CU Boulder

Flow Visualization

Clouds 1 Report

Ian Durkin

Purpose

The purpose of this image is to continue with the semester theme of capturing different images than have been previously seen in the Flow Visualization course at CU Boulder. While sticking within assignment criteria of photographing natural cloud phenomena, the idea of adding other objects in the image to add a sense of depth and a feeling of vast expanse came to mind. This report discusses the physics of the cloud phenomena found, the technique used to capture this phenomena, as well as the visualization and photographic techniques used to enhance the viewer's impression of the phenomena through an artistic avenue.

Description of Flow Physics

The image displayed on the front cover of this report was taken around 6:30 am on September 4th, 2015 shortly after sunrise. The image occurred in Boulder, Colorado while walking south on Folsom Street. The camera is pointed at a steep angle, short of 90 degrees toward the sky, approximately 75 degrees from horizontal.

The primary flow phenomena occurring in the image is a display of a cirrus cloud. These clouds occur high up in the atmosphere, about 7 mi and upwards, and are generally considered a stable atmosphere. More specifically, these clouds in question appear to be of the Cirrus Uncinus variety. These clouds are characterized as thin and fibrous but with a curvature or almost a hook near their tips. Based on the Skew-T diagram for September 4th, taken from Denver, the atmosphere is indeed stable. The determination of stability is based on the data from the skew-t closely following lines of adiabatic behavior and a consistent parcel lapse rate through the atmosphere. Further this stability can also be seen from the indices on the right hand side of the skew-T. Most notably of these indices is the CAPE value, or the Convective Available Potential Energy, is a zero value, thus showing a stable, non-convective atmosphere. This data is also fairly accurate due to the time the photographic is taken, 6:30 am, as the weather balloon that brought back skew-t data was released at 6:00 am that morning. The cirrus cloud in question is roughly between 4500 and 6000 meters in altitude given the disturbances in that area of the skew-T. This is consistent with where in the atmosphere cirrus clouds typically form. The weather directly previous to the event had also shown a stable nature, little wind, warm temperatures, little to no cloud cover. Below is the skew-t diagram.

