Clouds 2

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MCEN 5151- Flow Visualization
April 17, 2012
University of Colorado at Boulder

Introduction

This report documents the photographic techniques used to capture a cirrostratus nebulosus cloud and several altocumulus lenticularis clouds. It will also discuss the atmospheric conditions and weather patterns involved.

This project is the second of two cloud visualization assignments for the Flow Visualization Course at the University of Colorado at Boulder in the spring of 2012. The goal of the assignment was to capture and identify cloud types using pictures or video.

Methods

This image was captured during a road trip through the Teton Mountains in Wyoming and Montana. It was shot on March 29, 2012 at 5:23pm Mountain Time, on a wind farm near Medicine Bow, Wyoming

Analysis

Classifying cloud formations can be accomplished by combining a few techniques. Analyzing a Skew-T plot for this day and time (**Figure 1**) reveals several atmospheric conditions and helps suggest the type of clouds one should expect to see. It also suggests its elevation relative to the viewer's ground level orientation.

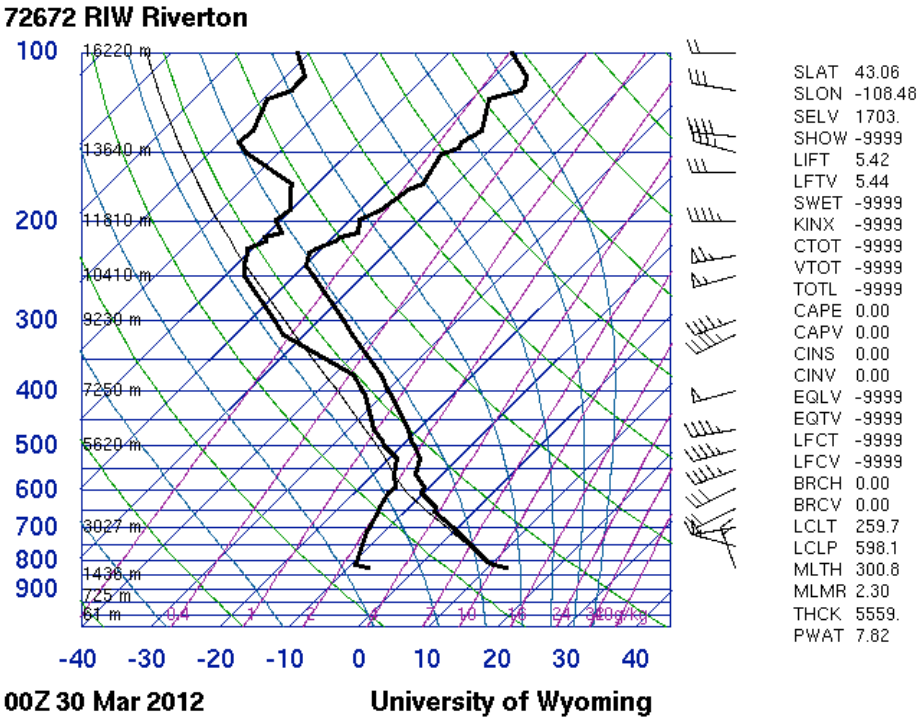

Figure 1: Skew T Plot for Riverton, WY on March 29th, 6pm[1]

This Skew-T indicates that clouds are of high probability and should appear between 5600 meters and 7250 meters above sea level. The elevation of Medicine

Bow, Wy is 2,200 meters above sea level. Cloud elevation would then be expected to be seen at 3,400 meters and 5,540 meters above ground level. The CAPE (or convective available potential energy) is 0.00, indicating a stable atmosphere and showing a strong wing from the west. One can classify clouds by combining and considering the data and what is shown in the image. The cloud formation on the left side of the image can be classified as a cirrostratus nebulous, described as largely transparent, milky veils of high clouds that are smooth and monotonous [2]. The smaller clumpy clouds to the right of the image can be classified as altocumulus lenticularis, or mountain wave clouds [3][4]. These clouds are described as mid-level layers or patches, in the form of almond shaped lenses appearing dense with pronounced shading [2]. They are formed as moist, warm air flows over mountainous terrain in stable atmospheric conditions [3]. The mountain wave formation is diagrammed in **Figure 2**. In the image, theses are most pronounced near the mountains and begin to loose their shape as the wind blows them away from the mountain range.

