



Wind Unit



The following pages are needed for students investigating **wind**.

Each student will need an investigation notebook.

You can choose to print evidence for each student, or one or two copies for students to look at together.

The evidence following the notebook are all primary sources, such as forecasted wind speeds from weather models and observed wind speed recorded during the fire.

Directions and handouts for all students are [here](#).

Notebook and evidence for Precipitation is [here](#).

Notebook and evidence for Temperature is [here](#).

Notebook and evidence for Forecast is [here](#).

Put it all together: Tell the story of wind and the Marshall Fire.

What evidence was most helpful in your investigation?



Fire Report



Investigator's Notebook



Wind
Unit



Name _____

Fire under investigation:

Location of fire:

Date(s) of fire:

Wind = The natural movement of air moving in a current

How does temperature impact fire risk?

Look at Front Range Downslope Winds. This graphic shows how wind moves from the west to the east over Boulder and surrounding areas.

What locations on this graphic do you think are likely to experience the fastest wind?

Look at the three maps of wind speeds at 11am, noon, and 2pm. Find five locations to compare. Write the locations, and wind speeds at 11am, noon, and 2pm.

Describe how wind speeds changed from 11am-2pm.

Look at the Highest Wind Reports for December 30th.

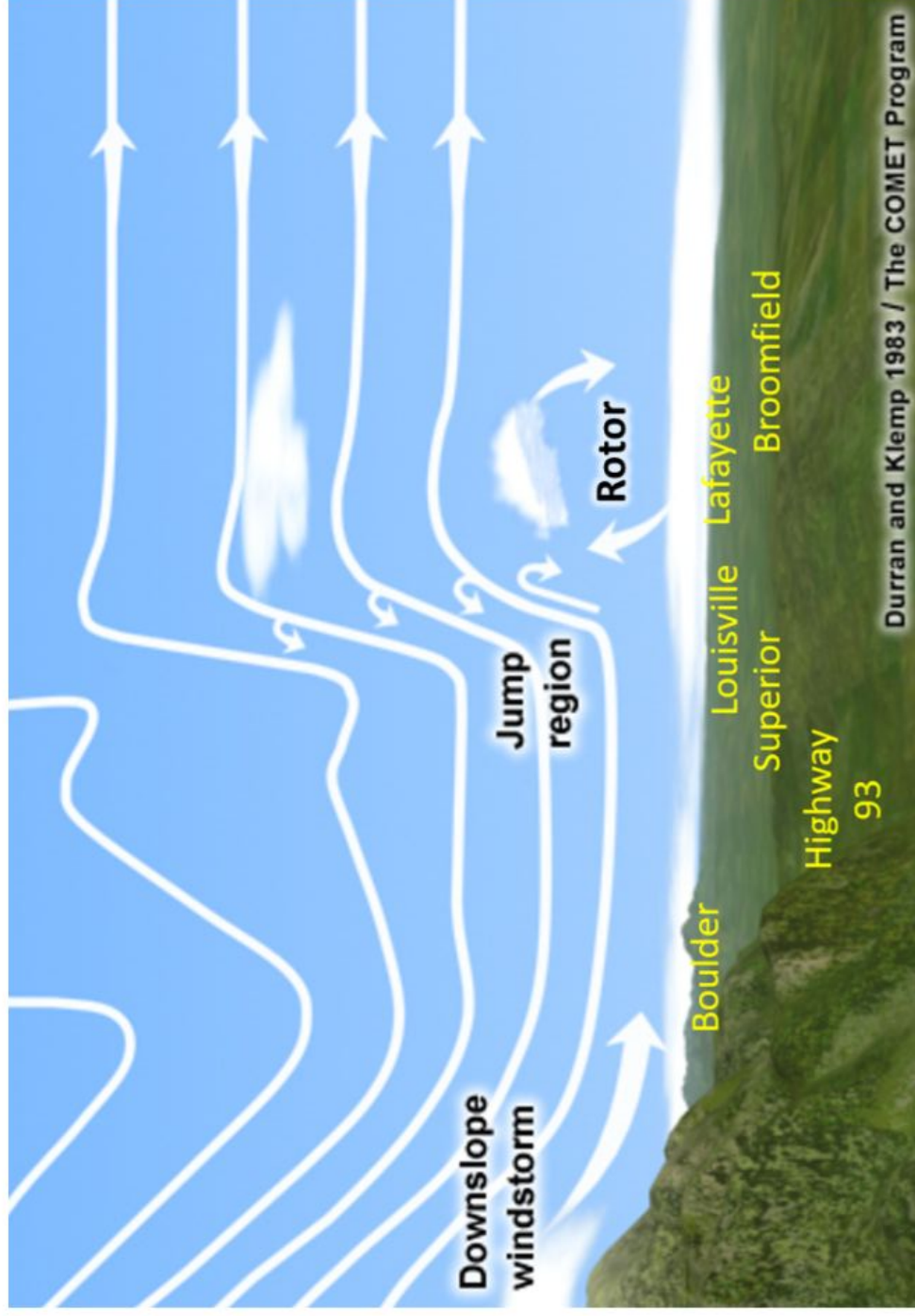
Which locations observed wind speeds over 75 mph? Write the location, wind speed and time of observation.

