Technical Bulletin
Sahara Dust/Sahara Air Layer (SAL)
TEM Network (Logo) Jamaica

July 17, 2020

The Saharan dust movement that occurred around June 2020 is regarded as the most extreme to have occurred in the period from 2002 and 2020, according to MODIS (Moderate Resolution Imaging Spectoradiometer) satellite record- *our most detailed, continuous record of global dust* (Michael Lowry, Twitter, June 24, 2020). The African dust cloud in the main development region from 2002 - 2020 is shown in **Figure 1**. The June 2020 event was an extreme one, however the movement of the Saharan dust of the West African coast and across the Atlantic into the Caribbean is a normal event.

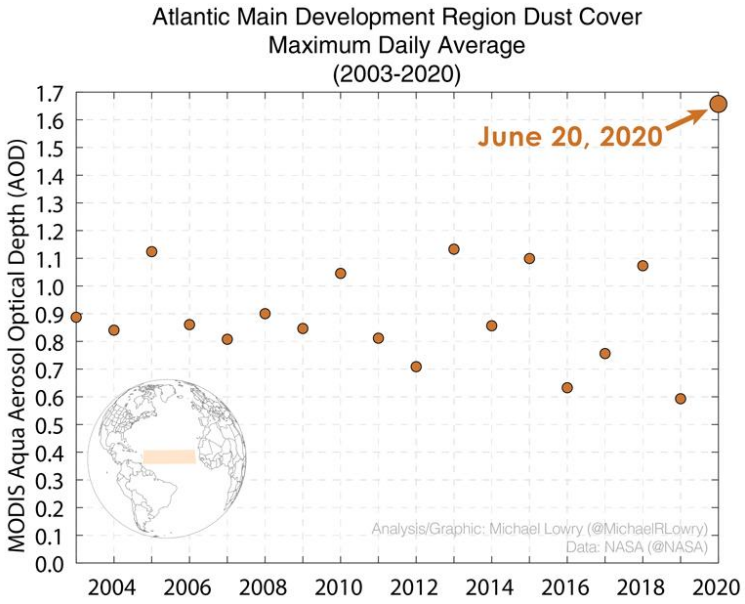

Figure 1. The African dust cloud over the tropical Atlantic's main development region (MDR) for hurricanes was at a record high thickness on June 20, 2020. (Photo credit: Michael Lowry 2020)

This Saharan Air Layer, also known as SAL (**Figure 2**) is a mass wave of dry, dusty air composed of sand and particulate matter, and usually intensifies in mid-June, peaks from late June to mid-August, and begins to rapidly subside after mid-August. This layer generally extends between 5,000 and 20,000 feet in the atmosphere.

When winds are especially strong, the dust can be transported west, across the Caribbean, Florida and as far as the U.S. Gulf Coast. This dust consists of particles, bacteria, fungi, viruses and several elements, fourteen of which have been reported for Sahara dust samples from Algeria and Mauritania (Figure3), the most abundant being silicon, aluminium, sulphur and iron (Rocha-Lima et Al 2018).