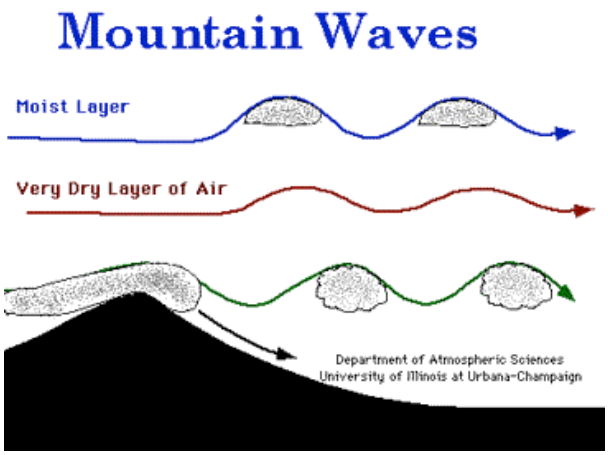

Figure 2: Mountain wave cloud formation [5].

Photographic technique

The camera was placed on a tripod about 20° from the horizon east of the …….mountains, with the lens facing west. This technique provided a great view of the still landscape and the clouds overhead. The sun provided the beautiful natural lighting on this day, as it light cast through the cirrostratus nebulosus cloud. The positioning of the camera was chosen to simulate what a person would see on this day if they were standing on the walking path gazing cross to the mountains in the distance observing the clouds overhead. The mountain range in the horizon is estimated to be 5 kilometers across, and about 15 kilometers away from the camera.

An 18.1 mega-pixel DSLR camera was used and captured the photograph. The camera was a Canon EOS Rebel T2i body, housing the high resolution CMOS sensor. This was fitted with a Rokinon 8mm f/3.5 Aspherical Fisheye Lens, providing an ultra-wide 167-degree diagonal field-of-view when mounted to the Canon camera.

The camera was focused manually and custom exposure settings were used including shutter speed, aperture, and ISO. A fast shutter speed of 1/2500 and and aperture value of f/3.5 were chosen to quickly capture the moving flow, minimizing distortion that maybe caused when photographing moving objects. A low ISO of 100 was used to compliment the shutter and aperture values and also due to the high light level provided on this day. The RAW image was 5184x3456 pixels, and is seen in **Figure 3**.

Figure 3: RAW image. Size 5184x3456 pixels

Post processing was then done using Adobe Photoshop CS5 and adjustments were made to enhance certain qualities and produce the final image. To achieve the red and black effect, the temperature was increased from 5,850 to 50,000 and the tint was increased to +150, this creates the red hue throughout the image. Next, the blacks were increased to +90, this deepened the blacks and also increased the contrast. Finially the image was cropped to 5180x2351 pixels giving the "wide screen" feel. The final image is seen in **Figure 4** below.

Figure 5: Final Image. Size: 5180x2351

Image Analysis

The final image grabs the viewer's attention, and many students added "It looks as if was taken from mars!" due to the red sky above. The sun peering through the cirrostratus nebulosus clouds gives a great lighting effect. The high contrast of the red clouds against the black mountains and cloudless sky to the right provides a very clear image. I also enjoy the windmills in the distance to the left and the fence posts spanning the entire image, closest to the viewer. This gives a sense of size to clouds and increases the realization where this image might have been taken. The post-processing greatly alters the image, but also increases its effectiveness. An adjustment that could improve the image is sharpening of the sun's shape, but can be argued unnecessary. I really enjoy the colors and feeling this image gives.

References:

[1] Atmospheric Soundings. *Wyoming Weather Web*. Web. <http://weather.uwyo.edu/upperair/sounding.html>.

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[3] Neiman, Paul J., Joseph A. Shaw, 2003: Coronas and Iridescence in Mountain Wave Clouds Over Northeastern Colorado. *Bull. Amer. Meteor. Soc.*, 84, 1373–1386.

[4] Chih-Chieh C, Hakim G, Durran D. Transient Mountain Waves and Their Interaction with Large Scales. *Journal Of The Atmospheric Sciences* . July 2007;64(7):2378-2400. Available from: Academic Search Premier, Ipswich, MA.

[5] Clouds and Precipitation. *University of Illinois at Urbana-Champaign*. Web. <ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cld/home.rxmlF1EZrvHe3g&cad=rja>.