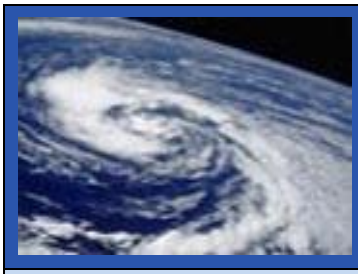


The Weather Wire

February 2020 **Volume 27 Number 2**

Contents:

Why Are Weather Models Sometimes Wrong?

Numerical weather models are one of the primary tools meteorologists use to forecast the weather. These models consist of mathematical equations which ingest physical data from several sources, eventually forming a "solution" for how the atmosphere will behave. The atmosphere is governed by the same laws of physics as everything else on earth, and we can use mathematics to explain how objects will behave. Yet sometimes, the solutions offered by weather models are wrong, but why? Is the math incorrect?

We can trace much of the error in weather models back to the data they ingest. More specifically, the quality of the data and the abundance of the data. A good analogy for this is baking a cake in your kitchen. You want to bake a delicious cake, but some of the ingredients you used were spoiled. No matter how good of a cook you are, your cake will *never* be delicious because you used bad ingredients. Similarly, access to quality data can be a problem.

This data consists of surface observations from local weather stations, real-time observations, and various upper-air data from weather balloons/airplanes/satellites etc. Unfortunately, the instrumentation used to gather this data can be inconsistent and prone to error. Even very small errors can magnify significantly over time and space as the weather model attempts to solve the future behavior of the atmosphere.

The availability of this data is not uniform over the earth or even the United States either. As we would expect, there is a significant lack of data over the oceans, which cover roughly 70% of the earth's surface. Despite the lack of data, weather models must still offer solution for better or worse. Unfortunately, many of our storm systems are of Pacific origin.

Closer to home, there is a general lack of data over the Intermountain West. With fewer urban centers, weather stations, balloon launches etc., available data can be few and far between, especially under a NW flow pattern. Unfortunately for us here in Colorado, this

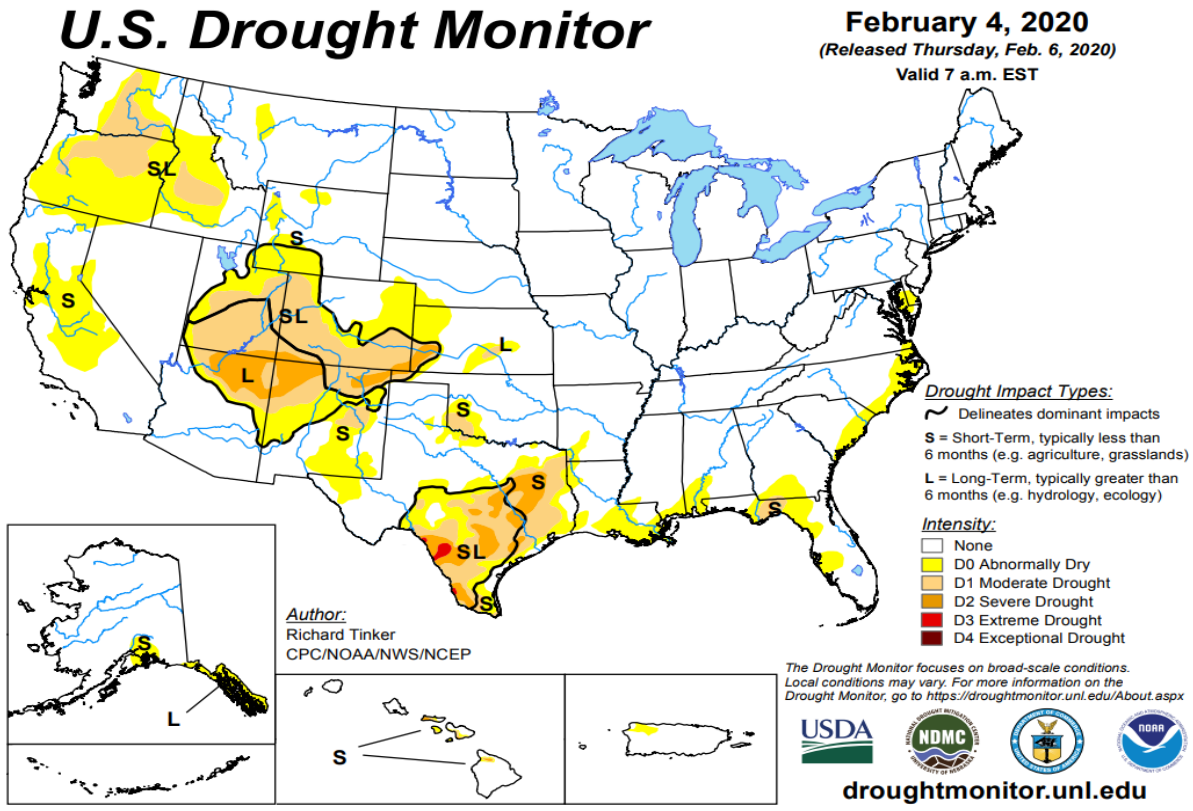
data gap is directly upstream. This is where our weather comes from, where storms strengthen/weaken, change course etc. It's no mystery that weather models are often more accurate east of the Rocky Mountains, simply because there is more data available.

