Cloud First

Flow Visualization: The Art of Fluid Flow

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10/16/2015

Image 1 Final Image

Background: The purpose of this image was to demonstrate a significant physical phenomenon of fluid mechanics in the form a visually striking presentation. This project "Cloud First" specifies that a cloud will be the fluid subject to be analyzed; it also provides a compelling presentation of the magnificence of nature. The planning, image capture, editing, and reporting were all conducted by the author Andre Szlendak. Though many clouds were captured in an effort to grasp the magnificence of clouds, this image was chosen for its clear demonstration of cloud characteristics. The intent was to provide a wonderful visualization, with a scientific explanation of shape.

Image Capture: Capturing the cloud image was tackled with the "wide-net" strategy. As nature is the best demonstrator of the physics I had to capitalize on opportunities to get my image. This method meant carrying a camera every day. This resulted in hundreds of pictures of clouds in a month. In this method images were captured throughout the day, usually from a high elevation to limit foreground distractions. For the specific image presented here, the capture was taken in Grand Junction Colorado at dawn, from the ground looking west.

Figure 1 Picture Orientation

The result of the image capture was an Altocumulus cloud illuminated by the early morning sunrise. The hypothesis of an Altocumulus was developed from the shape and apparent altitude of the cloud. Using the National Ocean and Atmospheric Administration's extensive cloud information, the shape fit an Altocumulus cloud. This visual hypothesis was confirmed using a Skew-T chart from the Grand Junction Airport cataloged by the University Of Wyoming Department Of Atmospheric Science. The data is an accurate catalog as the airport is within a mile of the image location and the image was captured 56 minutes after the data collecting weather balloon was released (12:00 Z). The data shows a very steady atmosphere demonstrated by the zero "Cape" factor. This is consistent with Altocumulus clouds especially in the morning hours. Altocumulus clouds are high altitude (alto) phenomena (between 6500 and 20000 ft.) with limited instability. They're formed with localized convection but are limited to small regions unlike Cumulus clouds which are at a large scale. The stability was again confirmed later in the day as all clouds disappeared.

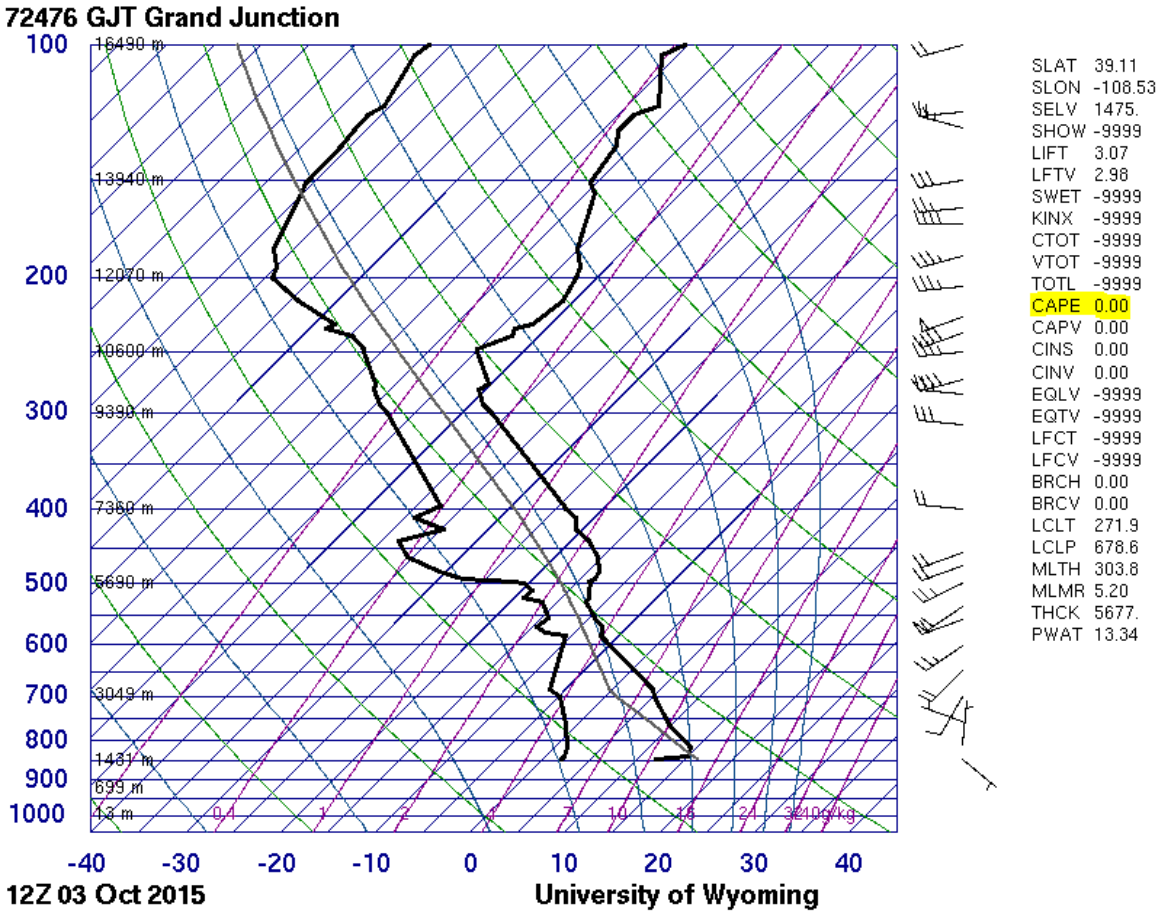

Figure 2 Grand Junction Atmosphere Data

Image Capture: The image was captured standing the ground pointing a camera West toward the cloud phenomena. It was taken in the early hours of the morning (6:50 am). This resulted in very soft lighting that highlights the clouds more than the foreground.

Photographic Technique: The image was capture using a Canon EOS Digital Rebel. With the low light a small F-stop (5.6) was necessary to increase the diameter of the aperture. Likewise a long shutter speed (1/125) was used to allow as much light in as possible without allowing motion blur. Finally, to maximize light sensitivity the ISO was set to 1600 to capture as much light possible. This gave a 4272x 2848 pixel dimension image. That image was enhanced using GIMP post processing. It was cropped to 4040x 2820 pixels to minimize the foreground distractions. The contrast was enhanced to demonstrate the cloud depth and put the foreground into a silhouette.

Image 2: Original Image

Takeaways: The final image is a striking representation of Altocumulus cloud phenomena. It shows the atmospheric stability overall but localized instabilities. It is confirmed using the Skew-T data and is consistent with other Altocumulus conditions and characteristics. Personally, I love the image and think it has great calmness consistent with morning hours of fall on the Western Slope of Colorado. I am particularly fond of the lighting and contrast across the clouds with their very dark flat bottoms.

References:

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