The Colorado killer tornadoes of November 4, 1922

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November 4, 2022

Abstract

One of the deadliest days for tornadoes in Colorado history came at a very unusual time of year: November. On the 100th anniversary of this event, we briefly explore its meteorology, impacts, and how it stands alone in the climatological record in Colorado.

Introduction

Tornadoes are common in eastern Colorado, but fatalities from tornadoes are rare. As shown by (Childs & Schumacher, 2019), the vast majority of Colorado tornadoes are rated either 0 or 1 on the Enhanced Fujita scale. Colorado's tornado season generally extends from March through October (Fig. 1), with a peak in late May and early June. Yet November 4, 1922 stood apart from anything that has been observed in the modern tornado record. At least two significant tornadoes occurred in eastern Colorado, both of which caused fatalities. The five, possibly six, tornado fatalities on this day are the second-most on any day in Colorado history (based on the records in (Grazulis, 1993) and included on tornadoarchive.com; Table 1). ***And there has not been a single tornado—let alone a significant, killer tornado—reported in November in Colorado since.*** As it's been 100 years since it occurred, let's take a closer look at this remarkable event.

Figure 1: Seasonal distribution of Colorado tornado reports. The thin red line shows the average number of reports per day, with the thick black line representing a 15-day rolling average. The dark red and black lines at the bottom are the same, but for significant (F/EF2+ tornadoes). See more maps and graphs at https://climate.colostate.edu/severe_wx_climatology.html

Date	Location (County)	fatalities	F/EF rating
1915-06-30	Bent	1	3
1917-08-10	Baca	2	2
1922-11-04	Crowley/Lincoln	4	3
1922-11-04	Yuma/Phillips	1	3
1924-08-10	Washington/Kit Carson	10	4
1925-06-14	Pueblo	1	1
1926-08-10	Logan	1	3
1928-06-08	Baca	2	4
1928-06-29	Weld	2	4
1930-10-02	Pueblo/Crowley	3	3
1942-04-30	Bent/Kiowa	4	4
1960-06-27	Sedgwick/Philips	2	4
2007-03-28	Prowers	2	3
2008-05-22	Weld	1	3

Table 1: List of killer tornadoes in Colorado. Sources: Grazulis (1993) and NOAA Storm Data.

What happened?

(Grazulis, 1993) lists two separate tornadoes in Colorado on 4 November 1922, both of which were rated F3, occurred in the morning, and moved to the north-northeast (Fig. 2). There were also significant tornadoes in Nebraska, Kansas and Oklahoma on this day, including an F4 tornado near Tulsa. The first Colorado tornado was reported near Sugar City in southeast Colorado, and moved northward to near Genoa. Grazulis reports the time of this tornado as 5:00am local time, and notes that this "was probably a family of tornadoes" and that "just how continuous the path was can never be determined." The second formed in eastern Yuma County and moved north-northeastward into eastern Phillips County, with a reported time of 9:30am. These times are also highly unusual. There are no other significant tornadoes on record in Colorado that occurred between 4-9am local time, and only a couple in the 9am-noon time frame.