Model resolution can also be a significant source of error in weather models. Despite recent advances in numerical modeling, weather models still cannot resolve very small, localized weather features like narrow bands of heavy snow which we have experienced recently or individual thunderstorm cells. Prior to the event, meteorologists can uncover clues that banded snowfall or thunderstorms may occur, but there is no way of knowing *exactly* where these features will set up. Weather models will offer a solution to consider, but their spatial accuracy is never 100% correct.

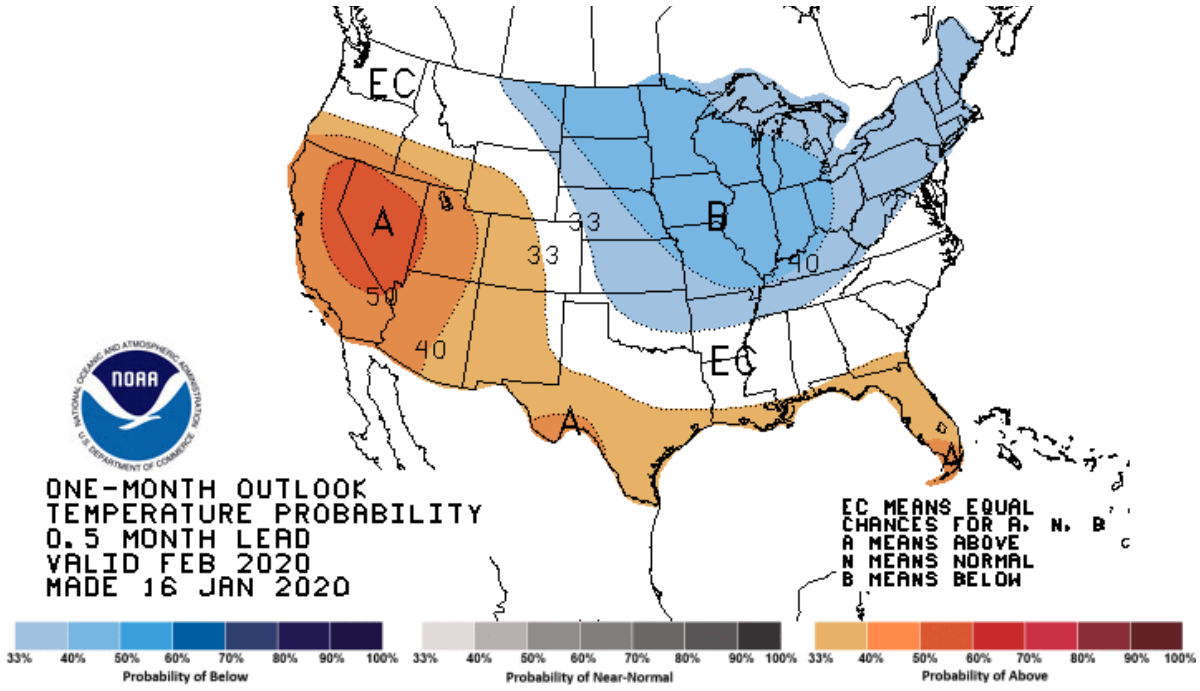
Complex terrain can also pose a problem for weather models, especially in places like Colorado. Terrain can have a significant influence on the resulting weather, especially concerning precipitation. It's no mystery that our mountains and higher terrain receive more snowfall than lower elevations. Do weather models know that we have complex terrain in Colorado? The answer is "yes," but only to a certain degree. This is where model resolution comes into play once again. Models recognize there is a terrain barrier in place, such as the Front Range or Palmer Divide, but their resolution does not recognize the smaller nuances of the terrain, which can be very important. Meteorologists must rely on local knowledge of the terrain and past experience to read between the lines and attempt to offer a more accurate forecast. Recently the weather models have been performing poorly for all of the reasons listed above and confidence in these weather models is at an all time low as of late.

