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Flow Vis Fall 2022

12/7/2022

Picture from 11/25/22, 1:14pm

Location: Huntington Park, San Francisco, CA

Cirrocumulus/altocumulus clouds

Clouds Second Report

Fig (1) edited, final image

Like the first assignment, the “Clouds Second” assignment is quite open-ended: take a picture of clouds and analyze the image. I always like open-ended assignments because it gives me more freedom to be creative and explore a topic that is interesting to me. Since the last assignment, the weather in Boulder has shifted and we no longer have the wonderful summertime thunderclouds. These were my

favorite clouds in this area, so my camera roll has become less saturated with pictures of clouds. Over thanksgiving break, I was excited to visit my family in the San Francisco area, because it would give me the opportunity to take pictures of clouds that don't exist or are less common in Colorado. Specifically, I was planning to take pictures of Karl the fog with my sister's vintage Pentax film camera. However, the fog was absent and the skies were are blue as can be. Aside from morning haze, this is how the entire week was, until Friday the 25th. My cousin's boyfriend from Texas visited for the first time, so we drove south from Marin to meet with them in San Francisco in the late morning. As we approached the Golden Gate Bridge, a large blanket of cirrocumulus or altocumulus clouds covered a massive portion of the sky just west of the bridge. Over the next few hours, it grew in size and moved east, covering most of San Francisco. However, the clouds were not fog, so Karl evaded me for the entire week.

On this particular day, November 25, 2022, San Francisco experienced somewhat typical fall weather, with less foggy skies than in the summer and sometimes a higher temperature. At 1:14pm, the time that the picture was taken, the temperature was 64 degrees Fahrenheit, with a dew point of 40F, 41% humidity, 9mph WNW wind, and 30.27 inHg pressure. The high of the day was 69F, and the low was 42. I always used to enjoy this time of year because it meant that I could get out in the sun for a few weeks before winter rainstorms came. The picture was taken from Huntington Park (299ft elevation), on Nob Hill, looking directly upwards.

The clouds in this picture could be altocumulus or cirrocumulus. Cirrocumulus clouds typically exist from 5000-15000 meters, and are characterized by small white patches held together closely (but not as a single entity) in a wooly manner. Altocumulus clouds look very similar, but exist in the 2000-7000 meter range.