Use the Colorado County map to mark the locations of the highest observed wind. Mark the location of the Marshall Fire.

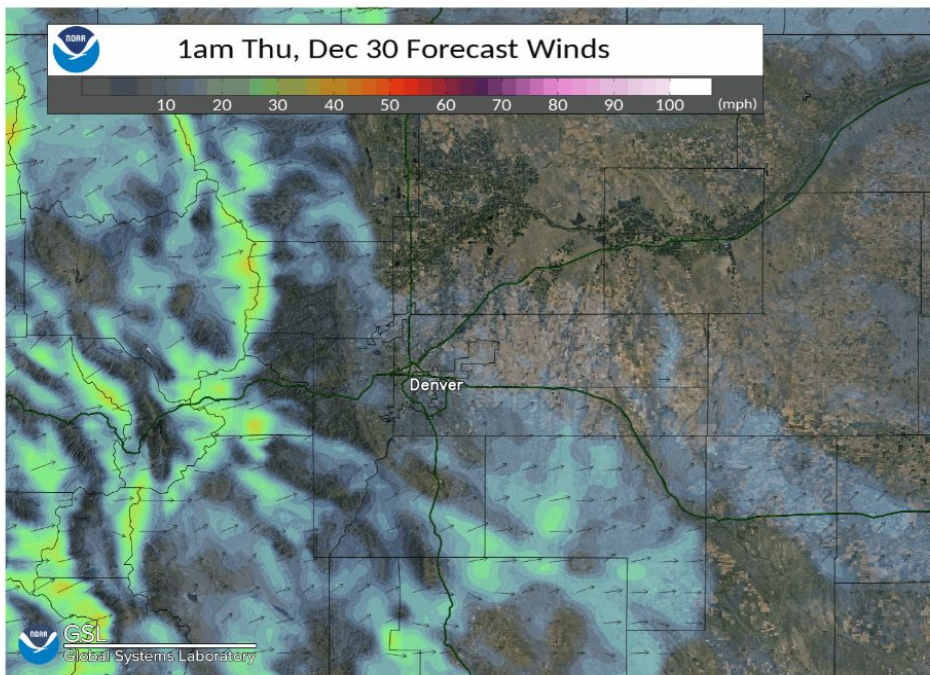
How do you think temperatures in December 2021 affected fire risk?

The winds around Louisville and Superior on December 30, 2021 were gusting up to 100 miles per hour. This is the same wind speed as a category 2 hurricane. High speed downslope winds in this area are strongest in December and January.