Drought Update

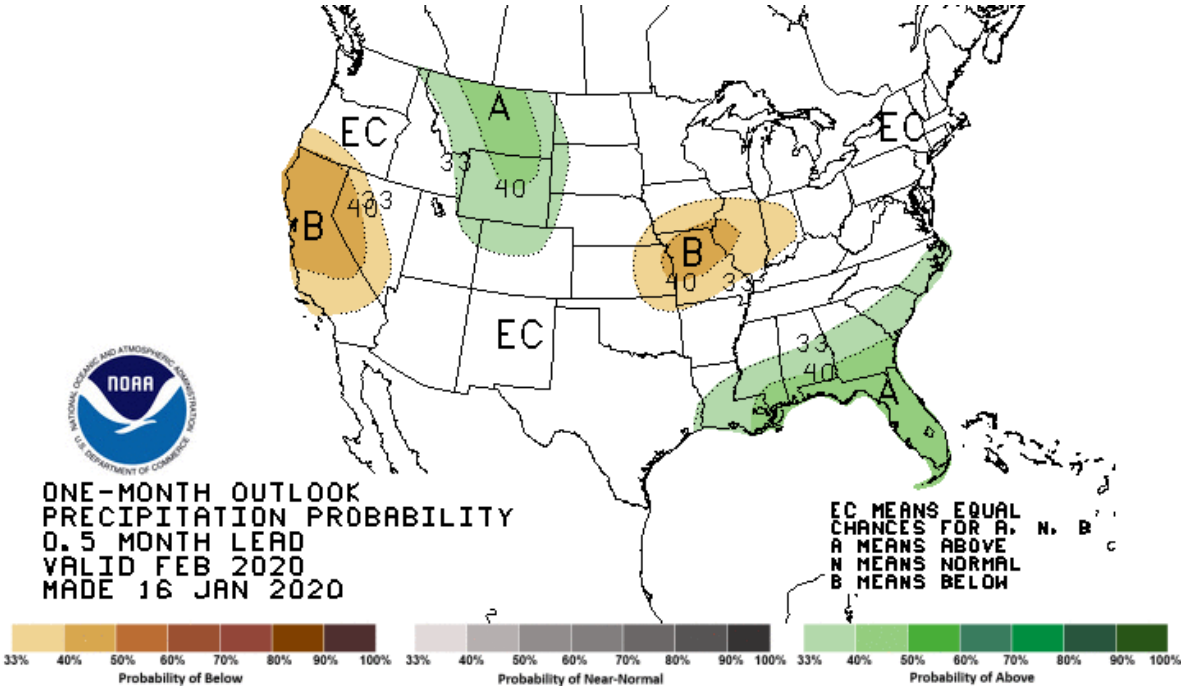
Colorado continues to experience persistent drought conditions over a fairly large percentage of the state. Elsewhere, the 4-Corner states, much of TX and Pacific NW are experiencing some type of drought.



