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March 1, 2006
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~The Altocumulus~

The purpose of the Cloud flow visualization assignment was to photograph the naturally occurring and exceptionally beautiful phenomena of clouds. Clouds can be seen by anyone at any time. What the average observer does not realize is that there is an enormous amount of physics and fluid flow taking place as they look up at the clouds. Clouds are an extremely interesting occurrence and that is why it is the topic of my photograph. The I decided to image altocumulus clouds. The clouds that I photographed had interesting texture and shading. It was my goal to capture this and at the same time have depth to my picture. I believe that I was successful in this. The final photo can be seen in Figure 1.

Figure 1: Altocumulus Clouds

The setup for this picture was rather simple. I set up my tripod so that the camera was about 90^o up from the horizon and focused in on the clouds. A sketch of this can be seen in Figure 2. It was taken at 4:13pm on February 2, 2006. The temperature outside was 5^oC with a humidity of 27%. The wind was blowing Northwest at a speed of 29.6 km/hr.

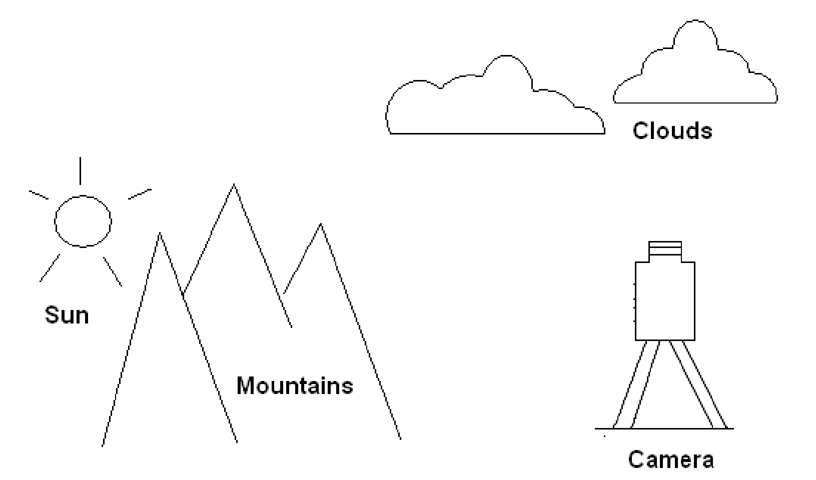

Figure 2: Camera Setup

The approximate Reynolds number can be calculated because we know the field of view and also how much time it took the smoke to pass through that field of view. Equation 1 shows how to find the Reynolds number.

$$R_e = \frac{\rho V D}{\mu}$$

Equation 1: Reynolds Number

V = Free-stream fluid velocity
D = Characteristic distance
ρ = Fluid density
μ = Fluid viscosity (dynamic)

The density of the air was found to be 1.252 kg/m^3. The dynamic viscosity of the air was found to be $17.4x10^6$ Ns/m^2. The distance was estimated to be 2 km. The velocity can be determined from Equation 2.

$$V = \frac{dx}{dt}$$

Equation 2: Velocity Equation

dx = Change in distance

dt = Change in time

Using values above found in *Principles of Heat Transfer* by Kreith and Bohn and calculating the velocity to be 40km/hr. The Reynolds number was found to be ~5.73×10^6.

The only lighting used what the light from the sun as it was setting behind the mountains. The camera used a HP Photosmart C945 (VO1.60) digital camera. The focal planes resolution is in a unit of centimeters and has 5.3 mega pixels. The size of the field of view is estimated to be approximately 2 km. Altocumulus clouds are a mid-range cloud that is located between 2,000 and 6,000 meters above the surface. I estimated my particular clouds to be about 4,000 meters high. The lens focal length was 7.6 mm.

The exposure specifications used for this picture were as follows. The exposure time was 1/180 second, the aperture value was set to 6.9 and the shutter speed was 1/180 second.

Altocumulus clouds typically have shading and can appear as laminae, rounded masses or rolls. They are formed by an instability in the air that causes convection before a cold front comes in. They usually form in a layer of moist air where the air is rising and falling. As the air rises, the vapor condenses and where the air troughs, the water evaporates. This creates the wave-like look that these clouds typically have. These clouds are primarily made up of water droplets and sometimes ice crystals as well. This image reveals a characteristic altocumulus cloud. I really enjoy this photo because the ratio of blue sky to cloud is very pleasing to the eye. I believe that the branches of the tree in the top right corner add to the depth of the photo. I feel that it is a simple, but exquisite photograph. The shading in the cloud makes it seem to have a soft-fluffy texture and the color of the blue sky adds a peaceful feel to the photo. If I were to further develop this idea, it would be very interesting to see photograph more altocumulus clouds and try to capture a sunset or sunrise with the clouds in the picture.

References:

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