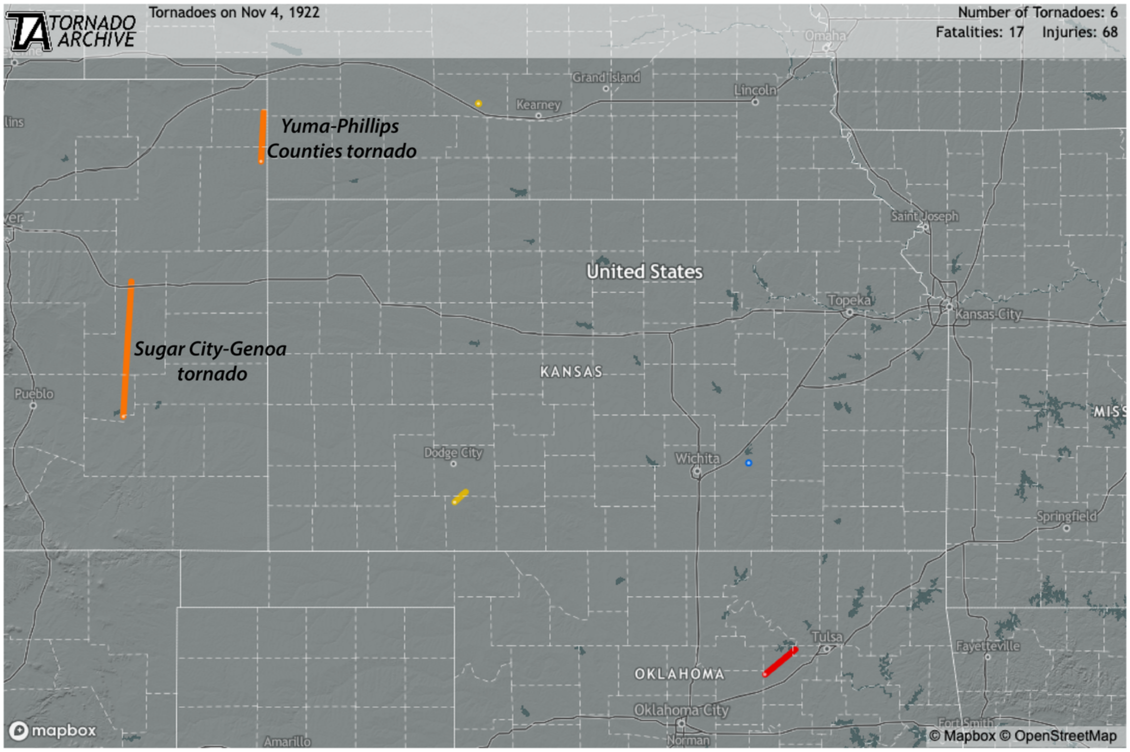
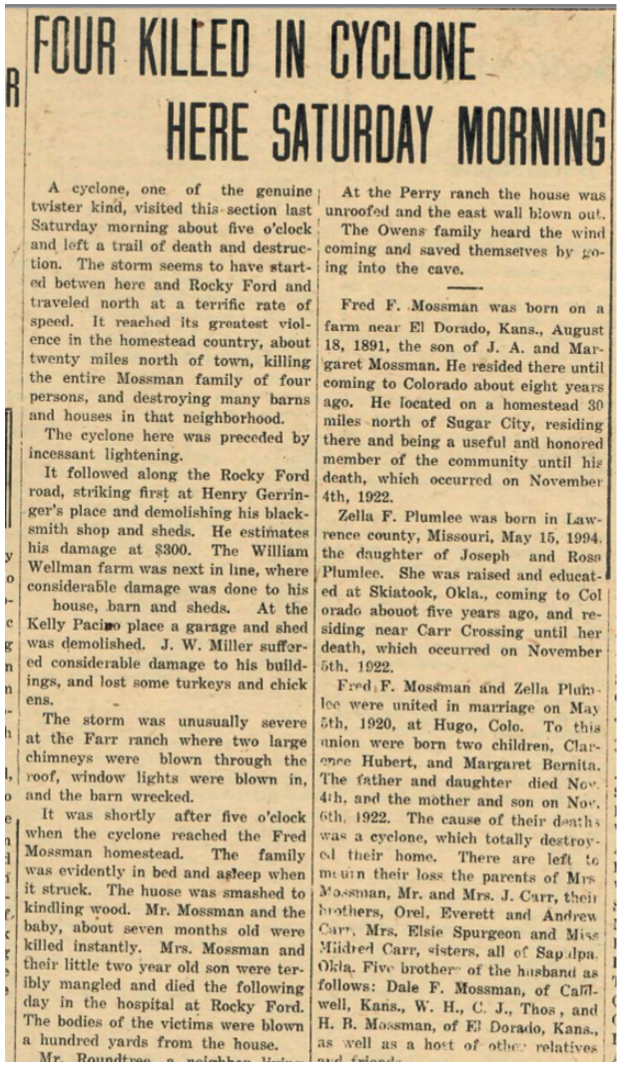


Figure 2: Map of tornadoes on 4 November 1922, from tornadoarchive.com

News articles provide a detailed account of the impacts of the tornadoes. The Sugar City Gazette (Fig. 3) documented the tragic story of the Mossman family—the two parents and two small children—who were sadly all killed as the tornado moved through their homestead north of Sugar City. This article notes that the tornado hit at about 5:00am, and the family was asleep when it hit. The Ordway New Era (Fig. 4) reports a similar narrative, and also notes that the storm brought the first moisture in months and large hail that remained on the ground until the next day. Furthermore, blizzard conditions arrived in the Pueblo area in the afternoon of November 4, and other news stories point out that an 11-year-old boy died after being stranded in the blizzard northeast of Pueblo.



FOUR KILLED IN CYCLONE HERE SATURDAY MORNING

A cyclone, one of the genuine twister kind, visited this section last Saturday morning about five o'clock and left a trail of death and destruction. The storm seems to have started betwen here and Rocky Ford and traveled north at a terrific rate of speed. It reached its greatest violence in the homestead country, about twenty miles north of town, killing the entire Mossman family of four persons, and destroying many barns and houses in that neighborhood.

The cyclone here was preceded by incessant lightening.

It followed along the Rocky Ford road, striking first at Henry Gerringer's place and demolishing his blacksmith shop and sheds. He estimates his damage at $300. The William Wellman farm was next in line, where considerable damage was done to his house, barn and sheds. At the Kelly Pacino place a garage and shed was demolished. J. W. Miller suffered considerable damage to his buildings, and lost some turkeys and chickens.

The storm was unusually severe at the Farr ranch where two large chimneys were blown through the roof, window lights were blown in, and the barn wrecked.

It was shortly after five o'clock when the cyclone reached the Fred Mossman homestead. The family was evidently in bed and asleep when it struck. The huose was smashed to kindling wood. Mr. Mossman and the baby, about seven months old were killed instantly. Mrs. Mossman and their little two year old son were terribly mangled and died the following day in the hospital at Rocky Ford. The bodies of the victims were blown a hundred yards from the house.

At the Perry ranch the house was unroofed and the east wall blown out.

