Clouds Report 2

Flow Visualization

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Introduction

The image above was taken for the second cloud assignment in the Flow Visualization course. The objective of the assignment was to photograph or film any cloud formation and be able to describe the genus, type and any physical properties of the weather that contributed towards the cloud formation. The bright red and orange cloud was unexpected and hence there was minimal planning for the photo. The shot was taken with a simple point and shoot camera that was being carried for the purpose of spontaneous photography of interesting cloud formations. The cloud is an altocumulus cloud at an elevation of approximately 6000 meters above sea level. The red and orange colors are reflection from the occurring sunset.

Location and Environment

The photo was taking at 6:05 PM on February 28th, 2011. It was taken in Boulder, CO in the parking lot off the intersection at Table Mesa and Broadway. The cloud photographed was northwest of this location. The temperature where the photo was taken was approximately 11^{o} C with a southern wind speed of about 4 mph (1). The temperature at the elevation of the cloud was about 5^{o} C with strong winds blowing east. The sun had set soon before the picture was taken at 5:50 PM (2). The setting sun is the cause for the red and orange glow of the cloud. This is because at sunset and sunrise the sun's rays must travel through a longer stretch of atmosphere. Light rays with shorter wavelengths, such as blue and green, get scattered more easily. The light that reaches the viewers eyes is comprised primarily of longer wave lengths which define red and orange colors. This is why the sun will appear orange or red when it is near the horizon. If the longer wave length light rays get reflected by larger particles in the atmosphere such as water or ice particles that compose a cloud then the cloud itself will glow red and orange. This phenomenon is clearly demonstrated in the photo for this paper (3).

Cloud Discussion

The image above is of an altocumulus cloud. Altocumulus clouds are mid altitude clouds that may occur anywhere between 2000 to 6000 meters. They are usually thin layers comprised of small cloud balls or patches. Altocumulus clouds are often preceded by a cold front and often thunderstorms if they are seen on a warm morning (4). Altocumulus clouds are also broken up into several species and varieties and can be further classified with a couple of supplementary features. The categorization of the cloud in the photo above is shown below.

Genus: Altocumulus

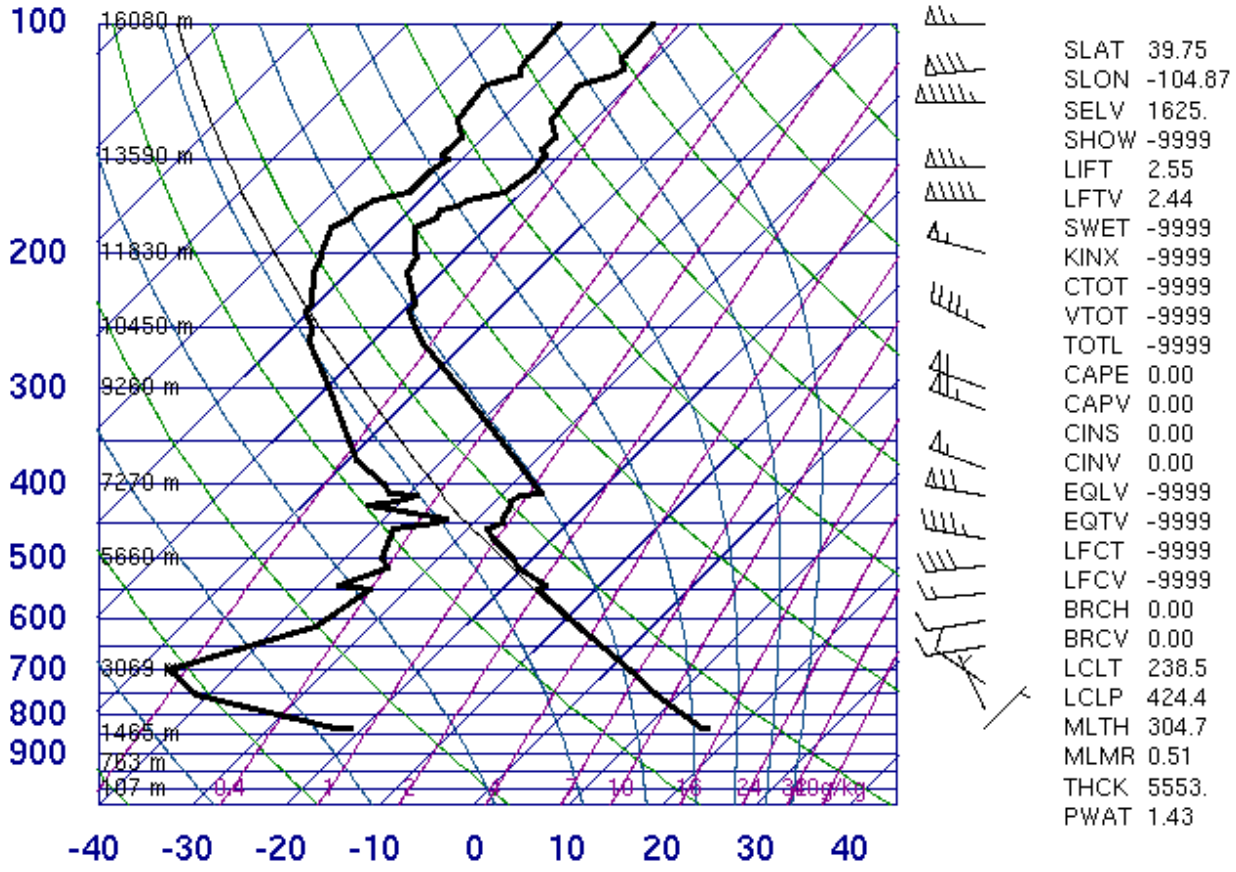
Species: Floccus

Varieties: None

Supplementary Features: Virga

The floccus species defines a cloud that is a small ragged tuft with a rounded top and often virga coming out of the base of the cloud. Virga is precipitation that evaporates before reaching the ground. This is seen in small diagonal streaks in the center of the photo (4).

