

Clouds Assignment



Tyler Harrison
February 27, 2006
MCEN 5228

The Image:

I believe it was put best by Henry Longfellow when he said the following: “By unseen hand uplifted in the light of sunset, yonder solitary cloud Floats, with its white apparel blown abroad, and wafted up to heaven.”[1] Through the monotony of everyday life, it is not often that one takes time to appreciate the wondrous sky above. I first caught sight of this cloud while driving to Eldorado Canyon. It looked as though it was being lifted upward by some unexplainable force. This initial curiosity is what drove me to take this photo, and then to use what knowledge of I have of fluids to better understand it.

The intent of the image is to interpret the movement of the atmosphere above by examining the movement of this cloud. It was after capturing this image that I was able to classify this particular pleasing cloud form as *Alto cumulus Undulatus*. The prefix “Alto” refers to an intermediate elevation of 6,500 to 20,000 ft (1,980–6,100 m) [2] at which this cloud type is most likely to occur. The word “cumulus” comes from Latin and means heap or accumulation, which accurately describes the vertically extending shape of the cloud. And finally “Undulatus”, which also comes for Latin and means to present a wavy appearance which is represented in the middle most part of the cloud.

Image Details:

Direction:

South

Location:

Intersection of Broadway and Table Mesa

Time:

2:30 pm

Date:

February 25, 2006

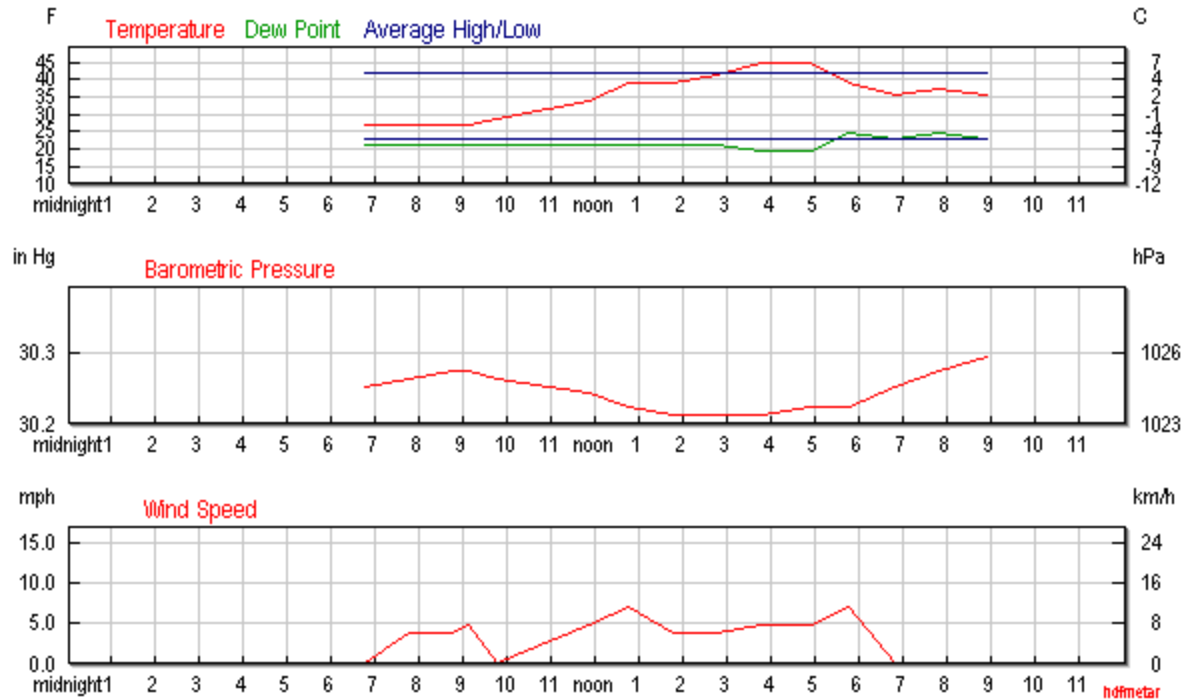
Archived surface data:

The following Archived data is from Broomfield Colorado at 2:45 pm on the day the photo was taken: [3]

Time(MST)	Temperature	Dew Point	Humidity	Visibility	Wind Direction	Wind Speed	Gust Speed	Precipitation	Conditions
2:45 PM	41.0 °F / 5.0 °C	21.2 °F / - 6.0 °C	45%	20.0 miles / 32.2 kilometers	NNW	3.5 mph / 5.6 km/h	-	N/A	Scattered Clouds

Although Broomfield is not the exact location at which the photo was taken it is close enough to give reasonable data for the intersection of Broadway and Table Mesa.