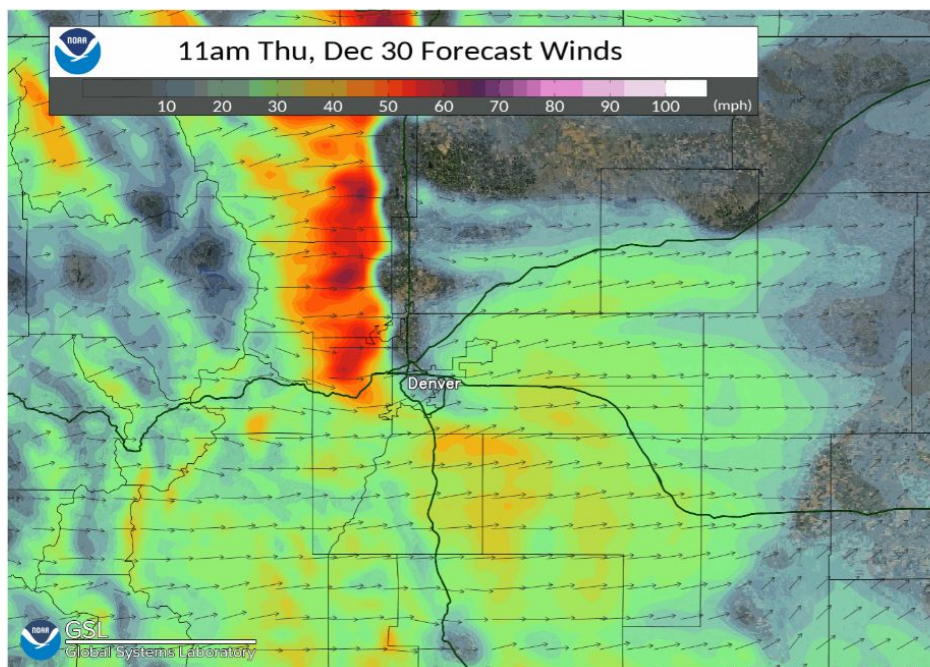
Front Range Downslope Winds



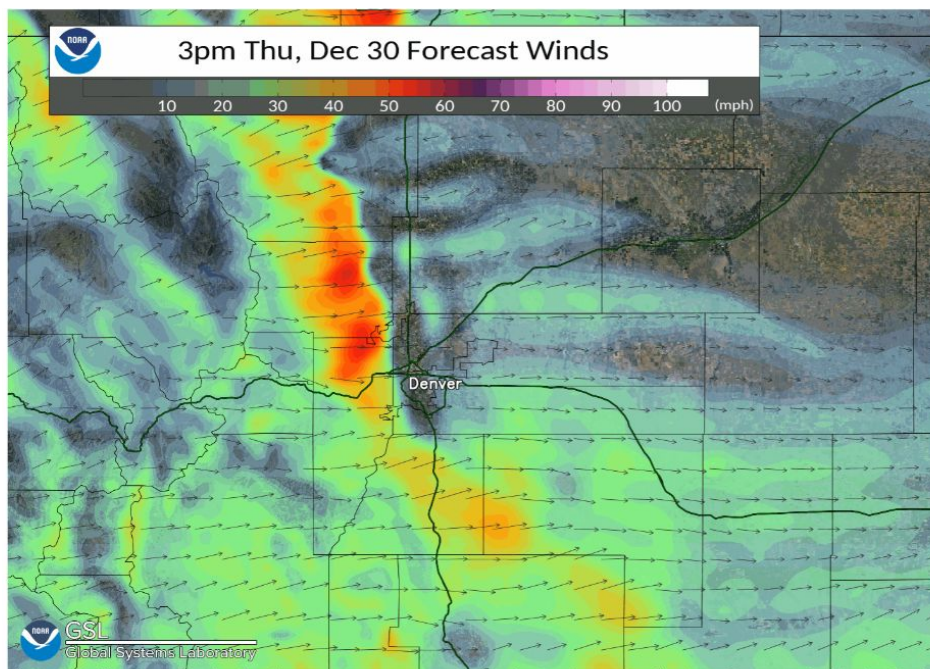
Durran and Klemp 1983 / The COMET Program



Forecasters could see a likelihood of very high speed winds by looking at the HRRR weather model. This image is a predication from the model from December 29th, predicting conditions on December 30th.



