section, we focus on May 2020, the first month of 2020 with EE days.



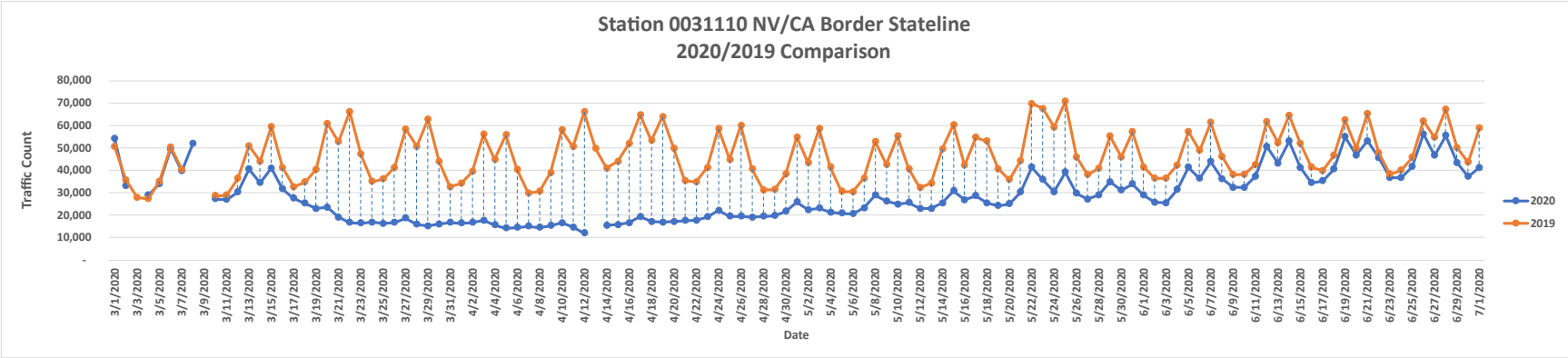
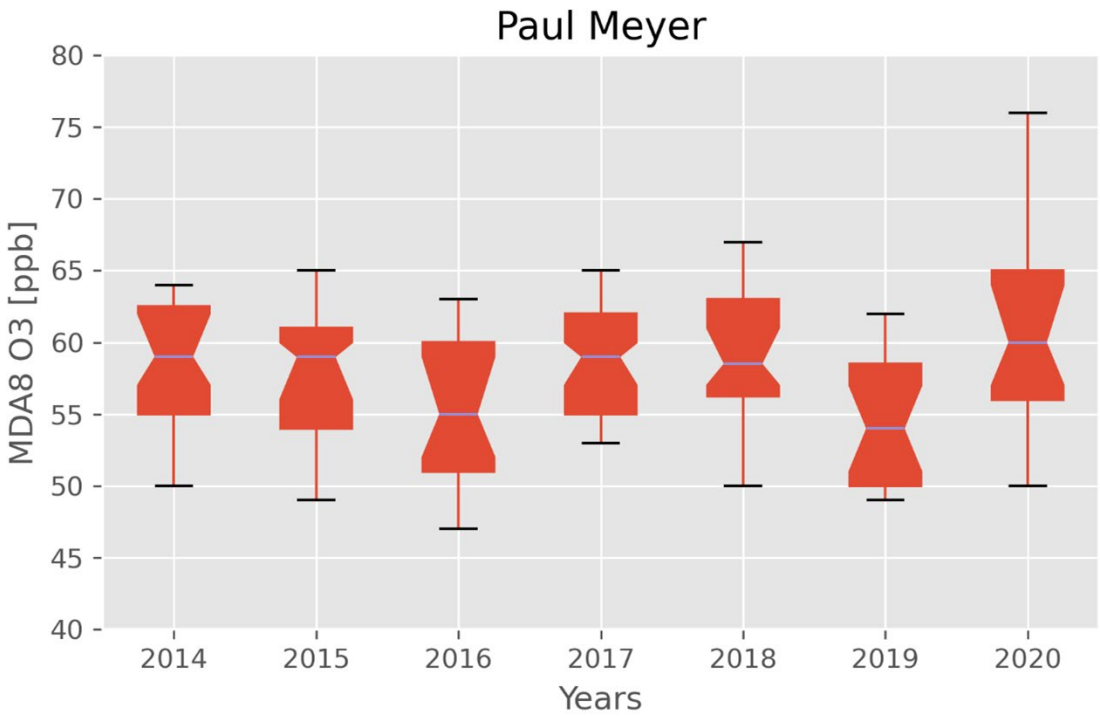


Figure G-1. Time series of 2020 and 2019 traffic counts at two stations: (top) along US95, south of Las Vegas, and (bottom) at the Nevada-California border, west of Las Vegas. Data were provided by the Nevada Department of Transportation.

