Altocumulus Undulatus Cloud

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Introduction

The objective of the Cloud 2 project was to capture a photograph of clouds which are great visual indicators of air flow in the atmosphere. I set out to take a photo of Altocumulus clouds as I think they produce some interesting patterns and are visually appealing in the sky. The obtained image is the result of luck and constantly looking into the sky.

Explanation of Clouds Formation

This photo was taken on November 5th, 2021, at 4:53pm near the town of Destin, Florida looking to the northwest. This corresponds to the skew-t taken in Tallahassee approximately 2hrs after the image was taken. Tallahassee is much further inland than Destin and about 130 miles to the east, while Destin is right on the coast of the Gulf of Mexico. As such I expect this Skew-T shown in Figure 1 to not represent the conditions we see in the image exactly, but it should be close.

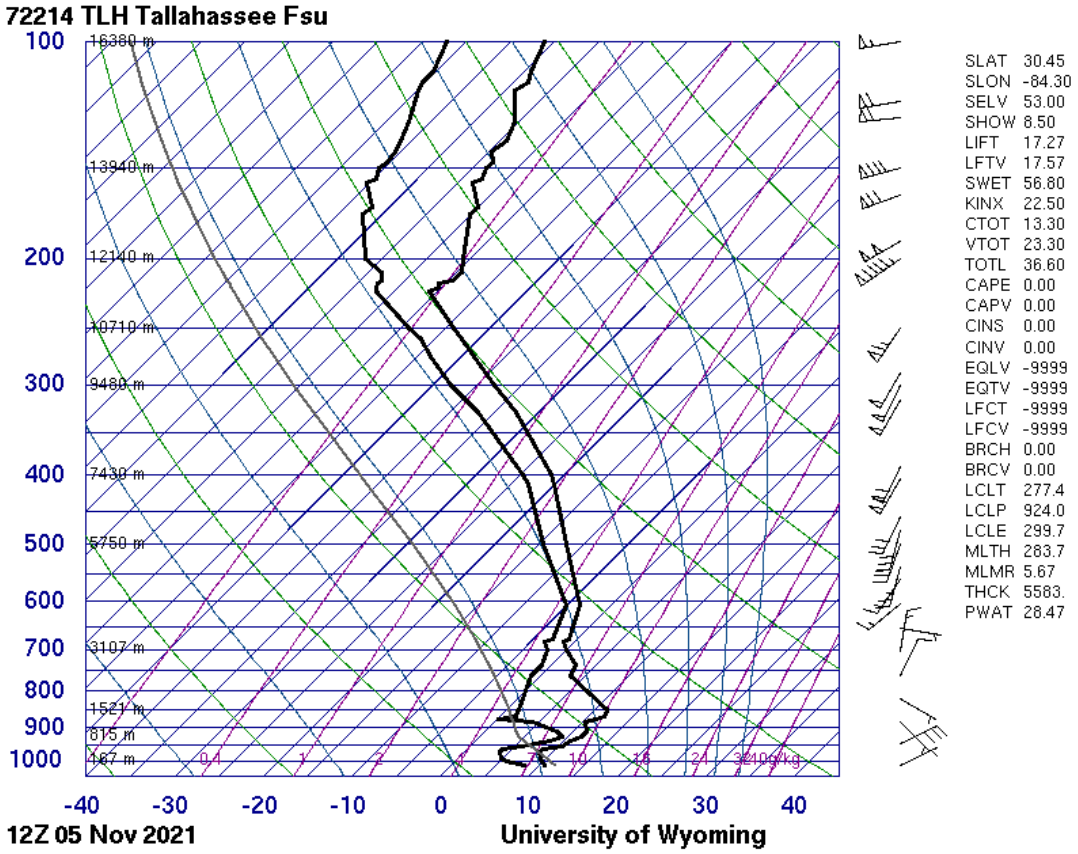

Figure 1: Skew-T Chart for 6pm Local Time, Salt Lake City, Utah.

