GOES-16 and GOES-17 ABI Bands 13, 9, and 2 Useful in Analyzing the Spread of Ash and its Effect on the Weather

CIMSS Blog, April 9, Multi-day Eruption of the La Soufriere Volcano in the West Indies

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ABSTRACT

The purpose of this research was to observe how the eruptions of the La Soufriere volcano lasting from April 9-13 had affected the weather in the surrounding areas. The La Soufriere Volcano is located on the island of St. Vincent, of St. Vincent and the Grenadines, in the West Indies. The research uses images from the Geostationary Operational Environmental Satellite (GOES). Our research focuses on GOES-16 and GOES-17 or GOES-East and GOES-West. Research on our phenomena helped to improve our understanding about the volcano and its location. We then proceeded to analyze the satellite imagery from band 13, band 9, and band 2 on the Cooperative Institute for Meteorological Satellite Studies (CIMSS) blog. There were also images from GOES-16's Ash and SO2 RGB (Red band, Green band, Blue band), but they did not prove to be as effective when finding the outcome of the damage caused by the volcano. Our research shows that the sulfur dioxide (SO2) along with the ash released by the volcano caused rapid warming in the area. The images provided show different perspectives on the volcano's many eruptions throughout several days. Some of the images were more helpful than others, but they all helped to show the effects of the ash and gases released from the La Soufriere Volcano. The many eruptions full of ash and dangerous gases caused the island of St. Vincent to be buried under ash a meter deep for weeks. We have concluded that the volcano is very harmful to the environment and the people around it.

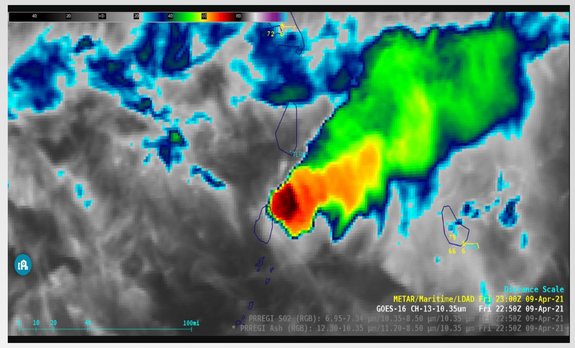
RESEARCH QUESTION

How does GOES-16 and GOES-17 imagery created using band 13, band 2, and band 9 help the phenomena Multi-day Eruption of the La Soufriere Volcano from April 9th 2021 - April 13th 2021?

The image above shows the La Soufriere Volcano as it erupts and the ash blankets the land below it.

METHODS AND RESULTS

Image 1
The first eruption started at 12:50 and the second one at 19:00. Pictured to the right is the end of the second eruption. We found the coldest temperature using the color key in the top left. The coldest temperature of the second eruption and then see how that area's weather was affected. that The darker red or pink means a colder temperature. The higher in the atmosphere the ash is, the colder it will become. The second eruption is pictured to the left, when the coldest temperature was detected near the volcano right after it erupted because the ash was shot straight up in the air. Highest reports say that at one point ash was shot at least 25,000 feet into the air.



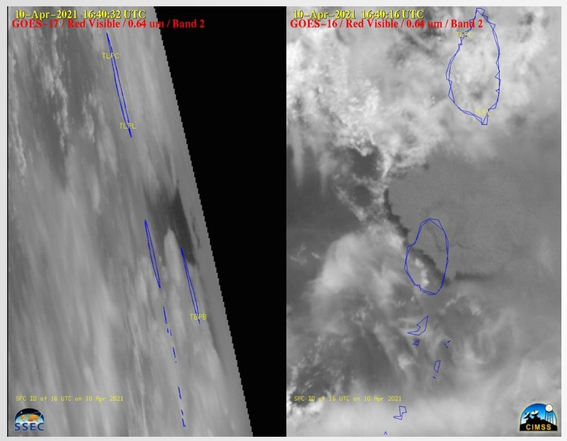
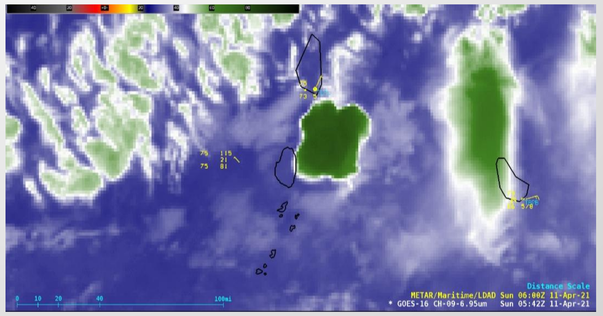