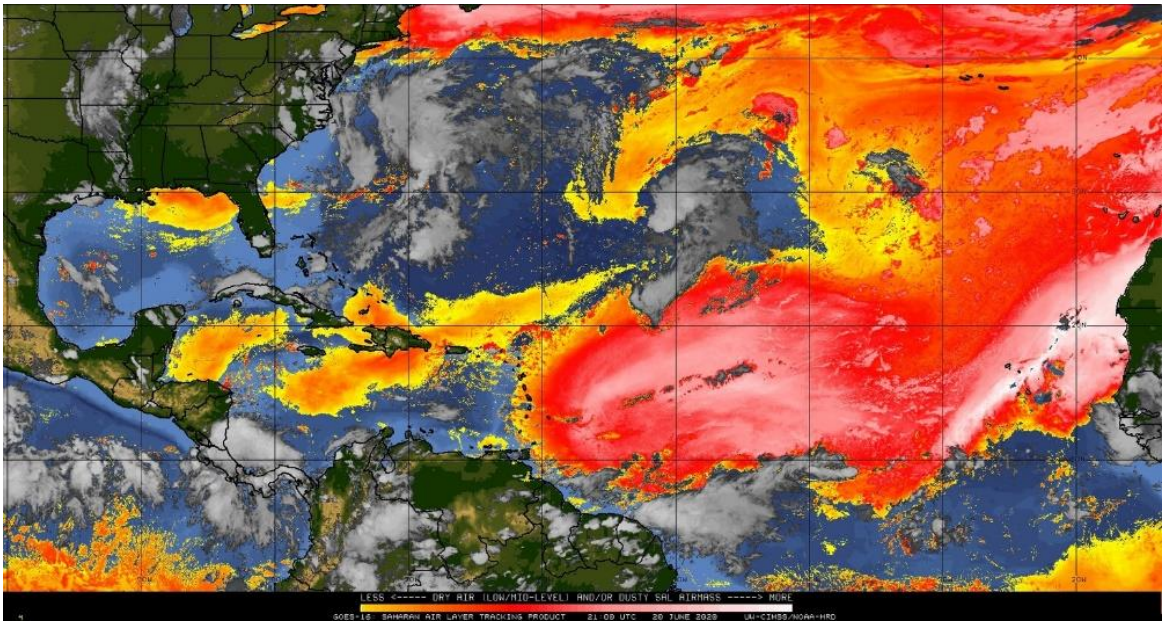

Figure 2. A wave of Saharan dust approaching the Eastern Caribbean (Jamaica Weather), NOAA

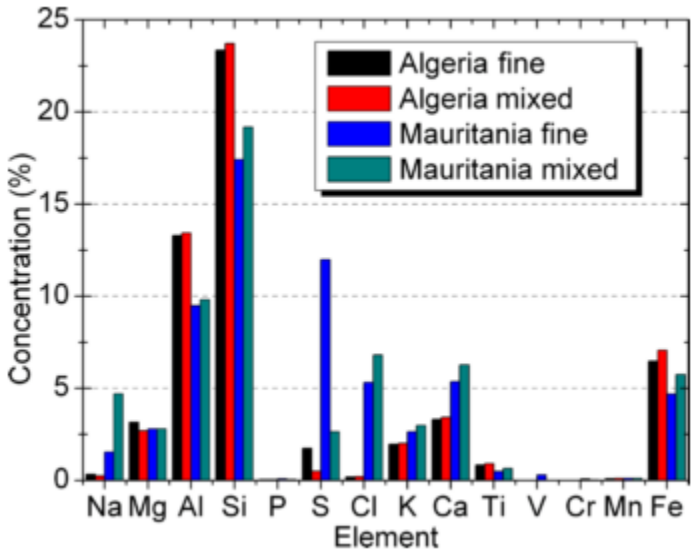

*Figure 3: Mean mass concentration in percentage of the total mass of the aerosol particles obtained for each element for fine and mixed mode (fine + coarse) of the Saharan dust from Algeria and Mauritania by energy dispersive X-ray fluorescence analysis (EDXRF). (*Rocha-Lima, A. et al, 2018)

In Jamaica and other Caribbean countries skies were hazy, with poor visibility, covering objects in the pathway of the SAL in a blanket of dust (**Figure 4 and 5**). In Puerto Rico concentrations of the dust were so high, that the aerosol optical thickness (a measure commonly used to estimate the quantity of particles in the atmosphere) reached around 2 on June 23rd, a level not seen since records began 15 years ago, according to Olga Mayo, an atmospheric chemist at the University.[1]

Figure 4. View of Bull bay, St. Thomas, Jamaica (Photo credit: Pierre Diaz)

[1] https://www.newsweek.com/sahara-dust-storm-jamaica-puerto-rico-us-1513014

Figure 5. View from Beverly Hills with dust obscuring the view of the city

In Jamaica there were two waves of this thick dust layer with the first on June 20th. Citizens were advised to wear masks and stay indoors as much as possible due to the health issues that could result from inhalation of the dust.

At the TEM office grounds on Mountain View Avenue, Kingston 6, PM10 was monitored for a short period in the morning and afternoon, using the EPAM-5000 real time, particulate monitor (**Figure 6**).

