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Flow Visualization
“Clouds assignment 2”

This report covers Geoff Duckworth’s cloud image submitted for Cloud Assignment 2 in Professors Hertzberg’s and Sweetman’s Flow Visualization course at the University of Colorado. The purpose of this assignment, and the image that resulted, was to observe and capture the extremely large-scale miscible fluid dynamics that result from movement of air and water vapor due to atmospheric conditions.

This image was captured in between the islands of Oahu and Hawaii, while flying from Honolulu to Kona. It was taken from approximately 18,000 ft above sea level, facing mostly west, at 5 pm on November 16, 2007. The temperature on the ground was approximately 80 degrees Fahrenheit, the humidity was very high, and the wind was calm.

As with all clouds, the flow phenomenon is very complex, but at a low level it is a seeded flow, with the seeding being water vapor. Upon inspection of the “Cloud Chart” from Purdue University, the clouds in this image match the description of Cumulus congestus rising above a blanket of Stratocumulus. I can’t be certain of the classification, since most cloud identification guides are accustomed to looking at the bottom of the cloud. I imagine that the upper surface could be quite different from the bottom, but I’m not sure. I am confident that the rising clouds in the center of the image show the rising anvil of a cumulus congestus. Interestingly, the stratocumulus layer of clouds typically indicate that there will be no precipitation for at least 12 hours, while the rising anvils indicate rain much sooner, if not currently. I am not too puzzled by this since the weather in Hawaii was very localized. It would rain all day in one spot, and upon driving 25 miles away, one would discover that it hasn’t rained at all.

The equipment used to capture this image was simply my Canon digital Elf model PowerShot SD400. This is clearly a case of abiding by the adage of “have your camera on you at all times.” The original image was captured at 72 dpi and 2160 x 2880 pixels with 8 bit color depth, but was cropped slightly in Photoshop. No image enhancements or color corrections were done, since none seemed to improve the original image. The final pixel dimensions are 2061 x 2060 pixels. Exposure settings were limited due to the equipment. White balance was “auto” but I estimate that it was for natural outdoor light. ISO was 80, Shutter speed was 1/30th of a second, aperture was f 2.9. The focal distance in this image is difficult to determine, but I estimate it to be 3 miles. At the least, the camera was focused to “infinity.” There was no flash used, as this would have obviously been useless. The lighting was entirely natural sun, but at a very low angle in the sky due to being near sunset. I happened to be very fortunate to catch this shot, with a flight at the right time, a window seat, and a fortuitous flight path.

I was unable to find sounding data from any of the Hawaiian Islands for this time period. However, even if I had found some, I would strongly question their relevance, since in the week that I spent on the Big Island, I observed the weather patterns to be highly localized.

I like this image for several reasons. First of all, a beautiful sunset is always easy to look at. Second of all, seeing a cloud layer from above is a very rare treat. On

occasion in the mountains I have experienced this, and it creates a very interesting feeling of looking out over a sea. In this case, since the cloud layer was, in fact, over the ocean, and perhaps due to my previous biases, many of the rising cloud formation created the impression of mountaintops rising out of the clouds. There are also some interesting formations in the rising clouds. When I first looked out the window, I immediately saw an elephant's trunk in the cloud rising from the center of the image. In the few minutes I watched the cloud (before the plane changed course), the trunk curled and uncurled almost like a real elephant. In terms of future development of this concept, I intend to in the sense that the "above the clouds" phenomenon is one of my favorite meteorological occurrences, and whenever I experience it I try to capture it in a way that can portray what a special feeling it is.