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Area Forecast Discussion

Issued by National Weather Service Denver/Boulder, CO

344 AM MST Thu Dec 30 2021

SHORT TERM... (Today and tonight)

Issued at 300 AM MST Thu Dec 30 2021

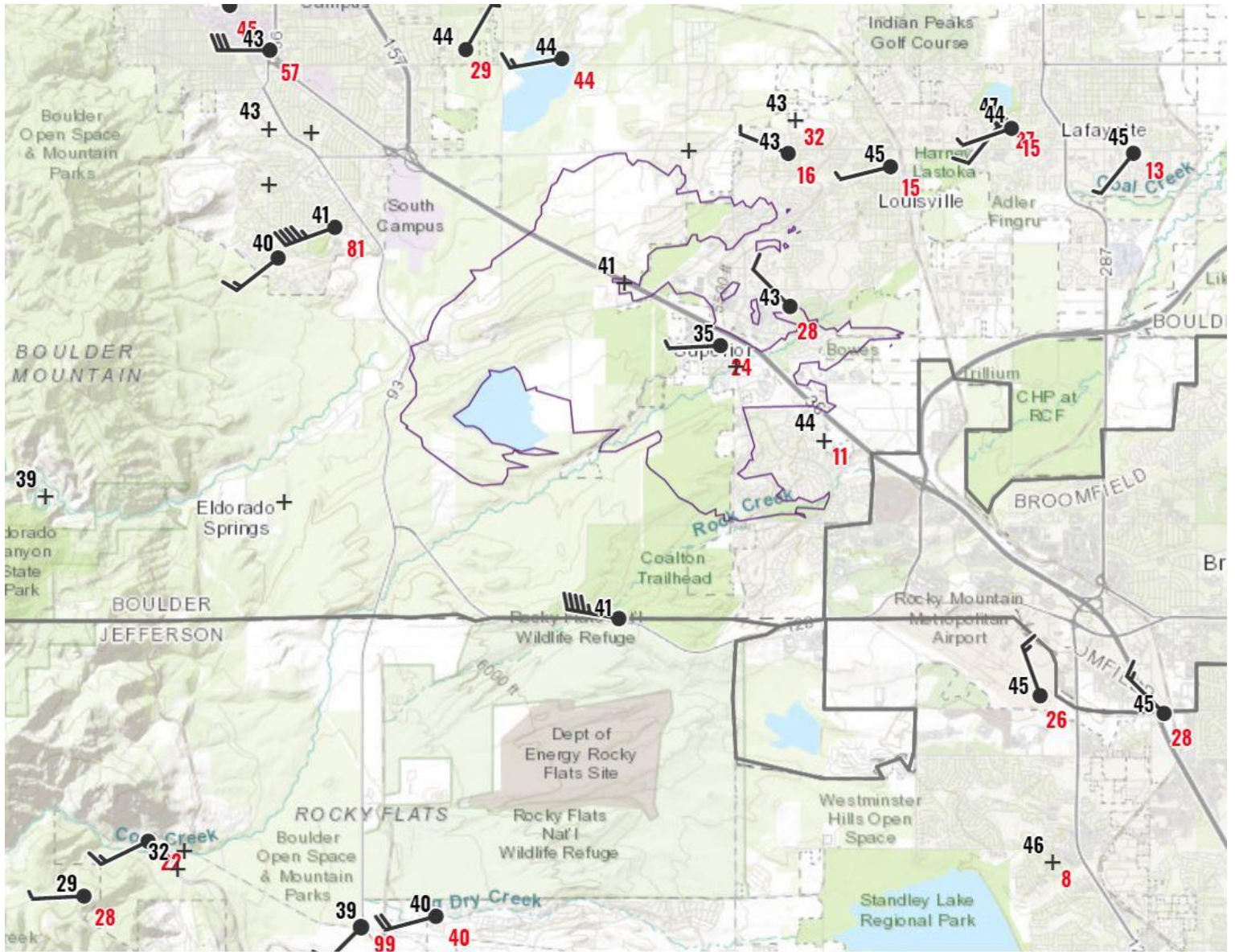
Nearly calm flow dominates over the area today through tonight as sfc low pres intensifies from WY into CO. For the mountains, cross-sections show moisture depth rather limited today but does increase by tonight. Orographics certainly are favorable along and south sides in the Front Range. Overall, though, most mtn areas will see periods of light snow through the day with heavier snow developing late this evening and overnight. Also surface winds will be sustained and a lot of blowing snow and low visibility will occur over the higher passes. Thus no changes have been made to warnings. However, Middle and North Park will need an advisory for blowing following snow for tonight which will continue through Friday.