Figure 6. HAZ DUST EPAM-5000 real time particulate monitor

Figure 7 and **8** show the levels of PM10 recorded on June 24th. The elevated levels were evident especially in the morning as shown below on June 24th (**Figure 7**) and to a lesser extent on June 25th (**Figure 9 and 10**). The highest PM_{10} measured on June 24, was 230µg/m^3, thereafter, PM10 levels decreased, returning to baseline conditions by June 26 (Figure 8).

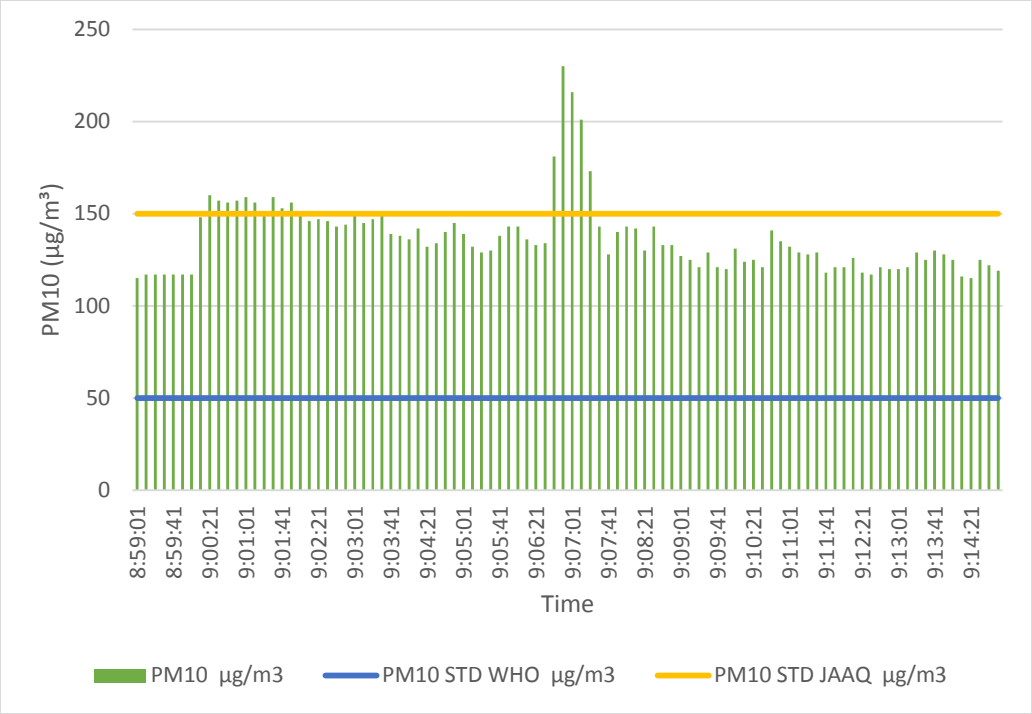

Figure 7. PM 10 concentration on the morning of June 24, 2020 at Mountain View Avenue, Kingston, Jamaica

