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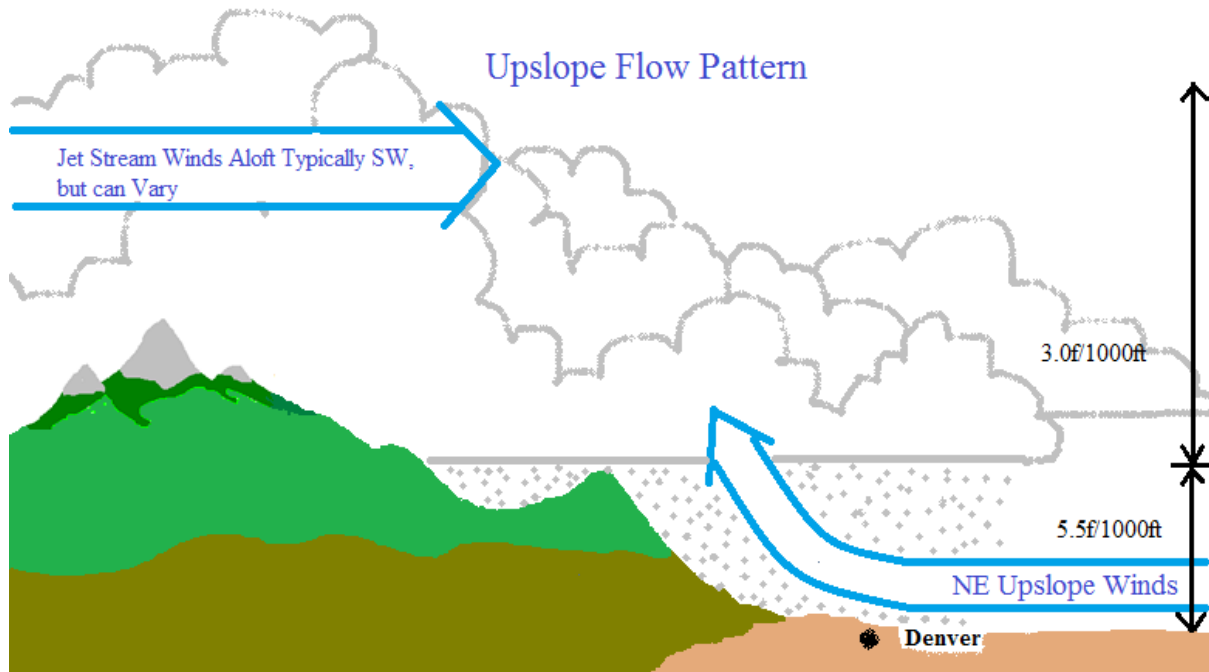
Upslope Winds

Here in Colorado we hear the term “upslope” used all the time especially when it comes to winter snow storms. The term upslope just means that the winds at the surface are blowing uphill or up the slope. In the Denver Metro area we associate upslope with northeasterly winds, but this is quite often NOT the case for many other areas of the state. The strength of the upslope depends upon a couple factors which is the wind speed and the overall depth of the winds from that direction. The depth can vary from as little as a few hundred feet up to 10,000ft above ground level or more! A crucial ingredient in the upslope as far as precipitation production goes is moisture. If there is not enough moisture present then the water in the atmosphere will not condense into water droplets which eventually form clouds and later rain or snow.