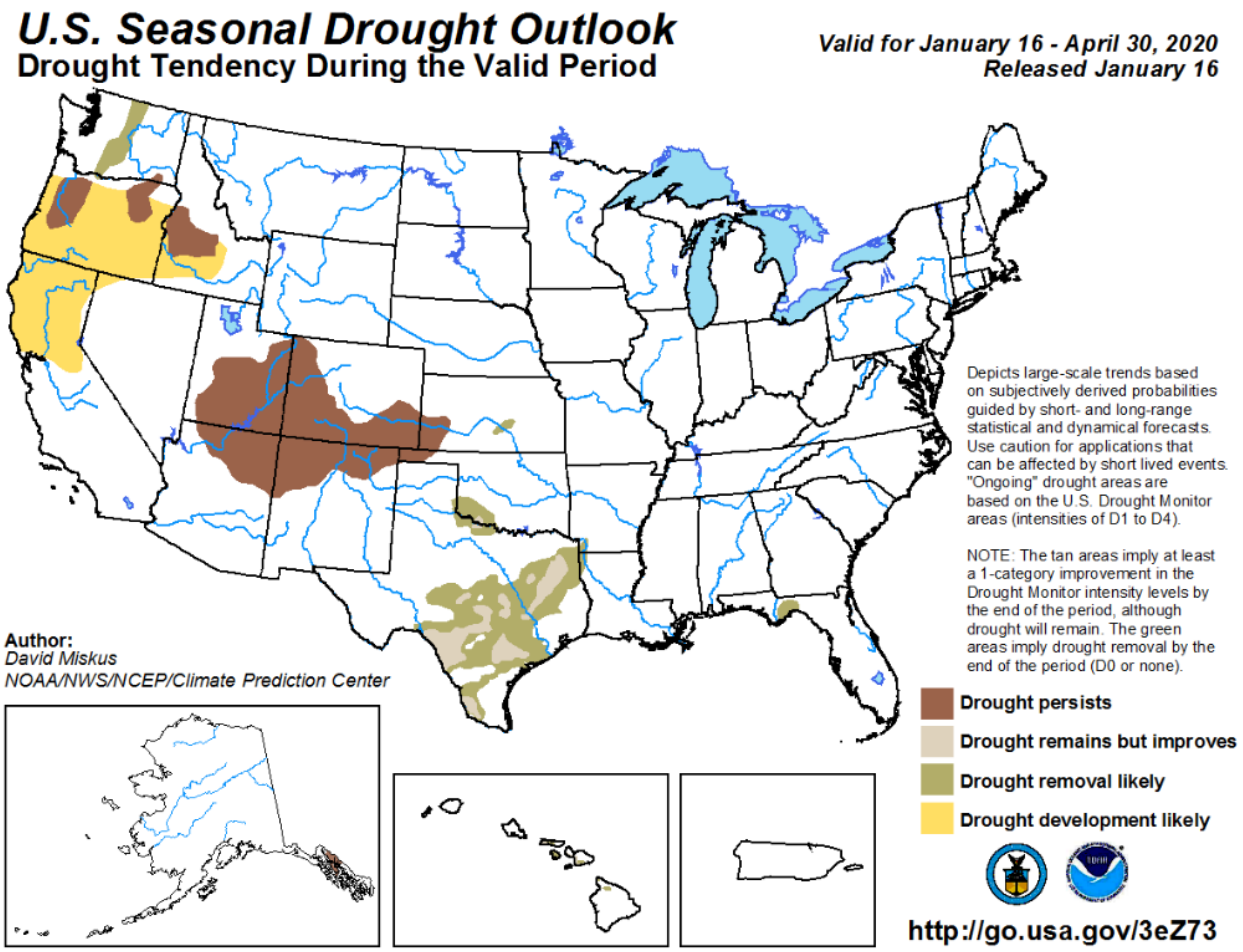
The map below shows forecasted temperature deviances for February 2020. There are equal chances for above or below normal temperaturs during the month over NE CO.



The map below shows forecasted precipitation deviances for February 2020. There is a bias towards above normal precipitation over N/NW portions of the state and equal chances elsewhere.



Colorado is not expected to see any worsening of the drought conditions this month but areas of drought are expected to persist.