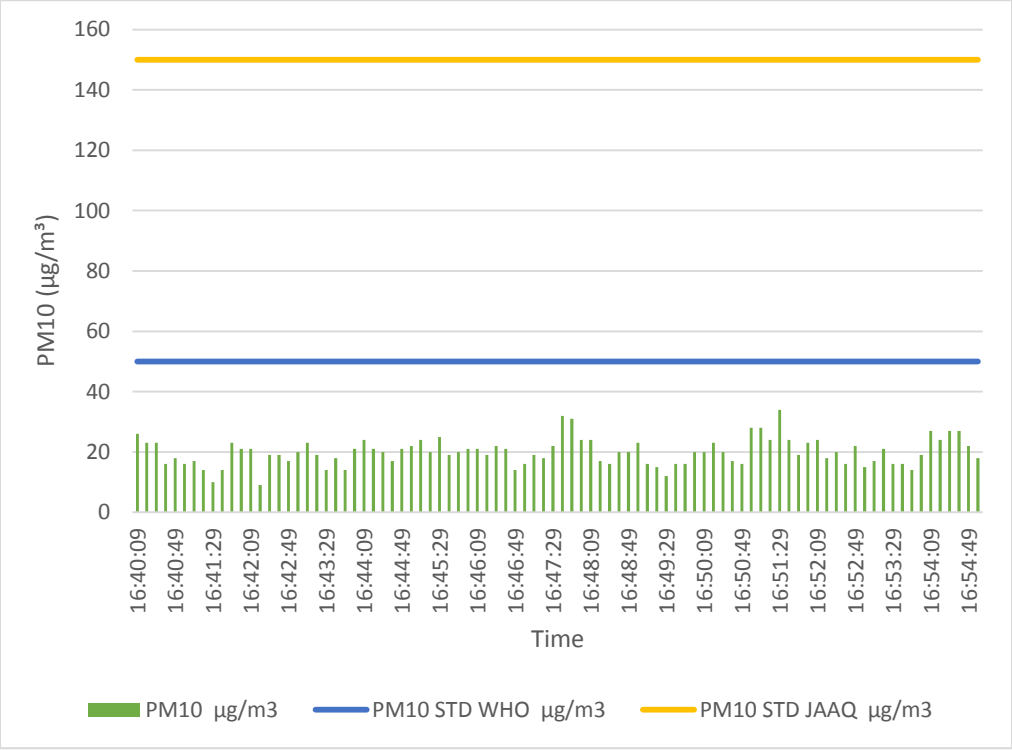

Figure 8. PM 10 concentration on the afternoon of June 24, 2020 at Mountain View Avenue, Kingston, Jamaica

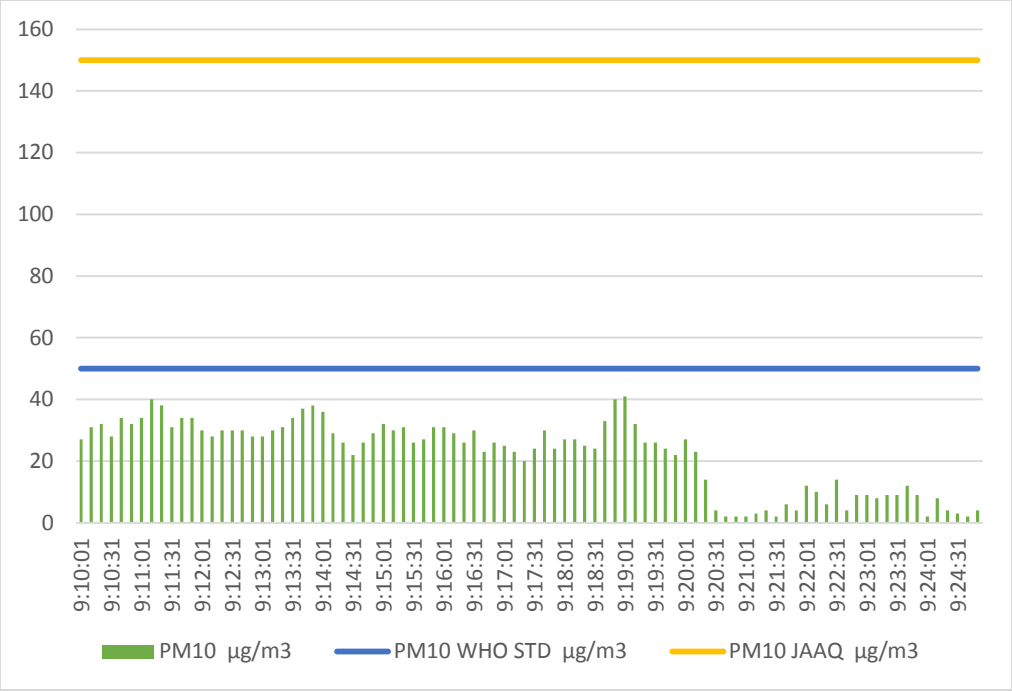

Figure 9. PM 10 concentration on the morning of June 25, 2020 at Mountain View Avenue, Kingston, Jamaica