We performed two sub-analyses for the ozone comparison to historical climatology. First, we compared the distribution of daily MDA8 ozone during May 2020 with those during May in each of the previous 5 years. Across all EE sites, we found median 2020 MDA8 ozone was not statistically different than any of the previous 5 years illustrated by the overlap in the 95th confidence intervals of the monthly medians in previous years with that for 2020 (**Figure G-2**). Furthermore, monthly median MDA8 ozone during May 2020 was not particularly high (much less than 65 ppb) at all sites despite the exceptional event days. This indicates that the EE day exceedances were extreme episodes that did not affect the monthly median. Thus, the observations do not suggest a month-long high ozone effect due to COVID emission precursor changes. Second, we compared the historical distribution of daily MDA8 ozone during May with the observations during May 2020 (**Figure G-3**). Across all EE sites, MDA8 ozone on the exceedance days for a given site rank above the confidence interval of the historical daily median MDA8 ozone. Based on these sub-analyses, we conclude that although precursor NO_x emissions decreased during May 2020 due to COVID restrictions, MDA8 ozone concentrations were not statistically higher than previous years. Therefore, the EE days cannot be attributed to a consistent COVID-shutdown influenced month-long increase in ozone concentrations.

To evaluate the GAM model residuals during the COVID shutdown period, Figure 3-83 in Section 3.3.3 provides a more in-depth look at results from April and May 2020, which are the most heavily affected months of the shutdown/COVID restrictions. The 95th confidence interval of the median GAM MDA8 residuals (shown by the notches in the box plots) overlap between 2020 and most other years, except for 2015 and 2016. The May 2020 median residual with EE days (1.5 ppb) is within the typical GAM model uncertainty (+/- [CI from Figure 3-77 from Section 3.3.3). This analysis shows that the median GAM residuals during May 2020 were within the typical GAM model error during the previous 5 years.

In summary, although mobile source precursor emissions of NO_x decreased during April and May 2020 due to COVID shutdown restrictions, we did not observe statistically higher ozone concentrations, nor a higher residual in the GAM model, during May 2020. We find consistent evidence across analyses that the EE day ozone concentrations cannot be attributed to an increase in ozone concentrations associated with COVID shutdown periods.



