Stratocumulus Stratiformis Translucidus

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Clouds1 Assignment – Flow Visualization 2012
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An investigation was undertaken to observe and capture various cloud formations, the intent of which was to learn to identify different cloud types and to develop an understanding for cloud formation processes. While various cloud formations were observed over a four week period, only a low stratocumulus cloud is discussed. The image was selected as an excellent example of the cloud variety translucidus. The photographic technique used is presented and reviewed. The image was produced for the assignment titled *clouds1*, of the mechanical engineering course Flow Visualization[1] at the University of Colorado at Boulder. The purpose of the assignment is to for students to capture fluid phenomena using an imaging technique in a visually pleasing manner.

The image was taken at 3pm in the afternoon on Wednesday February 15th 2012 in Boulder, Colorado. The image was taken near the intersection of Broadway and Baseline, while facing south-west with the camera oriented approximately 30 degrees above the horizon.

Figure 1 - Stratocumulus Stratiformis Translucidus

The field of view is filled with a low, stable cloud layer of stratocumulus stratiformis translucidus. The imaged stratocumulus cloud is mostly uniform, hence the species name stratiformis; the variety name translucidus is used because the clouds are transparent and allow the image of the sun to be clearly visible. The cloud layer is at about the elevation of the mountains, just greater than the 1,000 meter altitude limit for the similar 'stratus' genus of clouds.

The image of the clouds was taken during a small weather system which did not bring any precipitation. On the day before the clouds had been gathering, and the weather system passed by the following day. The weather of February 15th 2012 is presented in the form of a Skew-T[2] plot in Figure 1 (UW, 2012). The winds that day were steady from the west but not strong, and calm at the surface. The CAPE value of 0 indicates a stable atmosphere, which is typical for a stratocumulus cloud like that photographed. By examining the parcel lapse rate, no regions of instability can be identified. The temperature is typical for a winter day in Colorado with two

[1] The flow visualization course website can be found at: http://www.colorado.edu/MCEN/flowvis/
[2] General information about Skew-T plots can be found at: http://www.theweatherprediction.com/thermo/skewt/.

slight inversions (indicated in red). At low altitudes the temperature and dewpoint are close together, indicating that a small drop in temperature will cause water molecules to form water vapor (clouds). At around 4,000 meters the dew point drops and the air becomes very dry. This indicates that altocumulus clouds likely compose several layers at altitudes of 1 – 4km. Since the sun is visible through the clouds, the layers are likely thin and dispersed.