The skew-T plot for the cloud above is shown below. The plot is used for further analysis of the cloud.



From the plot it is seen that the atmosphere is stable. This is most easily defined by the cape number. When the atmosphere is stable the cape is 0 and the atmosphere grows more unstable the higher the value of cape. This can also be seen on the plot by comparing the dry adiabat temperature, curved green line, to the actual temperature, dark black line on right, of the atmosphere. If the temperature of a dry adiabat cools quicker than the actual temperature of the air then the atmosphere is considered to be stable. This is because as an air particle rises it will be cooler than the rest of the air around it, thus more dense and will want to sink. Digging deeper into the plot above it is seen that the temperature of the air, dark black line, nearly follows that of the dry adiabat. If the air temperature were to cool any more quickly, than the atmosphere would become unstable. This could be due to a cold front. An unstable atmosphere can bring about cumulonimbus clouds that are often associated with thunderstorms. This claim goes along with what was mentioned in the introduction (5).

The cloud elevation can also be determined from the skew T plot. Clouds will form at the "Lifted Condensation Level" or LCL. The LCL is the elevation at which the relative humidity of an air parcel reaches 100% and thus condenses. The LCL can be determined on a skew T plot from where the dry adiabat, starting at the ground temperature, intersects the lines of constant mixing ration, purple lines above. For the plot above this occurs slightly below 6000 meters.

Photography/Editing Techniques

The photo was taken using a Panasonic Lumix DMC TS2, a 14 megapixel point and shoot camera. The camera settings for the photo were as follows:

F-stop = 3.3

Exposure = 1/200

ISO = 400

Focal Length = 5mm

The photo was edited in Gimp photo editor. The photo was cropped and the colors were adjusted to blacken some of the dark colors, make the reds more intense and deepen the blues. Although it was still fairly light outside when the photo was taken the edited photo gives a much darker gloomy feel to the picture.

Works Cited

1. History for KCOBOULD54. *Weather Underground.* [Online] Weather Underground, Inc., February 28, 2011. http://www.wunderground.com/weatherstation/WXDailyHistory.asp?ID=KCOBOULD54&month=2&day=28&year=2011.

2. February 2011. *SunriseSunset.* [Online] 2011. http://www.sunrisesunset.com/calendar.asp.

3. WHY IS THE SKY BLUE. *Science Made Simple.* [Online] Science Made Simple, Inc, 2007. http://www.sciencemadesimple.com/sky_blue.html.

4. Floccus. *Glossary of Meteorology.* [Online] American Meteorological Society. http://amsglossary.allenpress.com/glossary/search?id=floccus1.

5. Altocumulus Clouds. *Atomospheric Sciences.* [Online] University of Illonois . http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cld/cldtyp/mdl/altcu.rxml.

Image Assessment Form

Flow Visualization

Spring 2010

Name(s)Scott Schollenberger

Assignment: Clouds 2 Date: April 22, 2011

Scale: +, ! = excellent √ = meets expectations; good. ~ = Ok, could be better. X = needs work. NA = not applicable

Art	Your assessment	Comments
Intent was realized	Good	
Effective	Good	
Impact	Good	
Interesting	Good	
Beautiful	Good	
Dramatic	Good	
Feel/texture	Ok	
No distracting elements	Good	
Framing/cropping enhances image	Good	

Flow	Your assessment	Comments
Clearly illustrates phenomena	Good	
Flow is understandable	Good	
Physics revealed	Good	
Details visible	Good	
Flow is reproducible	Na	
Flow is controlled	Na	
Creative flow or technique	Na	
Publishable quality	Good	

Photographic technique	Your assessment	Comments
Exposure: highlights detailed	Good	
Exposure: shadows detailed	Good	
Full contrast range	Good	
Focus	Good	
Depth of field	Good	

Time resolved	Good		
Spatially resolved	Good		
Clean, no spots	Good		

Report		Your assessment	Comments
Describes intent	Artistic	Good	
	Scientific	Good	
Describes fluid phenomena			
Estimates appropriate scales	Reynolds number etc.		
Calculation of time resolution etc.	How far did flow move during exposure?		
References:	Web level	Good	
	Refereed journal level	Ok	
Clearly written		Good	
Information is organized		Good	
Good spelling and grammar		Good	
Professional language (publishable)		Good	
Provides information needed for reproducing flow	Fluid data, flow rates		
	geometry		
	timing		
Provides information needed for reproducing vis technique	Method		
	dilution		
	injection speed		
	settings		
lighting type	(strobe/tungsten, watts, number)		
	light position, distance		
Provides information for reproducing image	Camera type and model	Good	
	Camera-subject distance	Good	
	Field of view	Good	
	Focal length	Good	
	aperture	Good	
	shutter speed	Good	
	film type and speed or ISO setting	Good	
	# pixels (width X ht)	Good	
	Photoshop techniques	Good	
	Print details	Good	
	"before" Photoshop image		