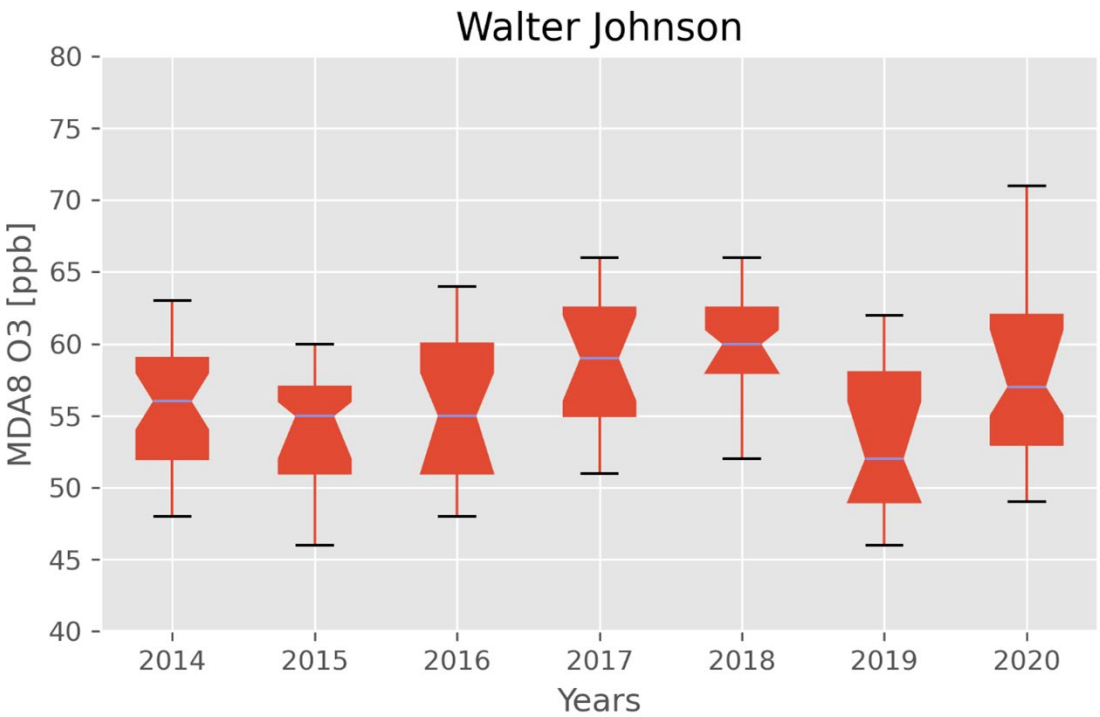


Figure G-2. Annual May distributions of MDA8 ozone at sites with exceptional events during May 2020. Notches denote 95th confidence interval