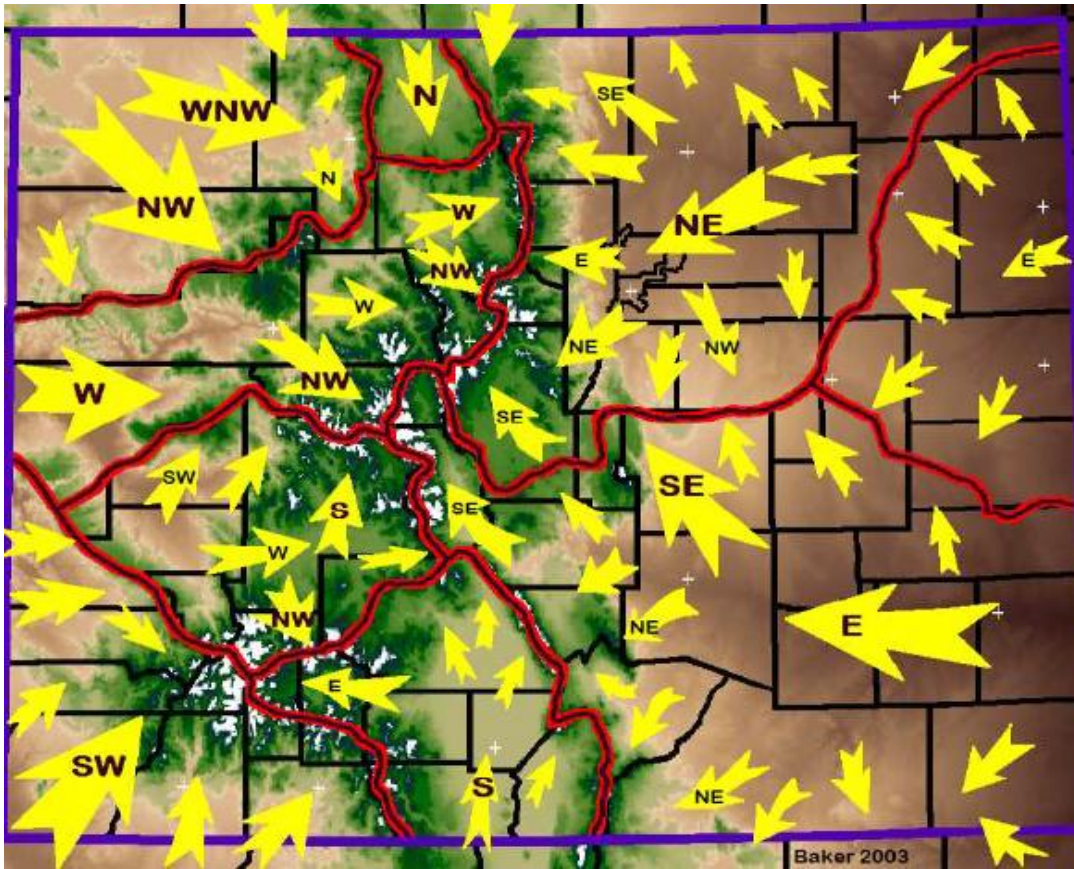
As the winds blow uphill DRY air cools at about 5.5 degrees Fahrenheit per 1,000ft. The dew point temperatures stays the same on the trip up the hill and when air temperature reaches the dew point temperature the water in the air begins to change phase from a gas to a liquid and condenses into water droplets. This change of phase from a gas to a liquid releases “latent heat”. This latent heat generated by condensation now cools the parcel of air about 3.0 Fahrenheit per 1,000ft making it warmer than the surrounding environment increasing the upward push as warm air rises. The point at which dew point and air temperature are the same is the cloud base and if this happens at the surface then fog forms as it is just a cloud on the ground. Typically as these upslope events occur the clouds will first develop over the higher terrain and as more moisture is transported from the east the cloud base lowers as dew points(moisture) increase and precipitation begins to develop.

The upslope flow is shallow compared to the depth of winds aloft and the upper level winds generally have some sort of westerly component. These jet stream winds aloft help to evacuate air and are actually the major drivers for winter weather systems. The stronger the jet stream winds the more

evacuation of air aloft and thus air is being forced upwards at the surface kind of like a vacuum. When upslope flow and upper level winds work in tandem a “snow machine” can get going producing heavy snowfall. The upslope flow at the surface is mainly an enhancer and focal point for heavier precipitation. Below is a picture showing an upslope flow pattern for the Denver Metro area:



The concept of upslope is the same everywhere but the wind direction changes with the terrain. For optimal upslope winds the winds need to be blowing perpendicular to the slope of the mountain. Below is a map of Colorado with favored upslope wind directions.