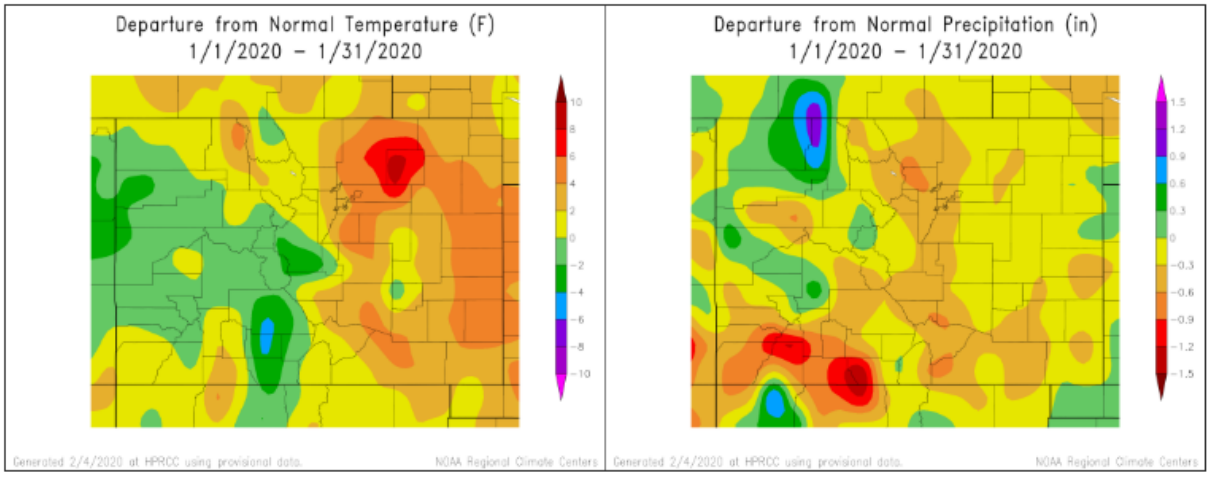


January Summary

January of 2020 was well above normal in temperatures and well below normal in precipitation and snowfall. Average highs for the month were 48 degrees which was 4 degrees above the normal of 44 degrees. Average lows for January were 21.1 degrees which was 3.7 degrees above normal. Combining the average monthly highs and lows resulted in a monthly mean temperature of 34.6 degrees which was 3.9 degrees above normal. Although January of 2020 was rather warm it was not very close to being the warmest January on record as that title goes to January of 1986 when the monthly mean temperature was 40.3 degrees. Snowfall for January was pitiful with only 0.9" reported at DIA which was 6.1" below the normal of 7". The 0.9" of snow was the 8th least snowiest January on record tied with 1970. Most Denver Metro locations reported only a trace to 2" of snow for the month. Moisture wise DIA reported 0.14" of moisture which was 0.27" below the normal of 0.41". January of 2020 was a rather uneventful month as far as the weather goes.

SE Colorado didn't do much better in the snowfall department with below normal snowfall and precipitation as well as above normal temperatures. The airport in Colorado Springs reported 0.8" of snow and 0.09" of moisture. The 0.8" of snow was 4.8" below the normal of 5.6" and the 0.09" of moisture was 0.23" below the normal of 0.32". The monthly mean temperature for Colorado Springs was 34.1 degrees which was 3.6 degrees above the normal of 30.5 degrees. The airport in Pueblo reported 0.2" of snow for the month and 0.11" of moisture. The 0.2" of snow was 6.3" below the normal of 6.5" and ranks as the 5th least snowiest January on record. The 0.11" of moisture was 0.24" below the normal of 0.35". The monthly mean temperature in Pueblo was 34.9 degrees which was 4.4 degrees above the normal of 30.5 degrees.

Below are maps for departure from normal temperature and precipitation statewide:



January Stats

TEMPERATURE (IN DEGREES F)

AVERAGE MAX	48.0	NORMAL	44.0	DEPARTURE	4.0
AVERAGE MIN	21.1	NORMAL	17.4	DEPARTURE	3.7
MONTHLY MEAN	34.6	NORMAL	30.7	DEPARTURE	3.9
HIGHEST	62 on the 4th and 8th				
LOWEST	7 on the 11th				

DAYS WITH MAX 90 OR ABOVE	0	NORMAL	0.0
DAYS WITH MAX 32 OR BELOW	1	NORMAL	5.5
DAYS WITH MIN 32 OR BELOW	31	NORMAL	29.4
DAYS WITH MIN ZERO OR BELOW	0	NORMAL	1.7

TEMPERATURE RECORDS

None

HEATING DEGREE DAYS

MONTHLY TOTAL	937	NORMAL	1063	DEPARTURE	-126
SEASONAL TOTAL	3436	NORMAL	3531	DEPARTURE	-95

COOLING DEGREE DAYS

MONTHLY TOTAL	0	NORMAL	0	DEPARTURE	0
YEARLY TOTAL	0	NORMAL	0	DEPARTURE	0

PRECIPITATION (IN INCHES)

MONTHLY TOTAL	0.14	NORMAL	0.41	DEPARTURE	-0.27
YEARLY TOTAL	0.14	NORMAL	0.41	DEPARTURE	-0.27
GREATEST IN 24 HOURS	0.13” on the 27th				
DAYS WITH MEASURABLE PRECIP.	2				

SNOWFALL (IN INCHES)

MONTHLY TOTAL	0.9	NORMAL	7.0	DEPARTURE	-6.1
SEASONAL TOTAL	29.9	NORMAL	29.7	DEPARTURE	0.2
GREATEST IN 24 HOURS	0.5”				
GREATEST DEPTH	TR				

WIND (IN MILES PER HOUR)

