

Can Saharan dust
intrusion be
considered a co-
factor on risk of
morbidity and
mortality in Puerto
Rico?

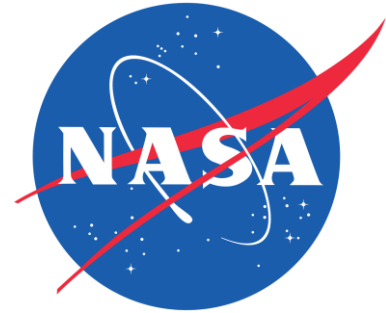
Dr. Pablo A. Mendez-Lazaro

University of Puerto Rico Medical
Sciences Campus

Environmental Health Department

pablo.mendez1@upr.edu

WMO SDS-WAS/inDust webinar
February 16, 2022



Can Saharan dust intrusion be considered a co-factor on risk of morbidity and mortality in Puerto Rico

- On Nov 2017, we proposed to characterize the distribution pattern and variability of ***Saharan Dust*** using Earth observations data from satellites and ground stations, and quantify the impact on respiratory diseases in Puerto Rico.
- This research is co-designing a **Public Health Early Warning (Monitoring) System** that integrates data from Earth observing satellites, in situ, and modeled weather information, and public health data.
 - **Working Group 1:** Resilience, Public Health and Well Being.
 - **Working Group 2:** Atmospheric Forcing and Air Quality.
 - **Working Group 3:** Decision Support Tool: Computation and Visualization.

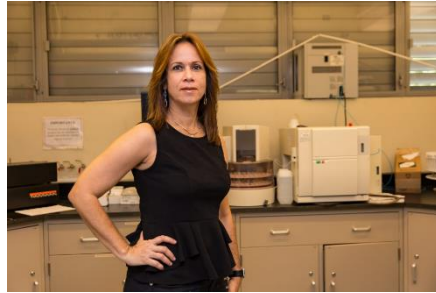


HCD Approach

Core Team members: Epidemiology, Environmental Health, Remote Sensing, Chemistry, Atmospheric Science, Climatology



Olga L. Mayol-Bracero, Ph.D.



PI: Pablo A. Méndez-Lázaro, Ph.D.



Daniel Otis, PhD



Frank Muller-Karger, Ph.D



Cynthia M. Pérez-Cardona, Ph.D.



Digna Rueda-Roa, Ph.D.

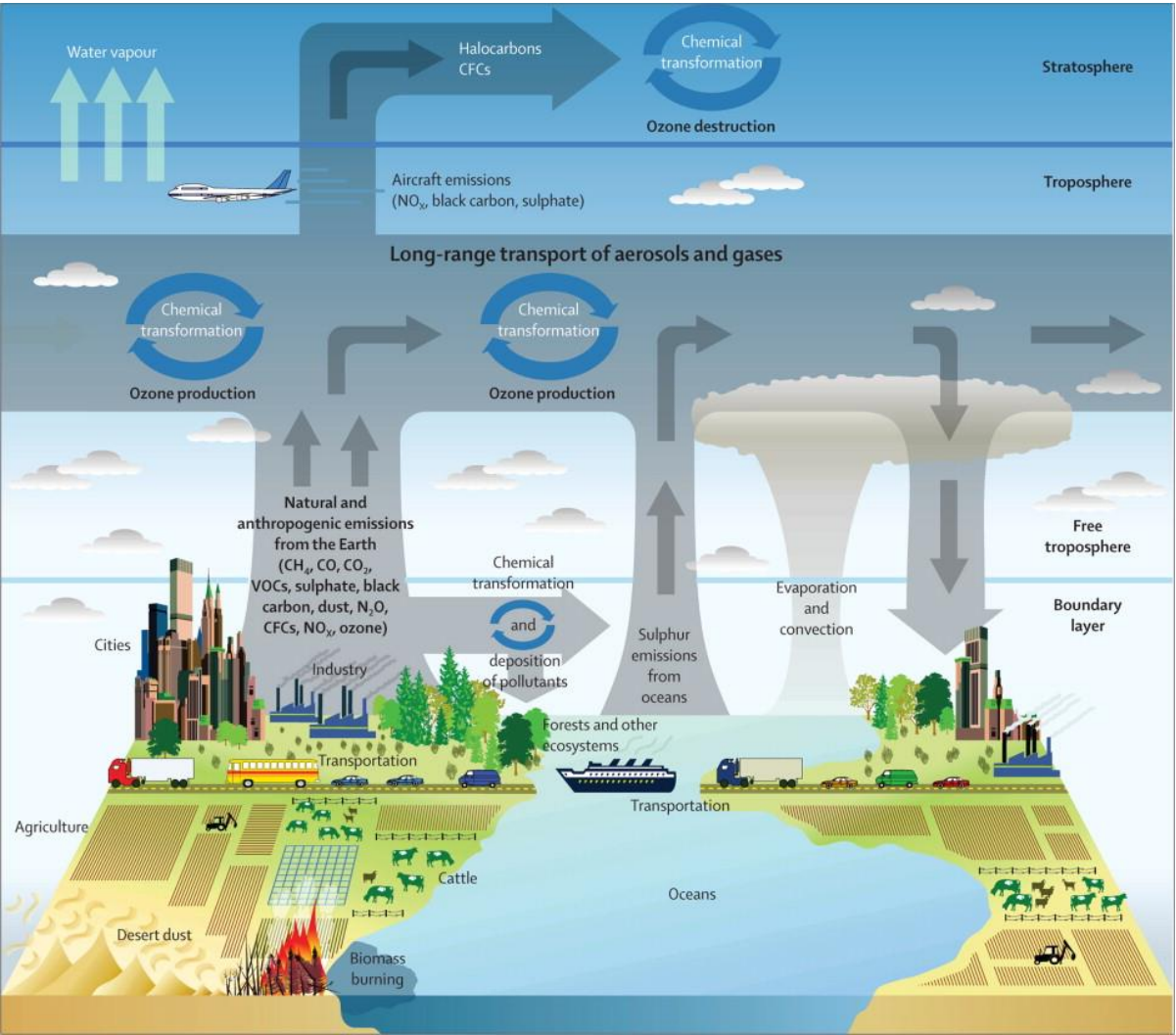
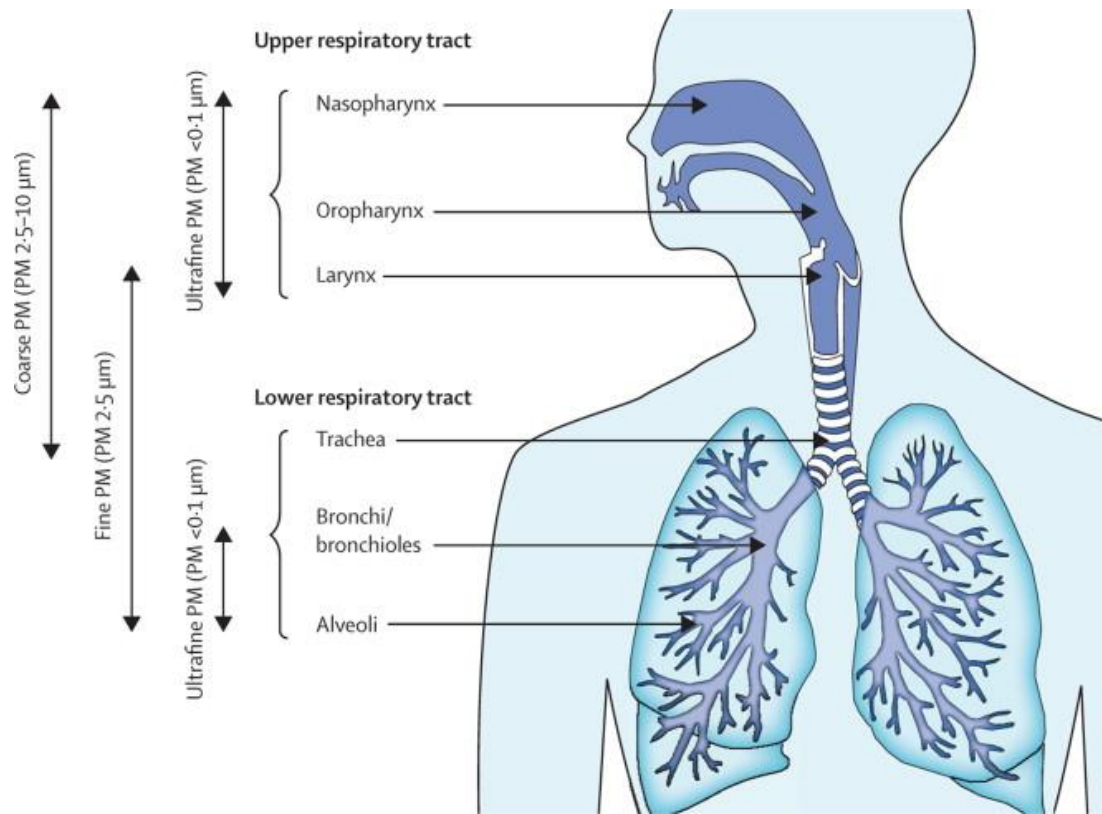


Aluisio Pimenta, PhD, PE

Can Saharan dust intrusion be considered a co-factor on risk of morbidity and mortality in Puerto Rico

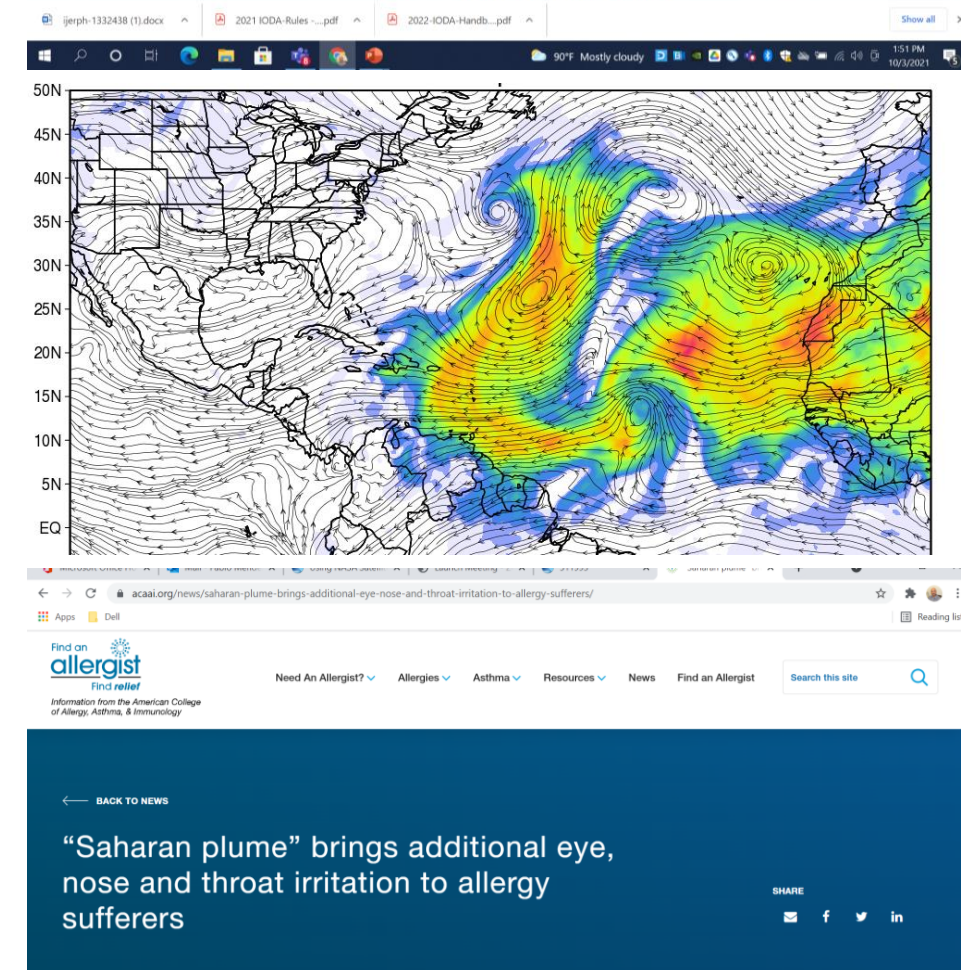
- Over 20 million tons of mineral dust from Africa are transported every year by the Trade Winds over the Atlantic Ocean, reaching South and North America, Caribbean Sea nations, and US territories between May and August every year.
- In the Caribbean islands, dust is associated with increased to excessive risk of emergency room visits and hospitalizations related to respiratory diseases.
- On the other hand, the coronavirus SARS-CoV-2 responsible for the present COVID-19 pandemic increases the risk of mortality due to severe respiratory illness and cardiac injury.
- Our transdisciplinary team proposes to examine these interactions and help understand whether specific African dust transport events lead to higher or lower COVID-19 cases or exacerbate health effects.