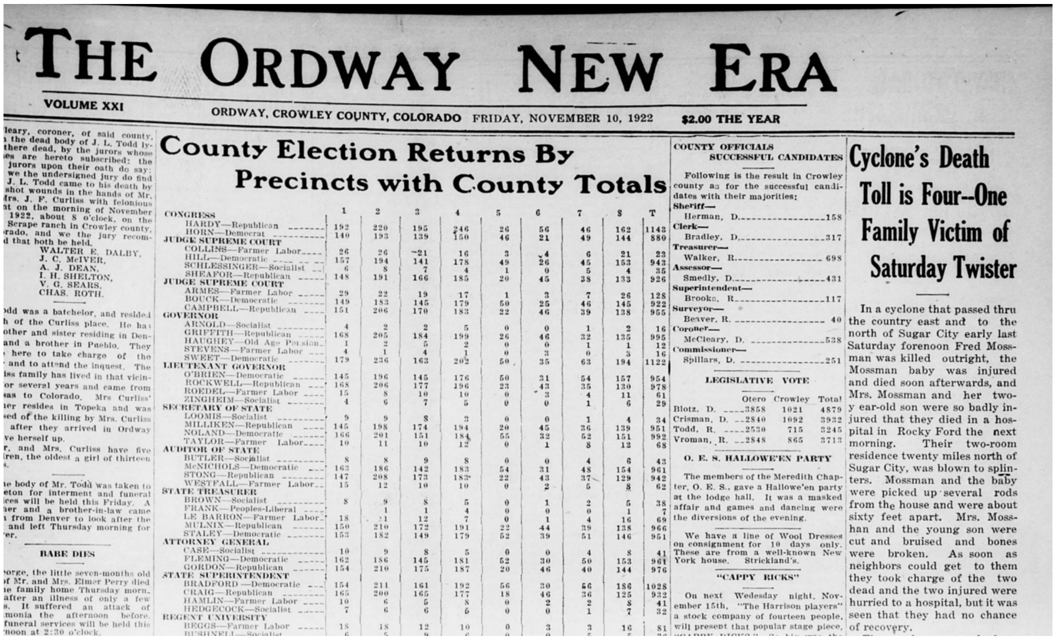
The Owens family heard the wind coming and saved themselves by going into the cave.

Fred F. Mossman was born on a farm near El Dorado, Kans., August 18, 1891, the son of J. A. and Margaret Mossman. He resided there until coming to Colorado about eight years ago. He located on a homestead 30 miles north of Sugar City, residing there and being a useful and honored member of the community until his death, which occurred on November 4th, 1922.

Zella F. Plumlee was born in Lawrence county, Missouri, May 15, 1994, the daughter of Joseph and Rose Plumlee. She was raised and educated at Skiatook, Okla., coming to Colorado abouot five years ago, and residing near Carr Crossing until her death, which occurred on November 5th, 1922.

Fred F. Mossman and Zella Plumlee were united in marriage on May 5th, 1920, at Hugo, Colo. To this union were born two children, Clarence Hubert, and Margaret Bernita. The father and daughter died Nov. 4th, and the mother and son on Nov. 6th, 1922. The cause of their deaths was a cyclone, which totally destroyed their home. There are left to mourn their loss the parents of Mrs Mossman, Mr. and Mrs. J. Carr, their brothers, Orel, Everett and Andrew Carr, Mrs. Elsie Spurgeon and Miss Mildred Carr, sisters, all of Sapulpa, Okla. Five brothers of the husband as follows: Dale F. Mossman, of Caldwell, Kans., W. H., C. J., Thos, and H. B. Mossman, of El Dorado, Kans., as well as a host of other relatives

Figure 3: Article in the Sugar City Gazette, November 10, 1922. Kindly provided by Annette Barber of the Crowley County Heritage Center.



THE ORDWAY NEW ERA

VOLUME XXI — ORDWAY, CROWLEY COUNTY, COLORADO — FRIDAY, NOVEMBER 10, 1922 — $2.00 THE YEAR

County Election Returns By Precincts with County Totals

	1	2	3	4	5	6	7	8	T
CONGRESS									
HARDY—Republican	192	220	195	246	26	56	46	162	1143
HORN—Democrat	140	193	139	150	46	21	49	144	880
JUDGE SUPREME COURT									
COLLINS—Farmer Labor	26	26	21	16	3	4	6	21	23
HILL—Democratic	157	194	141	178	49	26	45	153	943
SCHLESSINGER—Socialist	6	8	7	4	1	0	5	4	35
SHEAFOR—Republican	148	191	166	185	20	45	38	133	926
JUDGE SUPREME COURT									
ARMES—Farmer Labor	29	22	19	17	1	3	7	26	128
BOUCK—Democratic	149	183	145	179	50	25	46	145	922
CAMPBELL—Republican	151	206	170	183	22	46	39	138	955
GOVERNOR									
ARNOLD—Socialist	4	2	2	5	0	0	1	2	16
GRIFFITH—Republican	168	205	184	199	26	46	32	135	995
HAUGHEY—Old Age Pension	1	2	5	2	0	0	1	1	12
STEVENS—Farmer Labor	4	1	4	1	0	3	0	3	16
SWEET—Democratic	179	236	163	202	50	35	63	194	1122
LIEUTENANT GOVERNOR									
O'BRIEN—Democratic	145	196	145	176	50	31	54	157	954
ROCKWELL—Republican	168	206	177	196	23	43	35	130	978
ROEDEL—Farmer Labor	15	8	10	10	0	3	4	11	61
ZINGHEIM—Socialist	4	6	7	5	0	0	1	6	29
SECRETARY OF STATE									
LOOMIS—Socialist	9	9	8	3	0	0	1	4	34
MILLIKEN—Republican	145	198	174	194	20	45	36	139	951
NOLAND—Democratic	166	201	151	184	55	32	52	151	992
TAYLOR—Farmer Labor	10	11	10	12	0	1	8	12	68
AUDITOR OF STATE									
BUTLER—Socialist	8	8	9	8	0	0	4	6	43
McNICHOLS—Democratic	163	186	142	183	54	31	48	154	961
STONG—Republican	147	208	173	183	22	43	37	129	942
WESTFALL—Farmer Labor	15	12	10	10	0	2	5	8	62
STATE TREASURER									
BROWN—Socialist	8	9	8	5	0	1	2	5	38
FRANK—Peoples-Liberal		1	1	4	0	0	0	1	7
LE BARRON—Farmer Labor	18	21	12	7	0	1	4	16	69
MULNIX—Republican	150	210	172	191	22	44	39	138	966
STALEY—Democratic	153	182	149	179	52	39	51	146	951
ATTORNEY GENERAL									
CASE—Socialist	10	9	8	5	0	0	4	8	41
FLEMING—Democratic	162	186	145	181	52	30	50	153	961
GORDON—Republican	154	210	175	187	20	46	40	144	976
STATE SUPERINTENDENT									
BRADFORD—Democratic	154	211	161	192	56	30	56	186	1028
CRAIG—Republican	165	200	165	177	18	46	36	125	932
HAMLIN—Farmer Labor	10	6	5	8	0	2	2	8	41
HEDGECOCK—Socialist	7	6	6	5	0	0	1	7	32
REGENT UNIVERSITY									
BEGGS—Farmer Labor	18	18	12	10	0	3	3	16	81