The graphs below show the change in temperature, barometric pressure and wind speed from 7am to 9pm on February 25, 2006: [3]



Height:

From the above data an estimated height and temperature of the cloud can be calculated to be: [4]

Select a Temperature Unit: Degrees C	
Select a distance unit: Feet	
1. Enter the Air Temperature (A)	5
2. Enter the Dew Point (D)	-6
3. Estimated cloud altitude	4500.125
4. Estimated cloud temperature	-8.496

This calculation is based on the assumption that there is a linear relationship between cloud height and cloud temp. The linear relations used are listed below:

$$\text{cloudTemp} = -0.00984 * \text{cloudHeight} + \text{airTemp} [4]$$

$$\text{cloudTemp} = -0.00182 * \text{cloudHeight} + \text{dewPoint} [4]$$

Boulder's elevation from sea level is roughly 5,400 feet so we must add the corresponding cloud elevation of 4,500 feet to calculate the total elevation of the cloud as 9,900 feet. This falls into the range where Altocumulus Undulatus cloud formations occur.

Stable or Unstable:

Cumulus clouds develop in an unstable atmosphere this is why they grow vertically. The unstable warmer air pushes up through the bottom of the cloud pulling some of the frozen water crystals and air with it. This in turn creates an even larger cloud. Cloud forms depend on the strength of the uplift and the stability of the atmosphere. I was unable to obtain a Skew T diagram for this particular day. This would have helped in determining the stability of the cloud.

Visualization Technique:

My camera was set to landscape so that the best focus of the distant cloud would be achieved. The lighting for the subject was supplied by the sun which was behind me and to the right. There were no clouds blocking the sun so it was a very bright light source. No flash was used for it would have had no effect on lighting the cloud. There were no buildings or objects around that would have reflected light back at the camera and thus the sun was the only light source. The sky adjacent to the cloud was empty giving great contrast between the cloud and the sky.

Photographic Technique:

The minimum distance that two object can be recognized from each other is called spatial resolution. Photography of clouds has very poor spatial resolution because the clouds are so far away and so large. Another difficulty that affects spatial resolution is the difficulty of a camera to focus on a three dimensional semi transparent object. Conversely, the temporal resolution of cloud photograph is excellent due to the distance from and the low speeds of the cloud.

Lens focal length and other lens specs:

71.00 mm at f6.70

Type of camera:

Kodak CX7330 Zoom digital camera

Exposure specs:

Normal Program, shutter speed: 1/500 sec., ISO speed: 100

Photoshop processing:

None, photo was only slightly cropped

What the Image Reveals:

The aspect of the image that I like most is how the cloud formation allows for a visualization of the air flow. If no clouds were present it would be impossible to visually interpret the stability of the atmosphere. The image reveals the humungous power of the atmosphere moving above us. These clouds which measure thousands of feet by thousands of feet are so easily manipulated and deformed by atmospheric changes.

What I dislike about this image is that I only had my 3 mega pixel digital camera with me at the time the photograph was taken. I wish a higher resolution camera was

present so that the photograph could be seen in more detail. My intent was fulfilled in this project and I find that even when not taking photos of clouds I spend more time inspecting investigating them for signs of the changes in the atmosphere. If it were possible the direction that I would take next would be to use a time lapse camera to capture the change in a cloud over a given period of time. I believe that this would allow for a better interpretation of the atmospheric changes.

