

The purpose of this assignment was to capture an image of a cloud, and to identify the cloud type and the weather causing it. Because I had an airline flight planned prior to the assignment due date, I chose to utilize this opportunity to capture a unique perspective of the clouds. I waited for interesting cloud formations and layers that I felt were difficult if not impossible to see from the ground.

The image was photographed on a flight from Tampa, Florida to Denver Colorado on February 20th, 2012. The image was taken at 9:00am EST, about thirty minutes into the flight. Using data from flighttracker.com, the altitude, speed, heading, and position of the aircraft can be read from

08:55AM	29.8172	-83.9650	307°	West	388	447	31,900		📍 Jacksonville Center
08:56AM	29.8833	-84.0664	306°	West	388	447	31,900		📍 Jacksonville Center
08:57AM	29.9469	-84.1678	306°	West	388	447	32,000	↑	📍 Jacksonville Center
08:58AM	30.0086	-84.2669	307°	West	388	447	32,000	-60	📍 Jacksonville Center
08:59AM	30.0742	-84.3686	305°	West	388	447	31,900	↓	📍 Jacksonville Center
09:00AM	30.1356	-84.4706	305°	West	388	447	32,000	↑	📍 Jacksonville Center
09:01AM	30.1969	-84.5725	307°	West	388	447	31,900	-60 ↓	📍 Jacksonville Center
09:02AM	30.2603	-84.6697	305°	West	388	447	31,900		📍 Jacksonville Center
09:03AM	30.3194	-84.7694	304°	West	388	447	31,900		📍 Jacksonville Center
09:04AM	30.3786	-84.8694	307°	West	388	447	31,900		📍 Jacksonville Center
09:05AM	30.4439	-84.9694	304°	West	388	447	32,000	↑	📍 Jacksonville Center

Figure 1.

Time	Position		Orientation		Groundspeed		Altitude		Reporting Facility
USA: Eastern	Latitude	Longitude	Course	Direction	KTS	MPH	feet	Rate	Location/Type
08:55AM	29.8172	-83.9650	307°	West	388	447	31,900		📍 Jacksonville Center
08:56AM	29.8833	-84.0664	306°	West	388	447	31,900		📍 Jacksonville Center
08:57AM	29.9469	-84.1678	306°	West	388	447	32,000	↑	📍 Jacksonville Center
08:58AM	30.0086	-84.2669	307°	West	388	447	32,000	-60	📍 Jacksonville Center
08:59AM	30.0742	-84.3686	305°	West	388	447	31,900	↓	📍 Jacksonville Center
09:00AM	30.1356	-84.4706	305°	West	388	447	32,000	↑	📍 Jacksonville Center
09:01AM	30.1969	-84.5725	307°	West	388	447	31,900	-60 ↓	📍 Jacksonville Center
09:02AM	30.2603	-84.6697	305°	West	388	447	31,900		📍 Jacksonville Center
09:03AM	30.3194	-84.7694	304°	West	388	447	31,900		📍 Jacksonville Center
09:04AM	30.3786	-84.8694	307°	West	388	447	31,900		📍 Jacksonville Center
09:05AM	30.4439	-84.9694	304°	West	388	447	32,000	↑	📍 Jacksonville Center

Figure 1: Position, altitude, and heading data at various times [1]

Using the above position data, the location from which the image was captured can be determined as the area south of Tallahassee, Florida, shown in Figure 2.

