Altocumulus stratoformis Over Rainbow Bridge

Second clouds image for MCEN 5151: Flow Visualization

Millie Blackstun
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Purpose

The purpose of the second clouds assignment was to expand on the goal of the first clouds image. The first time around, students were to find an example of the cloud types being taught in class. From the cloud photo captured, and atmospheric data accessed retroactively, students should be able to classify the type of cloud, or clouds, viewed in the image. For the second image, the cloud classification should be more sophisticated and better understood. Students were tasked with creating an aesthetically pleasing and intriguing photo of clouds, and explaining the physical phenomenon taking place to create said clouds. The photos themselves should focus on the cloud formation and influencing factors in creating the different cloud types.

Image Setup

My first go at the clouds assignment was in the middle of the day, with sharp and dramatic contrast between Colorado's famous blue sky and the bright white clouds. For the second image, I wanted to capture the extensive color palette that occurs in the sky, especially at sunrise and sunset. Over Spring Break, I had the great privilege of traveling to Japan. In Colorado, opportunities abound to capture cloud images with intense frames of mountains. I took my trip to Japan as a chance to frame my picture instead with a city skyline. In Tokyo, on March 28th, 2014, at about 6:30 in the evening local time, I was walking alongside Tokyo's newly constructed bridge on the island of Odaiba as the sun was setting. Remnant storm clouds were breaking up in the sky, and the view into Tokyo created just the effect I was looking for. Right next to Tokyo's Statue of Liberty replica, I captured my second clouds image.

Cloud Description

The Skew-T diagram (seen in Figure 1) for this cloud image was taken from the University of Wyoming's Atmospheric Sounding data. Tokyo's time zone is GMT+9, so ideally, I would have liked to get the Skew-T for March 28th at 12 Zulu. However both soundings were unavailable for the Tokyo station on March 28th, so I had to retrieve the diagram for March 29th at 00 Zulu, or about 9 o'clock the next morning.

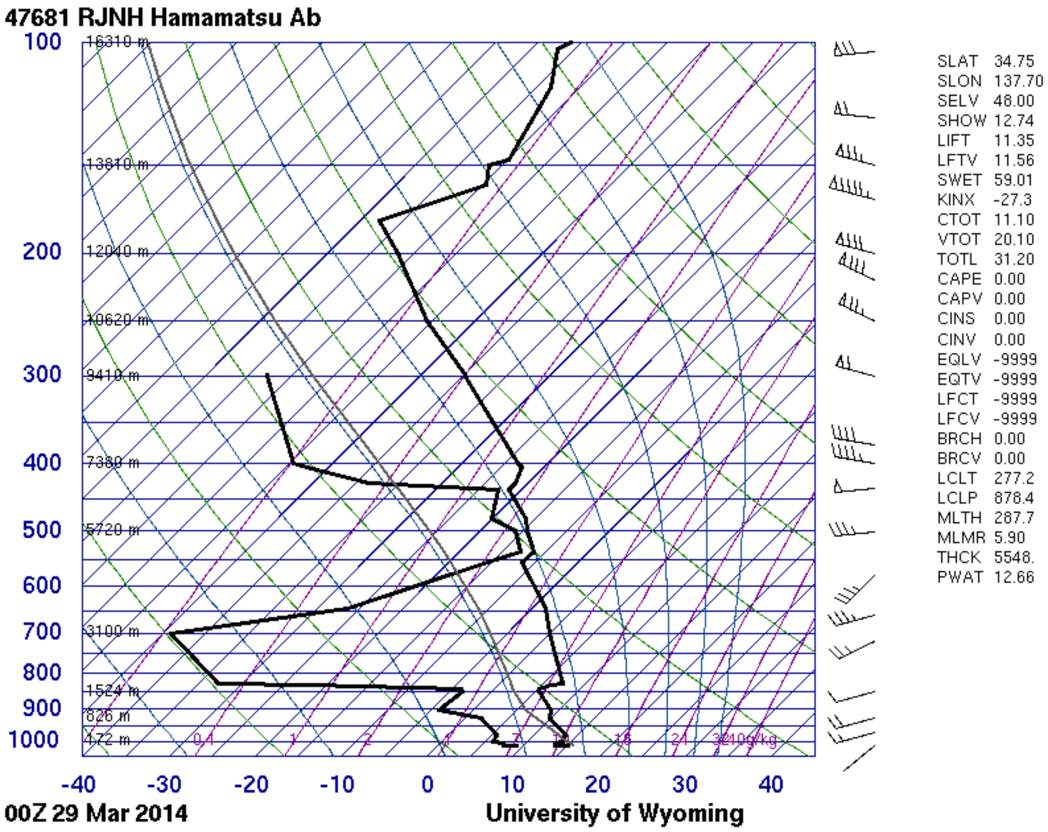

Figure 1: Skew-T Diagram for Clouds Over Rainbow Bridge (University of Wyoming)

As discussed in my first report, there are several different ways to determine atmospheric stability and storm probability from a Skew-T diagram. The easiest is to look at the Total Totals Index (TOTL), which sums up different thunderstorm predictor variables. (Colorado State University) Values above 52 indicate that thunderstorms will most likely become severe while values lower than 44 insinuate only normal thunderstorms will occur. As the TOTL value for this day is well below 44, there was a very low probability of thunderstorms occurring. The number may have been slightly higher on the more accurate Skew-T diagram, as a thunderstorm had passed through earlier that morning.