COUNTY OFFICIALS SUCCESSFUL CANDIDATES

Following is the result in Crowley county as for the successful candidates with their majorities:

Sheriff—
Herman, D. 158
Clerk—
Bradley, D. 317
Treasurer—
Walker, R. 698
Assessor—
Smedly, D. 431
Superintendent—
Brooks, R. 117
Surveyor—
Beaver, R. 40
Coroner—
McCleary, D. 538
Commissioner—
Spillars, D. 251

LEGISLATIVE VOTE

	Otero	Crowley	Total
Blotz, D.	3858	1021	4879
Crisman, D.	2840	1092	3932
Todd, R.	2530	715	3245
Vroman, R.	2848	865	3713

O. E. S. HALLOWE'EN PARTY

The members of the Meredith Chapter, O. E. S., gave a Hallowe'en party at the lodge hall. It was a masked affair and games and dancing were the diversions of the evening.

We have a line of Wool Dresses on consignment for 10 days only. These are from a well-known New York house. Strickland's.

"CAPPY RICKS"

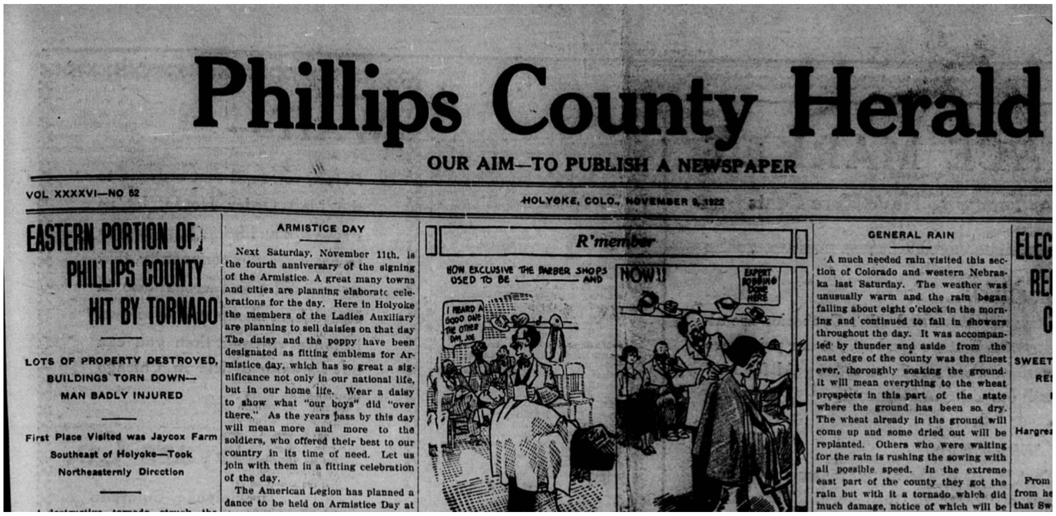
On next Wedesday night, November 15th, "The Harrison players" a stock company of fourteen people, will present that popular stage piece,

Cyclone's Death Toll is Four--One Family Victim of Saturday Twister

In a cyclone that passed thru the country east and to the north of Sugar City early last Saturday forenoon Fred Mossman was killed outright, the Mossman baby was injured and died soon afterwards, and Mrs. Mossman and her two-y ear-old son were so badly injured that they died in a hospital in Rocky Ford the next morning. Their two-room residence twenty miles north of Sugar City, was blown to splinters. Mossman and the baby were picked up several rods from the house and were about sixty feet apart. Mrs. Mosshan and the young son were cut and bruised and bones were broken. As soon as neighbors could get to them they took charge of the two dead and the two injured were hurried to a hospital, but it was seen that they had no chance of recovery.

Figure 4: Front page of the Ordway New Era, November 10, 1922. The full issue can be found at Colorado Historic Newspapers. Thanks to the team at Colorado Historic Newspapers for preserving this history!