This map was made back in 2003 by Mark Baker and is available at the NWS Boulder website at:

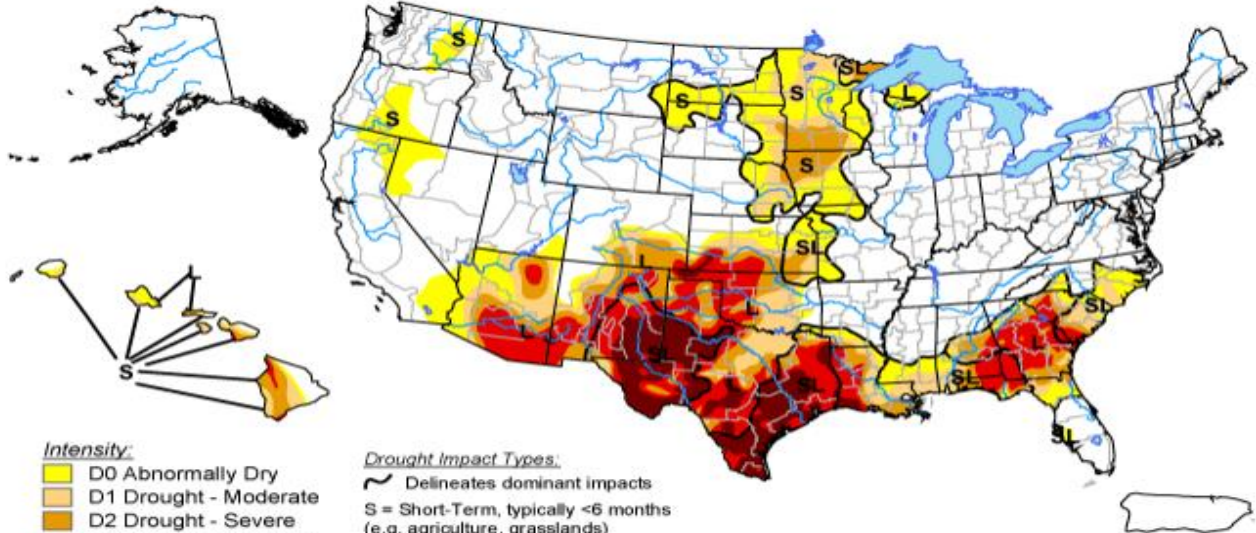
<http://www.crh.noaa.gov/images/bou/showimages/DEC-FEB2011-12Outlook.pdf>

Drought Update

Drought conditions persist in parts of southern and southeastern Colorado but have started to improve over the past few months. Drought conditions continue to be extreme and exceptional in parts of New Mexico and Texas despite some moisture as of late.

U.S. Drought Monitor

December 6, 2011
Valid 7 a.m. EST



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

- Delineates dominant impacts
- S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g. hydrology, ecology)

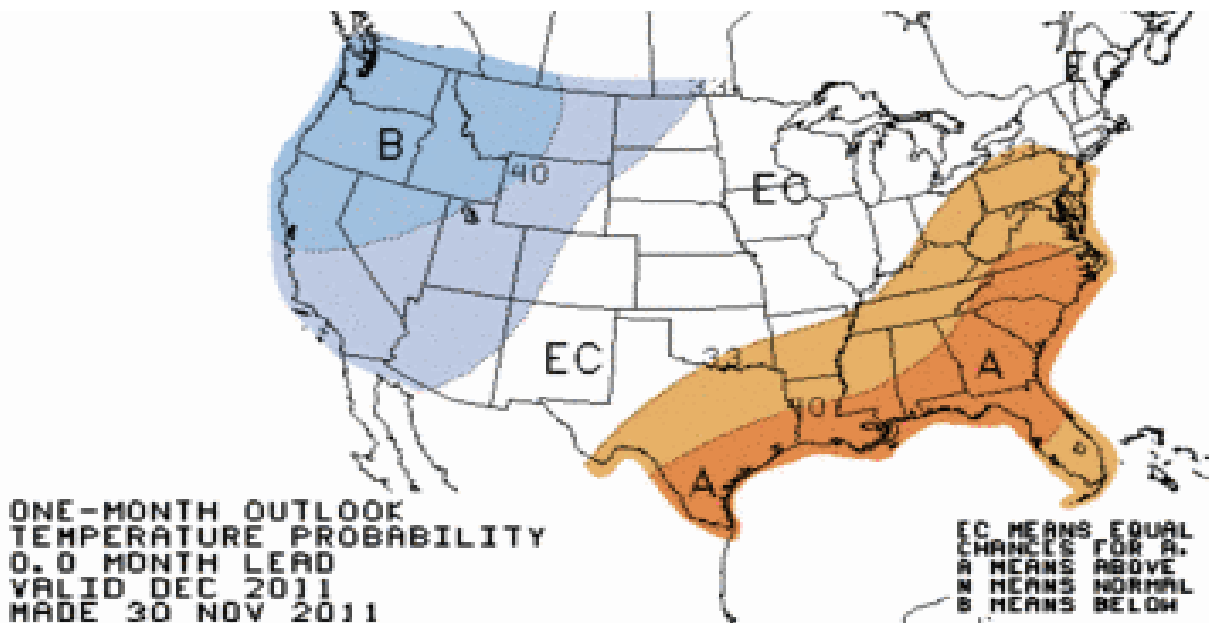
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu/>

