

Clouds 1: Parallel Streaks



Isaac Martinez

Clouds 1

MCEN 5228: Flow Visualization

October 24, 2022

Image Context and Circumstances

This photo was taken on Friday, September 30th at 1:17 PM above Farrand Hall on the CU Boulder campus on an overcast day. The purpose of this initial cloud assignment was to capture the specific behavior and flow of the clouds in the sky and characterize it based on researched data for that day. Given these parameters, I hoped to image the interaction between two types of clouds, altocumulus and stratocumulus, since the combination of them would be a unique visual, like streaks across the sky. Ultimately, I was able to meet this goal with the photo above.

Cloud Formation

As mentioned, this photo was taken on a fairly cloudy day in Boulder, Colorado. The high for the day was 77 degrees and the low was 52 degrees on the Fahrenheit scale. The Skew-T diagram shown in Figure 1 corresponds to five hours after the image was taken for the Grand Junction weather station, since it is the closest approximation for Boulder. The CAPE value on the diagram being zero shows that the clouds in this image are likely stable. The elevation where the dew point and temperature become the closest is at ~3500 meters, which leads me to believe this image has an interaction between altocumulus and stratocumulus clouds. The diagram also indicates that there should be clouds at higher elevations forming, but since they are not seen in the image, I am assuming they are associated with a stormfront that came into Boulder later that day.

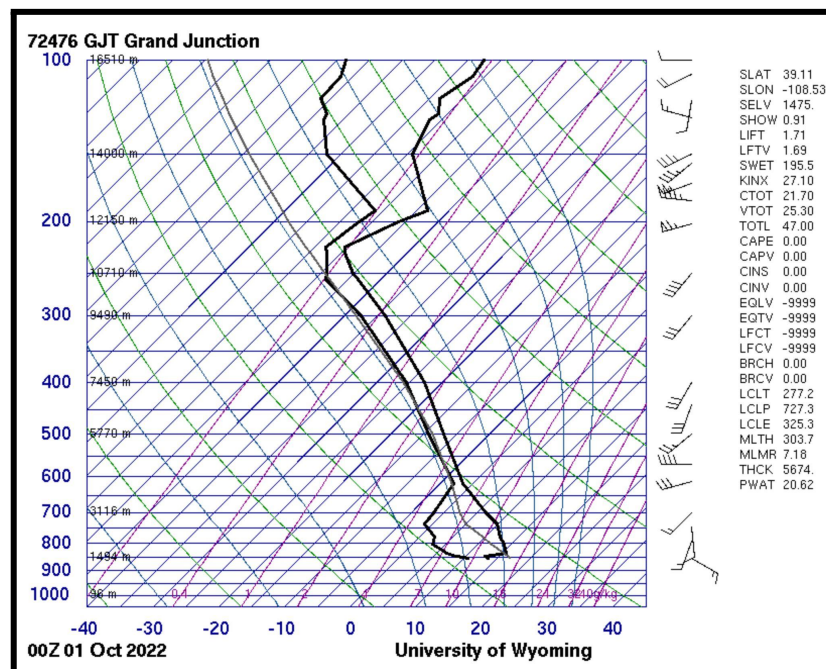


Figure 1: Skew-T diagram of Grand Junction at 6pm MST on September 30, 2022

The weather data gathered by the University of Colorado Department of Atmospheric and Oceanic Sciences is shown in Figure 2, to compare the Skew-T diagram with local weather data.

These plots show that the air pressure was dropping and wind speeds in Boulder were rising at the time the image was taken. It also shows that about four hours after the photo was taken it began to rain, which could explain the dark tones of the imaged clouds and may help explain why we cannot see the clouds at higher elevations that the Skew-T indicates should be there. The wind direction does show that there were some winds coming from the north and west through Boulder between the times the image was taken and when Boulder saw rainfall, so it is possible that the cloud formation seen in Grand Junction could have blown into Boulder later in the day.