Guarnieri, M., Balmes, J.R. 2014. Outdoor air pollution and asthma. DOI:[https://doi.org/10.1016/S0140-6736\(14\)60617-6](https://doi.org/10.1016/S0140-6736(14)60617-6). Lancet 2014; 383: 1581–92

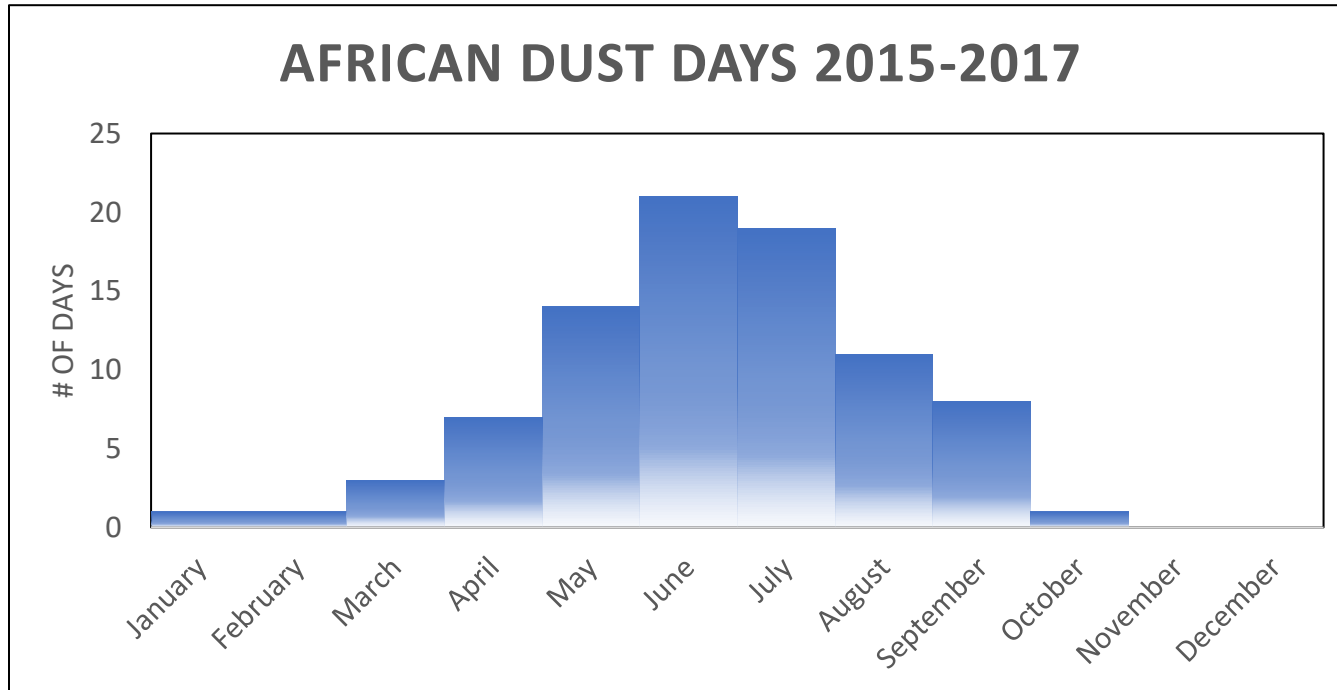


What is Saharan Dust and its seasons in the Caribbean?

- The mineral dust particles that reach us in the Americas from Africa could contain minerals, organic matter, marine salts, viruses and bacteria.
- Dust Clouds are aerosols, small solid and liquid particles suspended in the atmosphere.
- Examples of aerosols include windblown dust, sea salts, volcanic ash, smoke from fires, and factory pollution.
- These particles are important because they can affect the climate, ecosystems and people's health.



Dust “seasons” in the Caribbean

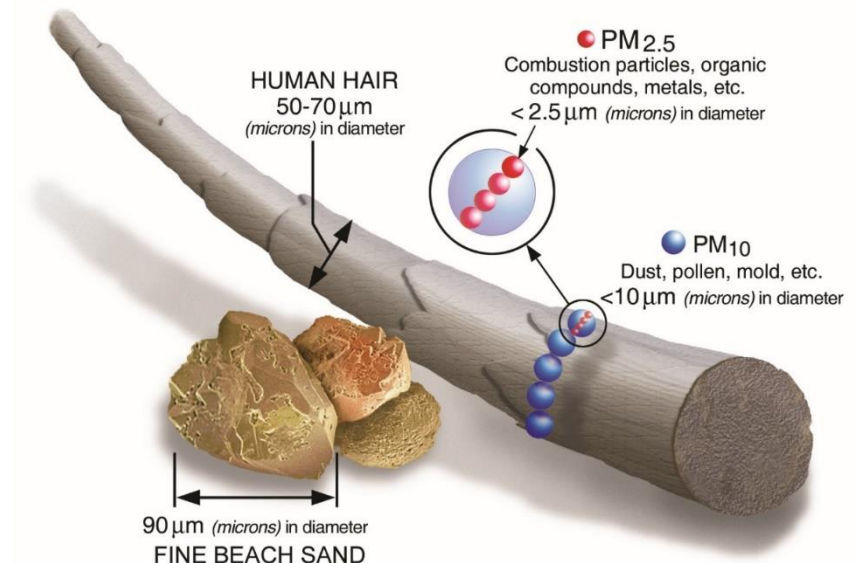
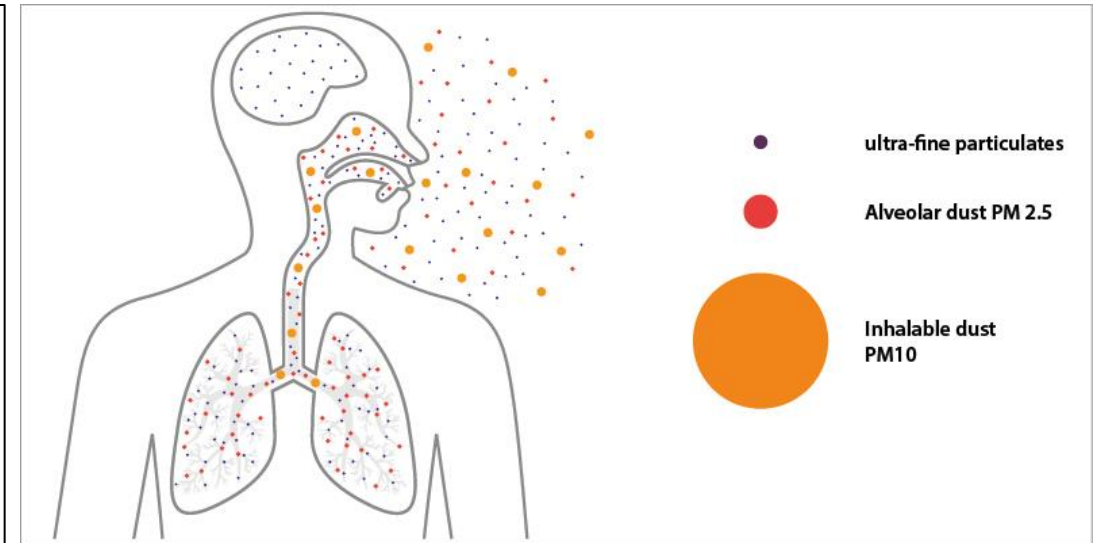
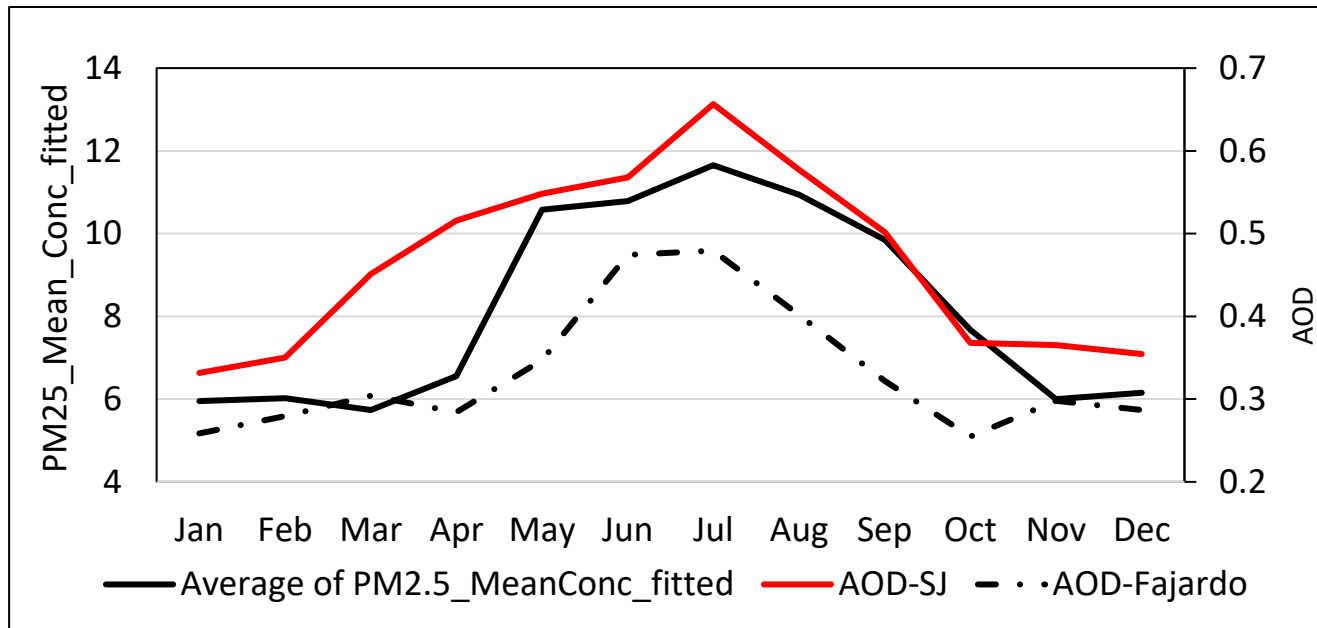


Dust Season in the Caribbean occurs between May and September. (Summer)

The most intense months in Puerto Rico are between the months of June to August.

	#’s of African Dust Events	75th Percentile	90thPercentile	95th Percentile	99.9th Percentile
Autumn	1	5	0	0	0
Spring	10	3	1	0	0
Summer	73	72	32	17	1
Winter	2	1	0	0	0

Aerosol Optical Depth and PM2.5 seasonal patterns



Dust is positively associated with cardiovascular and respiratory conditions in the Caribbean (Lillianne et al. 2019).

Dust outbreaks have also been associated with increased to excessive risk of emergency room visits and hospitalizations related to asthma in children in Trinidad & Tobago (Gyan et al., 2005), Guadeloupe (Cadelis et al., 2015), and Grenada (Akpınar-Elci et al., 2015).

An optical thickness of less than 0.1 indicates a crystal clear sky with maximum visibility, while a value of 1 indicates the presence of aerosols so dense that people would have difficulty seeing the Sun, even at noon.

Journal of the American College of Cardiology Volume 72, Issue 17, October 2018

DOI: 10.1016/j.jacc.2018.07.099

ESO Data

Data Source/Sensor	Variable	Temporal Resolution	Period
Visible Infrared Imaging Radiometer Suite (VIIRS)	AOD (n=1539) SAE (n=1512) MC (n=1368)	Daily	2012-2020
Multi-scale Ultra-high Resolution Sea Surface Temperature	SST (n=1536)	Daily	2012-2020
MODIS-Aqua: Land Surface Temperature	LSTd (n=921) LSTn (n=895)	Daily	2012-2020
ERA5-HEAT (Human thErMal comfort)	UTCI (n=1539) HI (n=1539) T2M (n=1539)	Daily	2012-2020



