MCEN 5151 Cloud First: Solar Disc Through a Cirrus Cloud

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ABSTRACT

Cirrus cloud photographed on Highway 36 to Broomfield on September 6th, 2026 at approximately 10:03.

Keywords: Flow Visualization, Clouds, Cirrus

INTRODUCTION

The image seen in Figure 1 was produced for the Cloud First assignment. We attempt to use clouds as a vehicle for visualizing the flow of water vapor and atmospheric gases. This image was selected to capitalize on the filamentary structure of the ice crystals that make up this cloud. The ice crystals become their own stream- and streak lines, self-organizing to visualizations of their own flow. Additionally I enjoyed the way the Sun looks partially obscured in the cloud.

This image was taken on Highway 36, almost to Broomfield, at 10:03a.m. on September 6th, 2026. The camera was facing South-East by East and elevated to approximately 48° above the horizon. The rest of the sky was a calm and apparently motionless.

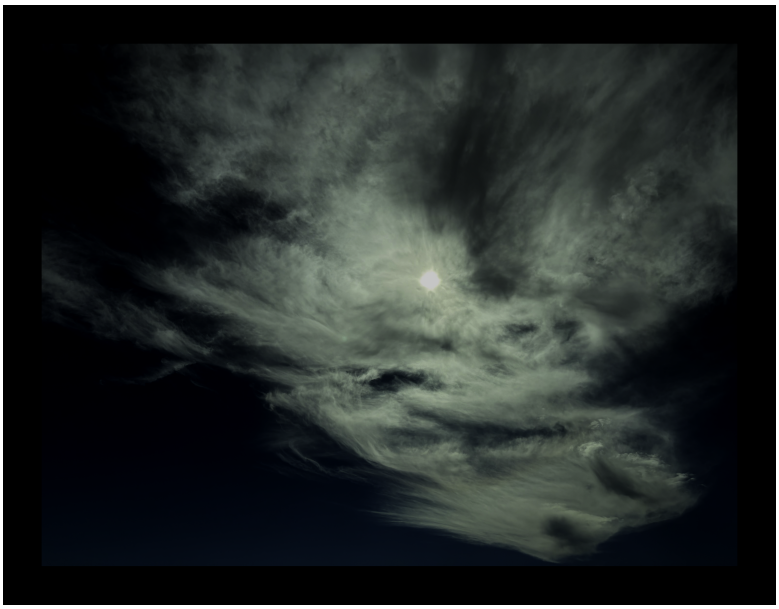


Figure 1. Final processed image of solar disk visible through a cirrus cloud.

CLOUD TYPE AND SUPPORTING DATA

The photographed cloud is a cirrus cloud, which we can determine from the ”feathery” appearance. This indicates that the cloud is likely make of ice crystals suspended in the upper atmosphere. The closest available sounding data were produced in Grand Junction, CO and was made available through the

University of Wyoming's Upper Air Data Portal (Figure 2. Reading the skew-T diagram, regions of probably cloud formation are in/around the 300 and 600 isobar lines.

With Grand Junction being approximately 250 miles from where the photo was taken, it was not immediately clear that the skew-T diagram would have depicted accurate trends. In Figure 3 we see the isobaric lines provided by NOAA. The region between Western and Central Colorado appears to sit at approximately the same pressure, indicating that the skew-T trends from Grand Junction ought to be reliable. Thus we invoke the same trends in Broomfield, with cloud formation near the 300 and 600 isobar lines. There will be, of course, a difference in humidity from Colorado's Western Slope to the Foothills, which would likely change the dew-point profile.