Meanwhile, biggest headache tonight has been trying to figure out high wind potential, in and near the foothills, later this morning through the afn hours. High resolution data has been showing sporadic down-sloping momentum even to the base of the foothills, and possibly affecting the western areas of the I-25 Corridor from Denver north to the Wyoming border. Analysis of cross-sections don't show much mtn top stability for a mountain wave to develop. However, some of the higher resolution data does show some amplification late this morning thru mid afn. Cross-sections show low level gusts of winds near the surface.

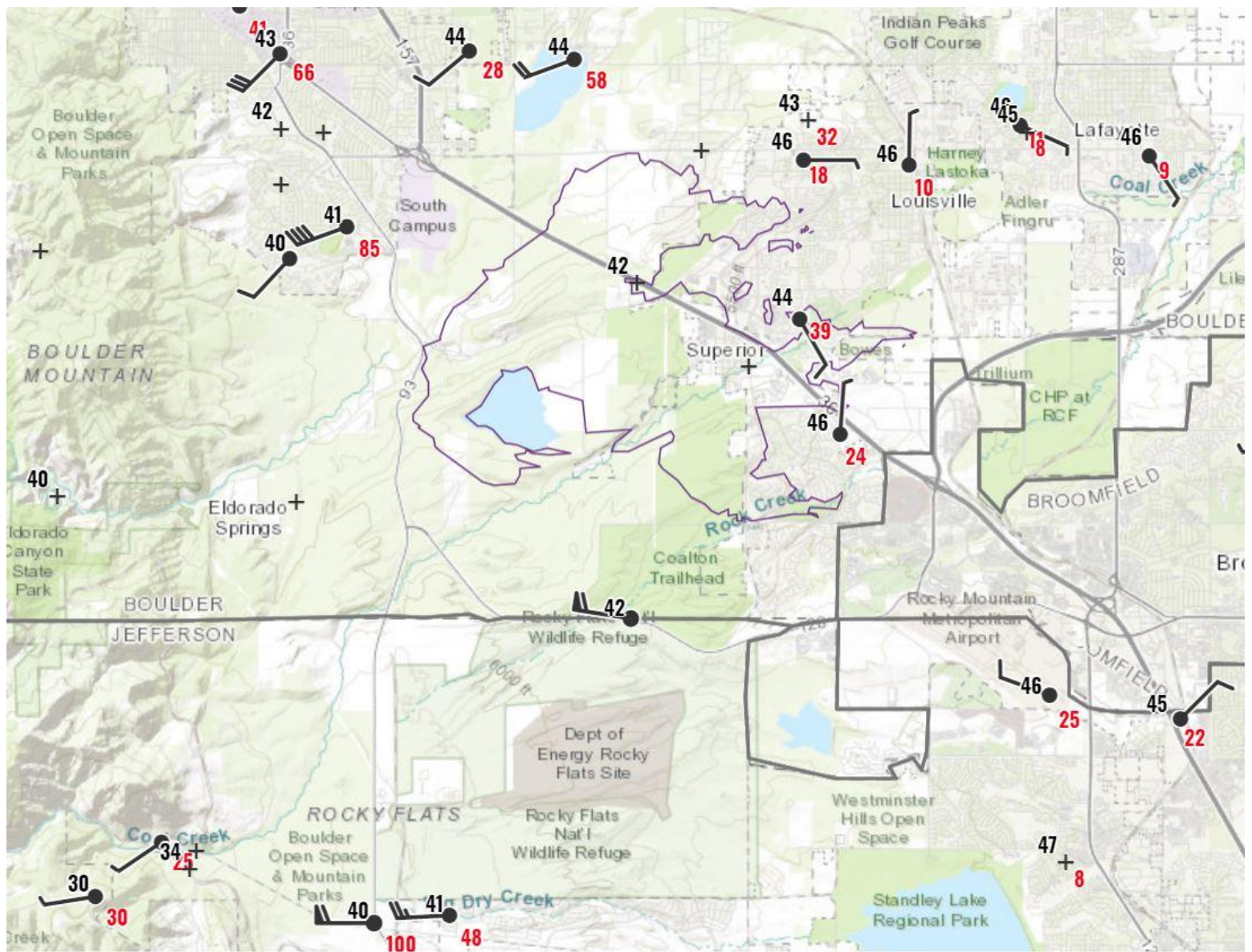
I certainly can't rule out strong winds at lower elevations near the base of the foothills for a few hours. HRRR shows gusts up to 90 mph and has these winds spreading further east than some of the other Hi-Res data. Confidence in all of this isn't high, however, I can't ignore what I'm seeing so will issue a High Wind Warning for zones 138,38 and 39. Overall appears high wind threat will decrease by 2300.