National Aeronautics and
Space Administration



EARTH FLEET

INVEST/CUBESATS

- CSIM-FD 2023
- HARP 2022
- CIRIS 2023
- CTIM* 2022
- HYTI* 2022
- SNOOPI* 2022
- NACHOS* 2022
- NACHOS2* 2022

JPSS INSTRUMENTS

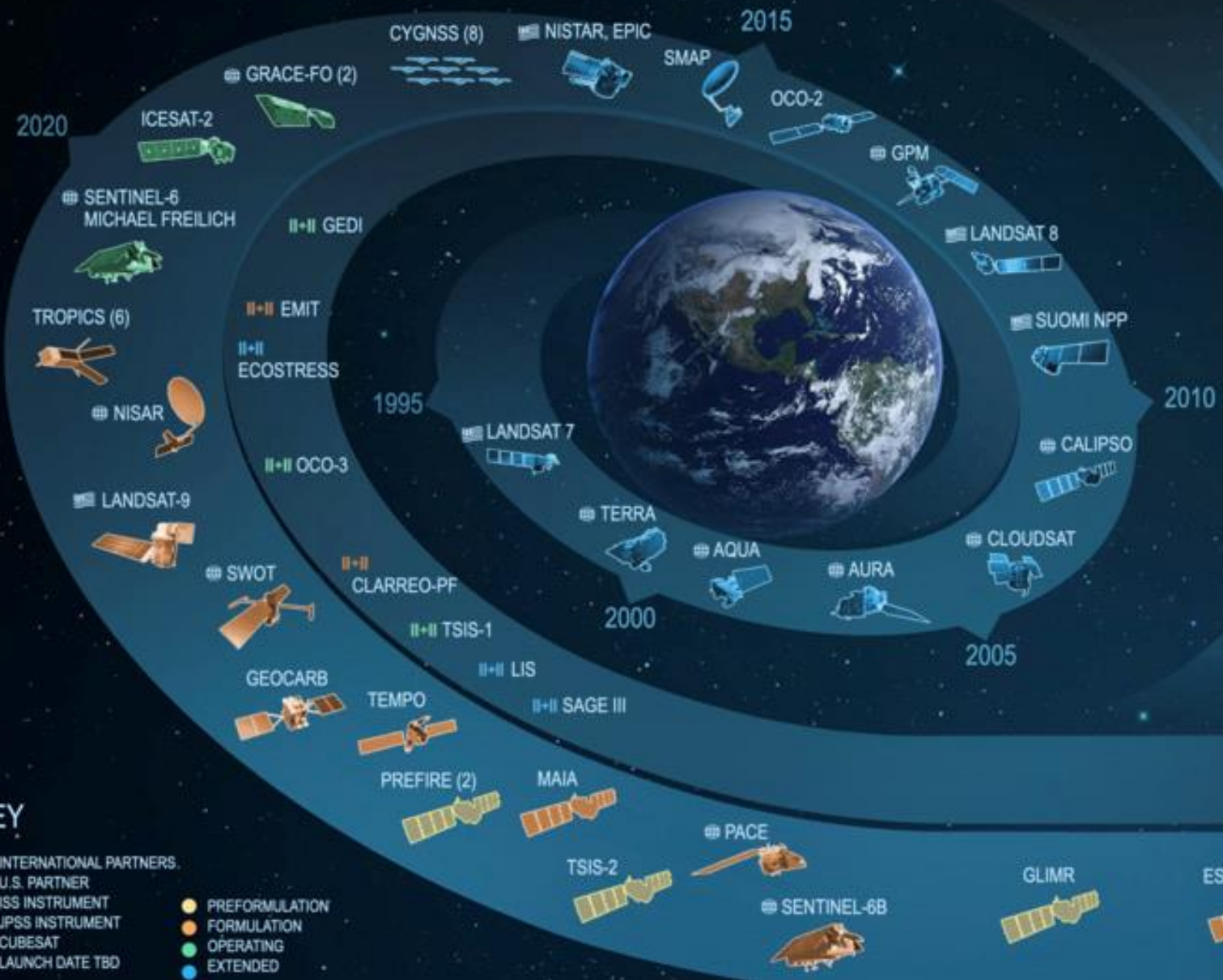
- OMPS-LIMB 2022
- LIBERA 2027

ISS INSTRUMENTS

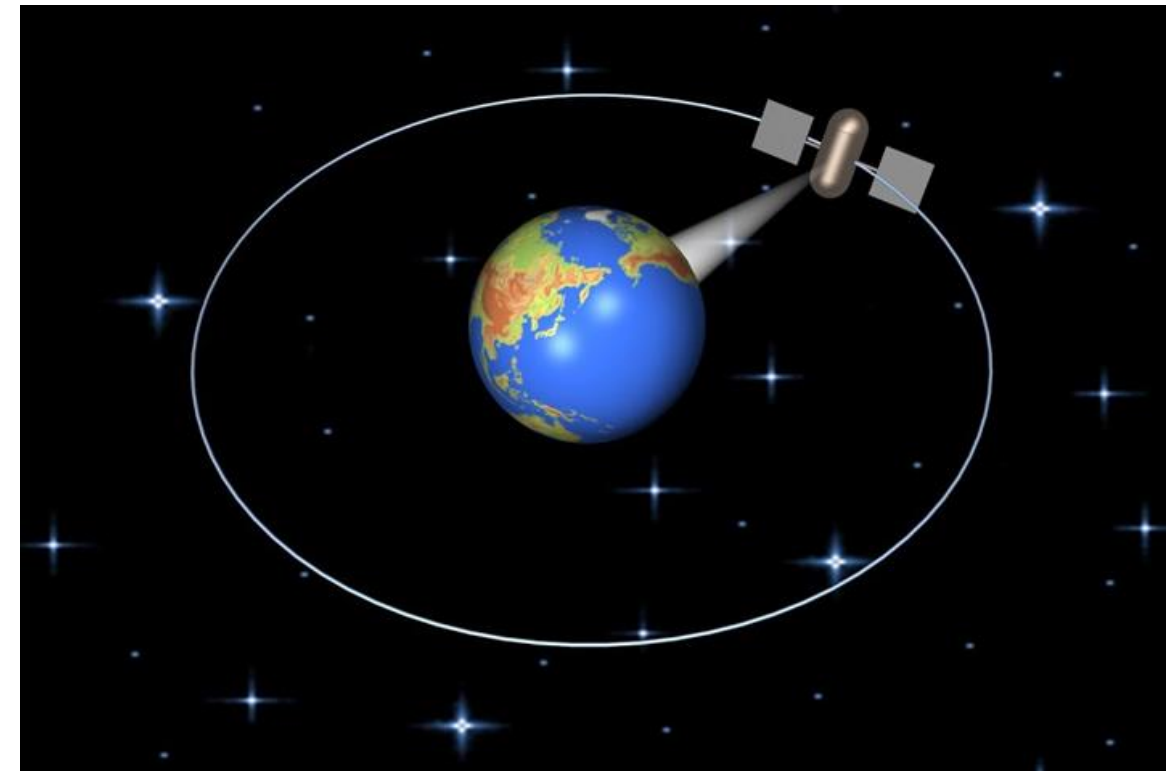
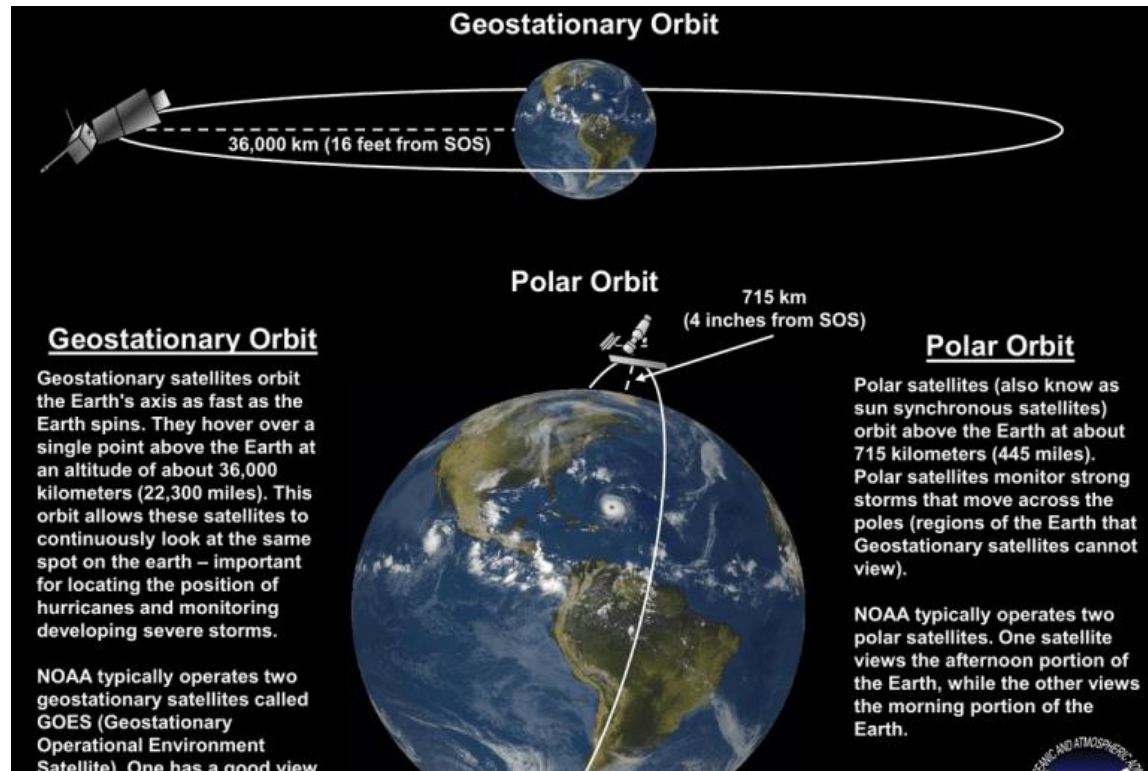
MISSIONS

KEY

- INTERNATIONAL PARTNERS
- U.S. PARTNER
- ISS INSTRUMENT
- JPSS INSTRUMENT
- CUBESAT
- LAUNCH DATE TBD
- PREFORMULATION
- FORMULATION
- OPERATING
- EXTENDED



Earth Observatory (geostationary vs non geostationary)





AEROSOLS/SAHARAN DUST
LAST UPDATE: APR 13 12:00 PM AST

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GAUGE PONCE, PR ⓘ



PARTICULATE MATTER AND O₃

AirNow

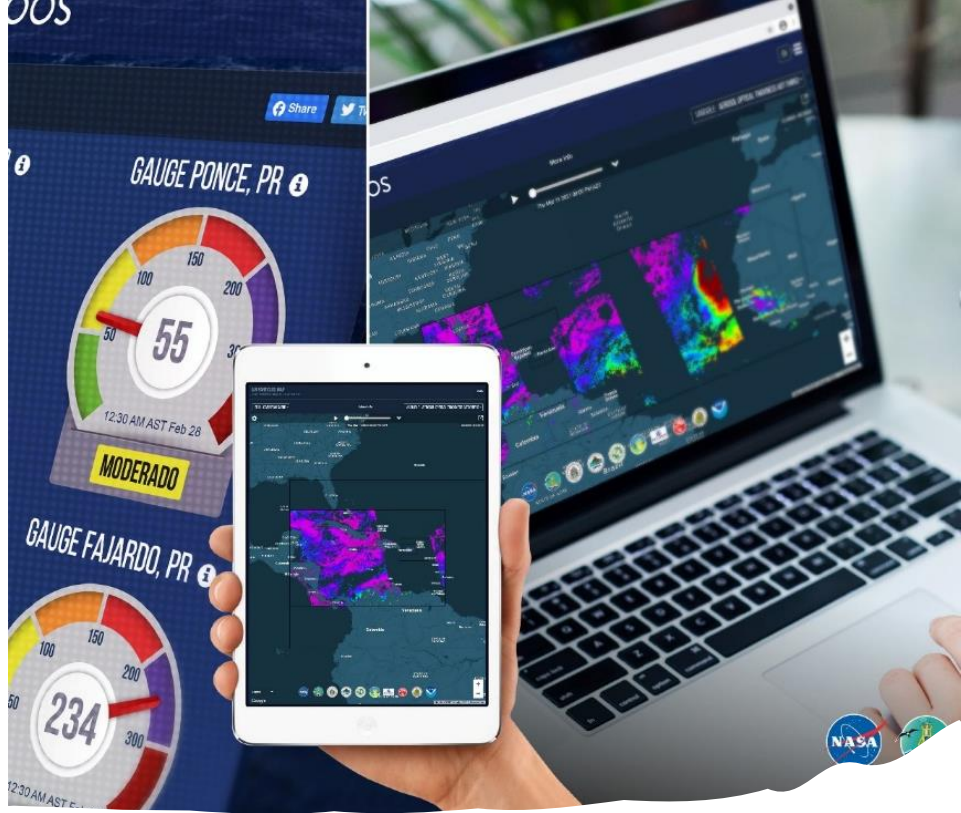
Current Forecast Loops



GAUGE MAYAGUEZ, PR ⓘ



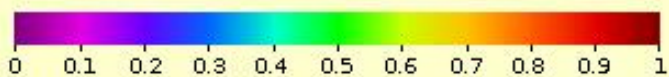
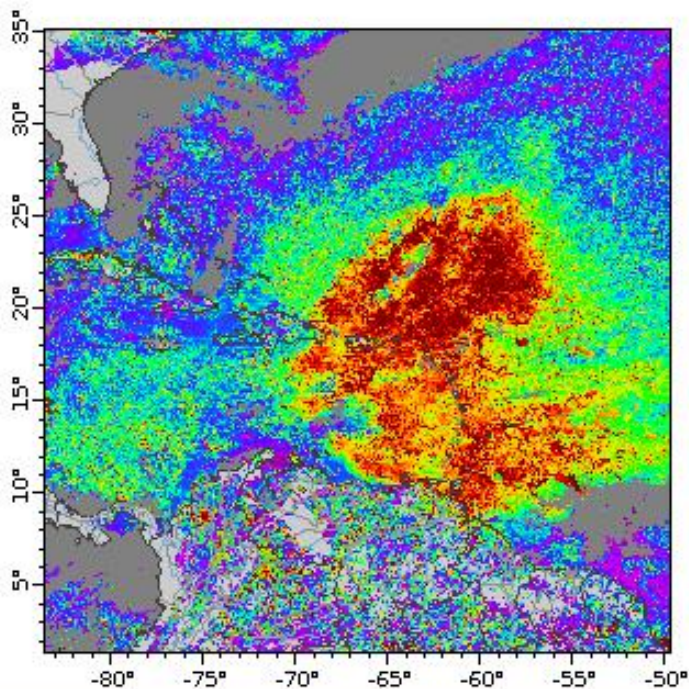
GAUGE FAJARDO, PR ⓘ



“X-perimental Decision Support Tool “

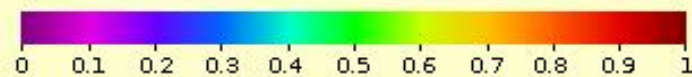
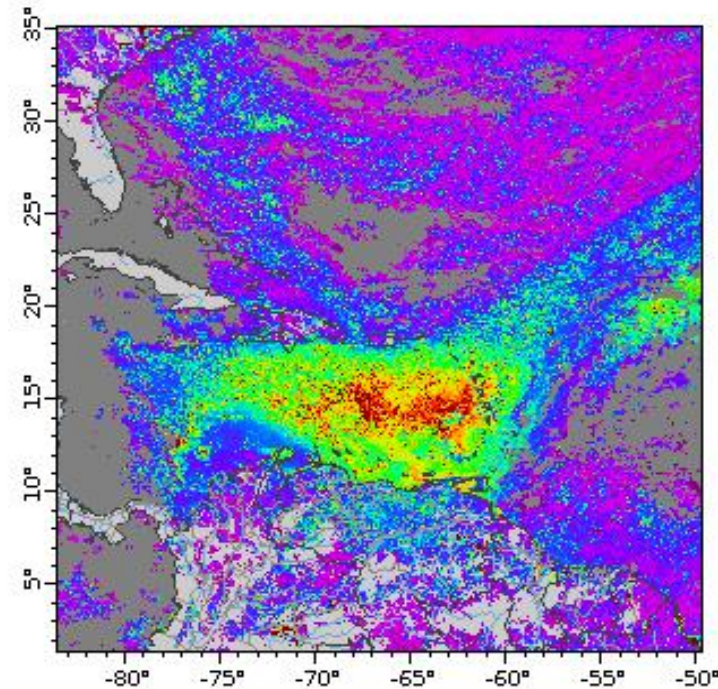
GOES-16: daily datasets: Experimental NRT AOD daily composite created from ABI L2 data from GOES-16. Fields generated by Atlantic OceanWatch node at NOAA/AOML

