Thunder over Arches

Report for “Clouds 2” assignment

MCEN 5228: Flow Visualization

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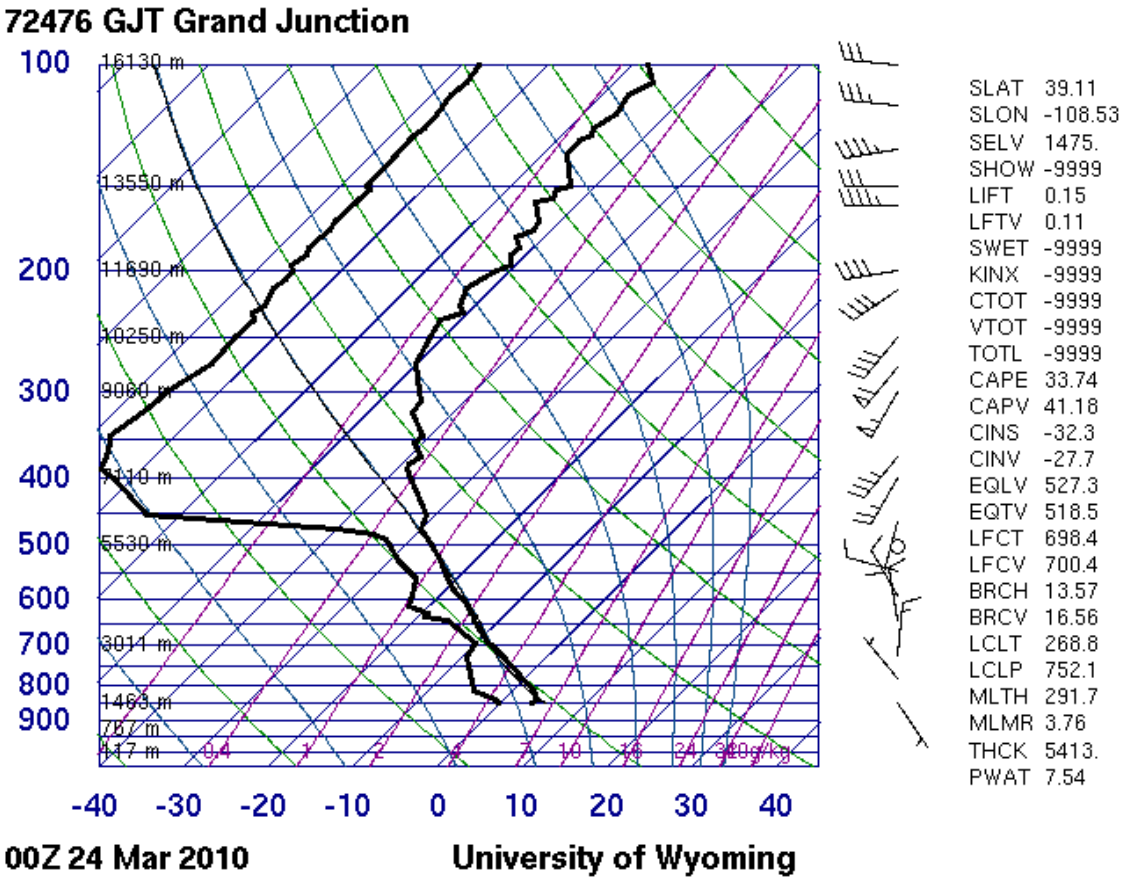
The second Clouds assignment seems less ominous than the first. The weather in the spring is less stable providing much more subject matter. Spring break, inevitably, provides travel opportunities that translate into cloud opportunities. Some of those are less expected than others, such as one that precipitated an emergency stop on I-70 west in a failed attempt to capture a picture perfect but rapidly vanishing Crow instability against an azure sky of the Western Slope.

Fortunately, I was afforded a perfect opportunity in just two days as we were driving through the Arches National Park. The day (March 23, 2010) started with warm temperatures and sunny skies but a weather system was coming in from the west with associated atmosphere instability and much colder temperatures. The morning's sun warmed up the ground providing plenty of energy for the convective flows that fed an increasing array of clouds overhead. What started as a clear sky was gradually filled with cumulus clouds and eventually became covered with a low level stratonimbus, culminating in snow late in the evening. Of the numerous images taken that day, the final one was taken at approximately 1PM and depicts a classic cumulonimbus cloud raining onto the landscape.

The closest skew-T diagram obtainable was from Grand Junction, CO at 00 Zulu the next day. The time is 5 hours later but the system was moving toward the west so the correlation is actually closer than 5 hours. The diagram, shown below, demonstrates the layer of humid air hovering between 3000 and 6000 meters with a peak at the lower bound. The very close space between the dry and wet bulb temperatures suggest very high local moisture content. The local elevation is approximately 1700m placing the lower bound of the clouds at approximately 1300 meters above the terrain and the upper bound somewhere below 4300 meters. The apparent wind direction change at that altitude would have sheared the cloud had it extended above that altitude. The CAPE of 33.74, while not excessive, does show an unstable atmosphere further supporting the observations.

The photograph was taken with a Canon SX120 digital camera. The lighting was still quite intense, with the sun lighting both, the landscape and the tops of the clouds, so the aperture was set at 4.5 with exposure at 1/1250 sec despite the ISO80 setting. The short exposure time assured good time resolution while relatively large aperture was not a significant factor with all the elements in the photo being fairly far away and therefore in focus. The camera lens was set to wide angle with focal length 8.2mm (49mm at 35mm equivalent). The field of view at this focal length is 27 degrees but distance to the clouds is a challenge to estimate since the terrain is rising and there is no level horizon reference to provide a datum. A rough calculation, assuming the spacing between the bottom of the cloud and the assumed level taking 1/3 of the frame, shows the distance to the cloud to be 10km. This makes the diagonal field of view approximately 9km at the cloud. No post-processing of the image was required and the relatively static nature of the subject, due to the distance, allowed for framing with the camera so no cropping was done either. The final image is a full frame 3648x2736 pixels.

The image depicts a classic cumulonimbus cloud. It was hard to resist such a picture perfect example despite a wide choice of clouds that were available that day. The image is well supported by the weather pattern that was developing with the morning heating and the incoming cold front. The only regret that I have, given such a perfect setting, is not trying a time lapse series, having seen a classmate's video.



References:

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