

GOES-16 ABI Band 2 and 13 and Product Sandwich RGB Useful in Analyzing Thunderstorms

“CIMSS blog, April 4, 2023, Severe thunderstorms across Iowa and Illinois”

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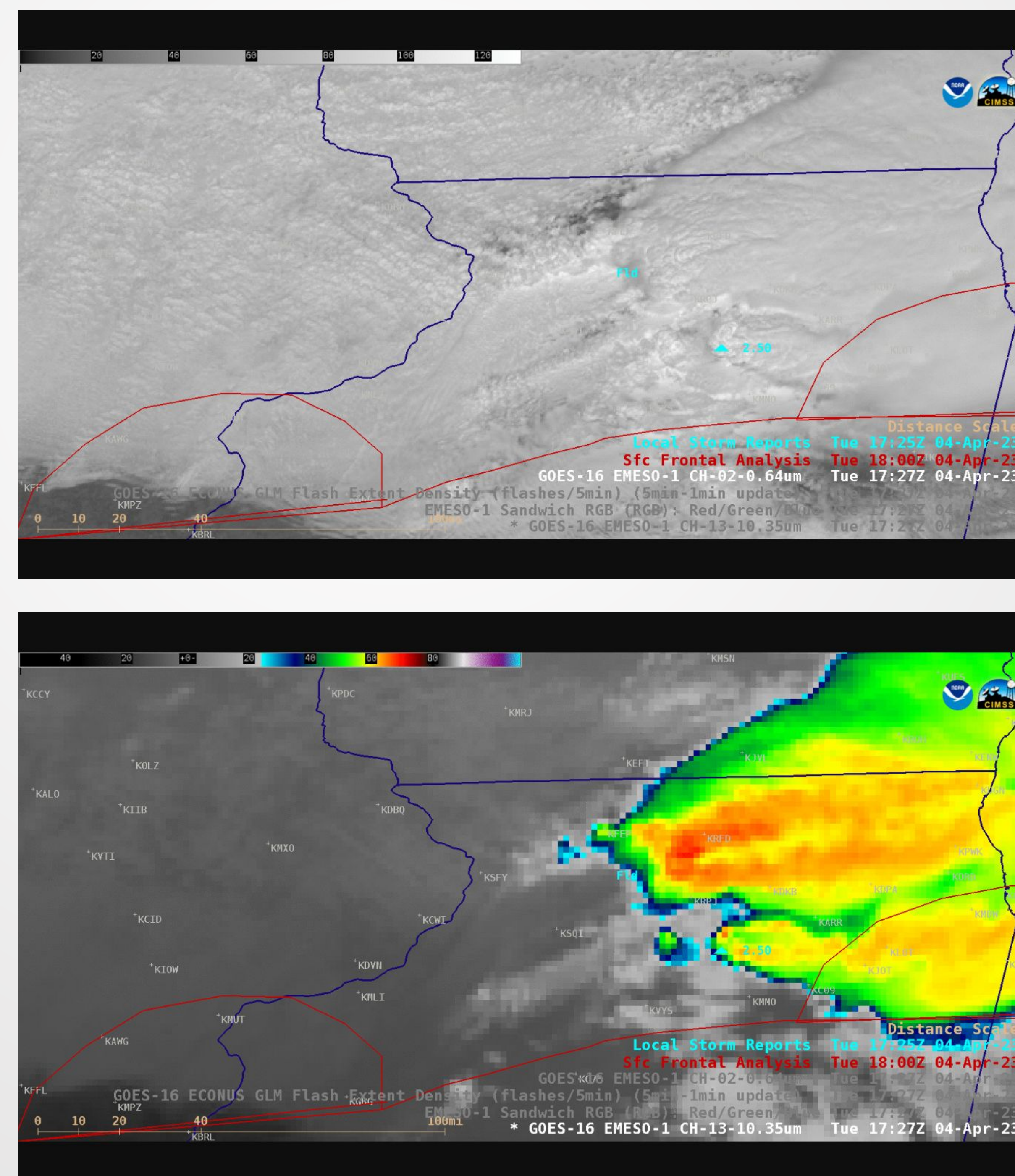
ABSTRACT