References:

- 1) <http://www.worldofquotes.com/topic/Clouds/1/index.html>
- 2) <http://www.answers.com/topic/cloud>
- 3) http://www.wunderground.com/history/airport/KBJC/2006/2/25/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA
- 4) <http://www.vivoscuola.it/us/rsigpp3202/umidita/copie/cloud.htm>

Intermediate clouds include *altocumulus*, patchy layer of flattened globular masses arranged in groups, lines, or waves, with individual clouds sometimes so close together that their edges join; and *altostratus*, resembling thick cirrostratus without halo phenomena, like a gray veil, through which the sun or the moon shows vaguely or is sometimes completely hidden.

intermediate clouds, 6,500 to 20,000 ft (1,980–6,100 m);

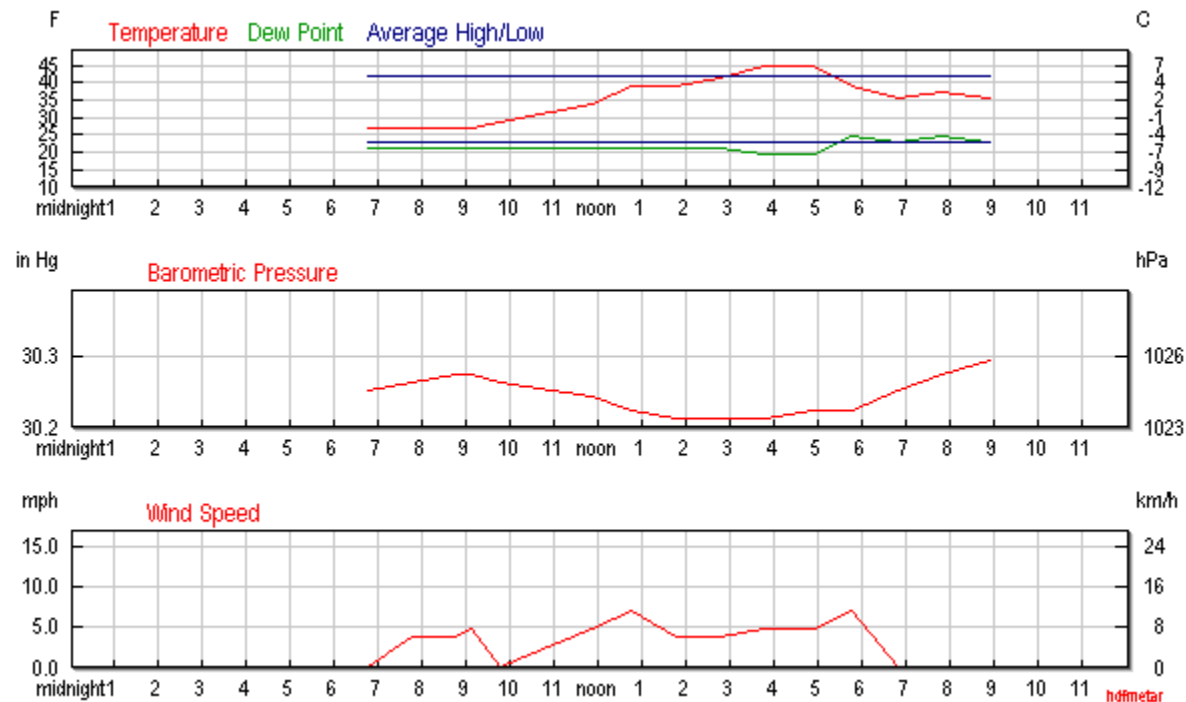
<http://www.weatherwizkids.com/cloud.htm>

<http://www.vivoscuola.it/us/rsigpp3202/umidita/lezioni/form.htm>

http://www.wunderground.com/history/airport/KBJC/2006/2/25/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA

Daily Summary			
	Actual	Average	Record
Temperature			
Mean Temperature	35 °F / 1 °C	-	
Max Temperature	44 °F / 6 °C	42 °F / 5 °C	75 °F / 23 °C (1986)
Min Temperature	26 °F / -3 °C	23 °F / -4 °C	3 °F / -16 °C (2002)
Degree Days			
Heating Degree Days	30		
Moisture			
Dew Point	21 °F / -6 °C		
Average Humidity	61		
Maximum Humidity	80		
Minimum Humidity	37		
Precipitation			
Precipitation	0.00 in / 0.00 cm	-	- ()

Sea Level Pressure	
Sea Level Pressure	30.25 in / 1024 hPa
Wind	
Wind Speed	2 mph / 3 km/h (NNE)
Max Wind Speed	7 mph / 11 km/h
Max Gust Speed	-
Visibility	17 miles / 27 kilometers
Events	
Averages and records for this station are not official NWS values.	
Key: T is trace of precipitation, MM is missing value	
Source: NWS Daily Summary	



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