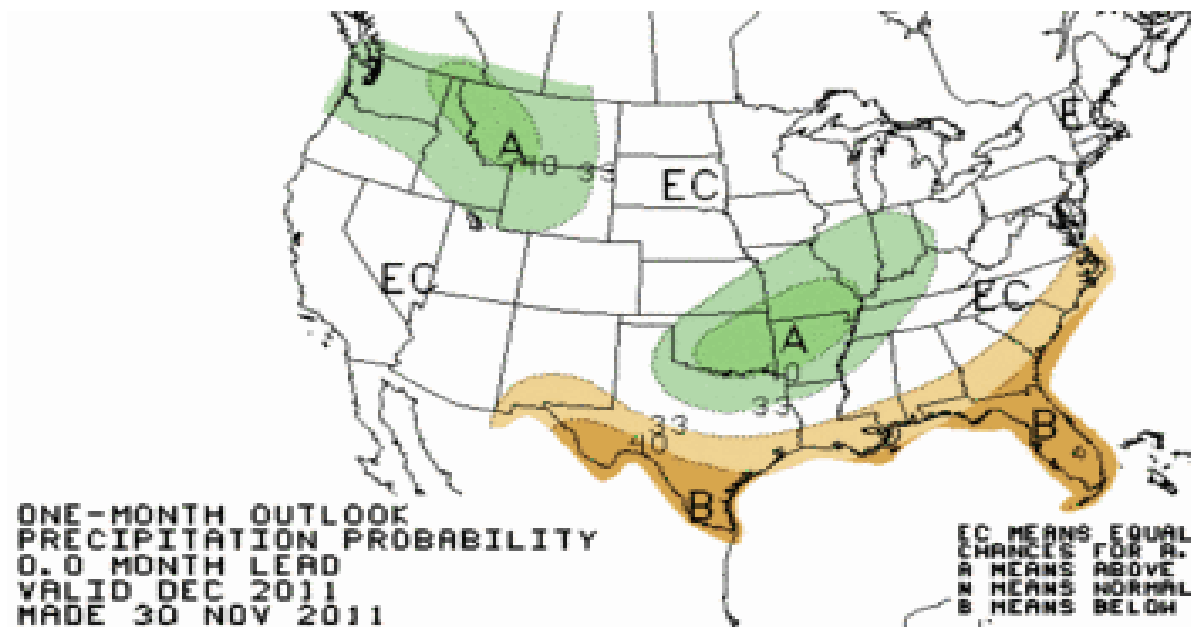


Released Thursday, December 8, 2011
Author: David Miskus, NOAA/NWS/NCEP/CPC

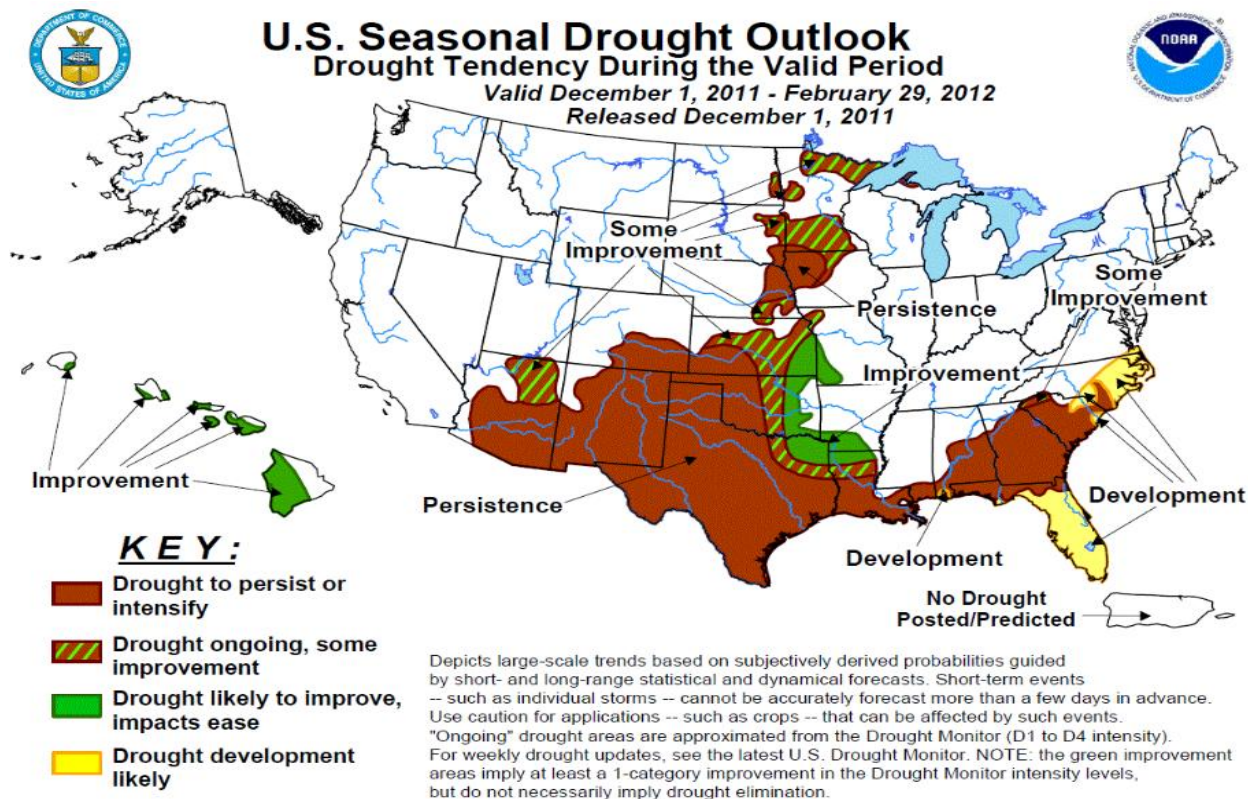
The map below shows forecasted temperature deviances for December 2011. Near normal temperatures are expected over eastern Colorado with below normal temperatures west.



The map below shows forecasted precipitation deviances for December 2011. Near normal precipitation amounts are expected across the state of Colorado but as we already know near normal to above normal snow has already fallen in some Front Range locations as of the 5th.



Overall drought conditions look to persist through March for areas of New Mexico and Texas and parts of Arizona. There may be some improvement in drought conditions over the upper plains states and parts of Oklahoma and Kansas.



November Summary

Except for the first couple days of November the rest of the month was relatively quiet weather wise. Most areas received near normal snowfall from one storm system in northeastern Colorado but there was not too much snow to speak of in the Colorado Springs area. DIA only reported 4.5" of