When beginning my research, the purpose I set out to fulfill is to find out how imagery from geostationary satellites can aid in identifying and understanding severe weather phenomena. The specific satellite used in my research was the GOES-16 geostationary Satellite, part of the GOES-R Series of geostationary satellites. The instrument that created the images that I used for my research is called the ABI (Advanced Baseline Imager). It takes images at different wavelengths, or channels/bands, on the electromagnetic spectrum. There are sixteen different bands on the ABI, there are two visible bands, four near-infrared bands, and ten infrared channels. This is a large improvement over previous GOES satellites. The first big step in my research was finding a blog to research on the Cooperative Institute for Meteorological Satellite Studies (CIMSS) website that interested me personally and that was easy enough to understand that I could create a project on. Next, I began reading and researching things about my blog like the bands and products used and what they do. For example, my research led me to find that band 13 can show cloud top temperature without as much interference from water vapor absorption compared to other infrared bands. Once I had a clear understanding of the bands and products used in my blog, I began to research things about the phenomenon in my blog. I looked at ground reports about the weather during the storms and noticed there were a lot of reports on the large hail, which made sense when I looked back at the images on my blog, which showed examples of Above-Anvil Cirrus Plumes that indicate large hailstones. To conclude, I found that the ABI on the GOES-R Series satellites were extremely helpful in comprehending and researching thunderstorms.

RESEARCH METHODS AND RESULTS

When I began analyzing my blog, I first read through it once, taking note of any words I recognized and understanding when and where the phenomenon in my blog occurred. I also zeroed in on the GOES-R series products mentioned in my blog. Once I had a basic list of what I did not understand or needed more information on, I began my research. I looked at my blog and found that the three images in the blog are Sandwich RGB images and one image switches between band 2 and band 13 imagery, so I started by looking at the linked Sandwich RGB quick guide in my blog and ABI band 2 and 13 quick guides. There, I learned the key piece of information that Sandwich RGB images were two images, an image from a visible band and another image like in this case a color-enhanced infrared image, layed on top of each other with the visible band image as the bottom or background image. I also learned that band 13 showed the heat given off by an object and band 2 shows the energy reflected off by an object. All this research on Sandwich RGB enhanced my understanding of the images to the point where I could begin making connections between what I had read on the phenomenon and what the images were showing me.

Images 2 and 3: Band 2 and 13 imagery
These images were taken as the storm was moving east out of Illinois. The band 2 image (top) shows bright white clouds. This means the cloud has a high albedo (the measure of radiation reflected) and therefore is a thick, cumulonimbus cloud. The band 13 image (bottom) taken at the same time also shows examples of Above-Anvil Cirrus Plumes (which look like plumes of smoke coming from above a cloud) where the cloud reaches higher in the atmosphere. Above-Anvil Cirrus Plumes are an indication that a storm may produce large hail chunks and powerful winds, both of which occurred during the storm.



