COMMENTARY

Tropical Cyclone Strengthens Due to Volcanic Eruption

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ABSTRACT

The MODIS satellite and ERA5 reanalysis data are used to evaluate the aerosol cloud implications of Tongan volcano eruptions on adjacent tropical cyclone (TC) Cody on January 14-15, 2022. Although the sea surface temperature and vertical wind shear of the ambient wind did not alter much after the main blast of the Tongan volcanic eruption on January 15, the precipitation and intensity of Cody were clearly amplified. MODIS measurements on January 15 captured the vision of a considerable amount of volcanic aerosol flowing into the Cody influx from the Tongan eruption. Deep convection was detected in Cody when the cloud top temperature plummeted and the cloud particle effective radius reduced.

Key Words: *Cardiac rehabilitation; Core components; Guidelines; Heart valve surgery; Heart valve replacement*

INTRODUCTION

HThe findings also show that significant volcanic eruptions could intensify convection and cause heavy precipitation in a nearby st--ructured convective system (e.g., TC or mesoscale convective systems). A volcanic explosion modifies the regional air composition swiftly, in addition to its climate consequences. Observations have demonstrated that volcanic aerosols can transform into Cloud Condensation Nuclei (CCNs) and participate in cloud microphysical processes, reducing the effective radius of liquid cloud droplets and increasing cloud top height in the process. During the eruption, there is a Tropical Cyclone (TC) Cody on the ocean around 500 km away from the Tonga volcano. What effects do volcanic aerosols from Tonga have on cloud microphysical processes in Cody?

Aerosol cloud effects in TC are dependent on the region where it functioned, according to simulated studies. Interactions between aerosols and clouds can enhance tropical storms' inner cores. The heated core structure is maintained, and the TC intensity is increased. Other research has indicated that the aerosol cloud effect in the periphery can help to energize peripheral convection. Increased ascending air near the storm's periphery draws low-level inflow toward the eyewall, preventing TC development. Satellites saw this phenomenon as well. In the inner core of TCs, however, a few observations show that the effects of aerosol cloud interaction boost convection. Could individuals in the TC confirm and comprehend these opposing effects of the aerosol cloud interaction? The ERA5 reanalysis data and MODIS satellite data are used. Could people in the TC verify and comprehend these opposing consequences of the ae--rosol cloud interaction? The effect of volcanic aerosols on the evolution of TC Cody (2022) is studied using MODIS satellite and ERA5 reanalysis data, which gives a unique opportunity to test previously simulated results of aerosol–cloud effects on TC. MODIS is one of five instruments aboard the Terra Earth Observing System (EOS) satellite, which was deployed into a sun-synchronous polar orbit in December 1999. The Aqua spacecraft, which was launched in May 2002, is also carrying the instrument. In a 24-hour period, the MODIS gives one daylight and one nocturnal image. Members of the MODIS atmosphere science team have developed a complete set of remote sensing algorithms for cloud detection and retrieval of cloud physical and optical properties. Climate change studies, climate modelling, numerical weather prediction, and fundamental atmospheric research all benefit from the archived products of these algorithms. The MODIS Aerosol Optical Thickness (AOT) output allows for global aerosol distribution observation. The MODIS data has been widely used in Earth research, including monitoring volcanic eruptions, detecting air quality, detecting tsunamis, and detecting atmospheric activity. We examine the interaction of volcanic aerosol with the TC using the cloud and AOT product at 1-km to 3-km spatial resolutions. When the satellite crossed the vicinity of Tonga volcano. According to one observation, the intensity of convection in the inner core indicates TC intensification. A profound convection outbreak in the interior core of TCs characterizes it. The cloud top temperature can be interpreted as a measure of convective intensity, with cloud top temperatures below 200 K indicating profound convection. Before the volcano erupted, there was still a lot of deep convective activity in Cody at 03:00 UTC

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on January 13, indicating that the TC was still growing and slowly moving southward. The TC's heavy convection diminished after 19 hours, and the rain band faded significantly, indicating that Cody was beginning to deteriorate. In the TC inner core, substantial convection was re-established. At the same time, there was a big area of low cloud top temperature over the Tonga volcano, which could be due to some weak eruptions in the Tonga volcano, as seen in the photograph. The inner core of Cody's convection was enhanced at this time, but the deteriorating tendency continued. Within 24 hours, the interior core of Cody has essentially no strong convection. Despite the fact that the MODIS did not provide continuous monitoring throughout the eruption, we discovered that the eruption produced a large amount of debris. Despite the lack of continuous MODIS observations throughout the eruption, we find that the eruption produced a large number of ash clouds in the upper troposphere, as the area of low cloud top temperature extended nearly twice as far at 22:00 as it did at 03:00 UTC on January 15. Meanwhile, convective activity in Cody has increased once more. Cody's low cloud top temperature is very similar to that of January 13. Cody appears to have become more intense following the eruption.

EFFECTS OF THE TONGAN VOLCANIC AEROSOLS

Because the hydrometeor content, particularly ice water, can well depict convective activity, the column-integrated ice and liquid water content of ERA5 largely exhibited the convective evolution in Cody on January 15. The in-draft of Cody's circulation enhanced the conve--ction in the periphery of Cody first after the Tongan volcano began erupting on January 15, which was unfavorable to the TC's strengthening. However, after the primary blast of the eruption, the precipitation on the outskirts was unable to deposit such a massive volume of aerosol. More volcanic aerosols then reached Cody's inner core, reviving the inner core convection Cody appeared to split the inner and outer rain bands as the inner convection intensified, and the TC structure grew more ordered indicating that Cody was intensifying. With the cessation of volcanic eruption, the intensity of convection in the inner core of Cody began to weaken, and the inner rain band expanded outward clearly depicts the progression of convective activity in the inner core.

After the major blow, the mass of hydrometeor in Cody's inner core rapidly grows, as shown in. At first, an increase in cloud liquid water correlates to an increase in precipitation. However, as the aerosol concentration in the inner core rises, more tiny droplets form. More little droplets are formed, causing rain to become less effective the droplets were then carried to the top layers, where they froze into ice crystals (corresponding to a smaller effective radius of cloud droplets. In the aforementioned process, more latent heating releases occurred, as did upward vertical velocity, implying severe deep convection. Even at the top of the troposphere, deep convection can be seen. The fall of the Minimum Sea-Level Pressure (MSLP) coincided with an increase in cloud ice water, implying that the process of convection augmentation in the inner core corresponds to Cody intensification. It's also in line with prior research, which found that deep convection in the inner ear is a real thing.