snow which was lower than most areas of the city with 6-9" common. Normal November snowfall is 10.7" leaving this month 6.2" below normal. This now results in a deficit of 3" for the winter so far for DIA with most areas from Fort Collins through Castle Rock enjoying normal to slightly above normal snowfall. Temperatures for the month were a little above normal for highs at 54.1 degrees and near normal for lows which resulted in a monthly mean temperature of 39.5 which is about a degree above normal. With just one meaningful storm for the month precipitation came in light at 0.47" compared to 0.82". For the year precipitation now stands at 16.4" which will be above normal for 2011 even if no precipitation falls during the month of December.

November Stats

TEMPERATURE (IN DEGREES F)

AVERAGE MAX	54.1	NORMAL 52.3	DEPARTURE 1.8
AVERAGE MIN	24.8	NORMAL 24.9	DEPARTURE -0.1
MONTHLY MEAN	39.5	NORMAL 38.6	DEPARTURE 0.9
HIGHEST	69 on the 24 th		
LOWEST	10 on the 2 nd and 3 rd		
DAYS WITH MAX 90 OR ABOVE	0	NORMAL	0
DAYS WITH MAX 32 OR BELOW	1	NORMAL	2.6
DAYS WITH MIN 32 OR BELOW	26	NORMAL	23.3
DAYS WITH MIN ZERO OR BELOW	0	NORMAL	0.4