RESULTS

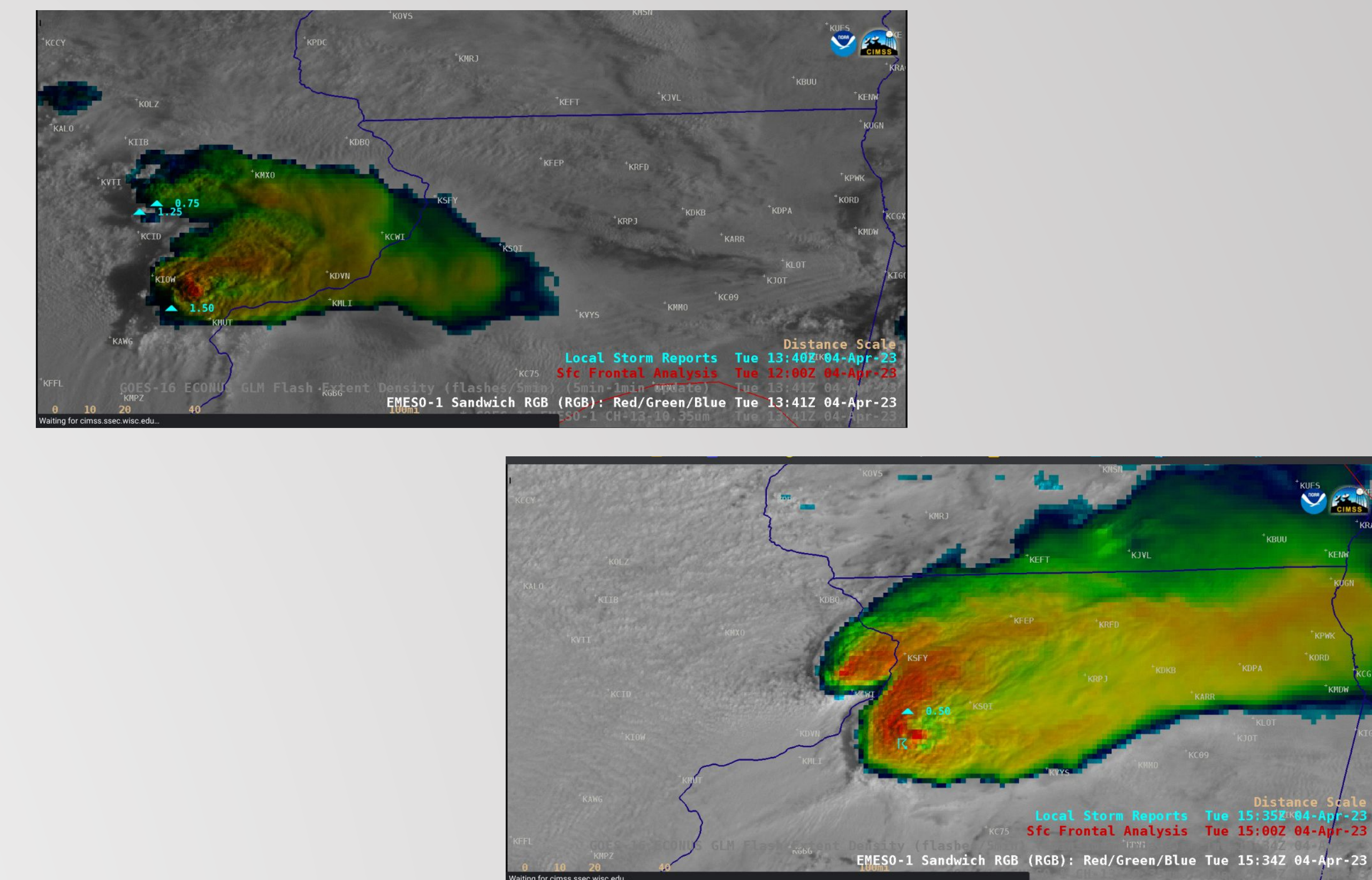
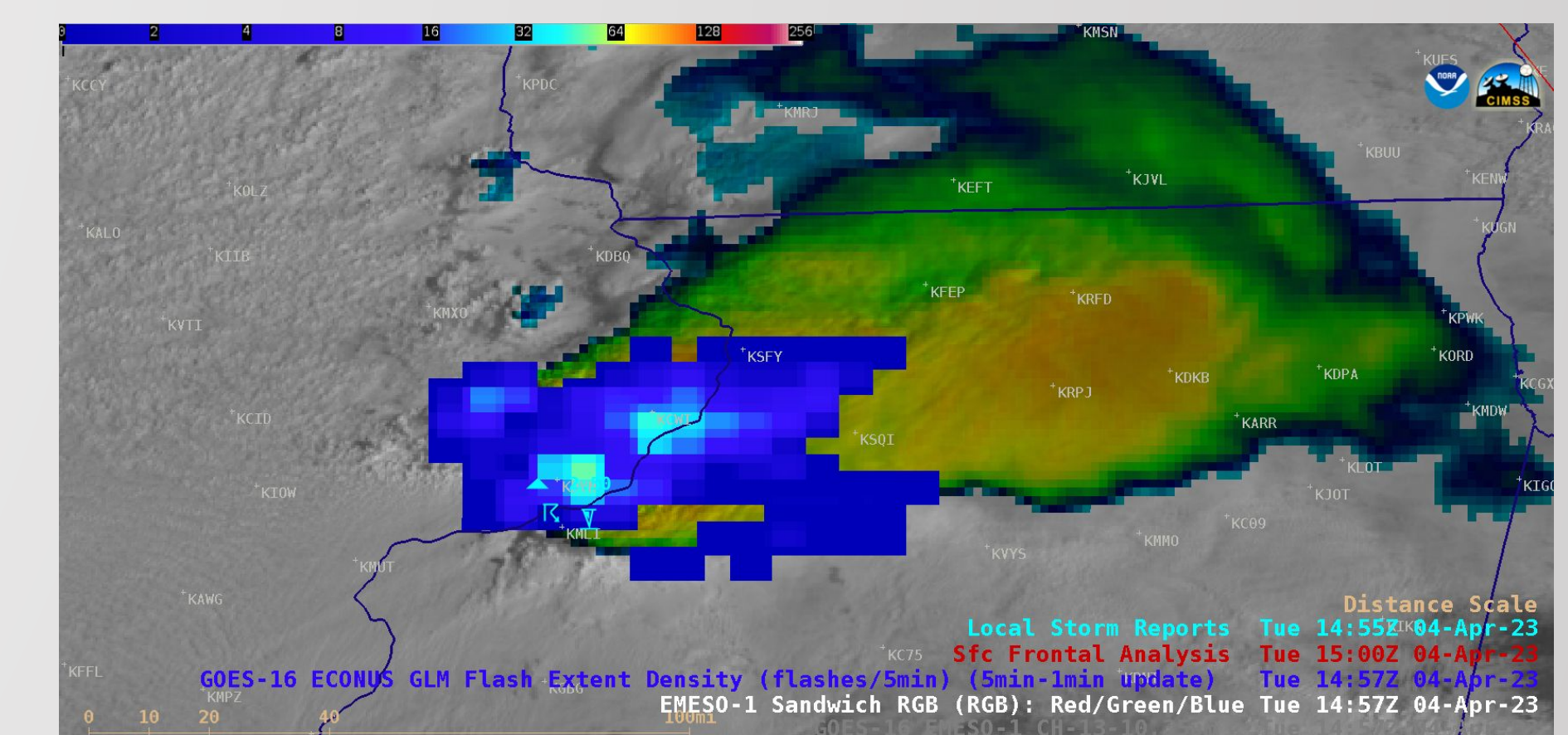


