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Clouds 1 – The Big Picture

Flow visualization is often inspired by flow phenomena that is often taken for granted; the wind's interaction with the clouds in the sky. The change in seasons, geographical location and even the pollution created from cities effect the clouds we see in the sky. All these elements combined together can create a beautiful display of art in the sky.

The Big Picture was one composed of 3 individual photos, stitched together to make one larger photo. The contents of the final image I thought were important as it showed a basic flow phenomenon that can sometimes be difficult to capture a good quality image. Looking at the image, with the wind blowing from left to right, it is apparent that the Local Reynolds number increases. At the cloud tips on the left, there is a smooth silky surface to the cloud. In the middle of the image the cloud begins to separate, marking the transitional phase. On the far right, the cloud shows that the area is now in a fully turbulent phase.

I captured these images next to the parking structure on the University of Colorado at Boulder's Campus, Lot 436. Facing generally north and with my camera elevated between 20 – 30 degrees, I captured 3 images, rotating approximately 25 degrees between each shot. These images were taken on January 21st 2009, at a time approaching sunset.

Based on my research, I believe that these clouds start out as Altocumulus or Lenticular clouds on the left side because of their stationary smooth body shape, but then become Altostratus on the right, resembling puffy little cotton balls. The temperature for this day was about -10 degrees C at an elevation of approximately 4000m AGL, possibly higher. Wind speeds were higher on this day, the skew-T plot taken in the afternoon showed that there were gusts around 13-20 knots recorded for that altitude. This data was collected from station 72469 DNR Denver Observations on 12Z 21 Jan 2009.

The technique I used to collect the set of images was to take several pictures, around the same camera orientation in order to allow a panoramic shot in the end. The length of the cloud easily spans dozens of miles after stitching. I believe that the clouds started about 20 miles to the north, just over Longmont, CO. The focal length was at 6mm on my CASIO EX-Z700, focused for objects at infinite distance. The F-Number was set at f/4.3 on all 3 images, but the shutter speed was the same for only 2 of the 3 images, 1/320 on the left and center section, and 1/250 for the right section. The 3 images were merged together using Photoshop and it's built in automated photomerge application.

As mentioned before, the reason why these images were chosen and stitched together was because of how it shows the flow developing from a laminar flow to a turbulent flow. I was satisfied overall with the image, but think that the next time an opportunity like this one comes around I really need to have a tripod available. The stitching wasn't as clean as I imagined it would have been and also there is some distortion in the image as a result.

VE Larson, AJ Smith, MJ Falk, KE Kotenberg, *What determines altocumulus dissipation time* - J. Geophys. Res, 2006