July 07, 2021



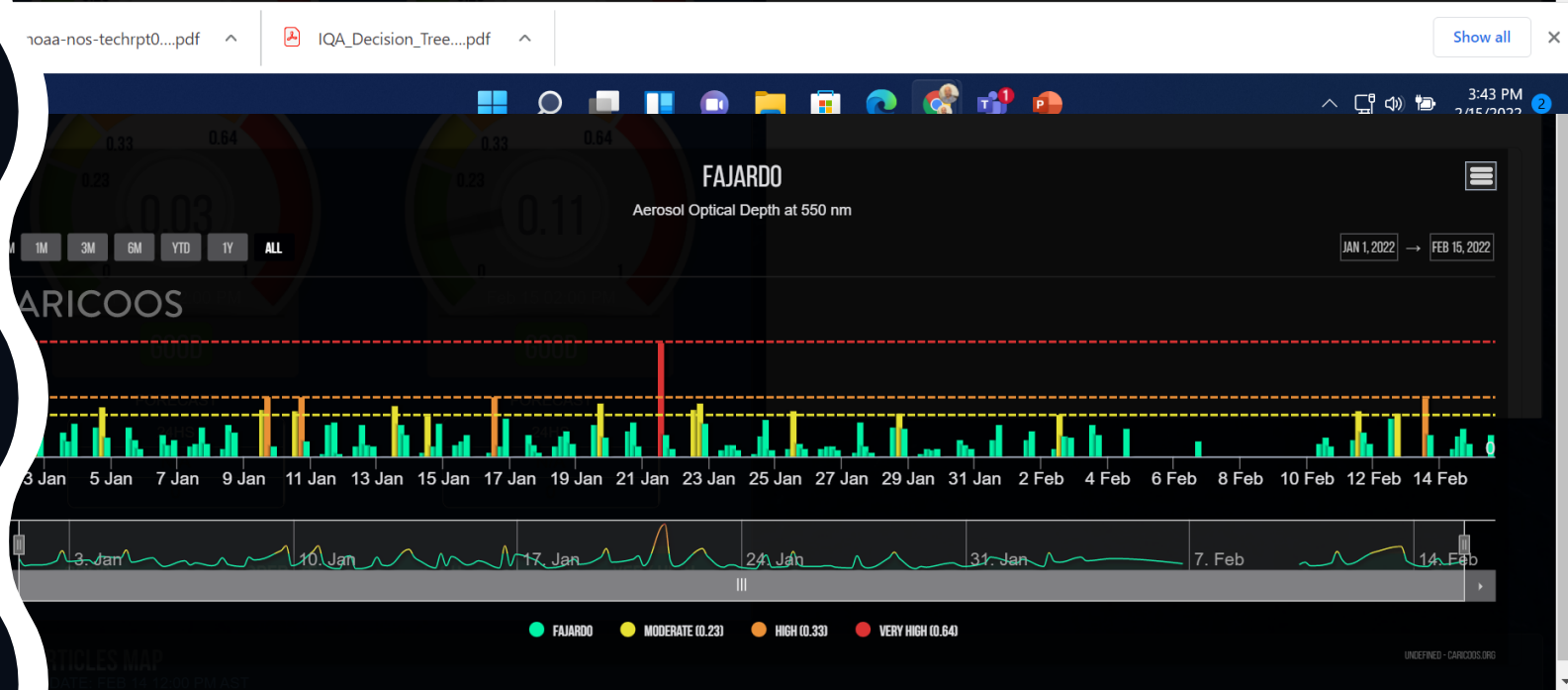
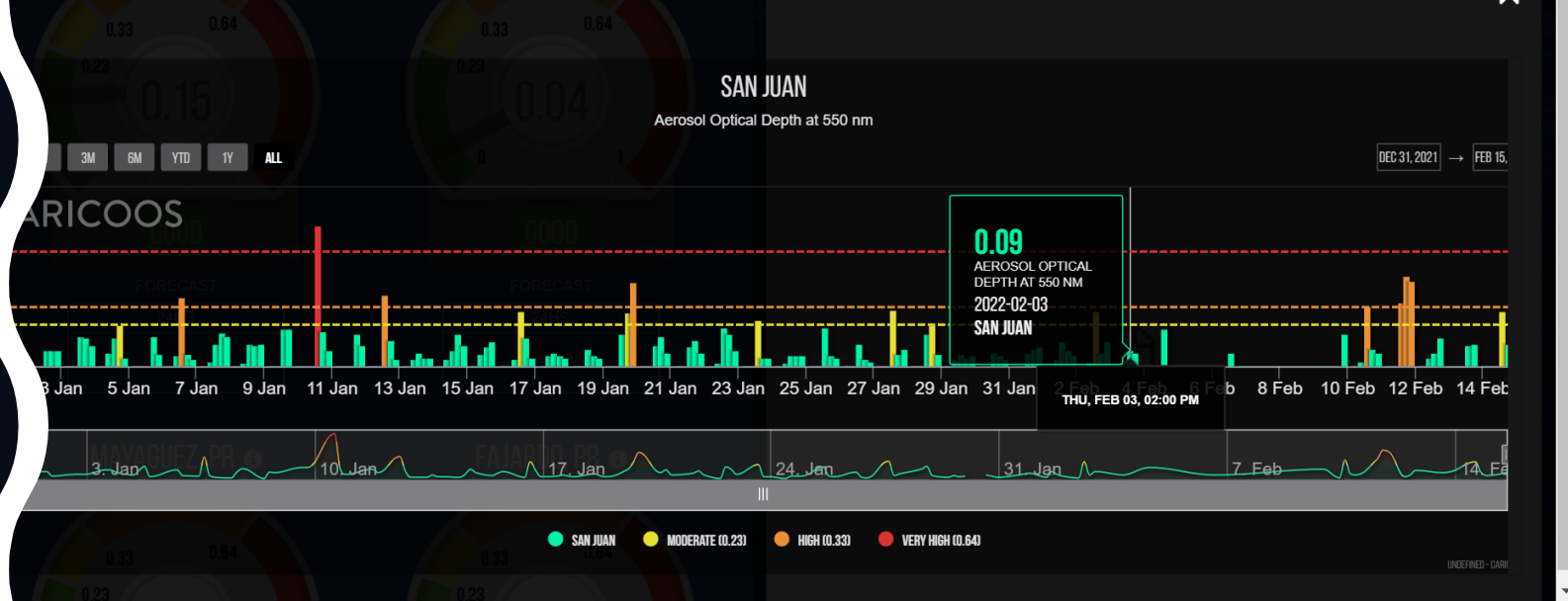
ABI L2+ Aerosol Optical Depth at 550 nm (1)
Experimental NRT AOD daily composite created from ABI L2 data from GOES-16. Fields generated by Atlantic OceanWatch node at NOAA/AOML
(2021-07-07T00:00:00Z)
Data courtesy of USD/C/NOAA/OAR/AOML/PHOD

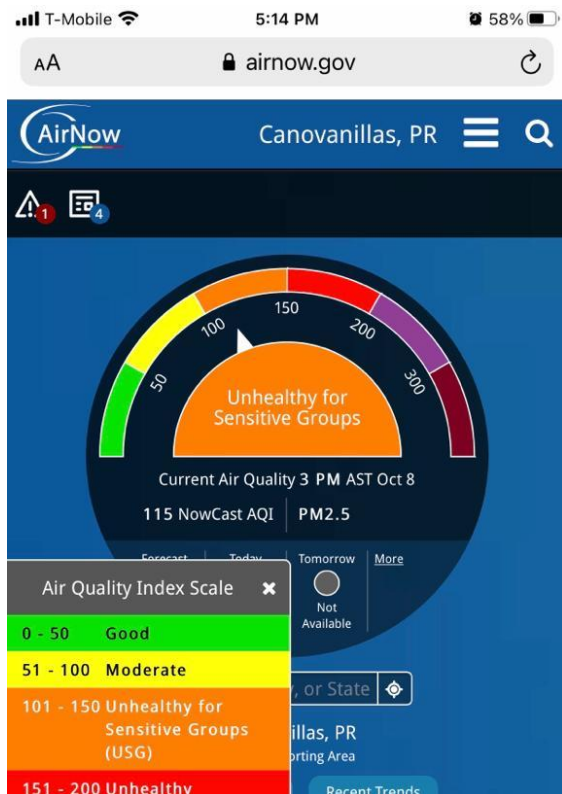
June 29, 2021



ABI L2+ Aerosol Optical Depth at 550 nm (1)
Experimental NRT AOD daily composite created from ABI L2 data from GOES-16. Fields generated by Atlantic OceanWatch node at NOAA/AOML
(2021-06-29T00:00:00Z)
Data courtesy of USD/C/NOAA/OAR/AOML/PHOD







POLVO DEL SAHARA Y ASMA

El Polvo del Sahara es uno de los factores ambientales asociado a complicaciones respiratorias. Estas nubes pueden contener virus, bacterias, materia orgánica, esporas de hongos, entre otros, que a su vez, se consideran provocadores del asma.

El asma es una enfermedad crónica que se caracteriza por la inflamación y estrechamiento de las vías respiratorias, produciendo un exceso de mucosidad que dificulta el paso del aire.

En Puerto Rico, aproximadamente:

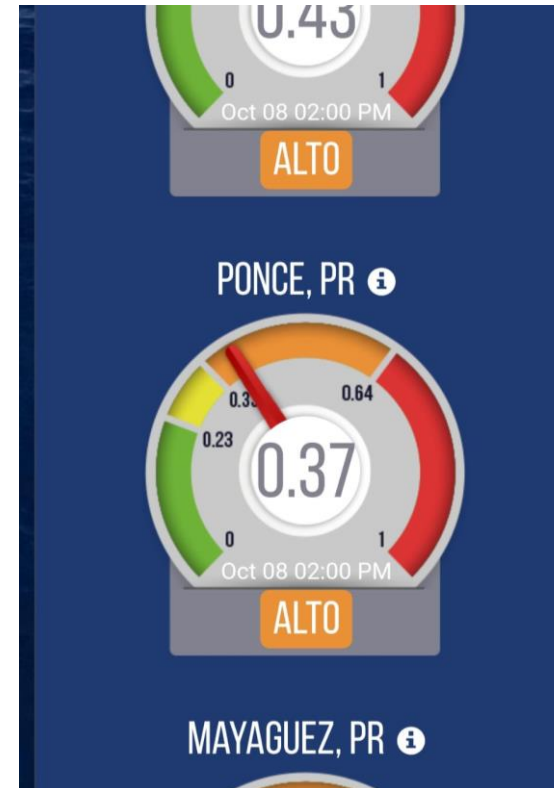
- 1 de cada 6 niños tiene asma actual
- 1 de cada 10 adultos tiene asma actual

Ante eventos asociados al polvo del Sahara, es importante que todas las personas tomen precauciones, especialmente aquellas que padecen de enfermedades respiratorias.

- Use sus medicamentos de mantenimiento, y tenga disponible los medicamentos de rescate.
- Limite sus actividades al aire libre. Si necesita salir, haga uso de mascarilla y gafas.
- Manténgase hidratado.

NASA, PR-CLIMAH, SALUD

www.proyectoasmapr.com proyectoasmapr@gmail.com



Area Forecast Discussion
Issued by NWS San Juan, PR

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000
FXCA62 TJJSJ 072012
AFDSJU

Area Forecast Discussion
National Weather Service San Juan PR
412 PM AST Thu Oct 7 2021

.SYNOPSIS...
Saharan dust will result in hazy skies through at least e. the weekend. However, afternoon activity may still develop the northwestern quadrant of Puerto Rico. **Unsettled** weather conditions are expected for the first half of the next week. **Seas** are gradually improving, but still remaining a little &&

.SHORT TERM...Tonight through Saturday...
A surface high pressure over the central Atlantic will maintain moderate east-southeast wind **flow** through the next several days. At the mid-levels, a **ridge** holds just west of Puerto Rico at the upper levels, a **trough** lingers north of the island. **Infrared satellite imagery** shows small areas of clouds advancing toward the region. The high resolution models have some of the areas reaching portions of the U.S. Virgin Islands and eastern Puerto Rico, but with **rainfall** accumulation mainly one inch.