Farther north, another tornado crossed from Yuma County into the eastern part of Phillips County later that morning. This tornado also caused significant damage to homes and farm buildings, caused several injuries, and killed a teacher as it passed to the east of Holyoke. The Phillips County Herald similarly details which homes and farms were affected by the storm (Fig. 5). Interestingly, the story in the Wray Rattler (Fig. 6) focuses first on the beneficial rains from the storms, before mentioning the tornado. This article also discusses a tornado fatality (Mr. O'Connor, north of Laird), that appears to be distinct from that in Phillips County (the teacher, Mr. Bishop). So it is possible that the Yuma-Phillips County tornado was actually responsible for two fatalities, and that the total for the day was six.



Phillips County Herald

OUR AIM—TO PUBLISH A NEWSPAPER

VOL XXXXVI—NO 52

HOLYOKE, COLO., NOVEMBER 9, 1922

EASTERN PORTION OF PHILLIPS COUNTY HIT BY TORNADO

LOTS OF PROPERTY DESTROYED, BUILDINGS TORN DOWN—MAN BADLY INJURED

First Place Visited was Jaycox Farm Southeast of Holyoke—Took Northeasternly Direction

ARMISTICE DAY

Next Saturday, November 11th, is the fourth anniversary of the signing of the Armistice. A great many towns and cities are planning elaborate celebrations for the day. Here in Holyoke the members of the Ladies Auxiliary are planning to sell daisies on that day The daisy and the poppy have been designated as fitting emblems for Armistice day, which has so great a significance not only in our national life, but in our home life. Wear a daisy to show what "our boys" did "over there." As the years pass by this day will mean more and more to the soldiers, who offered their best to our country in its time of need. Let us join with them in a fitting celebration of the day.

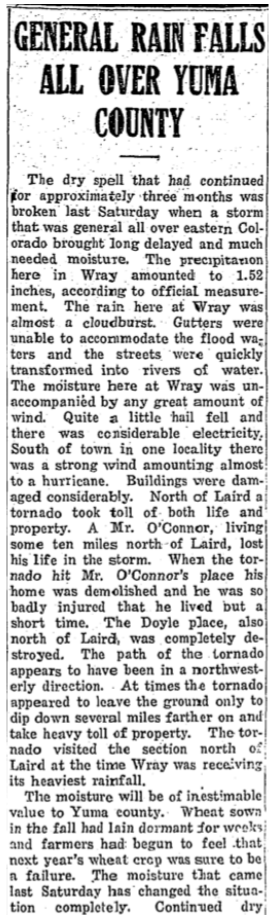
The American Legion has planned a dance to be held on Armistice Day at

R'member

GENERAL RAIN

A much needed rain visited this section of Colorado and western Nebraska last Saturday. The weather was unusually warm and the rain began falling about eight o'clock in the morning and continued to fall in showers throughout the day. It was accompanied by thunder and aside from the east edge of the county was the finest ever, thoroughly soaking the ground. It will mean everything to the wheat prospects in this part of the state where the ground has been so dry. The wheat already in the ground will come up and some dried out will be replanted. Others who were waiting for the rain is rushing the sowing with all possible speed. In the extreme east part of the county they got the rain but with it a tornado which did much damage, notice of which will be

Figure 5: Phillips County Herald, November 9, 1922. The full issue can be found at Colorado Historic Newspapers.



GENERAL RAIN FALLS ALL OVER YUMA COUNTY

The dry spell that had continued for approximately three months was broken last Saturday when a storm that was general all over eastern Colorado brought long delayed and much needed moisture. The precipitation here in Wray amounted to 1.52 inches, according to official measurement. The rain here at Wray was almost a cloudburst. Gutters were unable to accommodate the flood waters and the streets were quickly transformed into rivers of water. The moisture here at Wray was unaccompanied by any great amount of wind. Quite a little hail fell and there was considerable electricity. South of town in one locality there was a strong wind amounting almost to a hurricane. Buildings were damaged considerably. North of Laird a tornado took toll of both life and property. A Mr. O'Connor, living some ten miles north of Laird, lost his life in the storm. When the tornado hit Mr. O'Connor's place his home was demolished and he was so badly injured that he lived but a short time. The Doyle place, also north of Laird, was completely destroyed. The path of the tornado appears to have been in a northwesterly direction. At times the tornado appeared to leave the ground only to dip down several miles farther on and take heavy toll of property. The tornado visited the section north of Laird at the time Wray was receiving its heaviest rainfall.

The moisture will be of inestimable value to Yuma county. Wheat sown in the fall had lain dormant for weeks and farmers had begun to feel that next year's wheat crop was sure to be a failure. The moisture that came last Saturday has changed the situation completely. Continued dry

Figure 6: The Wray Rattler, November 9, 1922. The full issue can be found at Colorado Historic Newspapers.