Image 2
A comparison between the "Red" ABI band (band 2) on GOES-16 and on GOES-17 is shown to the left. The ash from an eruption of the La Soufriere Volcano is much more clear with band 2 because there are more pixels being used. The GOES-17 image (left) is at an angle because it is taking this image from its position more to the west of the volcano. This positioning does not allow it to get a clear view making GOES-16 more helpful. As the ash cloud expands it starts to blend with the clouds around it which can be seen in the GOES-16 image (right). Although more pixels were used in the makings of this image, it was not very clear due to lack of color. To analyze this image without the color, we used shadows under the ash clouds to see some height and dimension.

Image 3
The white and light green in the image to the right are very cold clouds which get their temperature from their high heights. The darker green shows even colder temperatures that were detected even higher in the atmosphere. The Mid-level tropospheric water vapor band (band 9) helps to detect the clouds and how they are affected by these volcanic eruptions. The eruption was caused by a change from low to high pressure. Because of this, it makes sense that there are no clouds in the immediate area due to the sudden release of pressure from the volcano.



RESULTS

We found ABI bands 9 and 13 most helpful. ABI band 9 gave us a clear image of the clouds and how the ash from the volcano spread. Band 13 provided information about the temperatures of the ash and gases released from the volcano. This helped us to find the areas most affected by the second eruption of the La Soufriere Volcano. ABI band 2 from GOES-16 and GOES-17 did not show as much data because of the lack of color. The image from GOES-17 was less useful than the image from GOES-16 because it was not looking directly at the eruption. `

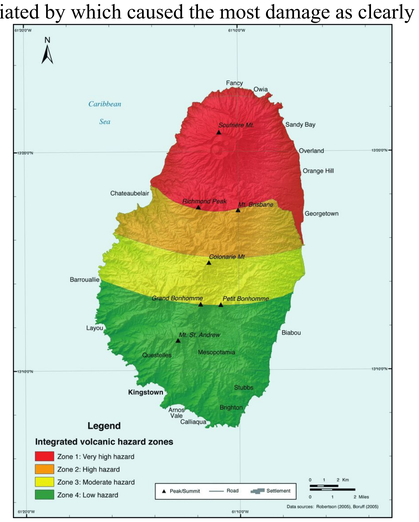
DISCUSSION AND CONCLUSIONS

The ABI bands included are band 13, band 2, and band 9. These bands were chosen because their images gave the most information about the eruption of the La Soufriere Volcano. Its effects on the weather around the islands of St. Vincent, St. Lucia, and Barbados can also be seen in most of the images.

Band 13 ("Clean" IR Long wave Window Band, 10.3 µm) on the GOES-16 satellite is used in image 1. This image shows the temperatures of the ash clouds from the volcano. By showing the temperature of the ash, it tells us how high it is in the atmosphere. The lower the temperature of the ash, the farther it is from the Earth's surface.

The image taken by band 2 ("Red" Band, 0.64 µm) on the GOES-16 satellite was decided upon because that image gave the clearest picture of the ashfall from the eruption. It is the band that uses the most pixels, making it more detailed as seen in image 2. Band 2 from GOES-16 was very useful when finding how the ash cloud spread and affected the weather around it. The image from GOES-17's band 2, was not as helpful when looking at how far the ash spread.

Band 9 (Mid-level tropospheric water vapor Band, 6.9 µm) shows how the ash cloud starts to disperse and blend with the clouds as it travels farther away from the island of St. Vincent. You can see how the cloud of ash starts to fall as it moves across the image towards the islands of St. Lucia and Barbados. This band is useful when finding the different intensities of the six eruptions. It allows the eruptions to be differentiated by which caused the most damage as clearly seen in image 3.



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