The next place one can look is the CAPE value (Convective Available Potential Energy), which is the amount of potential energy a parcel of air can acquire, based on its environmental surroundings. (Colorado State University) If a parcel has nowhere to go and isn't likely to move anywhere, the CAPE value is near zero, implying a stable atmosphere. If parcels of air have a high tendency to shoot upwards or downwards based on their current location and density, they have a high potential energy capability and therefore result in an unstable atmosphere. CAPE on this Skew-T is 0.00, implying a stable atmosphere, and the actual Skew-T diagram would probably reflect about the same, having calmed down after the rainstorm.

Lastly, one can follow the thin black line representing the adiabat line that starts above the boundary layer. If the temperature line (rightmost of the two thick black lines) and adiabat don't cross each other, the atmosphere is most likely stable. The thin black line indeed does not cross the temperature line, so it is most likely a stable atmosphere.

All indicators from the Skew-T lead to a stable atmosphere for the day my photo was shot. It was interesting to see that the winds were blowing in essentially the same direction at every elevation, but this explains the equal spreading distribution of clouds across the sky. The clouds are clumped towards the center of the photo, and look like butter being spread with a knife towards the left edge. Indeed the direction of the image is facing is north-northwest into Tokyo, from Odaiba, and the winds are spreading primarily westwards.

Weatherspark claimed a 100% CAVOK, or Ceiling And Visibility are OK, which means there were no clouds below 5000ft. (Weatherspark) According the Skew-T, the clouds were at about 5720m, or almost 19,000ft., which still equate to high level clouds. The final cloud classification is deemed to be Altocumulus stratoformis, as the clouds are high level, and appear to be the broken up remnants of larger cumulus clouds. (National Organization of Atmospheric Research)

Photographic Technique

Relevant image specifications are given in Table 1.

Lens Focal Length	27mm
Type of Camera	Canon T3 DSLR
Final Picture Size	3936 × 2783 pixels
Exposure	Shutter Speed: 1/50h second Aperture: 5.6 ISO: 1600
Post-Editing	Cropped Turned up all six color saturations. Increased contrast to make skyline one solid dark frame.

Table 1: Image specifications

An average shutter speed was used, as the image I was trying to capture was fairly stagnant, but to avoid motion blur by the boat lights, I needed it to be quicker rather than slower. Due to the darkness of the scene, I turned the ISO up a bit. The original image can be seen in Figure 2 for comparison.

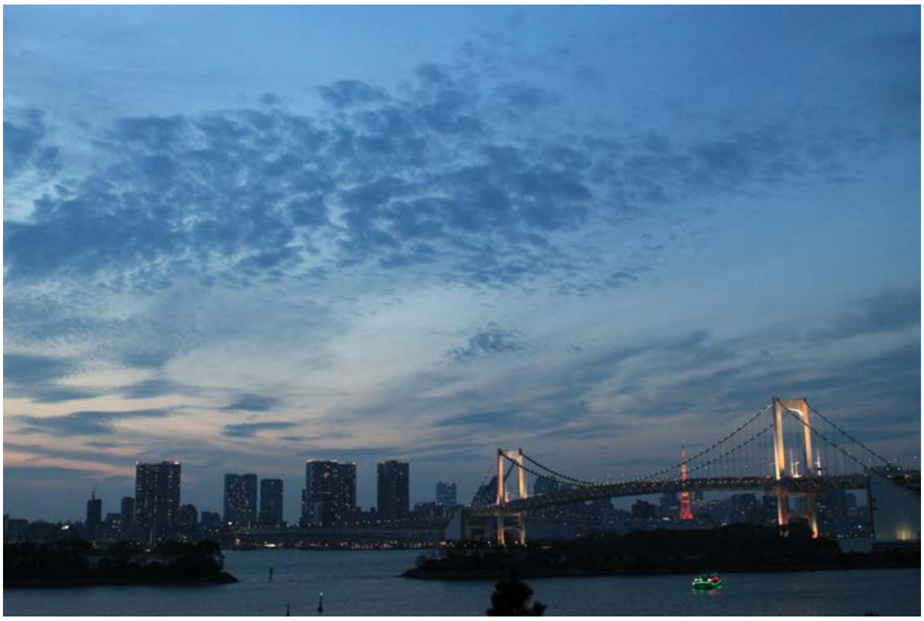

Figure 2: Original Cloud Image

Reflections and Conclusions

I set out to capture a sunset picture, which I was able to do, and it just so happened that I was also in an exotic location. If I had another cloud assignment to do, I think a time lapse may be my next attempt. I really enjoyed the passing of time visualizations we had in class. But I'm pleased with my photo and think that it makes for a dramatic cloud image.

Works Cited

University of Wyoming. "UWYO Upper Air Sounding." Skew-T Diagram. College of Engineering, 2014.

Weatherspark. Dashboard Weather (History). Weatherspark, 28 3 2014.

Colorado State University. "A Guide to the Skew-T/Log-P Diagram." Manual. n.d.

National Organization of Atmospheric Research. Cloud Classification and Characteristics. Louisville: National Weather Service Weather Forecast Office.