Image 4, 5, and 6: Sandwich RGB images and GLM Flash Extent Density overlay
The Sandwich RGB images (above) show the thunderstorm moving east through Iowa and into Illinois. The thunderclouds at their highest in the atmosphere (red) were also the coldest. The cold clouds produced large hailstones. When you take the Sandwich RGB images and overlay GLM product Flash Extent Density (FED), which measures the amount of lightning flashes in grid cells, you can see that the most lightning occurred where the clouds were highest in the atmosphere.



DISCUSSION AND CONCLUSIONS

While analyzing my blog, the product Sandwich RGB imagery and ABI bands 2 and 13 proved useful in understanding this phenomenon. The Sandwich RGB imagery allowed me to view the clouds through two perspectives at once, using visual and infrared pictures in one image. Using the Sandwich RGB images, I was able to better understand where the storm peaked in the atmosphere and where it was moving. Band 13 was helpful in understanding how high in the sky the cloud was in the atmosphere and where the Above-Anvil Cirrus Plumes formed in the thunderclouds. This was extremely important because it helped me link the large amounts of hail and large wind gusts to my images. Band 2 was the other band that played an integral role in my research because the imagery from band 2 helped me identify the kind of clouds I was looking at during the beginning of my research. I did this by identifying whether the cloud I was looking at appeared bright white in the images, or a darker shade of gray. Since the clouds appeared bright white, I concluded that they had to be thicker, cumulonimbus clouds. Ultimately, Sandwich RGB imagery and ABI bands 2 and 13 were incredibly helpful in examining and researching my blog.

RESEARCH QUESTION

How does GOES-16 imagery created using the ABI Product Sandwich RGB and ABI bands 2 and 13 help analyze the phenomena Thunderstorms in Iowa and Illinois, during the time period of April 4th?

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