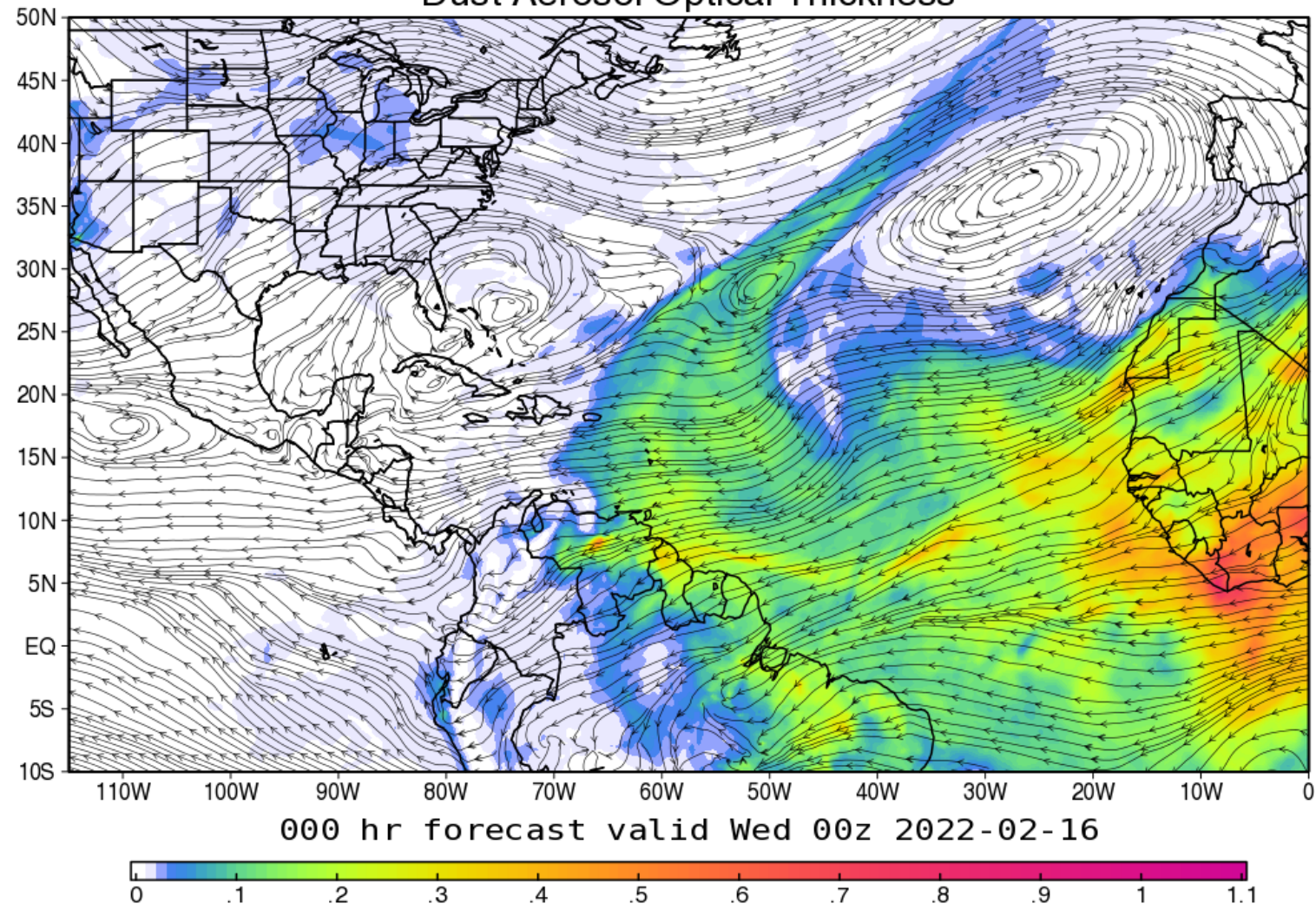
On Friday, a drier **air mass** east of the **Leeward** Islands and evident in Total **Precipitable Water** from **GOES-16** will reach local islands, with values falling to 1.3 to 1.5 inches. The air mass also contains Saharan dust, that will linger at least early in the weekend, hence hazy skies are expected. Each Friday and Saturday, passing showers may move over portions of eastern Puerto Rico and the U.S. Virgin Islands through the weekend. In the afternoon showers with **isolated** thunderstorms develop over the interior and northwestern Puerto Rico.

October 07, 2021

October 07, 2021

NASA/GMAO - GEOS Forecast Initialized on 00z 02/16/2022

Dust Aerosol Optical Thickness



February 15-16, 2022



Programa de Asma de Puerto Rico

131 followers

4h

Aquí le compartimos nuevamente información importante sobre el Polvo del Sahara.

#AsmaPR #DepartamentodeSalud #ProgAsma

SALUD PÚBLICA Y POLVO DEL SAHARA

¿Qué es el "Polvo del Sahara"?

Partículas de polvo mineral provenientes del desierto del Sahara y del desierto del Sahel, al norte del continente africano.

¿Qué puede contener el "Polvo del Sahara"?

- Las nubes de polvo se miden como aerosoles en la atmósfera y podrían contener, pero no se limitan a: minerales, materia orgánica, sales marinas, virus y bacterias.
- El "Polvo del Sahara" es un fertilizante natural y provee beneficios a ecosistemas marinos y terrestres. De igual manera podría ser perjudicial para la salud pública.
- Es transportado por los vientos Alisios sobre el Océano Atlántico y recorre sobre 5,000 km para alcanzar las costas de Puerto Rico y el Caribe.

Impactos del "Polvo del Sahara" a la Salud Pública

- Puede exacerbar las condiciones de salud en poblaciones inmunocomprometidas, vulnerables y sensitivas.
- Los médicos y científicos han observado un aumento en el número de exacerbaciones de las condiciones respiratorias entre sus pacientes durante los eventos de "Polvo del Sahara".

Síntomas asociados a la presencia del "Polvo del Sahara"

- Irritación de la nariz
- Sinusitis
- Alergias
- Exacerbación del asma
- Irritación de la garganta
- Irritación de los ojos e irritación de la piel
- Bronquitis aguda
- Riesgo de infecciones respiratorias

Prevención Para Eventos De "Polvo Del Sahara"

- Tener disponible sus medicinas
- Mantenerse hidratado
- Usar ropa ligera
- Evitar actividades al aire libre
- Usar mascarilla y gafas



www.proyectoasmapr.com programa.asma@salud.pr.gov

3:46



Programa de Asma de Puerto Rico

131 followers

8h

El particulado de polvo del Sahara provocará mucho calor y nubosidad toda la semana, y se espera que este patrón se extienda durante el resto de la semana laboral.

Tome medidas de prevención utilizando sus medicamentos de control para evitar crisis asmática y tenga listo su medicamento de rescate. Utilice mascarilla y gafas si planea realizar actividades al aire libre. #AsmaPR #ProgAsma #DepartamentodeSalud

ARENA y POLVO DEL SAHARA Llega al Caribe

La nube de arena y polvo que llega a América desde el desierto del Sahara puede causar enfermedades al ser humano y daños a algunos ecosistemas. Sin embargo también contribuye al crecimiento de selvas amazónicas.

Recorrido

Las nubes se desplazan desde África por los vientos alisios (dirección oeste) y una parte de estas avanza por las islas Canarias y afecta a varios países Europeos mientras otras van por el Atlántico y llegan al Mar Caribe.

7,500 km
es el recorrido de
nube de polvo y arena



6 días

tarda en llegar
las partículas del polvo
al Mar Caribe.

Sabías que...

La Organización Panamericana de la salud recomendó uso de mascarillas para las personas con males respiratorios crónicos.

Medidas de Prevención contra el "Polvo del Sahara"

- Tener disponible sus medicinas.
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- Usar ropa ligera.
- Evitar actividades al aire libre.

NATIONAL WEATHER SERVICE
SAN JUAN, PUERTO RICO

*Air Quality
Awareness Week*

Moderators:
Ian Colón-Pagán (left)
Fernanda Ramos (right)

Register:

WEBINAR: Saharan Dust & Air Quality
Thursday, May 6th, 2021 | 11:00 AM - 12:00 PM AST

Ernesto Morales: What is the NWS WFO San Juan?

Ernesto Rodríguez: WFO San Juan & Air Quality Events

Dra. Olga L. Mayol-Bracero: African Dust Measurements in the Caribbean

Dra. Odalys Martinez: African Dust in PR & USVI

Dr. Pablo Méndez-Lázaro: Aerosol Monitoring Support Tool

WEBINARS
13 al 17 de julio de 2020
3:00 p.m. a 4:00 p.m.

Edición Polvo del Sahara
y Salud Pública

CienciaVirtual

lunes 13
Sistemas de alertas temprana de polvo del Sahara para proteger la salud pública
Dr. Pablo Méndez Lázaro, Catedrático Asociado, UPR-RCM, Investigador Principal; NASA CALIMA-PH

martes 14
El polvo del Sahara visto desde el espacio
Dra. Digna Rueda-Roa, Biólogo Marino USF College of Marine Science, NASA CALIMA-PH
11:00 a.m.
Pronóstico del Tiempo: Aerosoles y Polvo del Sahara en Puerto Rico
Ernesto Rodríguez MS y Ernesto Morales MS del Servicio Nacional de Meteorología de San Juan, NOAA
3:00 p.m.

jueves 16
Impacto del Polvo del Sahara en la salud: Esfuerzos de investigación en Puerto Rico
Dra. Ana P. Ortiz, PhD, MPH, Profesora UPR-RCM, Centro Comprehensivo de Cáncer, NASA CALIMA-PH

viernes 17
NASA GEOS Aerosol forecasting system and its application to Saharan dust transport
Dr. Peter Colarco, Profesor, University of Miami

miércoles 15
10:00 a.m.
Taller: Cocinando en el EcoExploratorio
Chef Gali, Chef de Restaurant al aire libre, Chef de Actividades de la UAGR
3:00 p.m.
Polvo del Sahara en Puerto Rico: ¿Qué es y cómo se mide?
Dra. Olga Mayol Bracero, Catedrática, ACAR, UPR-Rio Piedras, Co-investigadora Principal; NASA CALIMA-PH

Registro: www.ecoexploratorio.org/cienciavirtual

Capacidad: ZOOM 500 personas

Un certificado de participación será otorgado a toda persona que complete el webinar a través de la plataforma de ZOOM. Ciertas restricciones aplican. Para más información, favor de escribir a webinar@ecoexploratorio.org

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Co-design strategies and solutions by engaging scientist and public health officials in all project phases.

>400,000 people impacted



Study of Imminent Interactions between SARS-CoV-2 (COVID-19), Air Quality due to Saharan Dust and Urban Aerosols, and Social-environmental Factors in Puerto Rico in summer 2020: Proxies of Health Risks in Small Island States in the Caribbean Region

In the Caribbean islands, Saharan dust is associated with increased to excessive risk of emergency room visits and hospitalizations related to respiratory diseases.

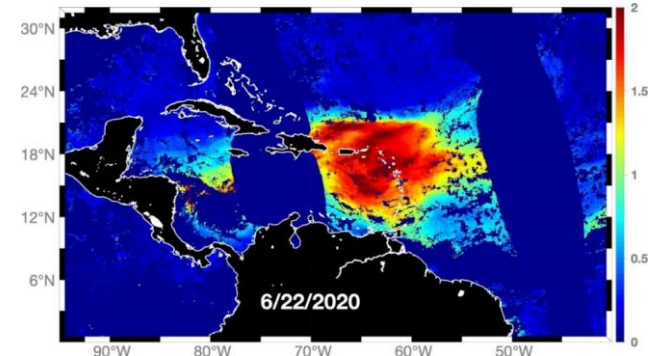
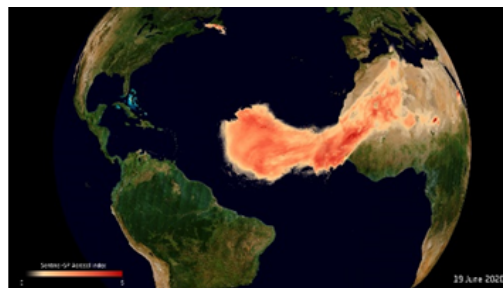
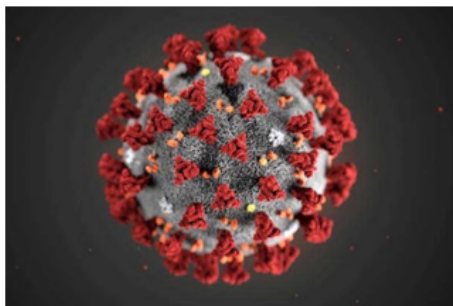
On the other hand, the coronavirus SARS-CoV-2 responsible for the present COVID-19 pandemic increases the risk of mortality due to severe respiratory illness and cardiac injury.

The goal of the proposed work is to expand the scope of a current NASA-sponsored African dust research (80NSSC19K0194) to better understand possible interactions between COVID-19, Saharan dust, and environmental factors (air temperature, sea surface temperature, and precipitation) in Puerto Rico.

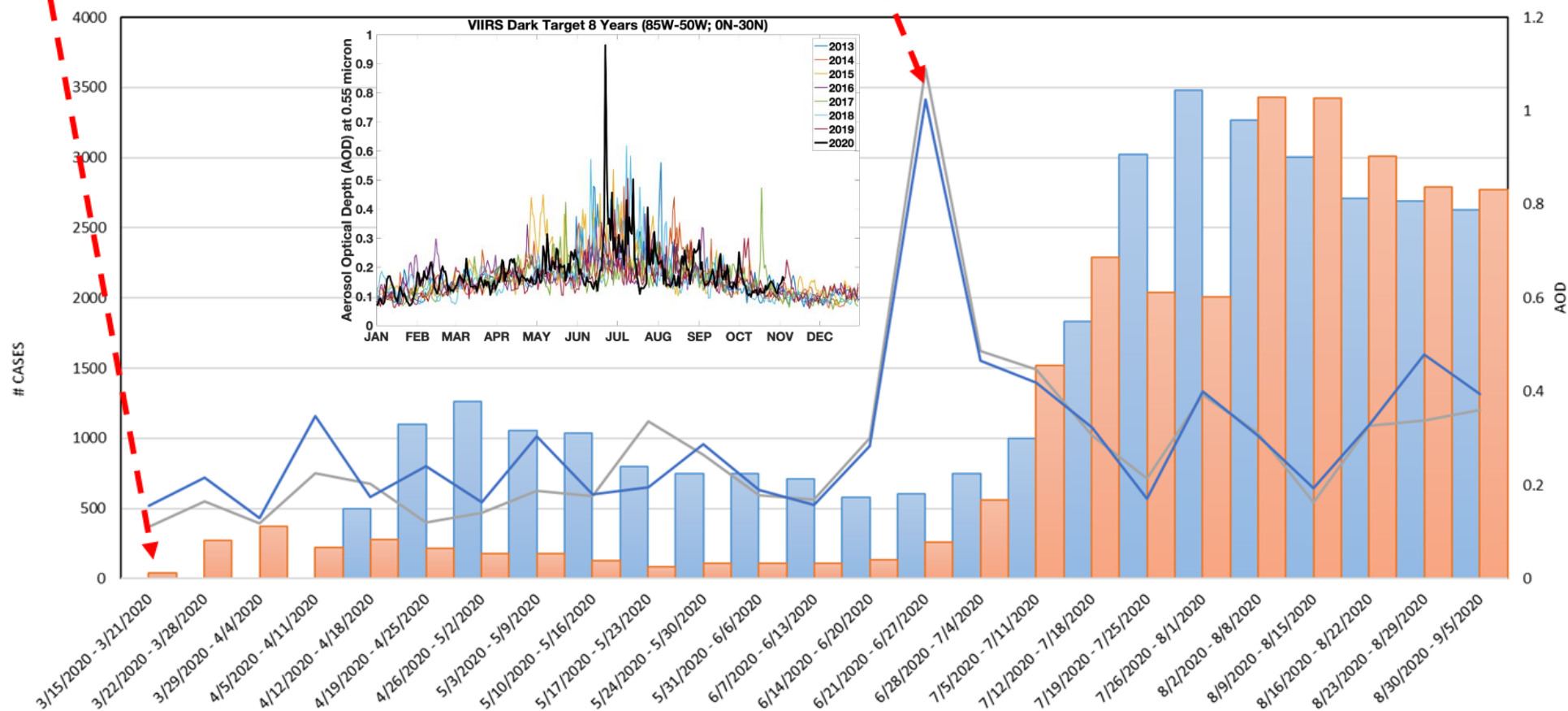
Study of Imminent Interactions between SARS-CoV-2 (COVID-19), Air Quality due to Saharan Dust and Urban Aerosols, and Social-environmental Factors in Puerto Rico in summer 2020: Proxies of Health Risks in Small Island States in the Caribbean Region