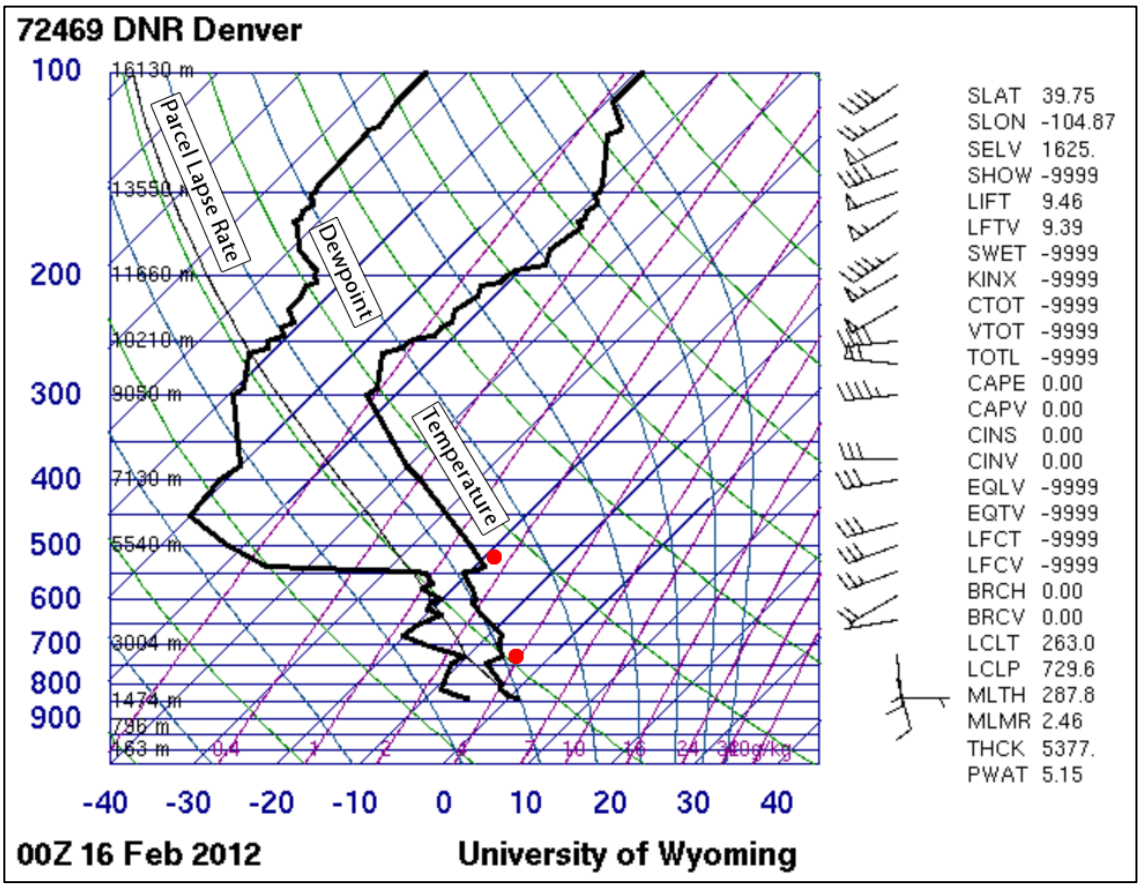

Figure 2 - Skew-T plot of the atmospheric conditions in Denver Colorado for the evening of February 15th 2012, when the image was taken (UW, 2012).

The formation of the stratocumulus cloud is closely linked to the presence of a temperature inversion. This occurs when the temperature of the atmosphere increases or stays constant with increasing altitude. Examining the Skew-T plot, an inversion can be identified at around 1 – 2km. Small currents of warm air will rise to the inversion layer, forming clouds in the process, but will be limited in their growth by this layer, since the air in the inversion layer will have similar properties to the rising air currents. The cloud layer formed will persist and spread out with minor fluctuations due to wind and additional convection currents (Pretor-Pinney, 2007).

Some small crepuscular rays are visible in the image at the lower edge of the translucent region of cloud. These rays are due to small particles and water vapor scattering the sun's light. The short length of the corpuscular rays indicates that the air was relatively clear and dry below the

cloud layer. The bright spot in the clouds below the sun is due to the sun's rays hitting a secluded patch of cloud and scattering.

Visualization Technique

The cloud was photographed using a high shutter speed and low ISO setting to capture the details of the sun. A midrange aperture was used, and could have been reduced to provide more clarity and a better exposer. The image information and camera settings are presented in Table 1. Some editing was done to bring out certain details of the image. Changing the exposure with curve adjustments recovered highlight detail, as can be seen in the edited and unedited versions of the image which are attached for reference. The imaging technique and editing seeks to emphasize the transparent aspect of the clouds and make the image more dramatic and intriguing. The final image is 3648 x 2736 pixels in size, with a field of view of roughly 50 degrees. I specifically included the tree and mountain in the image to provide a sense of scale and to help frame the break in the clouds. The mountain peak is 750m above the location where the image was taken and about 3km away. Based on this knowledge the clouds are estimated to be at an elevation of 1-2km. The translucidus area of the image is on the order of 500meters across.

Table 1: Camera's Image Capture Settings

Original and final Image Size	3648x2736 pixels
Resolution	240 pixels/inch
Shutter Speed	1/2000
Aperture	f/8
ISO Speed Rating	100
Focal Length	9.7 mm
Lens	6.0-42.6 mm f2.8
Camera	Nikon P7100

Concluding Remarks

The primary focus of the investigation was to describe the formation and appearance of a stratocumulus cloud. I was successful in capturing an image that illustrates the translucidus variety, as the image clearly captures the form of the sun through the clouds. The image reveals convective currents changing the cloud's appearance. I especially like the subtle corpuscular rays that are evident in the edited image. The image could have been improved by crisper focus. The topic could be investigated further by monitoring the development of a stratus layer into a stratocumulus to better understand the driving circumstances. Many interesting cloud phenomena were revealed over the 4 week investigation, which also created an appreciation for the clouds, and their relation to the weather, that will be rewarding to explore further.

References

Pretor-Pinney, G. (2007). *the Cloudspotter's Guide.* New York, NY: Perigree Trade.

UW. (2012, 02 15). *University of Wyoming Atmospheric Sounding data*. Retrieved 02 25, 2012, from http://weather.uwyo.edu/upperair/sounding.html

Original, as shot, image of *stratocumulus stratiformis translucidus.*

Edited Image: exposure decreased to bring in highlights, contrast increased.