

# **Cloud Photo 1**



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**Flow Visualization**

## **Purpose**

The purpose of this image is to depict and illustrate how well clouds in our everyday atmosphere can be a great representation of fluid dynamics. In the course Flow Visualization it is important to understand and capture fluid phenomena in any way. The cloud assignment allows for the students of the course to appreciate how well the clouds represent fluid and then further allow us to understand the physics behind different clouds seen on a daily basis. The image above represents clouds in an unstable environment taken from above, out of the window of an airplane. Other photos were taken in the Boulder area but this photo was chosen as it gives a different perspective from the other photos taken on the ground.

## **Image Details**

As stated above this image was taken from the window of an airplane, a Boeing 737. This image was taken on September 7<sup>th</sup> on a flight from San Diego to Denver at 1 pm. While just under an hour through the flight, above Arizona, the image was captured from the back of the airplane through one of the passenger windows with an iPhone. The image was taken at about a 30-degree angle downward from the horizontal plane. As we were travelling east leaving San Diego there were no clouds, farther left of the image, and as we travelled further east more and more clouds began to appear.

## **Cloud Description**

This image captures clouds in an unstable atmosphere. The main cloud in the focus of this photo is considered to most likely be a cumulus castellanus cloud. These clouds are formed from water vapor being carried in a powerful upward air current. [1] These clouds are also often associated with thunderstorms and are formed in atmospheric instability as stated before. There are few types of cumulus clouds but do to the tower like structures I believe them to be cumulus castellanus. These clouds are fairly tall and do to the predicted altitude they are may be a more slightly specified version of the cumulus congestus cloud. [2] These clouds are usually associated with rain and the ccumulus congestus can usually be considered to be a cloud that is at a lower altitude. [2] There are a few other clouds captured in the image and the majority of them are types of cumulus and cumulonimbus as

well but in the back there may be a presence of cirro or alto stratus clouds.[4] Due to the fact that we were travelling at approximately 30,000 ft. it can be estimated that these clouds all were at an altitude of approximately twenty to twenty five thousand feet. This can also be verified in the Skew-T diagram, the lines are very close together and begin to spread out near 30,000 ft. As this Skew-T was taken hours after the image it shows that the clouds continued to develop upwards and the estimation of them being slightly lower and at 25,000 ft. [3] It was difficult to determine if a front was moving in from any given direction due to the fact that I was moving but I believe the weather in the area was worsening and shaping up for some afternoon thunderstorms with rain, but it was not raining at the time. The figure below is the Skew-T for the flagstaff area at 6 pm in the evening on the 7<sup>th</sup> of September. As seen the atmosphere was very unstable at this time and the Cape was very high at 604.3. This proves that the atmosphere was indeed not stable and it is very understandable for there to be cumulus clouds present. Along with this it can be predicted that the clouds bottom or lowest part was around 15,000 ft.

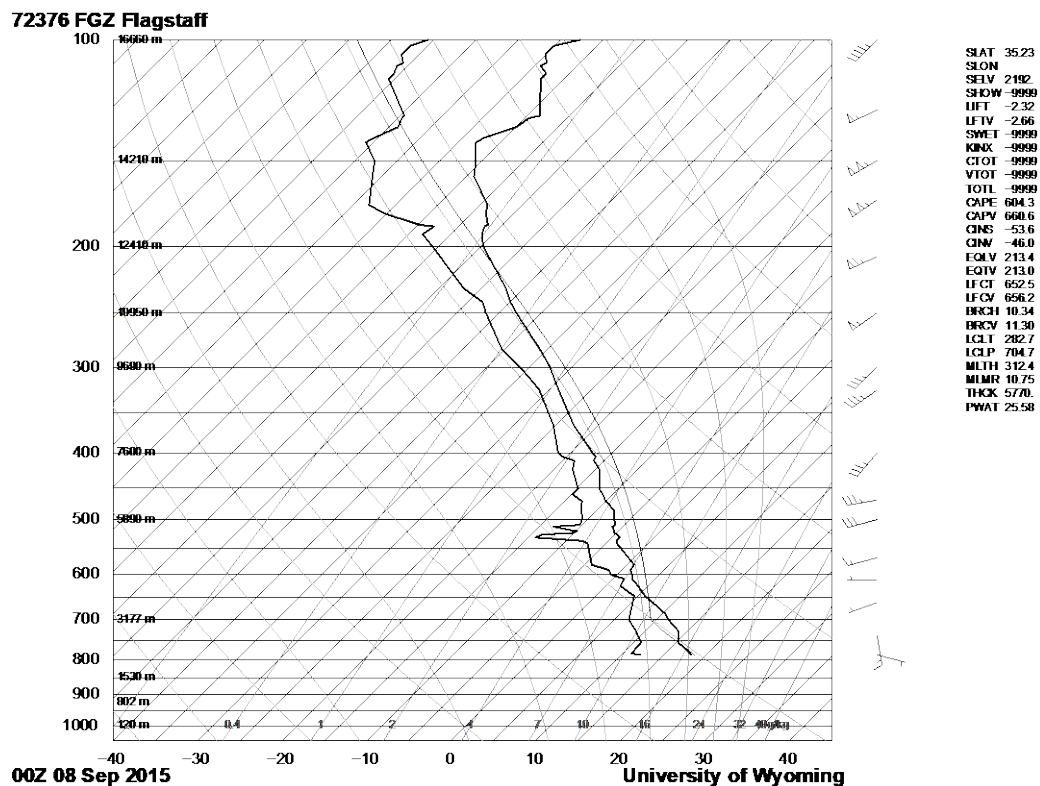


Figure 1: Flagstaff Skew-T

## **Photographic Technique**

As stated before this photo was ultimately chosen because of the different perspective as it was taken from a place above the clouds. The main goal was to focus on the center middle tower and allow the angle of the sun to highlight the edges of the cloud and bring out the detail. The image is 2448x 3264 pixels and the field of view covers approximately a half mile wide view and about ten to fifteen thousand feet in the vertical direction. Looking behind the main centered cloud there is a depth of around five to ten miles where clouds can be seen in the background. The main cloud centered in the image is approximately 2000 yards away and the camera had been slightly zoomed in when the photo was taken. No cropping or adjustments were made in after the image was taken. The photo was taken with an iPhone 5s. The focal length was 4.2 mm and the exposure was rather short being 1/3425 seconds. The ISO was set at 32 and no flash was used when the image was taken.

## **Summary**

This image captures the formation of what is soon to possibly be a thunderstorm in an instable atmosphere from above at 30,000 ft. The cumulonimbus cloud depicted in the center of the image is highlighted by the sun and depicted in a beautiful way, as the upward winds carry the water vapor higher into the atmosphere due to the instability in densities and pressures. The image does a great job in capturing the formation of this cloud but the colors could possibly be a little more vibrant to bring out a better artistic affect. Overall the purpose of observing, capturing and observing one of the great phenomena that happens on a daily basis is fully met.

## Sources

1. [https://en.wikipedia.org/wiki/Cumulus\\_castellanus\\_cloud](https://en.wikipedia.org/wiki/Cumulus_castellanus_cloud)

2. [https://en.wikipedia.org/wiki/Cumulus\\_cloud](https://en.wikipedia.org/wiki/Cumulus_cloud)

[http://www.flsc.org/portals/12/PDF/Read\\_Skew\\_T.pdf](http://www.flsc.org/portals/12/PDF/Read_Skew_T.pdf)

4. <http://edugeneral.org/blog/different-types-of-clouds/>