TEMPERATURE RECORDS

N/A

HEATING DEGREE DAYS

MONTHLY TOTAL	757	NORMAL 801	DEPARTURE -44
SEASONAL TOTAL	1252	NORMAL 1377	DEPARTURE -125

COOLING DEGREE DAYS

MONTHLY TOTAL	0	NORMAL 0	DEPARTURE 0
YEARLY TOTAL	964	NORMAL 769	DEPARTURE 195

PRECIPITATION (IN INCHES)

MONTHLY TOTAL	0.47	NORMAL	0.82	DEPARTURE	-0.35
YEARLY TOTAL	16.40	NORMAL	14.59	DEPARTURE	1.81
GREATEST IN 24 HOURS	0.47" on the 1 st – 2 nd				
DAYS WITH MEASURABLE PRECIP.					2

SNOWFALL (IN INCHES)

MONTHLY TOTAL	4.5	NORMAL	10.7	DEPARTURE	-6.2
SEASONAL TOTAL	13.0	NORMAL	16.0	DEPARTURE	-3.0
GREATEST IN 24 HOURS	8.5" On the 25 th – 26 th				
GREATEST DEPTH	NA				

WIND (IN MILES PER HOUR)

AVERAGE SPEED	9.9mph
PEAK WIND GUST	52mph from the W

MISCELLANEOUS WEATHER

NUMBER OF DAYS WITH THUNDERSTORM	0	NORMAL	<1
NUMBER OF DAYS WITH HEAVY FOG	2	NORMAL	1
NUMBER OF DAYS WITH HAIL	0		
NUMBER OF SUNNY DAYS	NA		
NUMBER OF PARTLY CLOUDY DAYS	NA		
NUNMER OF CLOUDY DAYS	NA		
AVERAGE RELATIVE HUMIDITY	NA		

December Preview

Now that we are already through the first week of December it is safe to say that this month will provide above normal snowfall as DIA has reported 9.2" as of the 5th. Other areas in and around Denver have experienced much higher amounts with 10-18" being common in the suburbs. This will help to make up for the lack of snow during November. It has been cold to start but a more tranquil weather pattern is currently developing and will likely carry us through mid month. Another 1-2 meaningful snow storms are possible by the end of the month. Temperatures are on average in the lower 40s for highs and mid teens for lows, but every day during the month has a record low of -10 or less and on average there are 3 days during the month where the high temperature does not even reach freezing. DIA is already above normal for precipitation so far this year and anything more this month will be gravy on the top of what has already been a good moisture year thanks to the thunderstorm activity in the summer months.

ENVER'S NOVEMBER CLIMATOLOGICALLY NORMAL (NORMAL PERIOD 1971-2000)

TEMPERATURE

AVERAGE HIGH	42.8
AVERAGE LOW	17.1
MONTHLY MEAN	30.0
DAYS WITH HIGH 90 OR ABOVE	0
DAYS WITH HIGH 32 OR BELOW	5.5
DAYS WITH LOW 32 OR BELOW	29.4
DAYS WITH LOWS ZERO OR BELOW	1.7

PRECIPITATION

MONTHLY MEAN	0.31"
DAYS WITH MEASURABLE PRECIPITATION	4
AVERAGE SNOWFALL IN INCHES	8.5"
DAYS WITH 1.0 INCH OF SNOW OR MORE	3

MISCELLANEOUS AVERAGES

HEATING DEGREE DAYS	1086
COOLING DEGREE DAYS	0
WIND SPEED (MPH)	8.4mph
WIND DIRECTION	South
DAYS WITH THUNDERSTORMS	0
DAYS WITH DENSE FOG	1
PERCENT OF SUNSHINE POSSIBLE	67%

EXTREMES

RECORD HIGH	79 on 12/5/1939
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RECORD LOW	-25 on 12/22/1990, 12/24/1876
WARMEST	43.8 in 1933
COLDEST	17.5 in 1983
WETTEST	5.21" in 1913
DRIEST	0.00" in 1881
SNOWIEST	57.4" in 1913
LEAST SNOWIEST	0.0" in 1881

Sunrise/Sunset (July - December Denver area)