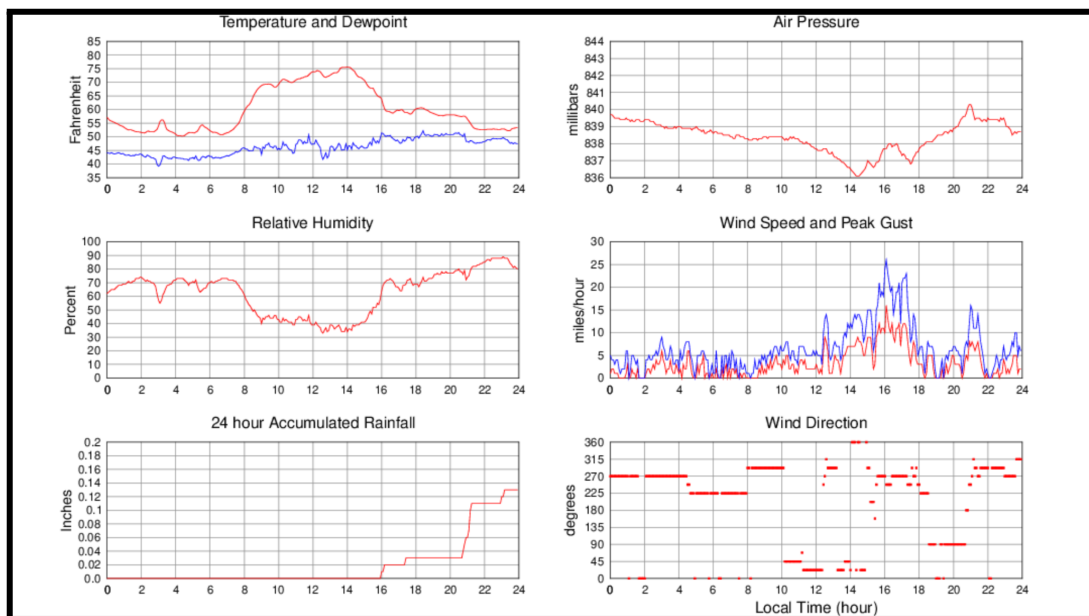


Figure 2: Weather data from CU Boulder ATOC for September 30, 2022

Photographic Technique

This photo was taken using my Pixel 6's back camera, since it was all I had available at the time. The unedited image had a fine resolution of 3072 x 4080 pixels with a focal length of 6 mm. I cannot give an exact value for the focus distance, but the field of view was ~30 feet. The photo was zoomed in and focused by the phone with the following settings applied:

- Aperture: f/1.9
- Exposure: 1/5650
- ISO: 48

I edited this photo in Dark Table, where I adjusted the contrast, saturation, brightness, and cropping. The contrast was increased to +0.2, the brightness was increased to +0.1 and the saturation was increased to +0.4. The image was cropped to 2877 x 2864 pixels in order to better frame the clouds in the trees and the colors of the leaves and sky were corrected to increase the contrast in color between them. The green-magenta was increased to 1.3 and blue-yellow was held constant. To further this color contrast, the transfer function of the RGB curve was edited to make the colors more vibrant. A side by side of the edited and unedited photo can be seen below in Figure 3.