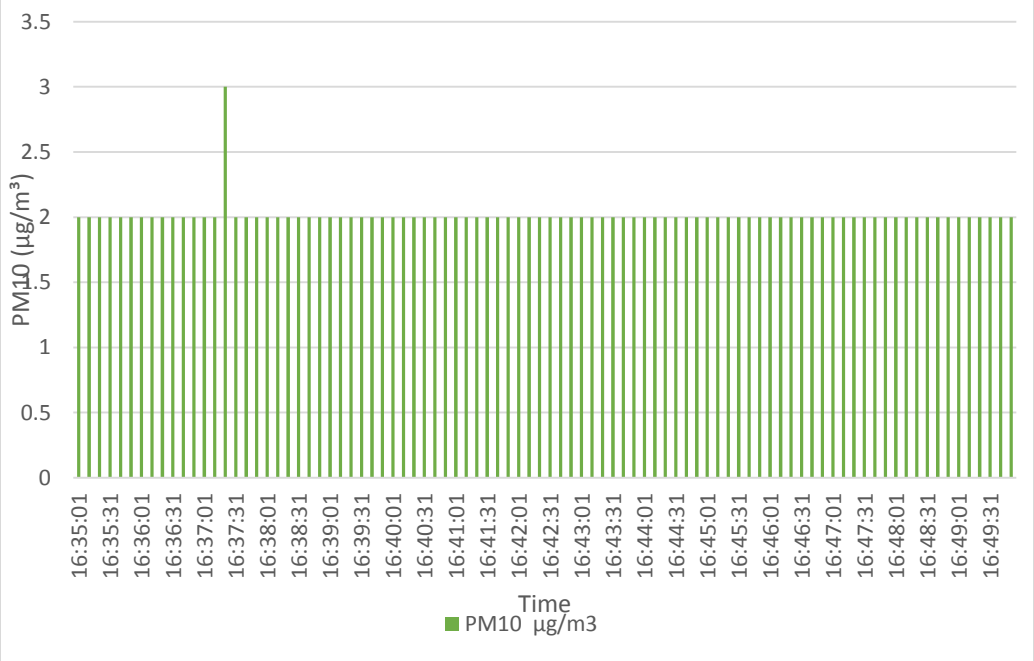

Figure 10. PM 10 concentration on the afternoon of June 25, 2020 at Mountain View Avenue, Kingston, Jamaica

It is suggested that the cause of an event of this magnitude may be due to climate change and the rise in desertification, as a result of natural and anthropogenic events[2]. The Saharan dust has both positive and negative implications on human health and ecosystems.

The positive effect may include the replenishment of nutrient depleted soils in the Amazon forest, allowing for increased fertility and productivity. The SAL provides phosphorus, which is an essential nutrient for plant proteins and growth (*Yu et al. 2015*). Microorganisms transported in the dust also play an important role in ecosystems function and sustainability through biogeochemical cycling of nutrients, primary productivity within food chains, and the sequestration and export of atmospheric CO_2 (*Behzad et al 2018*).

On the other hand, pathogens transported may be responsible for disease breakouts in various ecosystems. For instance the fungus, *Aspergillus sydowii*, that causes Aspergillosis or sea fan disease, was isolated from both the Sahara-derived dust samples in the Caribbean and from the diseased sea fan corals in the region (*Weir et al. 2000; Garrison et al.*). In addition fungal crop pathogens such as *Hemileia vastatrix,* which is responsible for the coffee leaf rust, which spread rapidly in West Africa from 1952 to 1962 were introduced to Bahia, Brazil in 1970 by windborne dissemination from Africa (*Bowden et al. 1971*). There have also been correlations between dust and sandstorm microbiota (DSM) and disease outbreaks in humans according to a few studies (Behzad et al 2018).

Though there are no available reports for Jamaica, concerning health impacts, the local Ministry of Health and Wellness in a press release, warned that "excess exposure to the dust particles can have severe health effects, including increased risk of respiratory and related illness such as asthma, chronic obstructive pulmonary disorder and respiratory infection, and allergies. Skin and eye irritation can also be experienced as well as there is an increased risk of water-borne illness."

The true global ramifications of Saharan dust dispersion are still unknown but temporary elevations in dust levels such as those associated with the SAL can have a negative impact on air quality index with high risk to individuals having health issues particularly those associated with the upper respiratory tract.

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[2] Global Ramifications of Dust and Sandstorm Microbiota, https://academic.oup.com/gbe/article/10/8/1970/5046809