Meteorological overview

What were the meteorological conditions that set the stage for such an unusual and impactful event? Information from the 20th-century reanalysis project ((Slivinski et al., 2019)), a reconstruction of the weather of the 20th century that assimilates surface pressure observations into a modern atmospheric computer model, provides valuable insights into what happened. At the midlevels of the atmosphere (Fig. 7), there was a deep trough of low pressure centered near the Four Corners on the morning of November 4th. To the east of this trough were strong winds out of the south-southwest. At the surface, a developing low-pressure system was located over eastern Colorado, with south-southeasterly winds transporting moisture northward across the Great Plains (Fig. 8). Dewpoints in eastern Colorado approached 10°C (50°F) to the east of what appears to be a dryline. These findings establish that the ingredients for strong, rotating storms (moisture, instability, lift, and vertical wind shear) were in place on this day. Deep troughs of low pressure and extratropical cyclones are often associated with high-impact weather in Colorado, including heavy snow and severe thunderstorms. Large-scale patterns such as these are also not that uncommon in the fall months. More detailed research would be needed to better understand what allowed this particular weather system to produce significant tornadoes, when broadly similar weather systems often occur in November but do not result in tornadoes, or at least not as far west as Colorado. But, we do have some additional tools we can use to dig in a bit further.

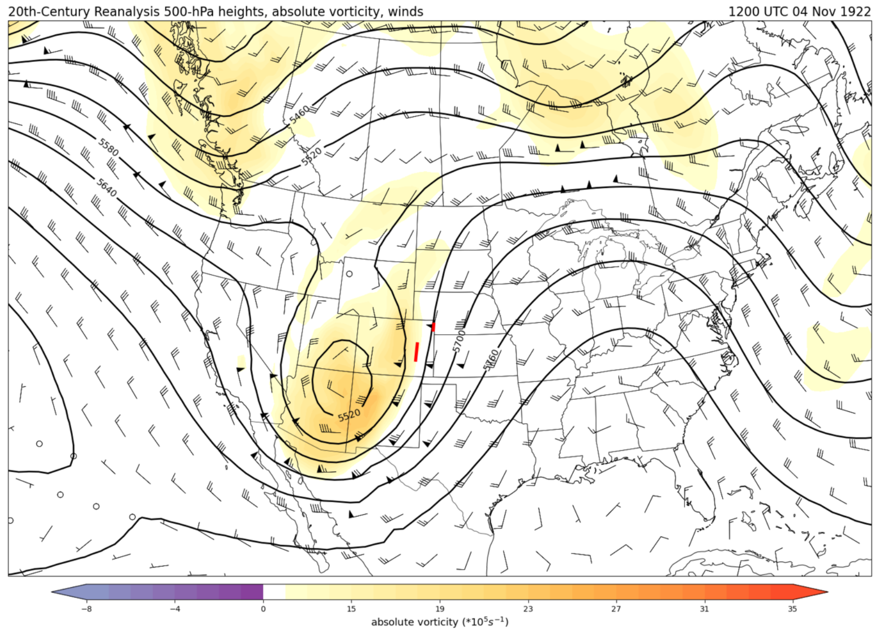


Figure 7: Map of 500-hPa geopotential height (m, black contours), absolute vorticity (color shading), and winds, from the 20th Century Reanalysis version 3, at 1200 UTC (5:00 am local time) 4 November 1922. The estimated tracks of the November 4 tornadoes in Colorado are shown in red.

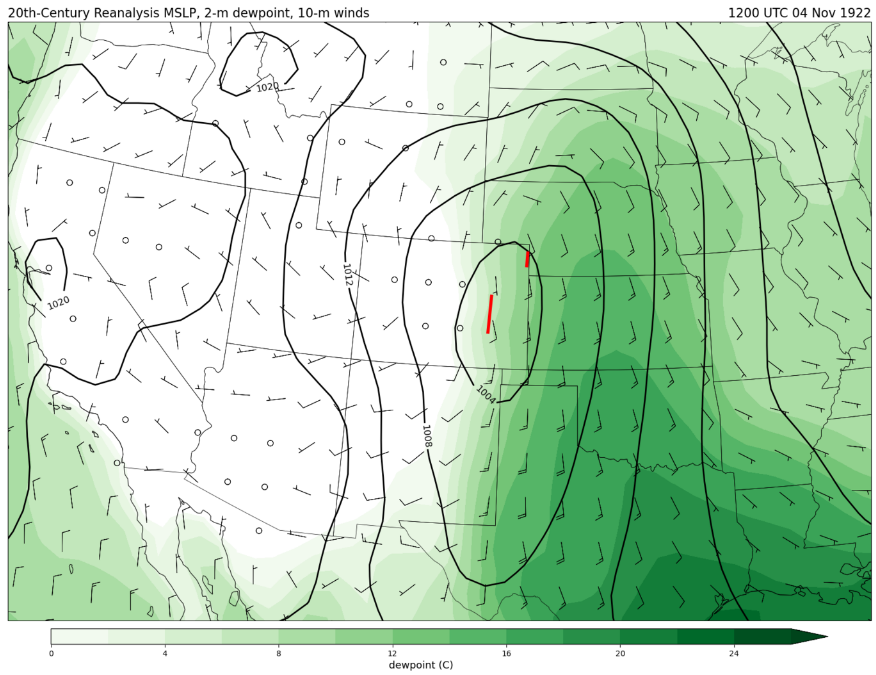


Figure 8: Map of pressure adjusted to sea level (hPa, black contours), 2-m dewpoint (°C), and 10-m winds from the 20th Century Reanalysis version 3, at 1200 UTC (5:00 am local time) 4 November 1922. The estimated tracks of the November 4 tornadoes in Colorado are shown in red.