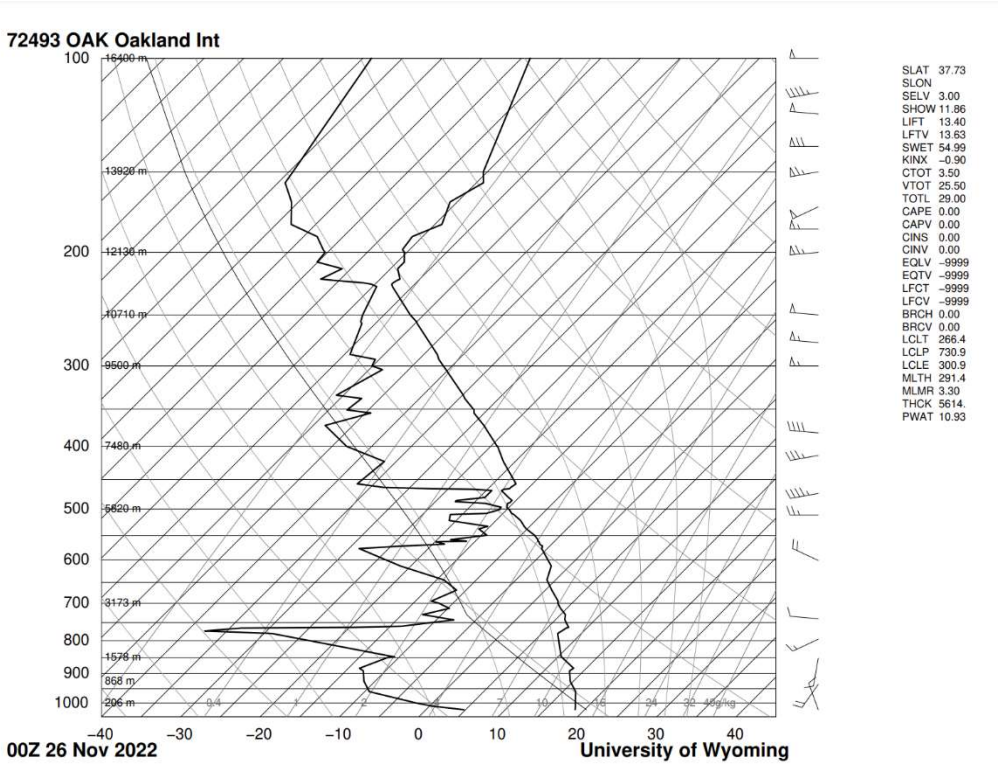

Fig (2) Skew-T diagram, University of Wyoming, Oakland, California, 4pm PT

As we can see from the Skew-T diagram from a nearby location, the formation of clouds could be at around 5820m or 11500 meters, further clarifying my assumption that the clouds were altocumulus or cirrocumulus type. The CAPE value was 0.00, indicating totally stable atmospheric conditions that can support these types of clouds.

San Francisco is known for being totally foggy, with the coldest daily mean, max, and minimum temperatures of any major US city in June, July, and August. So why, over the course of an entire week in late November, was it so sunny?

Well, it is due to the interaction between the hot air of the Central Valley and the cooler air from the Pacific Ocean. The Pacific Ocean air is unusually cold, around 54 degrees Fahrenheit, because it comes south from Alaska. This provides San Francisco with a form of “climate control”, where the average temperature remains remarkably constant over the course of the year. On the other hand, the Californian Central valley has more seasonal climate. Sacramento, for example, is supposed to be the sunniest location on earth from May until August, with approximately 100% possible sunshine; in the winter and shoulder seasons it reaches near-freezing to freezing temperatures. This is due to proximity to the Sierra Nevada Mountain Range and being more inland than the Bay Area. This means that the temperature differential between the valley and the bay is extremely large during the summer, and not quite as big during the winter.

The temperature differential is highly correlated to the maritime fog, Karl. As the hot air rises in the central valley, it creates a pressure differential between the bay area and the valley. Cold and humid Alaskan air rushes into the bay, over San Francisco, and into the eastern bay area to replace the hotter valley air. This means that during the high temperature differential in summer, there is also a large pressure differential which brings the fog in. In winter and in the shoulder seasons, this temperature differential is much less intense, so therefore there is less fog. During thanksgiving week when I was in the area, the temperature differential was not as large. On 11/25/22, there was only a 4-degree Fahrenheit temperature differential between Sacramento and San Francisco, and it was similar on the other days of the week. The next time I am in San Francisco, which will be late December, I should expect more sun and a possibly warmer temperature than in Sacramento, but it won’t be until spring until Karl returns. Until then, I can expect sun and similar clouds to the alto and cirrocumulus pictured in this report.

Fig (3) original, unedited image

I took this picture with my iPhone XS, which has a 12 MP camera with a 26mm f/1.8 aperture and optical image stabilization. ISO was 25, and 0 ev. The shutter speed was 1/3401 seconds. The picture was taken in the native HEIC format with 4032x3024 pixel resolution. I changed a few settings in darktable in order to create more contrast and details in the clouds. The main modification was making the RGB curve S-shaped, which accomplished both of these things, but I also changed color balance settings, vignette, and other settings like sharpness. The most notable change was removing the saturation to create a black and white image. This choice was because I liked the unimpeded, slightly vague image of shooting directly upwards, and changing it to black and white seemed to exaggerate this feeling.

References:

Osborn, Liz. “Coolest US Cities in Summer”. Current Results weather and science facts. Current Results Publishing Ltd, 2022.