of the median, boxes are 25th, 50th and 75th percentiles, and whiskers are 5th and 95th percentiles.

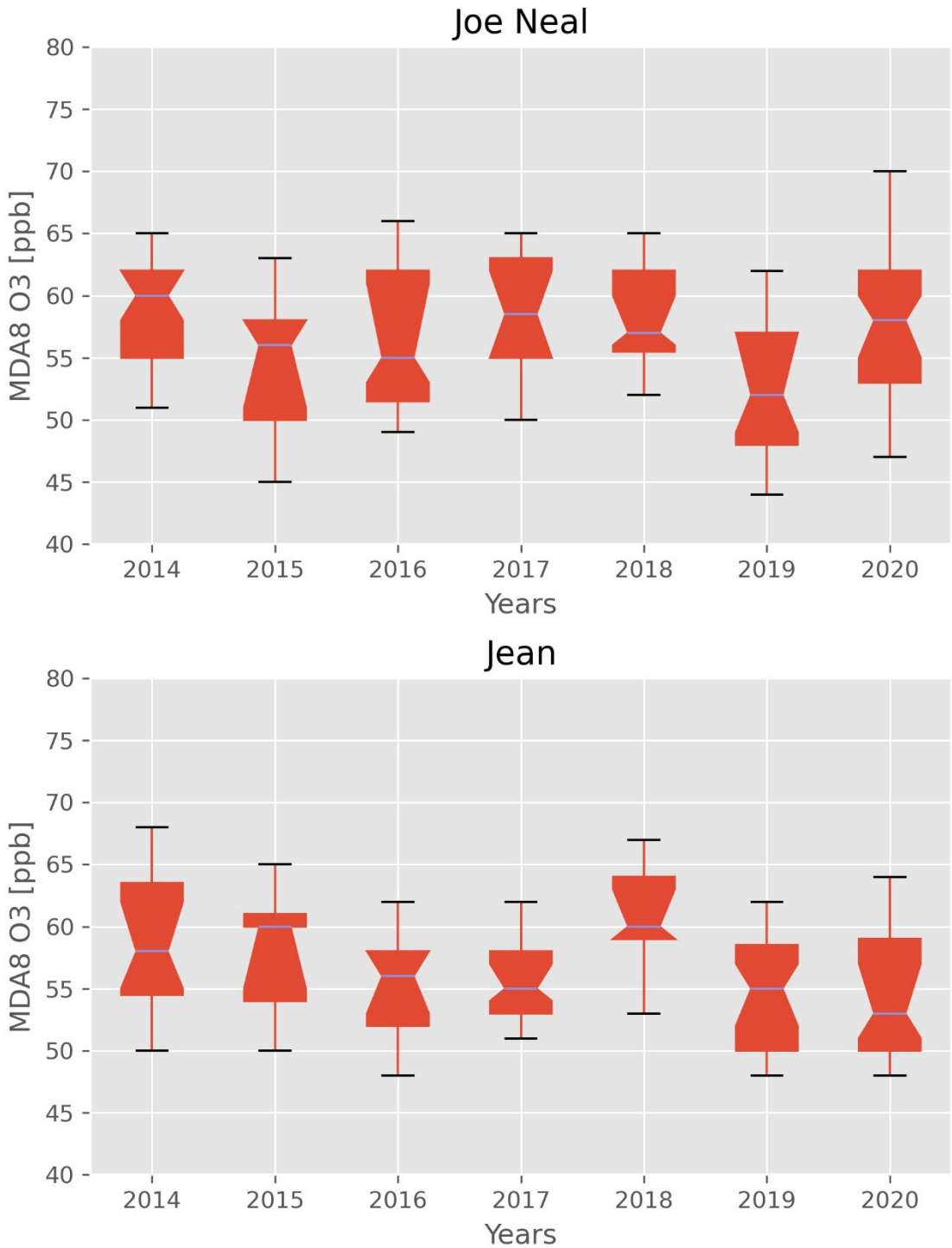
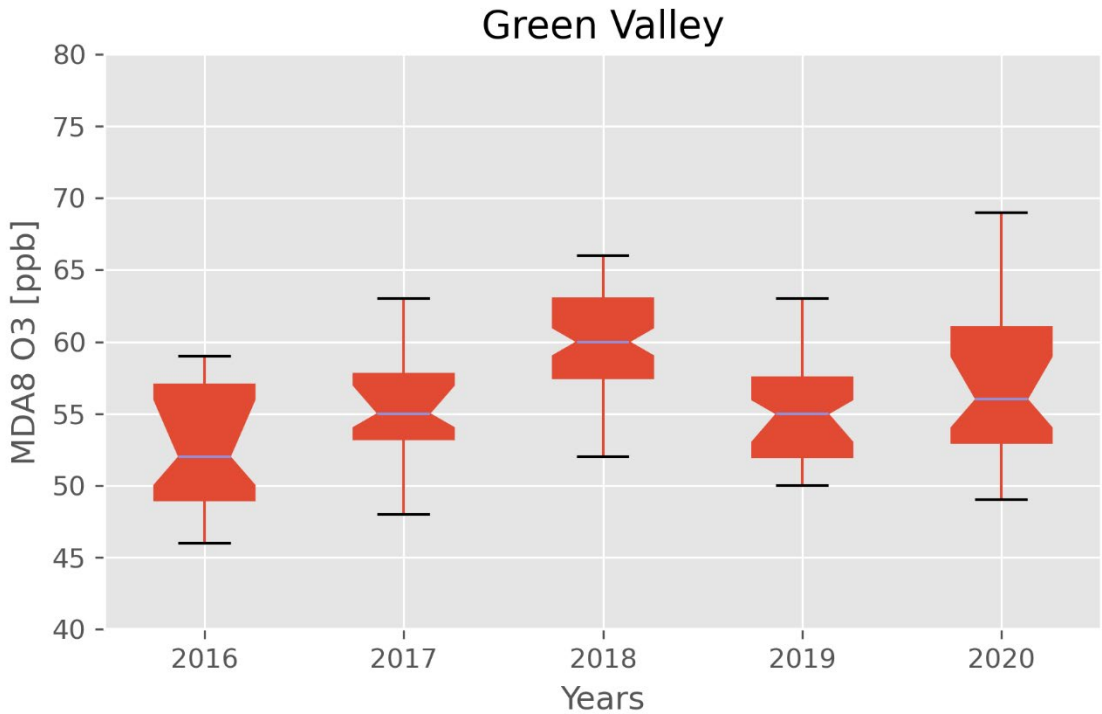