Numerical model simulation

What might this event have looked like, if we could see it through the modern understanding of severe storms? Unfortunately, we can't go back and take measurements with radars or satellites, but we can try to replicate aspects of the storms using computer models—the same type of models used to forecast the daily weather. Information from the 20th Century Reanalysis shown above can be put into the Weather Research and Forecasting (WRF) model to produce a retrospective simulation of the 4 November 1922 tornado-producing storms. Similar techniques have been used to simulate historic blizzards ((Michaelis & Lackmann, 2013)) and floods ((Mahoney et al., 2022)), among other phenomena.

The configuration of the WRF model was generally the same as that used for real-time 4-km forecasts by our research group at CSU, along with a 1.33-km nested grid centered over eastern Colorado. Key parameterization choices include the Morrison 2-moment cloud microphysics parameterization, the Mellor-Yamada-Janjic boundary layer parameterization. The simulations required some trial-and-error with respect to the model initialization time, and it was found that initializing with the ensemble mean analysis at 1800 UTC 3 November 1922, from version v2c of the 20th-century reanalysis, produced a simulation with numerous supercell storms in eastern Colorado, whereas other initialization times showed fewer supercells or different storm modes. So the discussion to follow is based on this most successful model run. Using the full ensemble of analyses from the 20CR in WRF would likely reveal even more interesting insights into this event, but that would require more time and computing resources than are available at the moment.

In this simulation, numerous supercells (rotating thunderstorms) initiate across eastern Colorado and move quickly toward the north and/or northeast (Fig. 9). Swaths of updraft helicity, which represent the combined strength of the updraft and rotation in the storm, followed tracks broadly similar to the reported tracks of the tornadoes in the November 1922 event. In addition to long-track storms in southeast and northeast Colorado, several other shorter-lived supercells also developed in the simulation. The longest-track storm in the simulation does follow a path similar to the Sugar City-Genoa tornado, and ends up moving into the Yuma-Phillips County area. This track and timing suggests that it's possible that a single supercell was responsible for both tornadoes, as alluded to by Grazulis, but of course this is impossible to know. One major discrepancy in the model simulation, however, is that the storms form in the evening of the 3rd (generally between 6-11pm local time), rather than on the morning of the 4th as was observed. The storms are also not in the exact locations of the observed storms. But precisely simulating the timing and location of the storm tracks would be unrealistic to expect for a simulation driven by the coarse input of the 20th-Century Reanalysis. These differences notwithstanding, the simulation provides insight into how the storms might have developed and behaved during an event in November 100 years ago.

Figure 9: Simulated radar reflectivity at 1 km AGL and swaths of 2-5-km updraft helicity (contoured at 150, 300, and 500 m^2/s^2) from the 1.33-km nest of the WRF simulation, animated between 2200 UTC 3 November and 0900 UTC 4 November 1922. (In Mountain time, 3pm 3 November to 2am 4 November.)

The simulation can also provide a closer look at the ingredients for supercells in eastern Colorado during this event. At the time the storms were intensifying in the simulation, convective available potential energy (CAPE) exceeded 1000 J/kg across eastern Colorado, and the vertical wind shear over the 0-6 km layer was greater than 25 m/s (Fig. 10). Likewise, model soundings in eastern Colorado showed unstable conditions, and strong vertical shear in both the near-surface layer and over a deeper layer (Fig. 11). All of these conditions are supportive of strong, rotating thunderstorms and potentially tornadoes. Similarly, commonly used parameters including the 0–1-km storm relative helicity and the significant tornado parameter had values in the model soundings that are often associated with strong tornadoes (over 350 m^2/s^2 and 2, respectively, Fig. 11). As noted above, the timing of these conditions was incorrect in the simulation, but it is probably safe to assume that they persisted into the morning hours during the real event, and supported the tornadoes that occurred.