- Designed and implemented (Cross sectional study) qualitative instruments aiming to capture **physicians and patients' risks, barriers, and vulnerabilities.**
 - Physicians N=55
 - Patients COVID-19 confirmed cases N=104
 - IRB-Protocol Number B1540520
- **Emergency Room Visits and Hospitalizations-2020-2021**
 - COVID-19 Weekly 2020-2021
 - Weekly in specific diseases of the respiratory system.
- **All Causes Excess Mortality Analysis Islandwide (weekly 2015-2020) Including COVID-19**
 - Weekly average deaths during 2015-2020: overall and by season
 - Weekly average deaths during 2015-2020: overall by year of death for each season
 - Weekly average during 2015-2020 in specific diseases of the respiratory system.
 - COVID-19 Mortality Analysis (weekly 2020)
 - RR adjusted by environmental data (weekly 2015-2020)

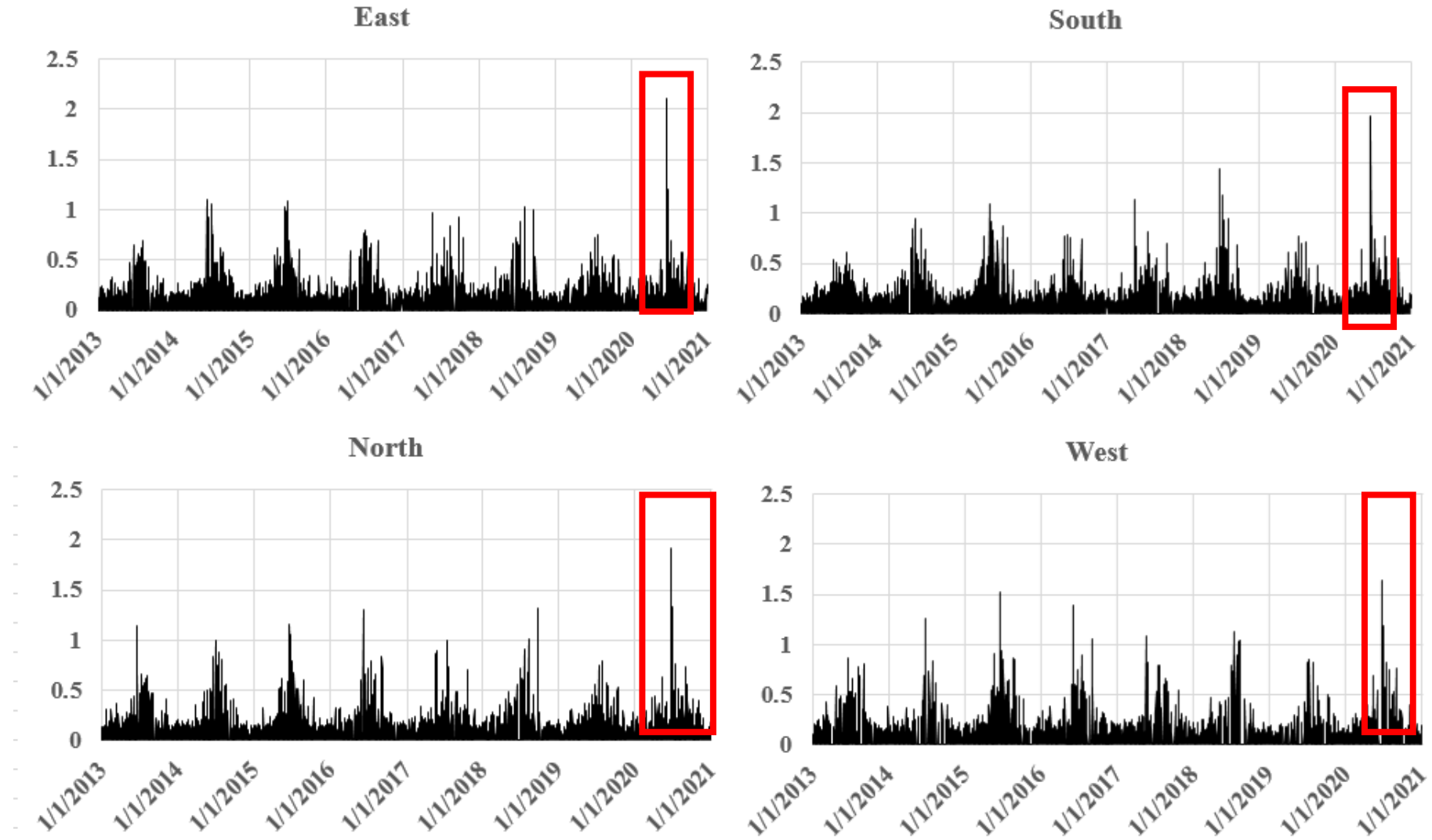
1st COVID-19 Confirmed Case In Puerto Rico



Godzilla Dust Event



Godzilla Dust Event: Summer 2020



Left: Upper picture June
Tuesday June 23rd, 2020
9:30am (AST)

Lower Image Saturday
June 20th, 2020 9:30am
(AST)

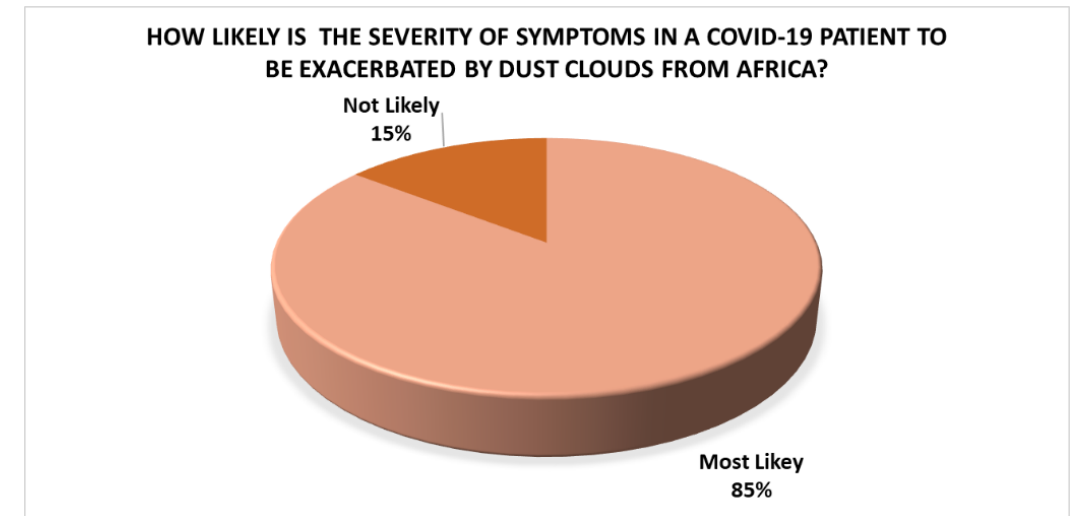
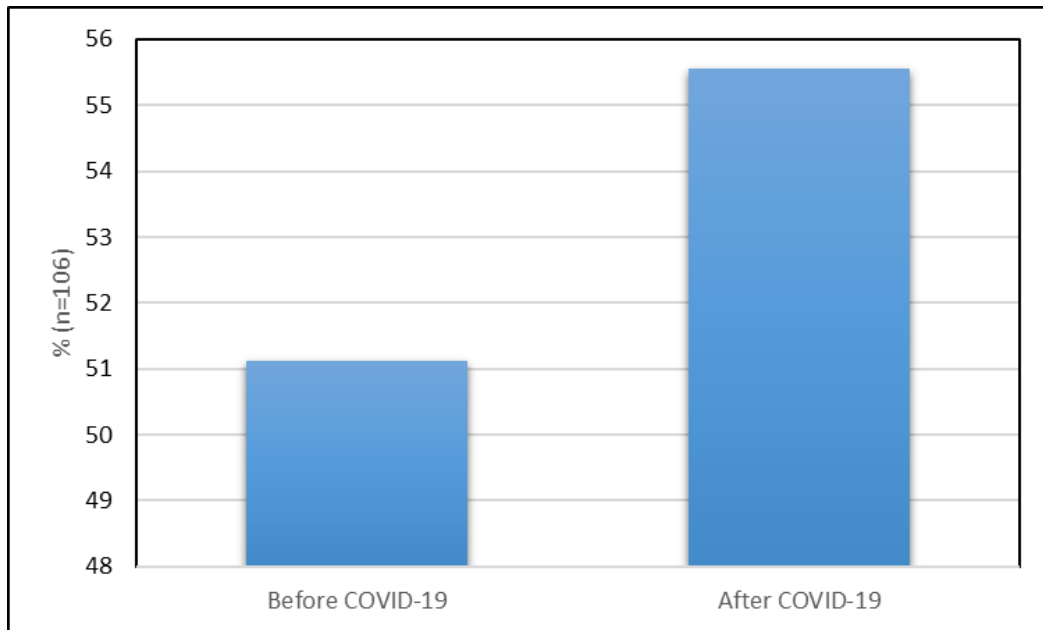


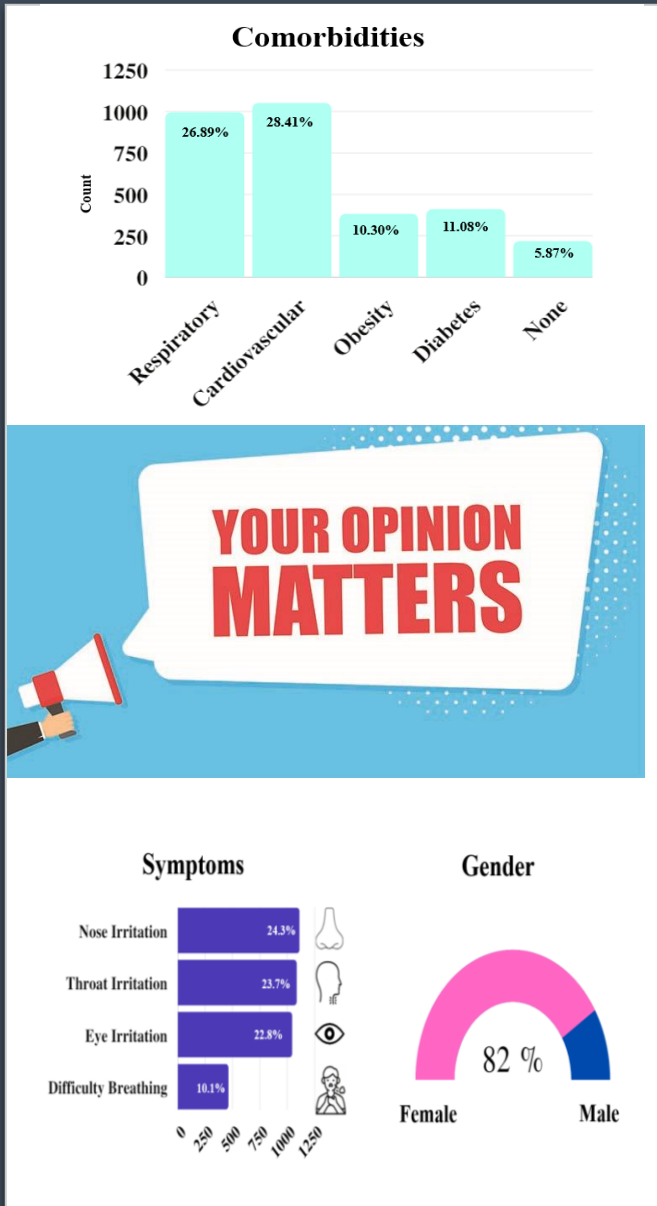
Right: Upper Image:
Morning Saturday June
20th, 2020

Lower Image: Morning
Tuesday June 22nd, 2020



- Females >55 years of age were more likely to be concern about Saharan Dust
- Females were more susceptible to Saharan Dust after being diagnosed with COVID-19.
- Participants positive to COVID-19 and with at least another pre-existing health condition are more likely to be affected by Saharan Dust





Godzilla Dust Event: Summer 2020 (Survey)