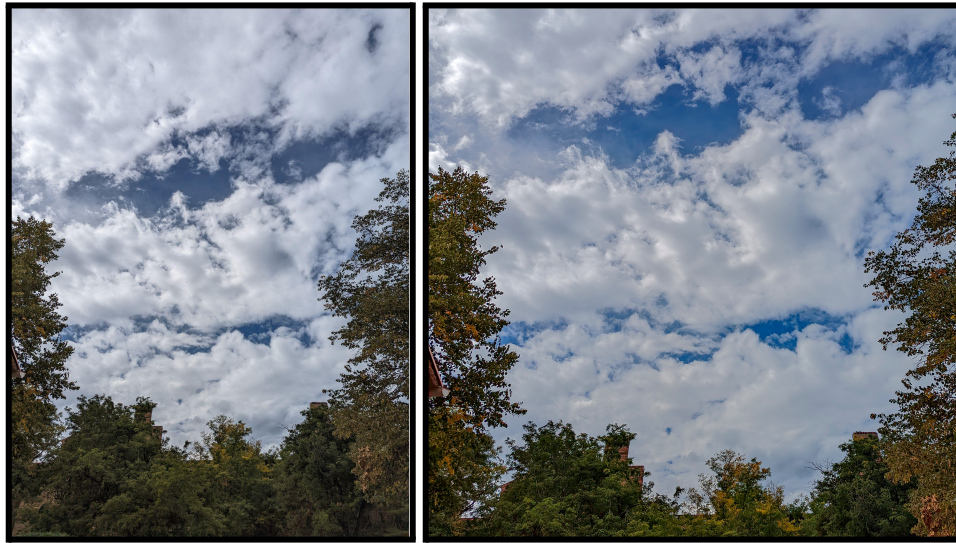


Figure 3: Side-by-side view of a) unedited photo and b) final edited photo

Image Reveals

The photo visually demonstrates how altocumulus and stratocumulus clouds formed above Boulder, Colorado on the afternoon of September 30th, 2022 and has the supporting data from the Skew-T diagram and the weather data provided by ATOC for that day. I believe I was overall successful with providing a quantitative and qualitative analysis of the flow that led to the photographed clouds. I am overall very content with how the edited version of the photo has a large contrast in color and a large contrast in textures between the fluffy clouds and the sharper, more rugged edges of the leaves. If I had the opportunity to take this image again, I would have tried to take it with the camera angled higher, to capture more of the sky and streaky clouds present, but I do still love the distinctiveness of the imaged clouds and the way they are cropped by the Autumn trees.

References:

- I. Oolman, L. (n.d.). Department of Atmospheric Science. 72476 GJT Grand Junction sounding. Retrieved October 18, 2022, from <http://weather.uwyo.edu/cgi-bin/sounding?region=naconf&TYPE=GIF%3ASKEWT&YEAR=2022&MONTH=10&FROM=0100&TO=0100&STNM=72476>
- II. Department of Atmospheric and Oceanic Sciences (ATOC) University of Colorado Boulder. (n.d.). Skywatch Observatory. Retrieved October 16, 2022, from <https://skywatch.colorado.edu/>

Image Assessment Form
Flow Visualization
Spring 2013

Name(s) Isaac Martinez

Assignment: Clouds 1

Date: 10/24

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

Art	Your assessment	Comments
Intent was realized	✓	
Effective	✓	
Impact	✓	
Interesting	!	
Beautiful	!	
Dramatic	✓	
Feel/texture	✓	
No distracting elements	~	<i>Some corners of buildings</i>
Framing/cropping enhances image	!	<i>Trees offer unique contrast</i>

Flow	Your assessment	Comments
Clearly illustrates phenomena	✓	
Flow is understandable	✓	
Physics revealed	✓	
Details visible	✓	
Flow is reproducible	N/A	<i>Occurs in nature</i>
Flow is controlled	N/A	<i>Occurs in nature</i>
Creative flow or technique	✓	
Publishable quality	✓	

Photographic/video technique	Your assessment	Comments
Exposure: highlights detailed	✓	
Exposure: shadows detailed	✓	
Full contrast range	✓	
Focus	✓	
Depth of field	✓	
Time resolved	✓	
Spatially resolved	✓	
Photoshop/ post-processing enhances intent	!	<i>Color correction offers a lot to the image</i>
Photoshop/ post-processing does not decrease important information	✓	

Report		Your assessment	Comments
Collaborators acknowledged		N/A	
Describes intent	Artistic	✓	
	Scientific	✓	Exp. of cloud physics
Describes fluid phenomena		✓	
Estimates appropriate scales	Reynolds number etc.	N/A	
Calculation of time resolution etc.	How far did flow move during exposure?	N/A	
References:	Web level	✓	ATOC & Skew-T
	Refereed journal level	✓	
Clearly written		✓	
Information is organized		✓	
Good spelling and grammar		✓	
Professional language (publishable)		✓	
Provides information needed for reproducing flow	Fluid data, flow rates	~	Gave info on cloud formation
	geometry	~	
	timing	✓	
Provides information needed for reproducing vis technique	Method	✓	
	dilution	~	
	injection speed	~	
	settings	✓	
lighting type	(strobe/tungsten, watts, number)	N/A	The sun
	light position, distance	N/A	The sun
Provides information for reproducing image	Camera type and model	✓	
	Camera-subject distance	✓	
	Field of view	✓	
	Focal length	✓	
	aperture	✓	
	shutter speed	X	
	Frame rate, playback rate	N/A	
	ISO setting	✓	
	# pixels (width X ht)	✓	
	Photoshop and post-processing techniques	✓	
	"before" Photoshop image	✓	