Wind Observations, December 30, 11am

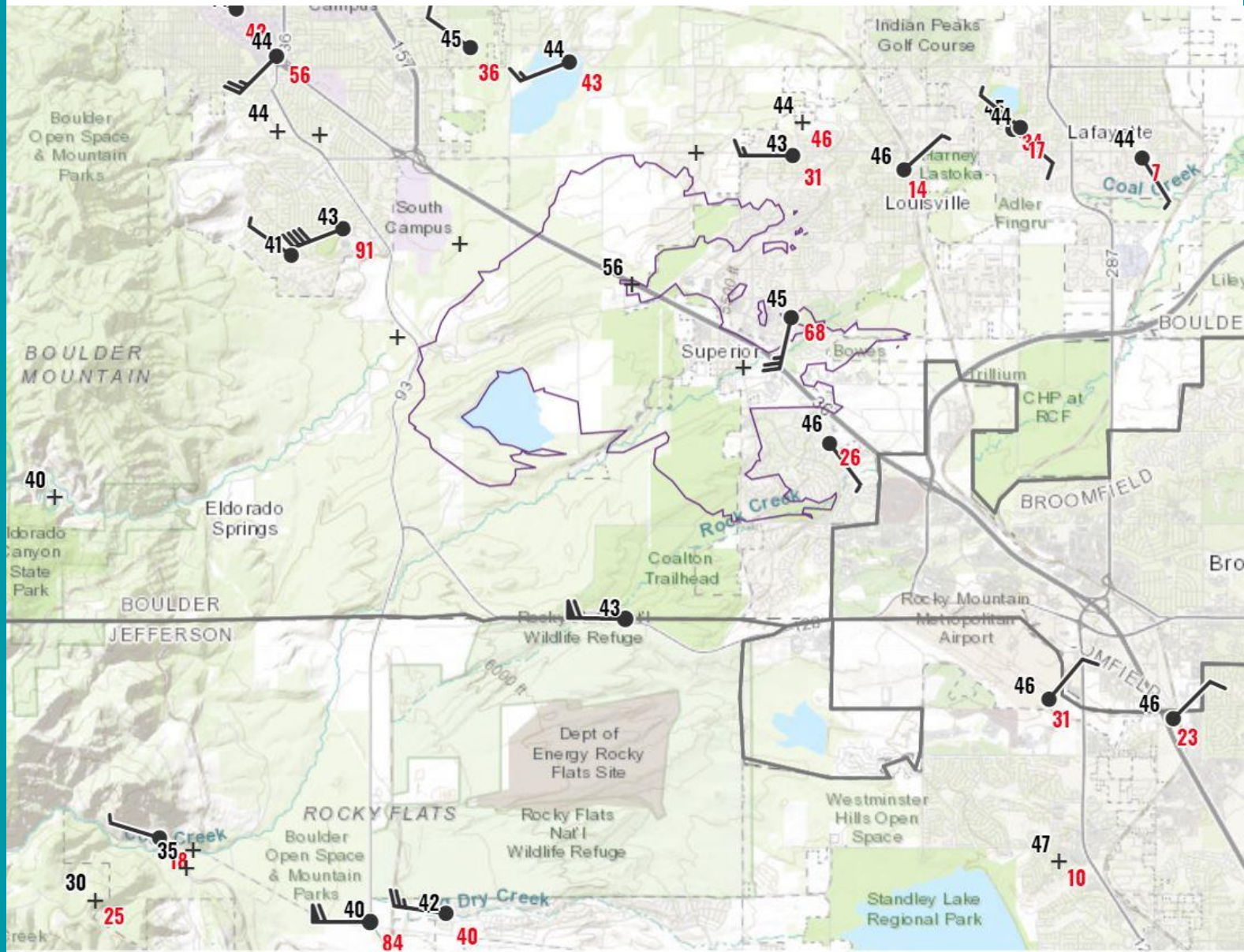
Black = sustained winds, Red = wind gusts



