



# Huracanes en Puerto Rico en el Contexto de Cambio Climático

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Campus

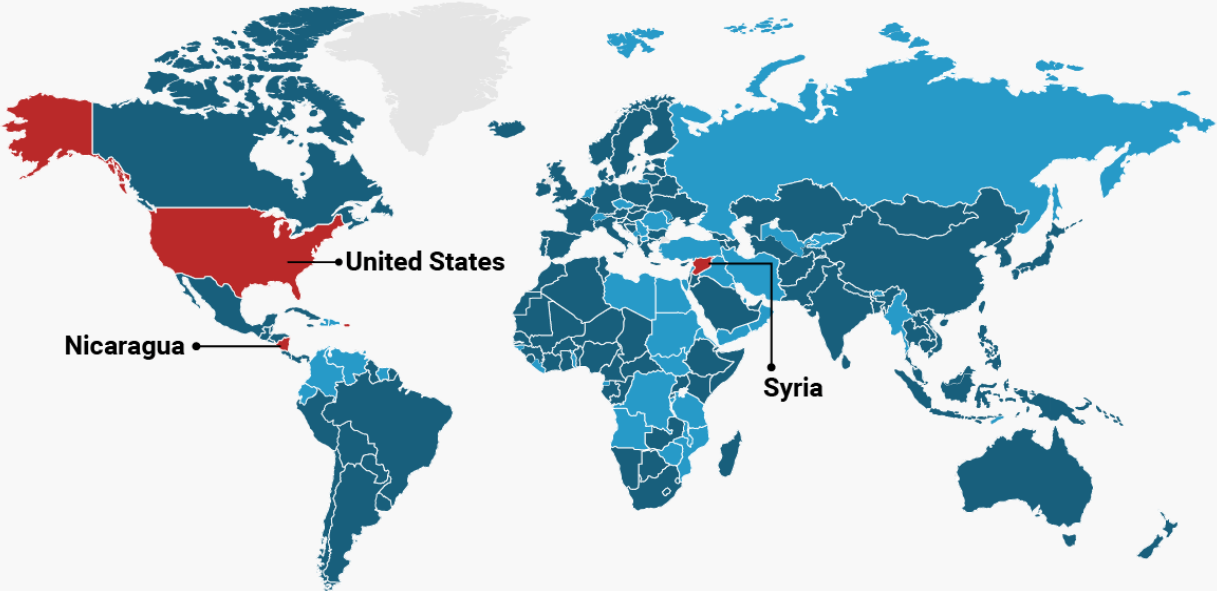
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# Indicadores y Evidencias del Cambio

## COUNTRIES THAT JOINED THE PARIS CLIMATE AGREEMENT

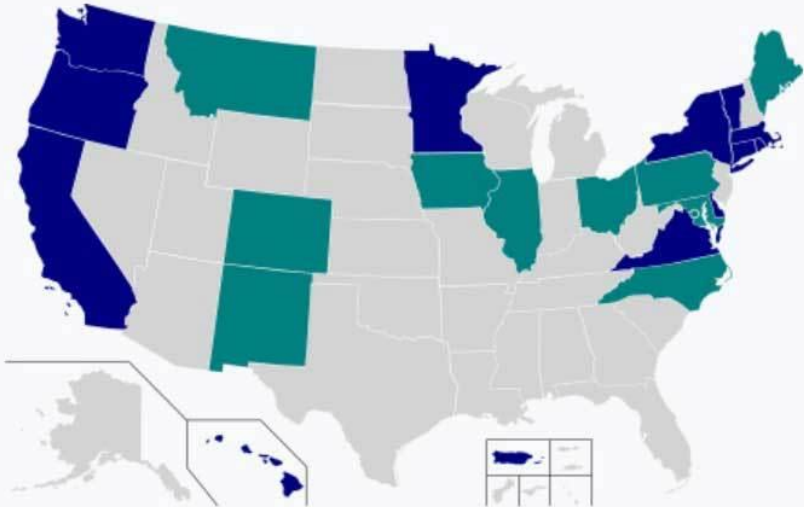
■ Ratified (146) ■ Signed (48) ■ Not signed/Withdrawing (3)



SOURCE: UNFCCC NOTE: Denmark's agreement excludes Greenland. Map is updated as of May 31, 2017.