Figure G-2 (Cont.). Annual May distributions of MDA8 ozone at sites with exceptional events during May 2020. Notches denote 95th confidence interval of the median, boxes are 25th, 50th and 75th percentiles, and whiskers are 5th and 95th percentiles.



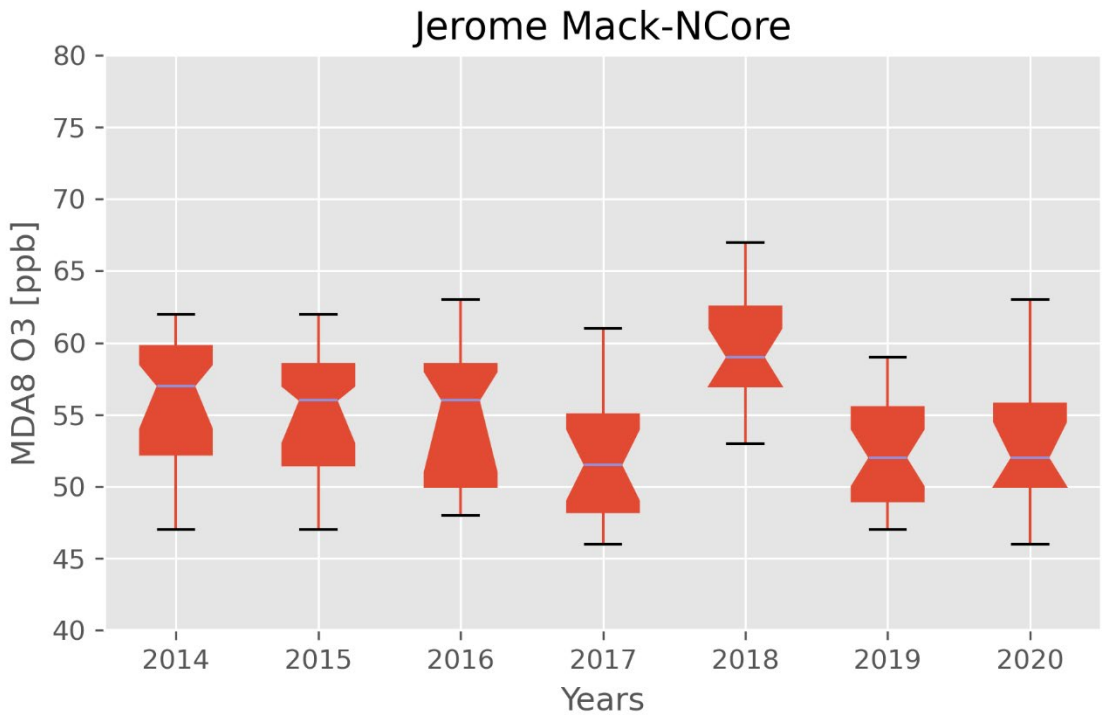
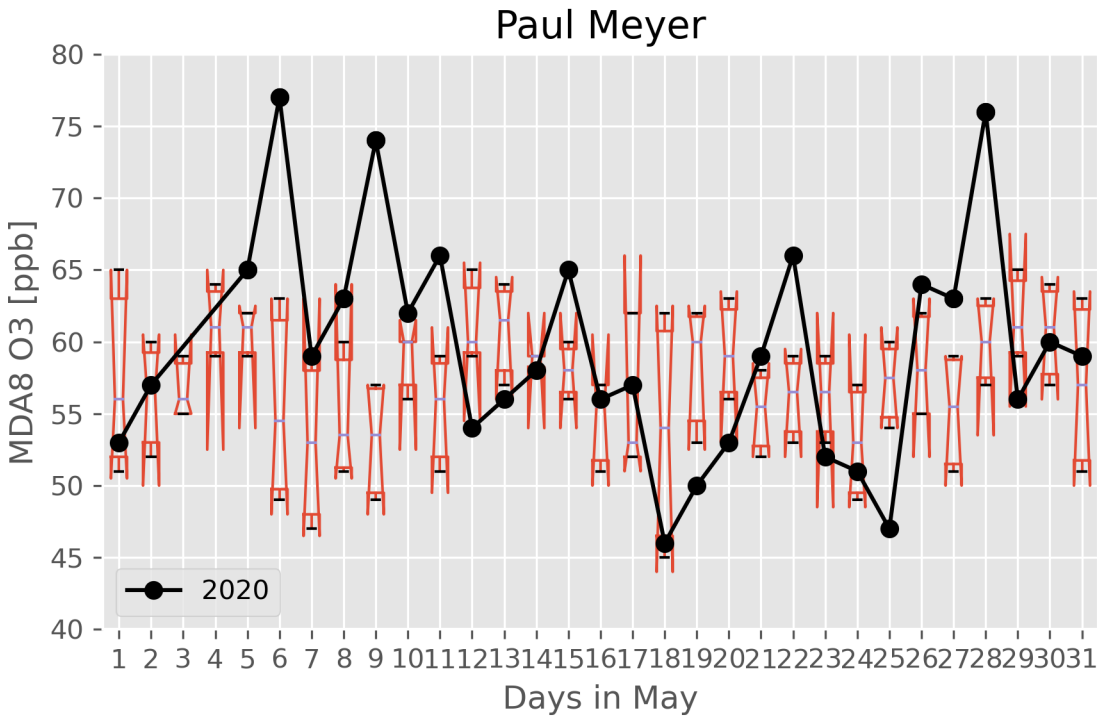


Figure G-2 (Cont.). Annual May distributions of MDA8 ozone at sites with exceptional events during May 2020. Notches denote 95th confidence interval of the median, boxes are 25th, 50th and 75th percentiles, and whiskers are 5th and 95th percentiles.