AVERAGE SPEED	10.1 mph
PEAK WIND GUST	40mph from the W on 1/1

MISCELLANEOUS WEATHER

NUMBER OF DAYS WITH THUNDERSTORM	0	NORMAL	0
NUMBER OF DAYS WITH HEAVY FOG	0	NORMAL	1
NUMBER OF DAYS WITH HAIL	0		
NUMBER OF SUNNY DAYS	9		
NUMBER OF PARTLY CLOUDY DAYS	19		
NUMBER OF CLOUDY DAYS	3		
AVERAGE RELATIVE HUMIDITY	NA		

February Preview

Average highs begin to climb into the mid 40s in February as we begin to gain sunlight each day. On the 1st of the month the sun rises at 7:08am and at the end of the month the sunrise is 6:34am a gain of 34 minutes on the sunrise side alone. The sun sets at 5:20pm on the 1st and 5:51 on the 28th adding 31 minutes on the sunset times. For the month there is a gain of 1 hour and 5 minutes of daylight! Average lows climb 1.5 degrees from December and highs gain 2.2 degrees from December. There are on average 4 days during the month where high temperatures remain below freezing with one overnight period where temperatures fall below zero. Average precipitation for February is only 0.32” with 5.7” of snowfall. There are usually 5 days during the month with measureable precipitation greater than a trace. February 2020 is already starting very active and it is safe to say that February of 2020 will feature well above normal snowfall for many areas and near normal to possibly slightly below normal temperatures.

DENVER'S FEBRUARY CLIMATOLOGICALLY NORMAL
(NORMAL PERIOD 1981-2010 DIA Data)

TEMPERATURE

AVERAGE HIGH	46.2
AVERAGE LOW	18.9
MONTHLY MEAN	32.5
DAYS WITH HIGH 90 OR ABOVE	0
DAYS WITH HIGH 32 OR BELOW	4
DAYS WITH LOW 32 OR BELOW	27
DAYS WITH LOWS ZERO OR BELOW	1

PRECIPITATION

MONTHLY MEAN	0.32”
DAYS WITH MEASURABLE PRECIPITATION	5
AVERAGE SNOWFALL IN INCHES	5.7”
DAYS WITH 1.0 INCH OF SNOW OR MORE	NA

MISCELLANEOUS AVERAGES

HEATING DEGREE DAYS	908
COOLING DEGREE DAYS	0
WIND SPEED (MPH)	8.8mph
WIND DIRECTION	South
DAYS WITH THUNDERSTORMS	0
DAYS WITH DENSE FOG	2
PERCENT OF SUNSHINE POSSIBLE	70%

EXTREMES

RECORD HIGH	77 on 2/4/1980, 2/28/2006
RECORD LOW	-25 on 2/8/1936, 2/1/1951
WARMEST	43.7 in 1954
COLDEST	17.6 in 1899
WETTEST	2.01” in 1934
DRIEST	0.01” in 1970
SNOWIEST	22.5” in 2015
LEAST SNOWIEST	TR in 2009

Snowfall

October 2019 to May 2020

City	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Aurora (Central)	17.2	15.9	3.4	1.8					38.3
Boulder	26.7	28.9	3.4	TR					59.0
Brighton	12.1	14.8	2.2	TR					29.1
Broomfield	24.0	20.5	5.5	0.1					50.1
Castle Rock	22.4	16.9	5.7	2.7					47.7
COS Airport	12.6	8.3	4.4	0.8					26.1
Denver DIA	12.5	13.7	2.8	0.9					29.9
Denver Dwntwn	21.2	16.4	2.4	0.9					40.9
Golden	22.5	28.4	3.8	0.7					55.4
Fort Collins	10.1	22.0	4.8	TR					36.9
Highlands Ranch	19.5	20.6	5.7	1.4					47.2
Lakewood	19.2	19.4	2.9	0.9					42.4
Littleton	18.0	19.9	4.5	1.0					43.4
Monument	19.4	23.0	10.9	3.9					57.2
Parker	15.9	16.0	3.9	3.0					38.8
Sedalia - Hwy 67	22.0	20.6	6.5	2.0					51.1
Thornton	16.6	17.9	3.7	0.4					38.6
Westminster	19.8	17.9	6.6	0.6					44.9
Wheat Ridge	20.8	22.8	3.9	0.9					48.4

Skyview Weather
2350 N Rocky View Rd
Castle Rock, CO 80108

Phone: (303) 688-9175
Fax: (303) 380-3338

E-mail: Tim@SkyviewWeather.com
On the web at www.SkyviewWeather.com