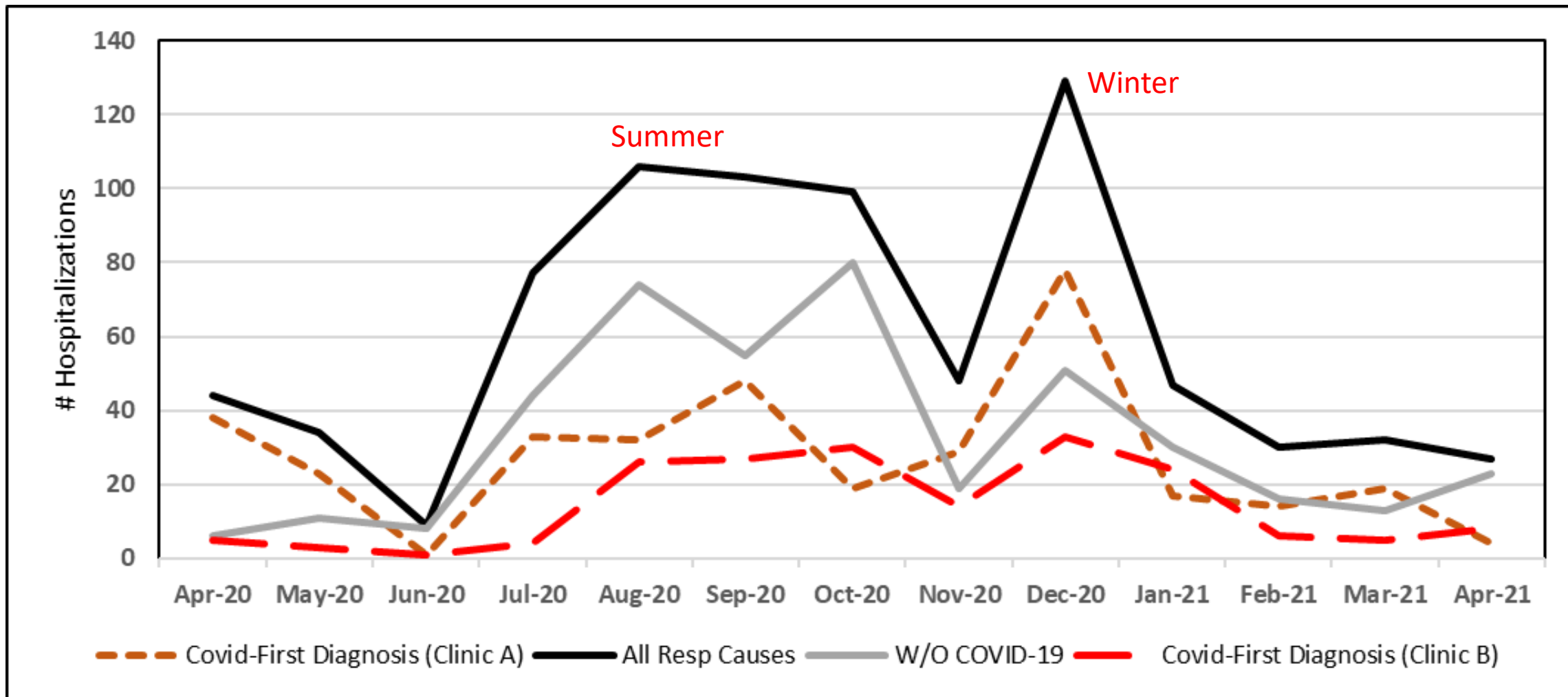
- 1500 participants: most respondents were females (82%), **65% had a history of at least one chronic condition.**
- **Nearly 90%** indicated that Saharan dust affected the health status of both respondents and their family members.
- **Asthma** was the most reported condition (55%).
- However, only 12% reported a physician's visit due to Saharan dust complications. Moreover, nearly two-thirds expressed concern regarding their family's welfare during the Saharan dust events.
- **Individuals with Comorbidities are 14.37% more likely to need medical services in Saharan dust events.**
- Over half (57%) reported that the Saharan dust always or frequently affected their health, causing postnasal drip, cough, red or itchy eyes, shortness of breath, and fatigue.

Public Health Data ER & HA

- **March 2020 to March 2021:**
- U07.1 = confirmed COVID-19
- J12.89 = pneumonia due to other viral pathogen
- J12.82 = pneumonia due to SARS-CoV-2
- J12.81 = pneumonia due to SARS-Associated coronavirus
- M35.81 = MIS-C
- Z86.16 = personal history of COVID-19
- Z20.828 = contact and suspected exposure to viral pathogen
- Z20.822 = contact and suspected exposure to SARS-CoV-2
- B97.2 = Coronavirus as the cause of diseases classified elsewhere
- B97.21 = SARS-associated coronavirus as the cause of diseases classified elsewhere
- B97.29 = Other coronavirus as the cause of diseases classified elsewhere
- We additionally requested the list generated include whether these diagnoses had also been added to each patient's problem list, as a means of expediting record review: I25.1, I50, I21 & I25.2 , I10 & I15, I60-I69, E10, E12, J45, J41-44, E66, G30-32, F33 & N18.

Databases and Sources

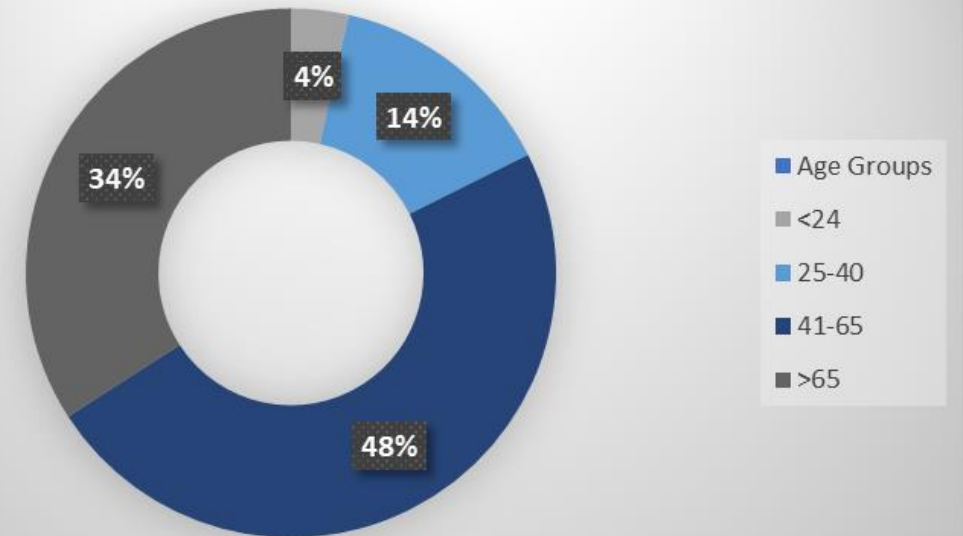
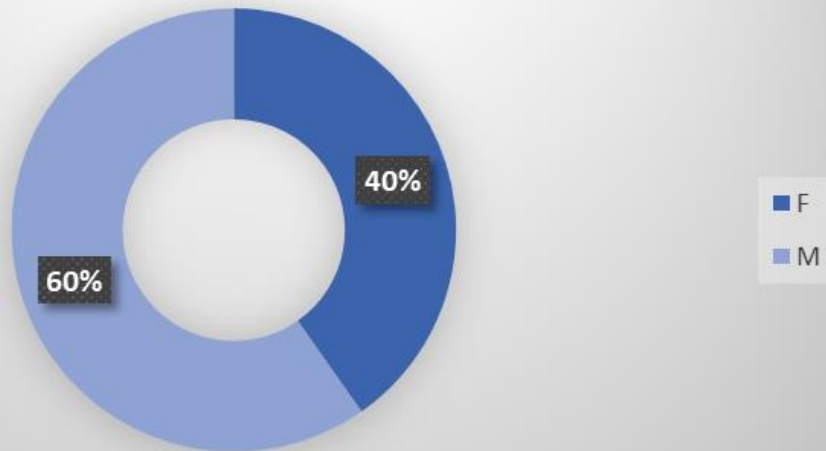
- Non_Acc: Non-Accidental Mortality Accumulated for the day of PM2.5 measurement
- Cardio: Cardiovascular Mortality Accumulated for the day of PM2.5 measurement
- Resp: Respiratory Mortality Accumulated for the day of PM2.5 measurement
- Resp_NoFlu: Respiratory Mortality without Flu cases for the day of PM2.5 measurement
- PM2.5_Mean_Conc_Stations: Mean of the Fajardo, Guaynabo and Bayamon Stations
- Tmax: Associated Maximum Temperature to Date variable
- Sahara: Dichotomous variable that indicates if the corresponding date had a Saharan dust event
- HeatIndex: Associated Maximum Heat Index to Date variable
- Year: Associated year of Date variable
- Population: Population of people 65 years and over in the northeast region of Puerto Rico
- VIIRS data Aerosol Products from Dark Target algorithm, version 1:



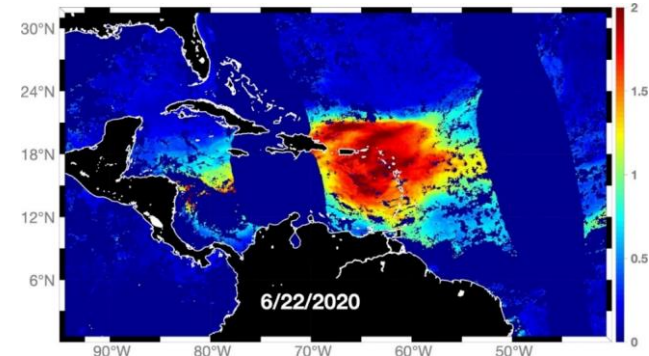
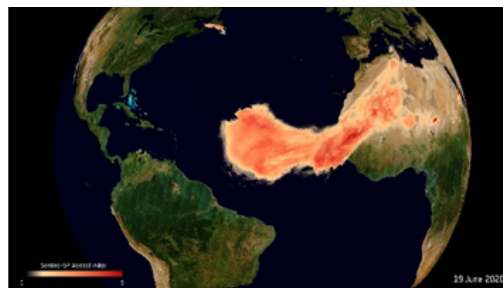
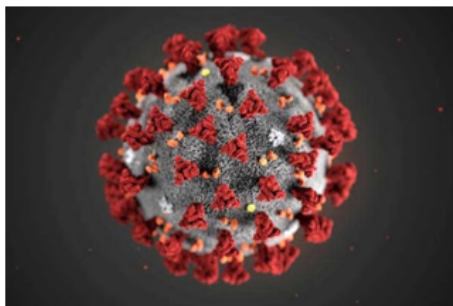
Behavioral risk factor