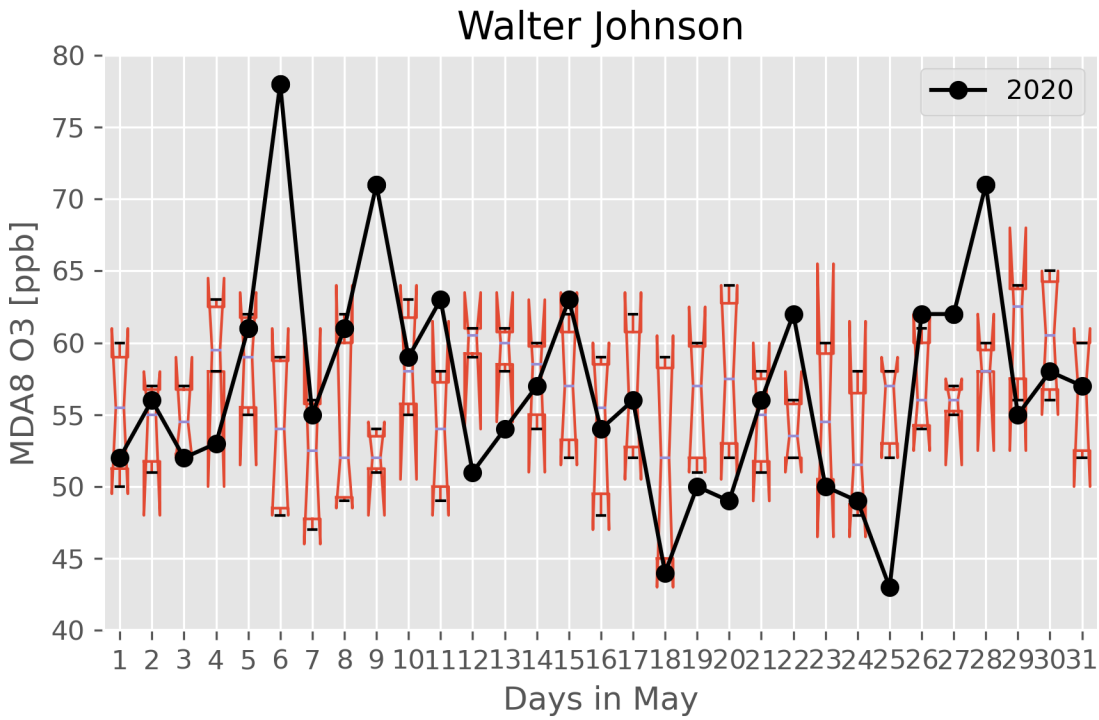


Figure G-3. Daily time series of 2014-2019 MDA8 ozone distributions and 2020 MDA8 ozone at each site with exceptional events during May 2020. Notches denote 95th confidence interval of the median, boxes are 25th, 50th and 75th percentiles, and whiskers are 5th and 95th percentiles.