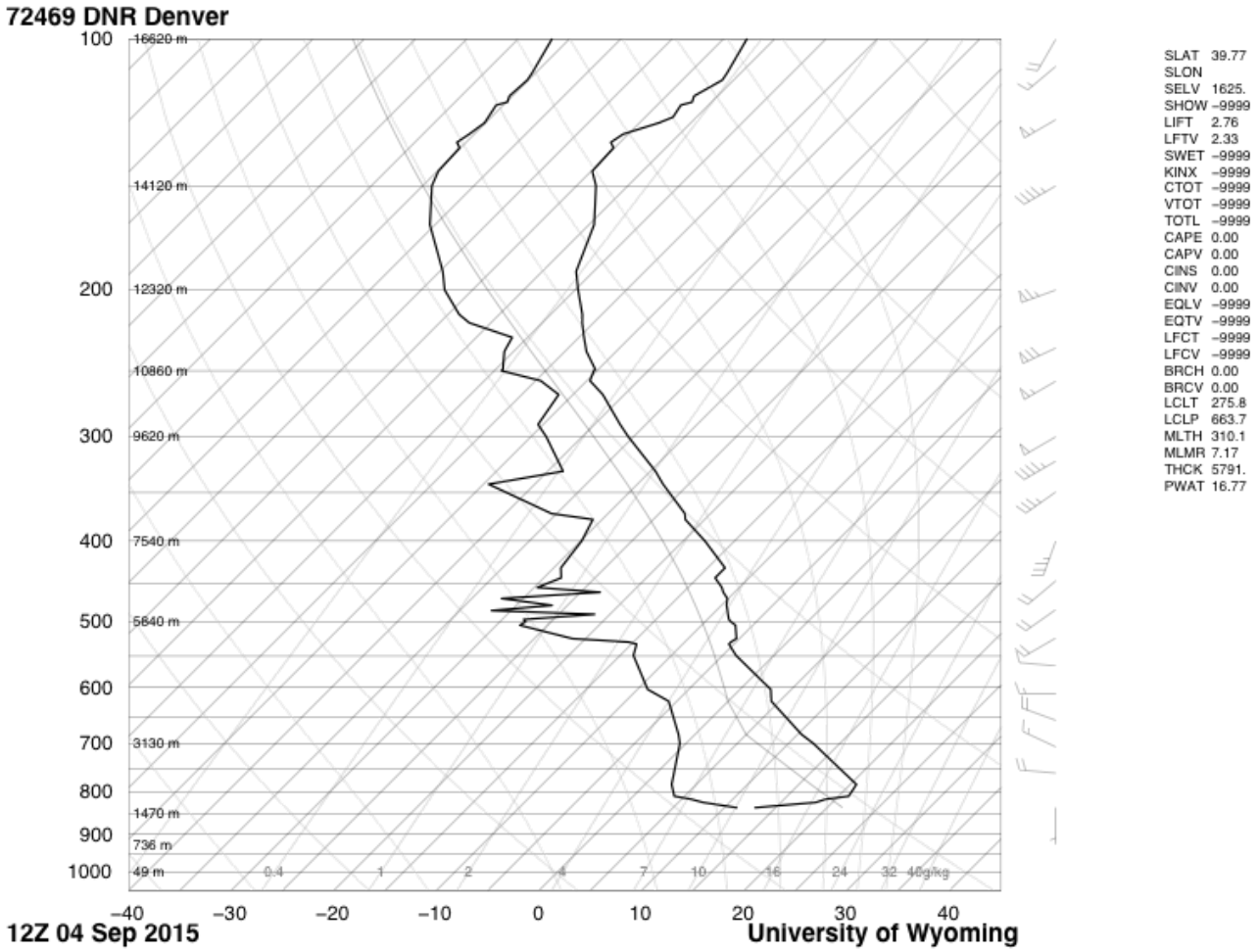

Figure 1: Skew- T diagram for September 4th, 2015

Photographic Technique

The photograph is taken on a Nikion D3000 digital SLR camera. The lens used has a focal length of about 55 mm. The specific picture used a f-number of 5.6 and a shutter speed of 1/125 seconds. The ISO used was set automatically by the camera, which worked out to be 180. The resolution of the image is 3872x2592 pixels and no cropping was performed. The idea behind using these settings was to preserve the detail in the cloud as much as possible while capture as much detail in the moon as the camera would provide in the bright morning light. Below is the original image captured.

Figure 2: Original image

Minor post processing was performed on the image using Photoshop Elements. The saturation of the image was increased to about 25% to bring out the rich blue of the sky, especially through the wispy cirrus cloud. The brightness of the image was also increased to make the whites of the moon and cloud more prominent, but it was quickly determined that increasing this image too much produced an undesirable washed out look to the image. The increase was kept low, about a 9% increase over the original.

Figure 3: Image after post processing

Conclusion

Based on the images displayed by the Fall 2015 Flow Visualization class, the goal of making a striking image while staying within the assignment bounds is achieved. Including the moon in the image remains the right decision, and the luck of watching the

event during sunrise especially adds to making this image special. The image is an excellent example of a cirrus cloud. If I were lucky enough to see this again, I would wish I had a zoom lens to be able to capture more detail in the moon's surface.

Reference:

SKEW-T BASICS. (n.d.). Retrieved November 9, 2015. http://www.theweatherprediction.com/thermo/skewt/

INSTABILITY. (n.d.). Retrieved November 9, 2015. http://www.theweatherprediction.com/severe/ingredients/instability/

Atmospheric Soundings. (n.d.). University of Wyoming. Retrieved November 9, 2015. http://weather.uwyo.edu/upperair/sounding.html

Cirrus uncinus. (n.d.). Retrieved November 9, 2015. http://clouds.wikia.com/wiki/Cirrus_uncinus