Public Health Data: ER & HA

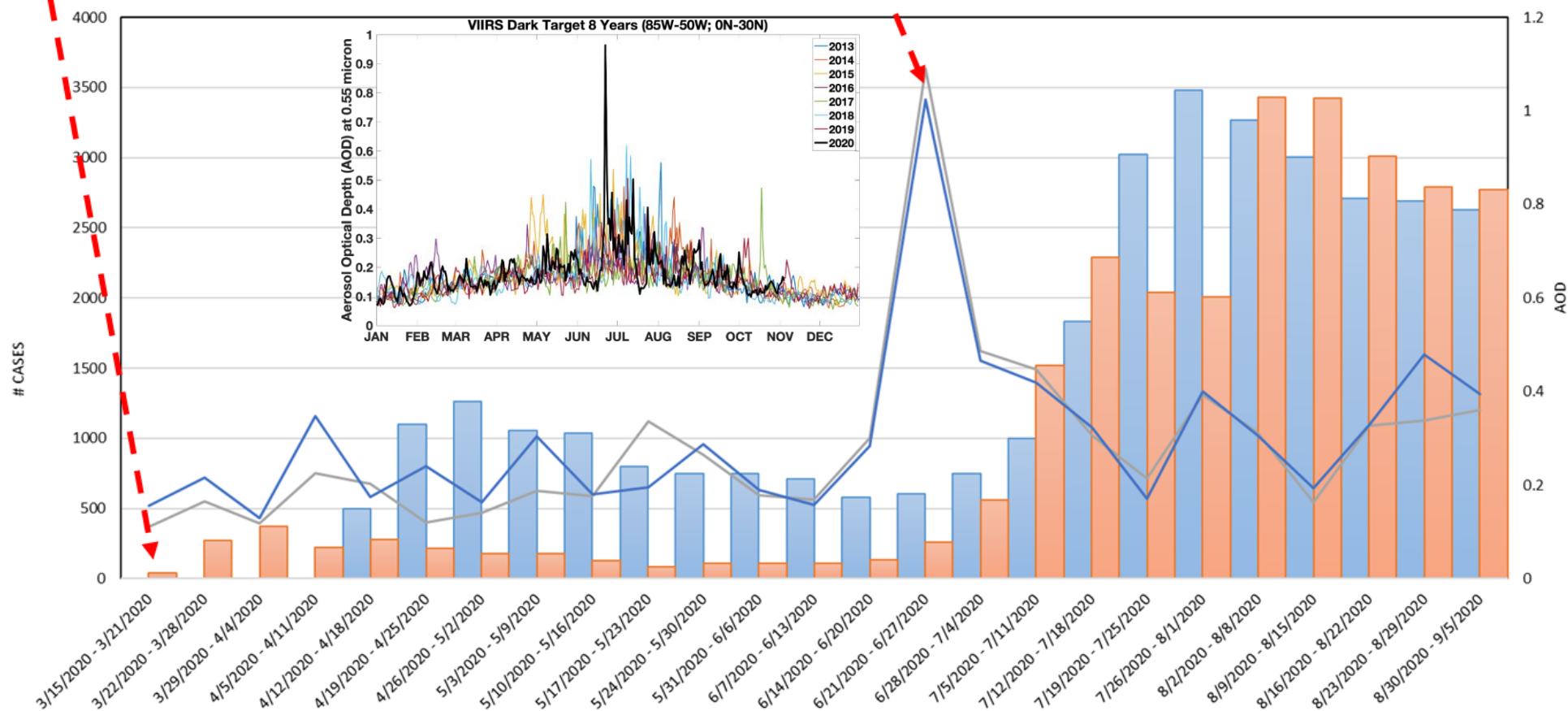
Sex



1st COVID-19 Confirmed Case In Puerto Rico



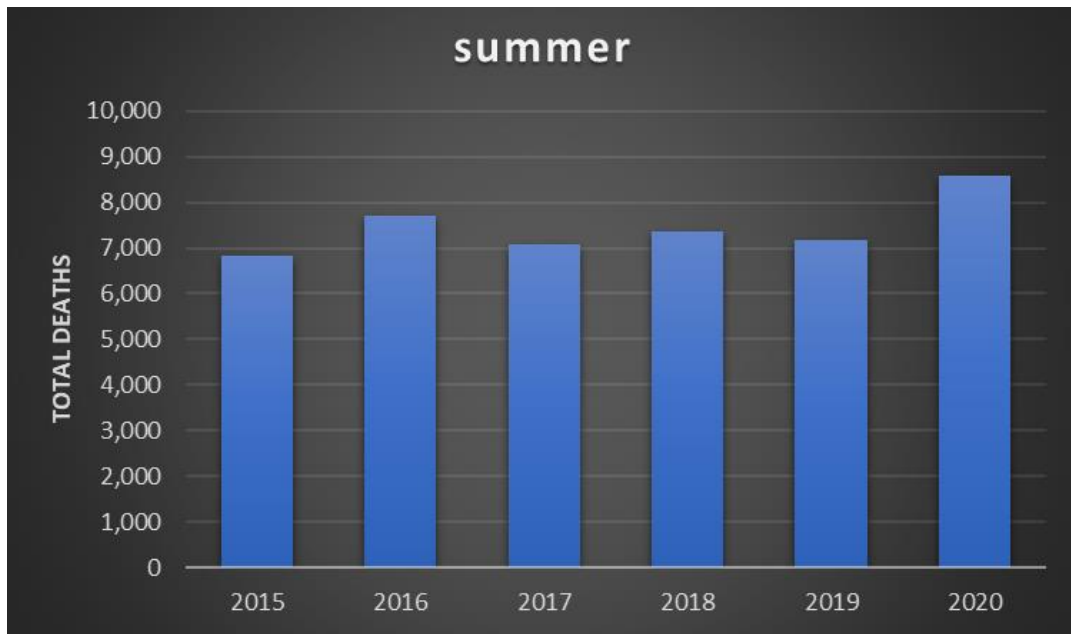
Godzilla Dust Event



- Stata
- 9 environmental variables
- 18 environmental indices
- Retrieved mostly from NASA (MODIS, VIIRS, Sentinel)

	heatindex~an	heatindex~in	hi_clima_d~x	airtemp_c~an	airtemp_c~in	airtemp_cl~x	utci_clim~in	utci_clima~x	utci_clim~an	angstr~s	mc_viirs	precip~5
heatindex~an	1.0000											
heatindex~in	0.9975	1.0000										
hi_clima_d~x	0.9967	0.9912	1.0000									
airtemp_c~an	0.9901	0.9901	0.9851	1.0000								
airtemp_c~in	0.9871	0.9912	0.9795	0.9946	1.0000							
airtemp_cl~x	0.9788	0.9771	0.9767	0.9929	0.9783	1.0000						
utci_clim~in	0.8614	0.8623	0.8650	0.8390	0.8522	0.8070	1.0000					
utci_clima~x	0.7795	0.7809	0.7844	0.7579	0.7700	0.7282	0.9504	1.0000				
utci_clim~an	0.8665	0.8653	0.8707	0.8416	0.8552	0.8084	0.9896	0.9599	1.0000			
angstrom_v~s	-0.4269	-0.4199	-0.4285	-0.4108	-0.4106	-0.4168	-0.1662	-0.0451	-0.1726	1.0000		
mc_viirs	0.4416	0.4362	0.4396	0.4221	0.4303	0.4173	0.2214	0.1333	0.2435	-0.7891	1.0000	
precip_chr~5	0.2444	0.2386	0.2661	0.2231	0.2051	0.2307	0.3539	0.3163	0.3319	-0.0154	-0.0262	1.0000
precip_chr~3	0.2335	0.2278	0.2552	0.2136	0.1953	0.2223	0.3449	0.3073	0.3215	-0.0112	-0.0315	0.9977
mursst_3x3	0.8788	0.8805	0.8795	0.8947	0.8840	0.8896	0.8772	0.8460	0.8721	-0.1051	0.1146	0.3300
mursst_5x5	0.8790	0.8807	0.8797	0.8949	0.8842	0.8898	0.8773	0.8461	0.8723	-0.1055	0.1151	0.3299
lstn	0.9174	0.9118	0.9199	0.9193	0.9168	0.9053	0.8109	0.7396	0.8163	-0.3662	0.3425	0.2404
lstd	0.4302	0.4125	0.4309	0.3704	0.3846	0.3380	0.3376	0.2841	0.3744	-0.3659	0.3442	-0.0285
aod550_viirs	0.4649	0.4563	0.4654	0.4413	0.4495	0.4314	0.2733	0.1758	0.2928	-0.7417	0.9118	0.0472

Deaths per year of death and season



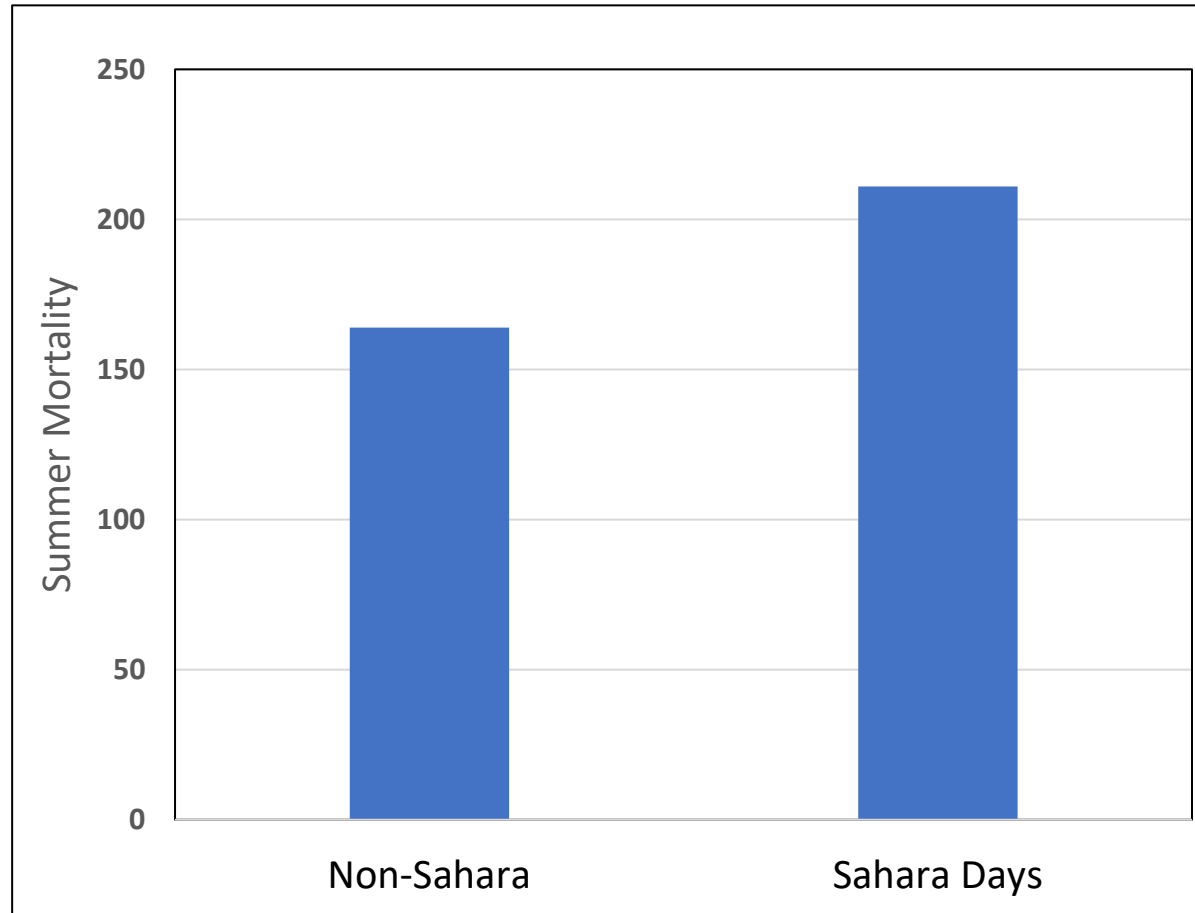
Deaths per year of death and season

dyr	winter	summer	autumn	spring	Total
2015	6,937	6,828	7,590	6,768	28,123
2016	8,113	7,691	7,478	6,375	29,657
2017	7,410	7,095	9,451	7,164	31,120
2018	8,240	7,356	7,206	6,425	29,227
2019	7,885	7,187	7,236	7,298	29,606
2020	6,463	8,573	8,166	8,077	31,279
Total	45,048	44,730	47,127	42,107	179,012

Hurricane Irma & Maria

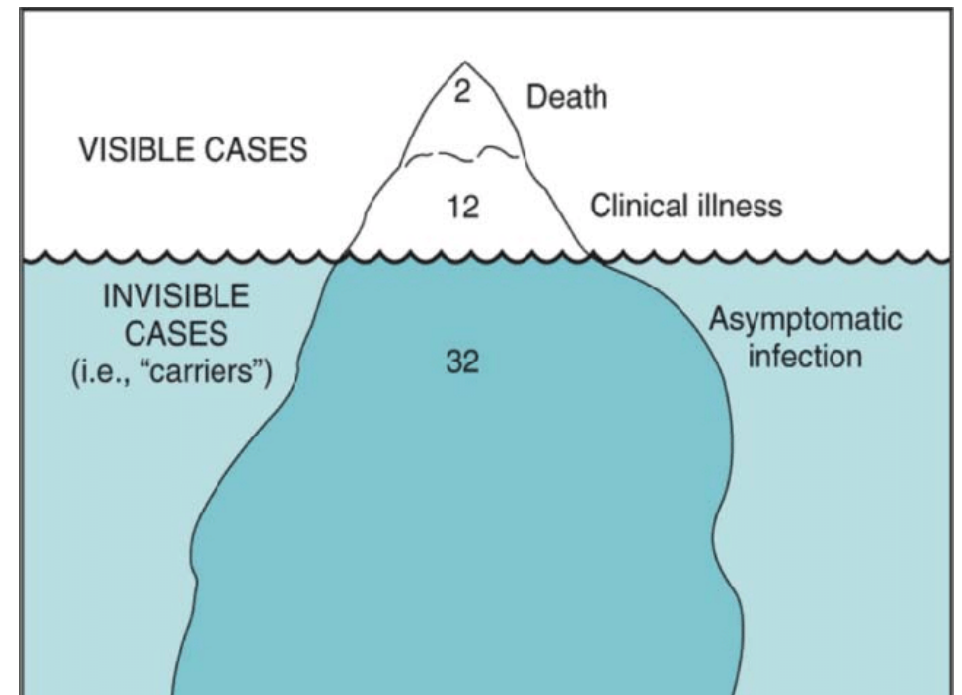
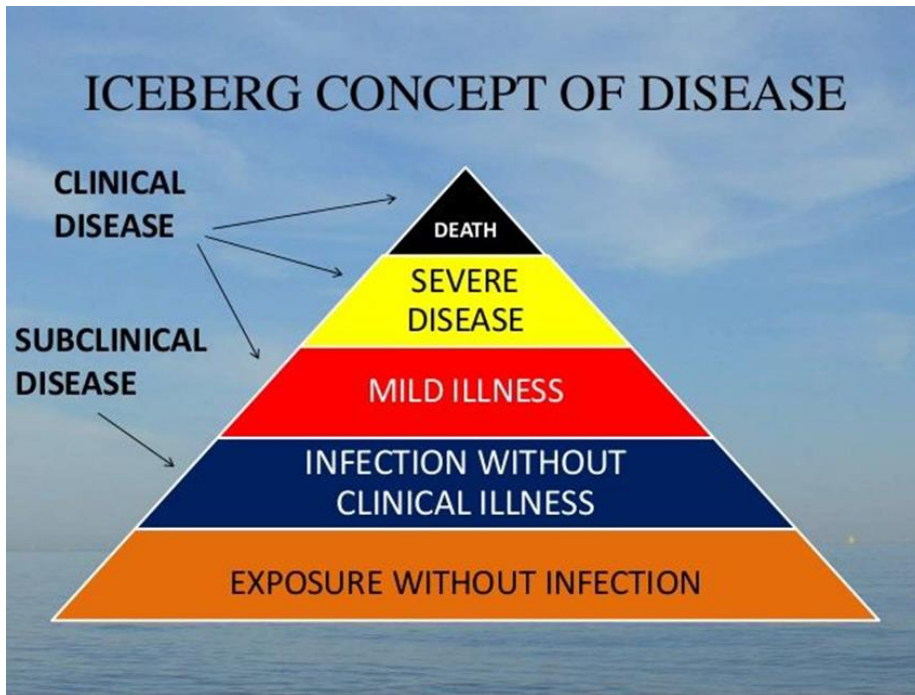
COVID-19

Respiratory Mortality 2015-2017: Dust Days vs Non Dust Days



- dust concentration increase in the Caribbean between May and September. These plumes are positively associated to respiratory (**without flu causes**) mortality with a relative risk of 1.23 (CI 95%: 1.03, 1.47) when adjusted for PM 2.5 and Air Surface Maximum Temperature.

Disease/Injury Iceberg Phenomenon



Considerations

- Mortality is always the tip of the iceberg.
- Findings suggest that the arrival from Saharan Dust in Puerto Rico contributes to an increase in cause-specific mortality.
- However, there are remaining questions regarding their effects on vulnerable patient populations, underlying mechanisms of action, and regional variations in both environmental and health effects.
- Better understanding of how these Dust Clouds events affect the health of the population will provide a useful tool for decision makers to address and mitigate the effects on public health.
- The enhanced Dust Early Warning System may be a crucial component in decision making during Watches and Advisories process.



Questions!

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