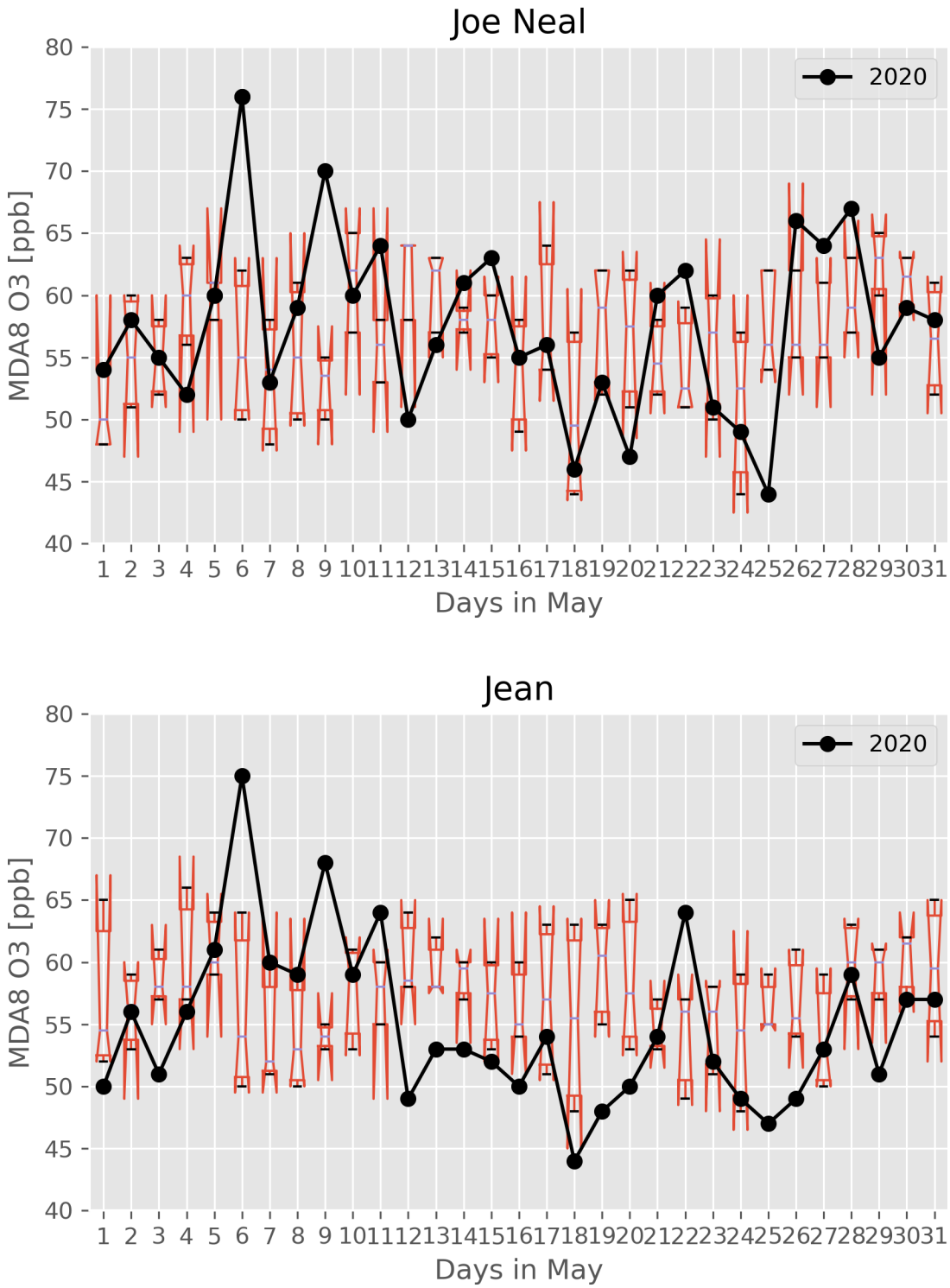
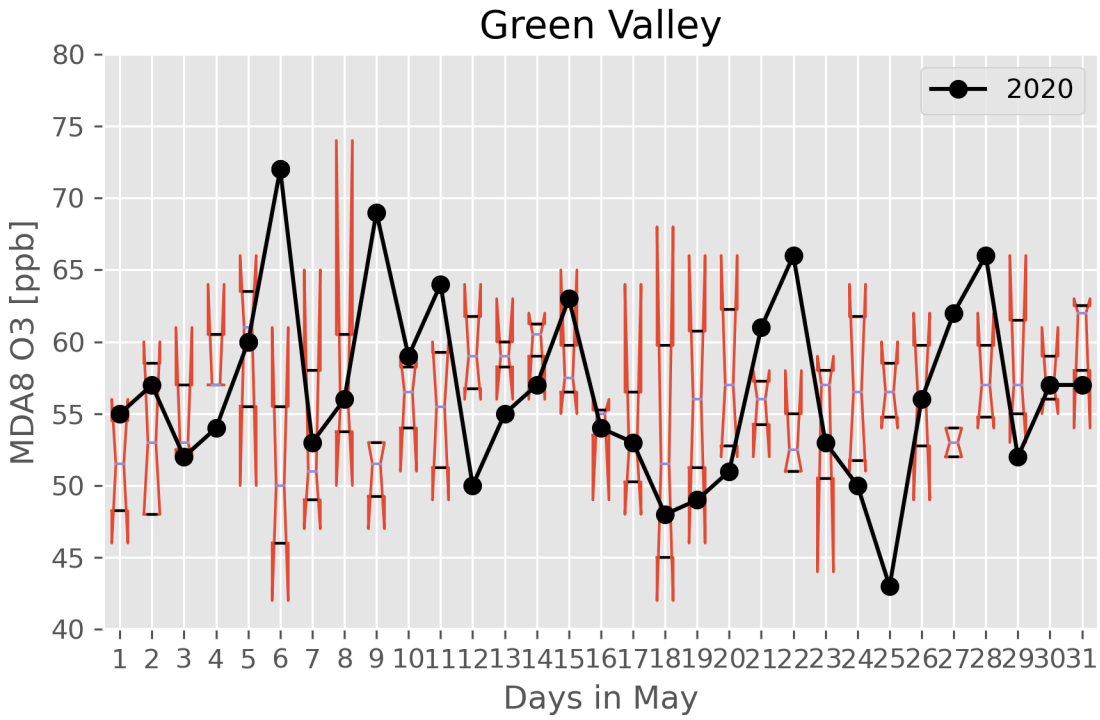