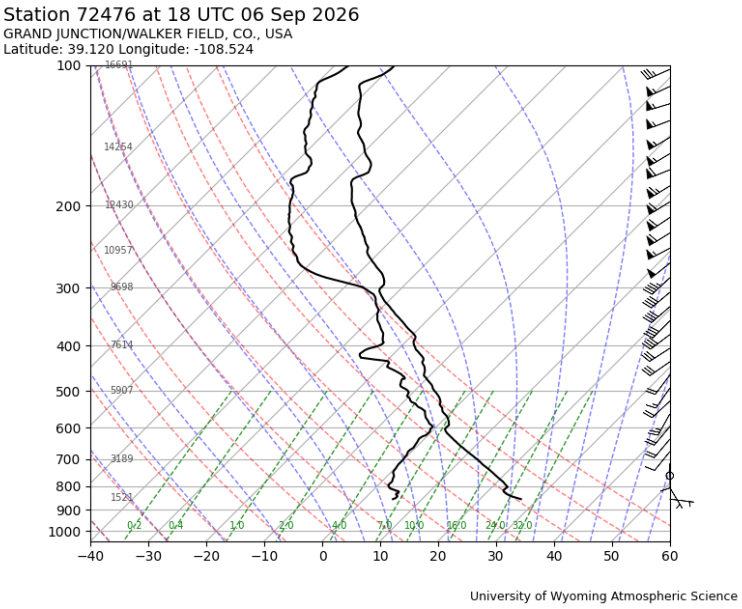


Figure 2. Skew-T diagram for September 6th, 2026. The closest sounding data were taken in Grand Junction, CO. Available through the University of Wyoming Upper Air Data Portal.

VISUALIZATION

The raw, unedited image (Figure 4) was taken on an iPhone 17 with automated settings. According to the photo metadata this yielded a focal length of 5.96 mm, an f-number of $\frac{f}{1.6}$, and exposure time of $\frac{1}{18{,}500}$s. Typically the Sun takes up approximately 0.5° in the sky, giving an approximate field-of-view of about 20°. Post processing included color correction in darktable to darken the sky and increase the contract of the cloud, as well as adding a frame. The final image is 3483px x 2700px.

I think the produced image is able to adequately capture mid-to-high troposphere air flows. The whirls and twists are especially exciting to me. The optical thickness/depth of ice crystals is readily on display since the Sun is shining directly through, bringing another sense of depth. I appreciate the picture and the ephemerality of a cloud made of ice crystals, but wish I could figure out why the image darkens when I upload it to FlowVis and/or Overleaf.

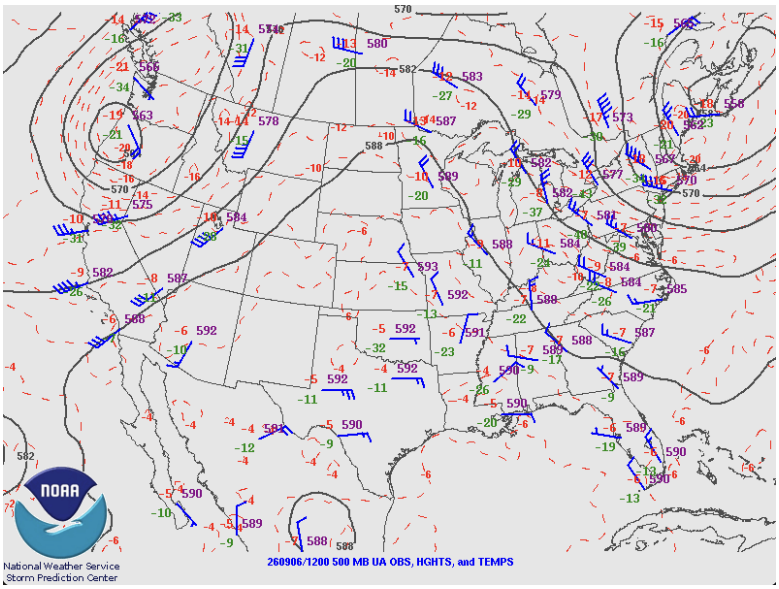


Figure 3. Distribution of pressure fronts around noon on September 6th, 2026. Grand Junction and Boulder, CO both sit roughly at the same pressure, so we can assert that the general pattern of the Skew-T applies despite the distance. Data provided by NOAA.



Figure 4. Unedited photo of cirrus clouds.