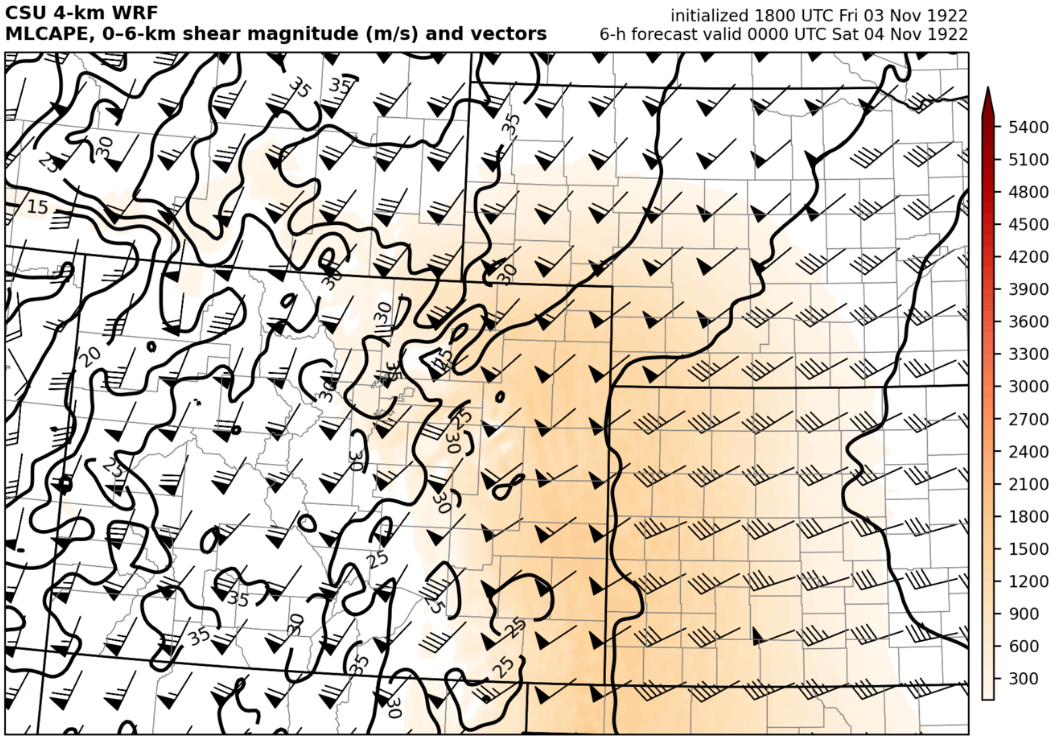


Figure 10: Mean-layer convective available potential energy (shaded in J/kg), 0-6 km vertical shear magnitude (black contours in m/s), and 0-6 km vertical shear vectors (barbs), from the 4-km grid of the WRF simulation at 0000 UTC 4 November 1922 (5pm November 3 local time.)

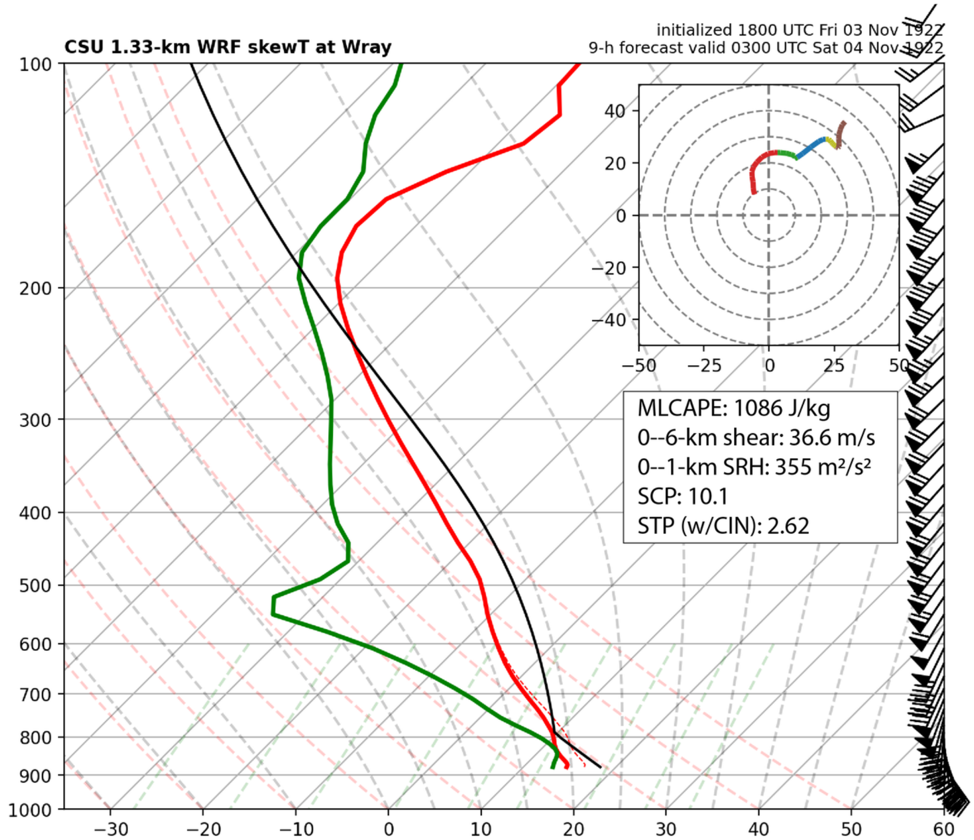


Figure 11: SkewT-logp diagrams from the 1.33-km grid of the WRF simulation at Wray in northeast Colorado, from 0300 UTC 4 November 1922 (8pm November 3 local time). Convective parameters are shown including the mean-layer CAPE, 0–6-km bulk wind difference, 0–1-km storm relative helicity (SRH), supercell composite parameter (SCP), and significant tornado parameter (STP).

Conclusion

On November 4, 1922, a most unusual, and devastating, outbreak of tornadoes occurred across eastern Colorado. It was the 2nd-deadliest day in state history from tornadoes, with at least 5 (possibly 6) people losing their lives, along with another fatality in the blizzard conditions that followed the severe weather. These are also the only tornadoes ever to be recorded in November in Colorado. The brief analysis presented here shows that a deep upper-level trough of low pressure over the Four Corners and a developing surface cyclone in eastern Colorado set the stage for severe thunderstorms on this day, and a high-resolution computer simulation sheds light on how the storms may have behaved during this historic event.

Acknowledgements

Huge thanks go to the Colorado Historic Newspapers project at the Colorado State Library, for archiving the news reports used here. Thanks also go to Annette Barber of the Crowley County Heritage Center, Mary Beth Tucker of CSU Extension in Crowley County, and Lane Simmons of the CSU Rocky Ford Research Station for helping to find valuable details about this event. Thanks also to Greg Heavener, Kyle Mozley, Jonathan Finch, and Steve Hodanish of the National Weather Service for pointing me to some of the relevant news stories that described the event. And thanks to the folks behind tornadoarchive.com for digitizing and maintaining historic tornado records.

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