Wind Observations, December 30, **noon** Black = sustained winds, Red = wind gusts



Black = sustained winds, Red = wind gusts



Highest Wind Reports on December 30, 2021

Observations reported to the National Weather Service in Boulder, CO

Data given is location, wind speed, time and date, latitude and longitude

...Adams County...	56 MPH	1235 PM 12/30	39.97N/104.99W	...Gilpin County...	58 MPH	1253 PM 12/30	39.84N/105.47W
0.7 Mi S Of Northwest Pkwy				Black Hawk	58 MPH	0955 AM 12/30	39.87N/105.55W
...Boulder County...				Dakota Hill	57 MPH	1250 PM 12/30	39.83N/105.48W
3 SSW Boulder	108 MPH	0225 PM 12/30	39.99N/105.27W	Aspen Springs	56 MPH	1131 AM 12/30	39.90N/105.40W
1 NE Crisman	102 MPH	1120 AM 12/30	40.05N/105.35W	Golden			
3 NW Marshall	90 MPH	0125 PM 12/30	39.98N/105.28W	...Grand County...			
Boulder	75 MPH	0215 PM 12/30	40.03N/105.23W	Winter Park Eagle Wind	73 MPH	0345 AM 12/30	39.85N/105.78W
036e03750rws1rp1 At Baseline	73 MPH	1123 AM 12/30	40.00N/105.26W	Berthoud Pass	63 MPH	0935 AM 12/30	39.80N/105.77W
Wondervu	72 MPH	0956 AM 12/30	39.91N/105.38W	Keyser Ridge	55 MPH	0427 AM 12/30	39.89N/106.04W
Atoc - Univ. Colorado Campus	71 MPH	1050 AM 12/30	40.01N/105.27W	...Jefferson County...			
Lyons 3W	70 MPH	1042 AM 12/30	40.22N/105.33W	Arvada	1206 PM 12/30	39.86N/105.22W	
Lafayette	70 MPH	1001 AM 12/30	40.06N/105.12W	Rocky Flats Hwy 93 and 72	110 MPH	1123 AM 12/30	39.87N/105.24W
Louisville	68 MPH	0200 PM 12/30	39.96N/105.15W	2.8 NE White Ranch Open Space	103 MPH	0126 PM 12/30	39.85N/105.25W
Longmont	68 MPH	1147 AM 12/30	40.13N/105.23W	2 NW Rocky Flats	98 MPH	1155 AM 12/30	39.91N/105.23W
Nederland	66 MPH	0900 AM 12/30	39.99N/105.45W	470w014 Wadsworth	81 MPH	0348 PM 12/30	39.55N/105.08W
Nederland	65 MPH	0938 AM 12/30	39.99N/105.45W	1.7 NE Rocky Flats (CDPHE)	78 MPH	1215 PM 12/30	39.91N/105.19W