From the Skew-T in Figure 1, there is clearly an inversion set up from the 950hPa layer to the 850hPa layer with some conditionally unstable sections between the surface and the upper layers. Based on this and the dewpoint line we could expect to see clouds low down at approximately 700m or 2100ft, however this is not where we would expect altocumulus clouds to form and it is more likely that the cloud base we are observing corresponds to where the dewpoint and temperature lines merge toward each other again near the 690hPa layer or roughly 10,000ft.

Altocumulus clouds normally form between the altitudes of 7,000ft and 18,000ft, which checks out with the section of the atmosphere we are expecting to see clouds from the skew-t. The METAR data on 11/5/2021 at 5pm for the Pensacola Airport is as follows

05/11/2021 21:53-> METAR KPNS 052153Z 04008G18KT 10SM CLR 17/09 A3010 RMK AO2 SLP195 T01720089=

This provides a better look at the conditions on the surface when the image was taken. The winds were coming from the NNE at 40° and blowing at 8kt gusting to 18kt, the visibility was clear, and the temperature was 17.2°C and the dewpoint was 8.9°C. The barometric pressure was 30.1 inHg. The big take away from looking at the METAR data is the wind direction and temperature of the surface. With the winds blowing in from the north this means that the air mass was coming in from the north. This air mass then hit the air mass that is the Gulf of Mexico and is what is going to be the largest factor in cloud generation. The warmer air from the inland air mass pushes toward the cooler air mass and mixes with it causing the condensation and cloud formation. The fact that the clouds are lined up directly with the direction the wind is coming from further confirms that these are Altocumulus Undulatus Clouds. Undulatus clouds "have a subtle wave pattern" and form "perpendicular to the direction of the wind" (Varieties, n.d.). The subtle wave pattern is present in the Altocumulus formation we see here as there is slight breaks of blue where you can see through to the sky, and the lines of clouds are all parallel to each other but perpendicular to the wind direction.

I think that it is rather curious that the altocumulus clouds formed with such a straight line cutting off where they are forming. Based on some of my knowledge of weather from my course in Weather Forecasting and Analysis, I think this is likely due to a Maritime Tropical Airmass (mT) merging with a Continental Polar Airmass (cP). coming from the north. A cold front bringing the cP airmass would hit the warmer air and cool it as it mixed causing the condensation (cloud formation) near the beaches like seen in the photo. The strong line is where the two airmasses are merging and the beginning of the cloud formation is occurring. The mT airmass that is the air over the ocean " is more humid than those(airmasses) that form over land" (University Corporation for Atmospheric Research, n.d.). This means that as the dry air mass mixes with the humid air mass that is where you will likely see cloud formation and correlates with what is occurring in this photo.

Visualization Method

I unfortunately did not have my nice camera with me while I was on this trip to Florida, however the camera in my phone does a decent job at capturing high quality images. I was using a Samsung Galaxy S20 Smartphone and the camera settings are as follows in the table below.

Camera	Samsung Galaxy S20
Shutter Speed	1/750s
Aperture	f/2
Focal Length	5.9mm
ISO	25

I simply framed the photo to crop out any unwanted objects in the image like the buildings and streets. I was standing on the ground and looking up at about a 45° angle.

Image Processing

I did not do any image processing for this photo. I think that everything turned out quite well. There is good contrast in the image against the blue sky and the white clouds. The Image is well composed with the eye being drawn from top left to bottom right at the diagonal of the clouds, and you really focus in on the Altocumulus clouds as the subject. I think the diagonal creates a great depth to the image.

Figure 2: Original

Final Thoughts

I am really pleased with the fact that I was able to capture this image on my smartphone camera. It was such a cool scene to witness and the fact that I could capture it to share was wonderful. I really enjoyed trying to learn why the line of clouds so abruptly stops as you look to the northwest. I find this image to be very visually appealing and I hope the viewers do too.

References

University Corporation for Atmospheric Research. (n.d.). *Air Masses | UCAR Center for Science Education*. Retrieved from Scied.ucar.edu: https://scied.ucar.edu/learning-zone/how-weather-works/air-masses

Varieties, C. (n.d.). *Learn About Undulatus Clouds: Wavelke, Undulating*. Retrieved from whatisthiscloud: https://whatsthiscloud.com/cloud-varieties/undulatus/