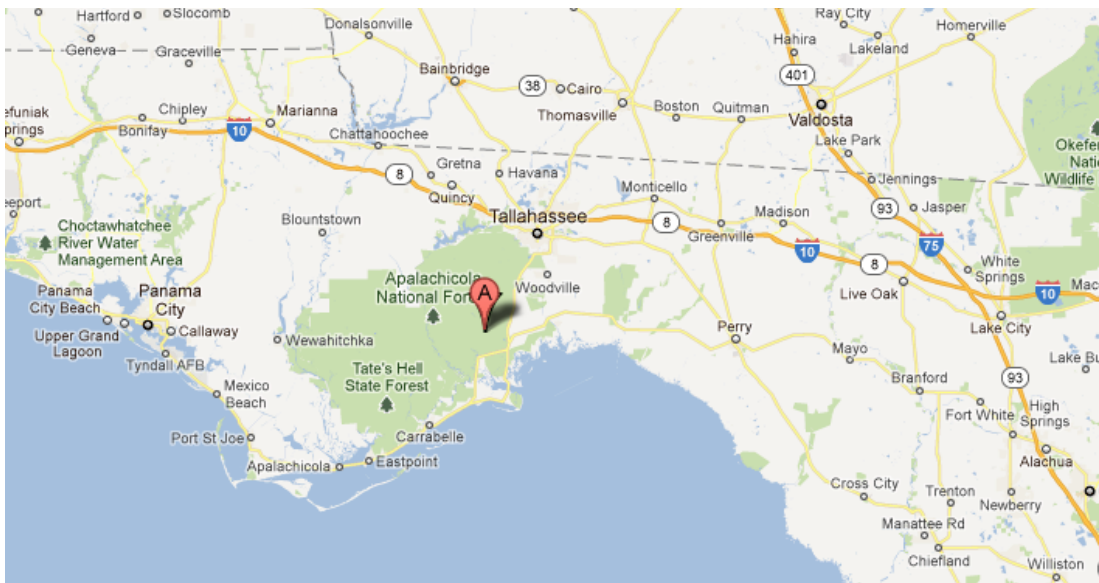


Figure 2: Location of aircraft at time of photograph [2]

Based on the aircraft heading of 305 degrees, and that the photo was taken from the right side of the aircraft approximately perpendicular to the direction of travel, the camera was facing north-north east, or approximately 35 degrees. Given the flat topography of the area, there were no available reference points to estimate the distance from the aircraft to the clouds; therefore, the weather data for Tallahassee will be used in the analysis.

The Skew-T plot for Tallahassee at 12Z, or 6am EST, is the closest match to the flight time. The atmosphere was stable based on the CAPE value being equal to zero. From the Skew-T plot shown in Figure 3, the majority of clouds were most likely initially present around an elevation of 8600m, where the temperature comes within 4 degrees Celsius of the dew point. After this point, the temperature remains relatively close to the dew point—especially compared below to below 8000m—explaining the apparent height and various layers of the clouds in the photograph. The clouds that appear almost like a lake, well below the other clouds, appear to be around 800m based on Figure 3.

