

Flow Visualization: Clouds 1



MCEN 4151: Flow Visualization
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Introduction

Photographing clouds can yield very unique and beautiful images. Many variations of clouds exist in the sky. They are determined by the atmospheric conditions and the altitude in which they exist. A key factor when determining what cloud is being viewed is to determine if the atmosphere is stable or unstable. A stable atmosphere will typically consist of a form of stratus clouds. An unstable atmosphere will typically consist of a form of cumulus clouds. The stability of the atmosphere can be determined using a Skew-T diagram. If the CAPE value is 0.00 then the atmosphere is considered stable. If the CAPE value is greater than 0.00 then the atmosphere is considered unstable. Also the altitude that a cloud is expected to be present can be determined using a Skew-T diagram. Clouds are typically present where temperature is close to dew point, the two heavy black lines converge, and the T line kinks towards being steeper.¹ By recording the time and day a photograph is taken and by observing the structure of the clouds in image, the clouds can be accurately characterized.

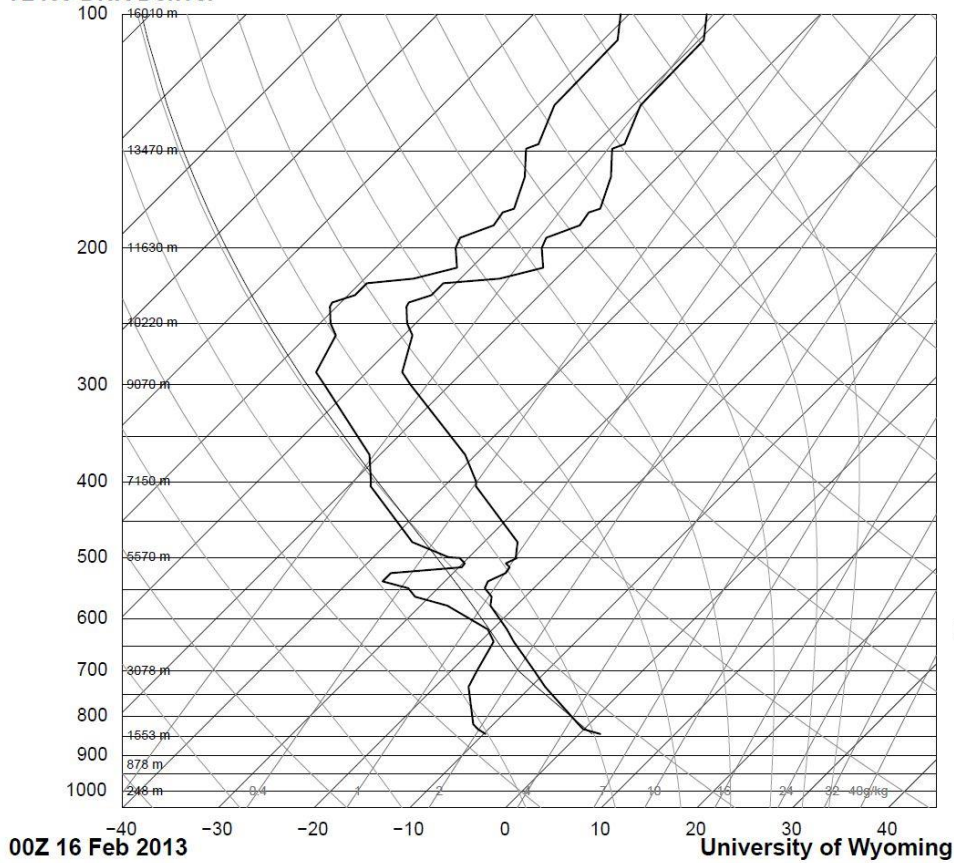
Image Details

The presented image was captured in Boulder, Colorado at 5:37 pm (MST) on February 15, 2013. The photograph was taken to display the beauty of a setting sun in Boulder. The sun had just set behind the mountain line in the west which is the direction that the photograph was taken. The photo was chosen to present because of its variety of cloud types. Various layers of clouds are easily observed. Also the sunset coloring and western feeling of the image add a favorable element. The tree and mountain in the bottom corners of the image provide perspective.

Cloud Details

Interpreting the Skew-T diagram below, it is possible to see that there are two types of clouds present in the photo. Since the image was taken at 5:37 pm (MST) on February 15, 2013, the best Skew-T diagram is one from 00Z to 12Z on the 16th (MST to Z is +7 hrs). Since the CAPE value is 0.00, the atmosphere is considered stable.¹ Taking into account that Boulder is at 1655 m above sea level, the lower clouds are at a very low altitude of about 7000 ft (~2000m). These clouds are mostly blocked from the sun which explains their darkness. Given that the clouds are distinct and grouped together, they are most likely stratocumulus lenticularis or mountain wave clouds. The other clouds present in the photo are at a higher altitude of about 15000 ft (~4500m). These clouds are much less grouped together and can be characterized as altostratus clouds.² They are receiving light from the sun which explains why they are much brighter and colorful. Since the photograph was taken during a sunset, it is expected that the sun was obstructed by the mountains for the lower clouds causing them to be darker, but the sun was still in contact with the higher clouds. These two types of clouds are very common in the spring season.

72469 DNR Denver



SLAT 39.75
SLON
SELV 1625
SHOW -9999
LIFT 8.28
LFTV 8.29
SWET -9999
KINX -9999
CTOT -9999
VTOT -9999
TOTL -9999
CAPE 0.00
CAPV 0.00
CINS 0.00
CINV 0.00
EQLV -9999
EQTV -9999
LFCT -9999
LFCV -9999
BRCH 0.00
BRCV 0.00
LCLT 259.0
LCLP 689.2
MLTH 288.1
MLMR 1.88
THCK 5322
PWAT 4.92

Figure 1: Skew-T Diagram³

Photographic Technique

The camera used was a point and shoot: Canon PowerShot SX230 HS (12.1 megapixels, 14x optical zoom, f3.1-5.9, 28-392mm (35mm equiv)).⁴ The original photograph is 12 megapixels (4000 X 3000). The ISO was set at 100 (low sensitivity) to remove noise and ensure a clean image. The shutter speed was set to 1/160 of a second which allowed plenty of light and captured a clean focused image. Aperture was F5.0 which allowed an effective volume of light to enter the lens.⁵ Since the image was taken to capture the natural beauty of clouds during a sunset, very little Photoshop enhancement was made. The image was not cropped because I thought the tree and mountains added a sense of perspective. Using the spot healing tool, the street light in the bottom left corner was removed. The contrast curve was adjusted to enhance the colors and bring out detail. However, the enhancement was limited because I wanted to maintain the western color tones.



Figure 2: Before (left) and After (right) of Image

Conclusion

There are very many different cloud types. It is not always easy to determine which clouds are present in the sky. By researching the appearance of specific clouds and analyzing Skew-T diagrams, it is possible to obtain a good idea of what clouds are actually being viewed. I found this photograph and project to be very interesting and fun. The images of clouds change drastically based on atmospheric conditions and time of day. I feel that utilizing a spring sunset and limiting Photoshop rendering allowed me to develop a pleasing image and representation of various cloud types.

References

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