	JUL	AUG	SEP	OCT	NOV	DEC	
	sr - ss	sr - ss	sr - ss	sr - ss	sr - ss	sr - ss	
01	0535-0831	0558-0814	0627-0732	0655-0644	0728-0558	0701-0436	01
02	0536-0831	0559-0813	0628-0731	0656-0642	0729-0557	0702-0435	02
03	0536-0831	0600-0812	0629-0729	0657-0641	0730-0556	0703-0435	03
04	0537-0831	0601-0811	0630-0728	0658-0639	0731-0554	0704-0435	04
05	0537-0831	0602-0809	0631-0726	0659-0637	0733-0553	0705-0435	05
06	0538-0831	0603-0808	0632-0725	0700-0636	0634-0452	0706-0435	06
07	0538-0830	0604-0807	0633-0723	0701-0634	0635-0451	0707-0435	07
08	0539-0830	0605-0806	0634-0721	0702-0633	0636-0450	0708-0435	08
09	0540-0830	0606-0805	0635-0720	0703-0631	0637-0449	0709-0435	09
10	0540-0829	0607-0804	0636-0718	0704-0630	0638-0448	0709-0435	10
11	0541-0829	0608-0802	0637-0717	0705-0628	0639-0447	0710-0435	11
12	0542-0829	0608-0801	0637-0715	0706-0627	0641-0447	0711-0435	12
13	0542-0828	0609-0800	0638-0713	0707-0625	0642-0446	0712-0436	13
14	0543-0828	0610-0758	0639-0712	0709-0624	0643-0445	0713-0436	14
15	0544-0827	0611-0757	0640-0710	0710-0622	0644-0444	0713-0436	15
16	0545-0827	0612-0756	0641-0708	0711-0621	0645-0443	0714-0436	16
17	0545-0826	0613-0754	0642-0707	0712-0619	0646-0443	0715-0437	17
18	0546-0825	0614-0753	0643-0705	0713-0618	0647-0442	0715-0437	18
19	0547-0825	0615-0752	0644-0703	0714-0616	0648-0441	0716-0437	19
20	0548-0824	0616-0750	0645-0702	0715-0615	0650-0441	0716-0438	20
21	0549-0823	0617-0749	0646-0700	0716-0613	0651-0440	0717-0438	21

22 0549-0823 | 0618-0747 | 0647-0659 | 0717-0612 | 0652-0439 | 0717-0439 22
 23 0550-0822 | 0619-0746 | 0648-0657 | 0718-0611 | 0653-0439 | 0718-0439 23
 24 0551-0821 | 0620-0745 | 0649-0655 | 0719-0609 | 0654-0438 | 0718-0440 24

25 0552-0820 | 0621-0743 | 0650-0654 | 0720-0608 | 0655-0438 | 0719-0440 25
 26 0553-0819 | 0622-0742 | 0651-0652 | 0721-0607 | 0656-0437 | 0719-0441 26
 27 0554-0818 | 0623-0740 | 0652-0650 | 0722-0605 | 0657-0437 | 0719-0442 27
 28 0555-0818 | 0624-0739 | 0653-0649 | 0724-0604 | 0658-0437 | 0720-0442 28

29 0556-0817 | 0624-0737 | 0654-0647 | 0725-0603 | 0659-0436 | 0720-0443 29
 30 0556-0816 | 0625-0736 | 0655-0645 | 0726-0601 | 0700-0436 | 0720-0444 30
 31 0557-0815 | 0626-0734 | | 0727-0559 | | 0720-0445 31

Snowfall

Oct 2011 to Sept 2011

City	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
Aurora (Central)	6.0	7.0						13.0
Brighton	5.8	7.5						13.3
Broomfield	9.7	7.2						16.9
Castle Rock	10.1	9.5						19.6
Colo Sprgs Airport	3.6	1.0						4.6
Denver DIA	8.5	4.5						13.0
Denver Downtown	7.9	7.0						14.9
Golden	8.9	7.1						16.0
Fort Collins	9.7	10.6						20.3
Highlands Ranch	7.4	10.5						17.9
Lakewood	7.8	4.8						12.6
Littleton	6.0	7.6						13.6
Parker	12.1	10.0						22.1
Sedalia - Hwy 67	6.5	9.0						15.5
Thornton	6.6	7.1						13.7
Westminster	8.8	7.8						16.6
Wheatridge	7.6	7.6						15.2

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