Boulder	64 MPH	0325 PM 12/30	40.06N/105.29W	I-70 at C470	73 MPH	1224 PM 12/30	39.71N/105.19W
Boulder	64 MPH	1117 AM 12/30	40.04N/105.26W	Genesee	71 MPH	1212 PM 12/30	39.71N/105.29W
Boulder	63 MPH	1116 AM 12/30	40.02N/105.29W	Coal Creek Canyon	69 MPH	1016 AM 12/30	39.88N/105.39W
Boulder	62 MPH	0223 PM 12/30	40.06N/105.21W	Lakewood	67 MPH	0346 PM 12/30	39.70N/105.15W
Boulder	61 MPH	1042 AM 12/30	40.00N/105.20W	Golden	66 MPH	0901 AM 12/30	39.79N/105.28W
Ward	60 MPH	0833 AM 12/30	40.10N/105.50W	Arvada	62 MPH	0146 PM 12/30	39.84N/105.17W
Boulder	57 MPH	0808 AM 12/30	40.03N/105.28W	Arvada	62 MPH	0139 PM 12/30	39.85N/105.16W
...Broomfield County...				Littleton	56 MPH	0316 PM 12/30	39.59N/105.13W
025s229 Sh7	57 MPH	1153 AM 12/30	40.00N/104.98W	4 SSE Rocky Flats	55 MPH	0230 PM 12/30	39.83N/105.19W
...Clear Creek County...				...Larimer County...			
Corral Creek	67 MPH	1158 AM 12/30	39.64N/105.46W	Glen Haven	89 MPH	0827 AM 12/30	40.47N/105.45W
I-70 Georgetown Lake	61 MPH	1235 PM 12/30	39.73N/105.69W	Livermore	79 MPH	0846 AM 12/30	40.71N/105.41W
I-70 Floyd Hill	60 MPH	1204 PM 12/30	39.72N/105.41W	Lyons	62 MPH	1156 AM 12/30	40.28N/105.31W
...Douglas County...				Virginia Dale	62 MPH	1134 AM 12/30	40.95N/105.35W
Cheesman	67 MPH	1223 PM 12/30	39.18N/105.27W	Buckeye	60 MPH	0235 PM 12/30	40.81N/105.04W
Carpenter Peak	56 MPH	0357 PM 12/30	39.42N/105.08W	Red Feather RAWS	58 MPH	1224 PM 12/30	40.80N/105.57W
Franktown	56 MPH	0320 PM 12/30	39.39N/104.75W	Livermore	57 MPH	0933 AM 12/30	40.87N/105.36W
Surrey Ridge	55 MPH	1224 PM 12/30	39.49N/104.87W	3 WNW Loveland	56 MPH	0217 PM 12/30	40.43N/105.12W
...Elbert County...				...Summit County...			
Elizabeth	60 MPH	0250 PM 12/30	39.35N/104.53W	Red Cliff Pass	55 MPH	0515 AM 12/30	39.48N/106.15W
				...Weld County...			
				Erie Muni	59 MPH	0915 AM 12/30	40.02N/105.05W