Figure G-3 (Cont.). Daily time series of 2014-2019 MDA8 ozone distributions and 2020 MDA8 ozone at each site with exceptional events during May 2020. Notches denote 95th confidence interval of the median, boxes are 25th, 50th and 75th percentiles, and whiskers are 5th and 95th percentiles.



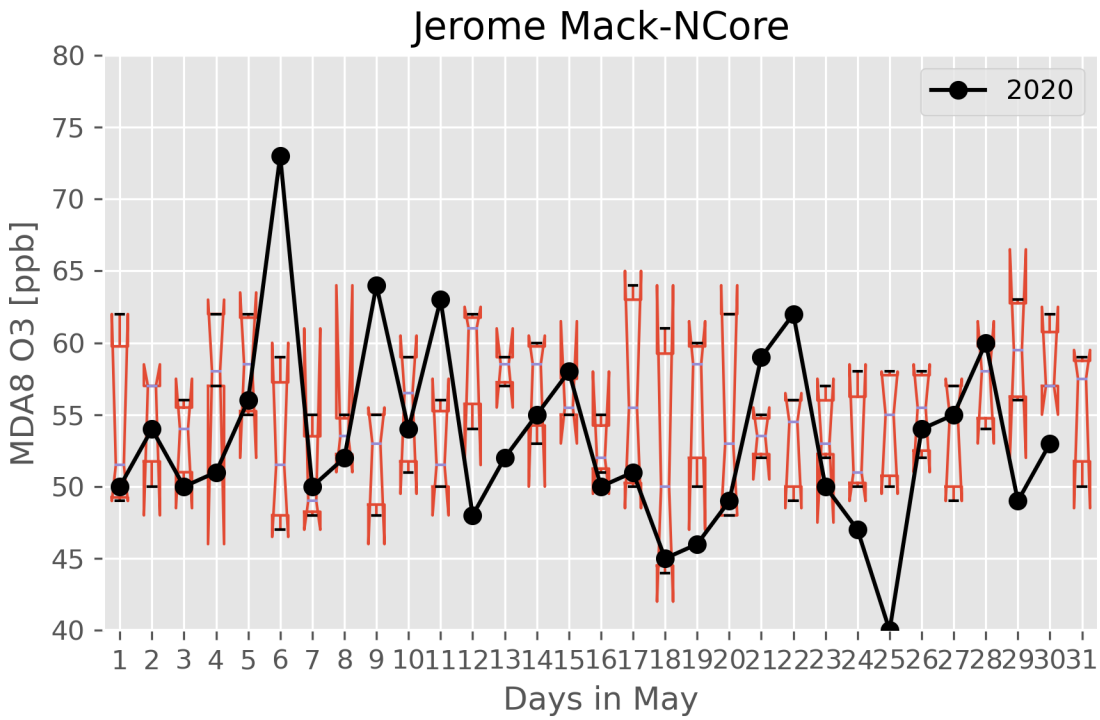


Figure G-3 (Cont.). Daily time series of 2014-2019 MDA8 ozone distributions and 2020 MDA8 ozone at each site with exceptional events during May 2020. Notches denote 95th confidence interval of the median, boxes are 25th, 50th and 75th percentiles, and whiskers are 5th and 95th percentiles.

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Appendix H. Documentation of Public Comment Process

This section provides documentation of the public comment process in support of Section 6 of this report.

To be updated once the public comment period has concluded.