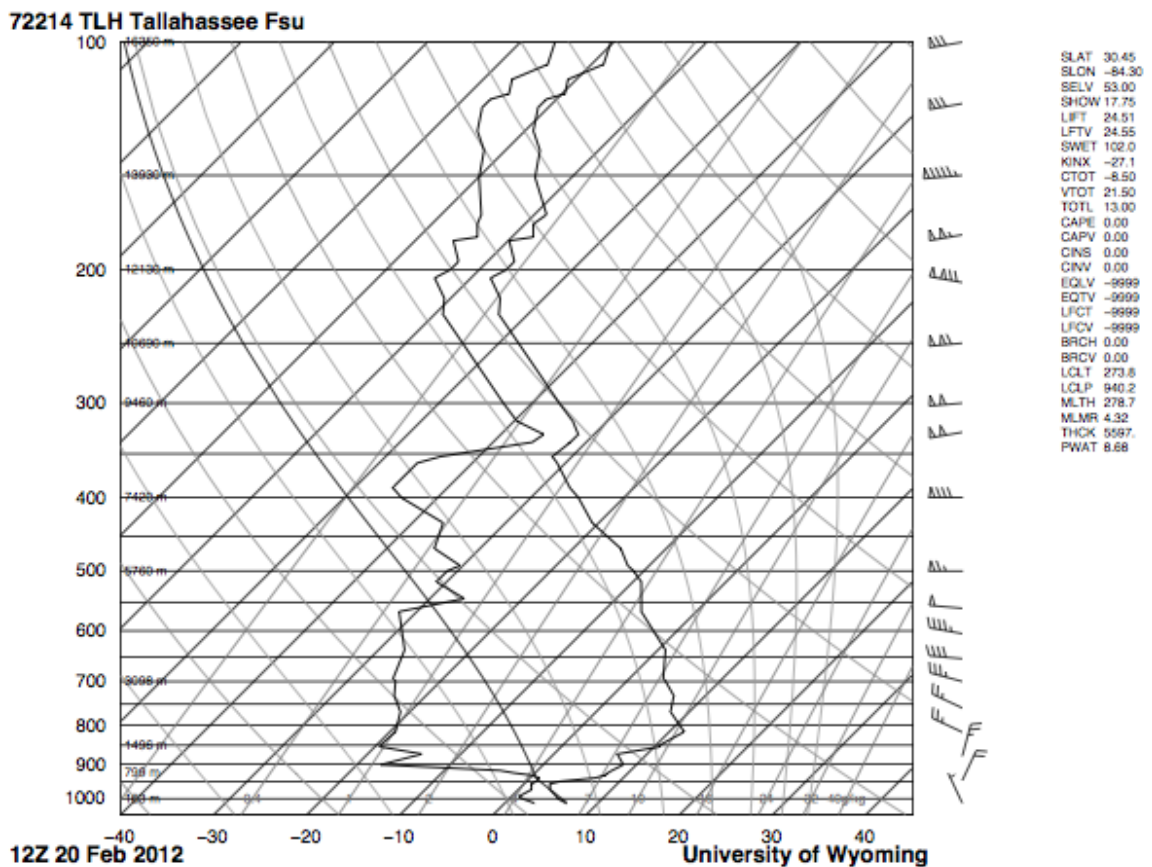


Figure 3: Skew-T plot for Tallahassee [3]

There was no precipitation at the time in the area; however there had been rainfall the day before, and the same storm system had moved toward Tampa, where it was raining at take off [4]. From the Skew-T plot, it can be determined that the wind direction was in the same direction throughout the altocumulus formations, and very low at ground level.

Because of the stable atmosphere, the darker color of the clouds, and the approximate cloud elevation, the in the middle of the image appear to be altostratus [5]. Below the altostratus are altocumulus undulates, caused by gravity waves in the atmosphere [5]. The low-level clouds that can be seen through the altocumulus undulatus seem to be stratus based on there appearance and altitude from the Skew-T plot [5]. Given that the atmosphere was stable at the time of the photograph, and from the potential cloud altitudes indicated by the Skew-T plot, the aforementioned cloud types seem to be reasonable estimates of what is depicted in the image.

When capturing the image from the aircraft, the field of view is limited as well as the angle of the camera to the window due to glare and scratches in the window. The biggest challenge was to angle the camera to avoid the presence of glare or the scratches in the image. Multiple shots were taken at various ISO levels in order to try to best highlight the clouds.

The image was captured using a Canon EOS Rebel XSi digital camera, at an f-stop of 10 and a lense focal distance of 55mm. A shutter speed of 1/1000 was used at it seemed to provide the best exposure. The original and final images were 4272 × 2848 pixels. The size

of the field of view and distance from the camera cannot accurately be determined, but were certainly on the order of magnitude of tens or perhaps hundreds of miles.

Photoshop processing of the image was limited to increasing the contrast around 200%, and adjusting the blue and RGB curves in an attempt to more clearly show the altocumulus undulatus in the foreground.

The original image is shown below.



Figure 4: Original image

The image reveals multiple types of clouds from an interesting perspective: an airplane. I would be interested if the darkness of the clouds is in any way influenced by precipitation or even air pollution, as the color seems unusually dark. It would also be extremely interesting to know the exact distance of the clouds from the aircraft and therefore their exact location as it is extremely difficult to ascertain a distance with no known reference points. I think that especially the altocumulus undulatus do an excellent job of showing a flow phenomenon, namely gravity waves.

I would like to improve the depiction of the altocumulus undulatus so that they are more clear, and be able to photograph a cloud in relation to a fixed reference (e.g. a mountain or lake) in order to have atmospheric and weather data for the *exact* location.

Works referenced:

[1] Flight Aware Live Flight Tracker. Available online: <http://de.flightaware.com/live/flight/UAL388/history/20120220/1321Z/KTPA/KDEN/tacklog>. Retrieved 2 March 2012.

[2] Google Maps. Available online: <maps.google.com>. Retrieved 2 March 2012.

[3] University of Wyoming, College of Engineering. Department of Atmospheric Science. Available online: <<http://weather.uwyo.edu/upperair/sounding.html>>. Retrieved 2 March 2012.

[4] Weather Underground. Available online:
<http://english.wunderground.com/history/airport/KTLH/2012/2/19/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA>. Retrieved 2 March 2012.

[5] Hertzberg, Jean. Class notes. Flow Visualization, Spring 2012. University of Colorado at Boulder.