BUSINESS INSIDER

## United States Climate Alliance



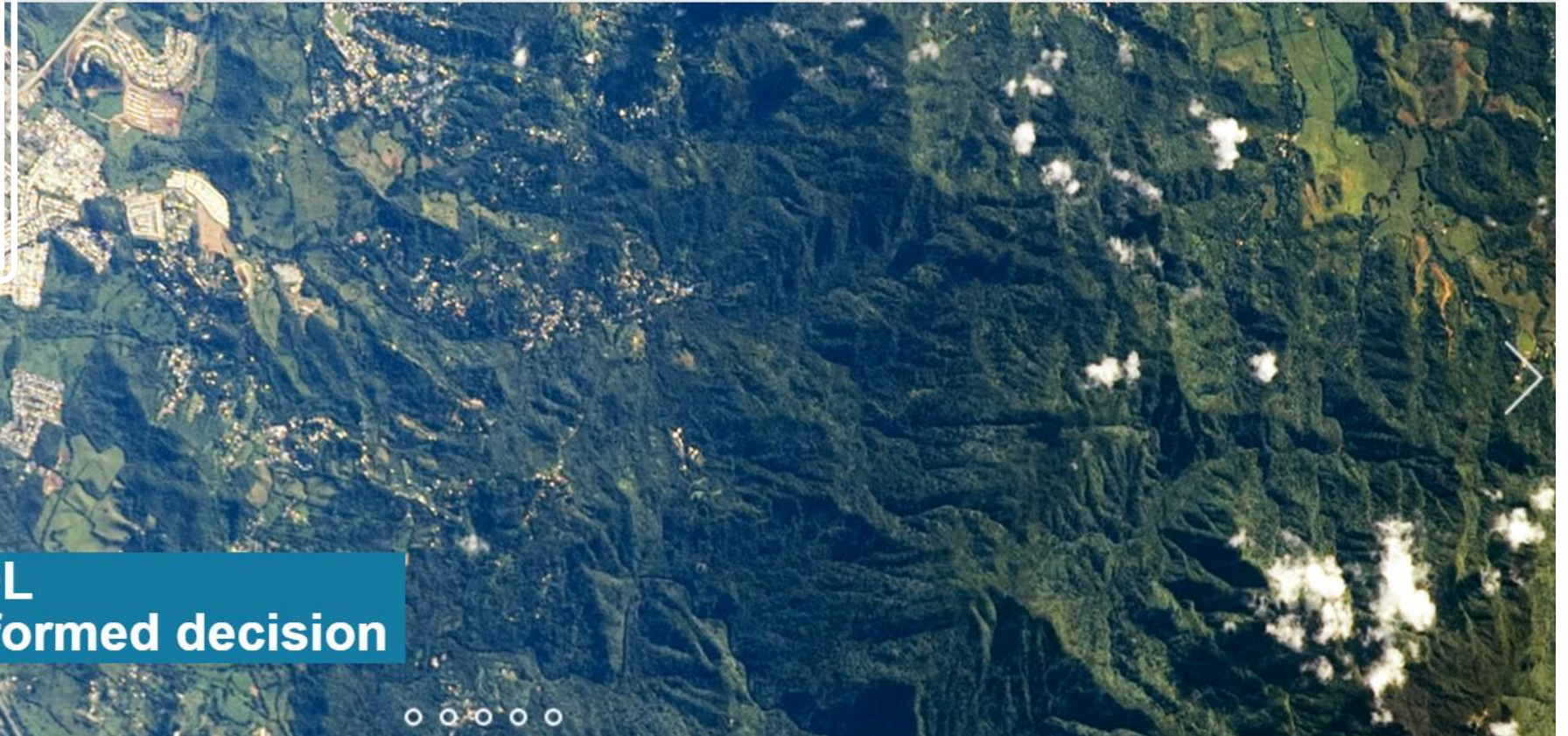
■ United States Climate Alliance

■ Other areas whose governing officials have expressed support for the Paris Agreement





# Puerto Rico Climate Change Council



**CLIMATE DATA TOOL**  
**We need to make informed decision**



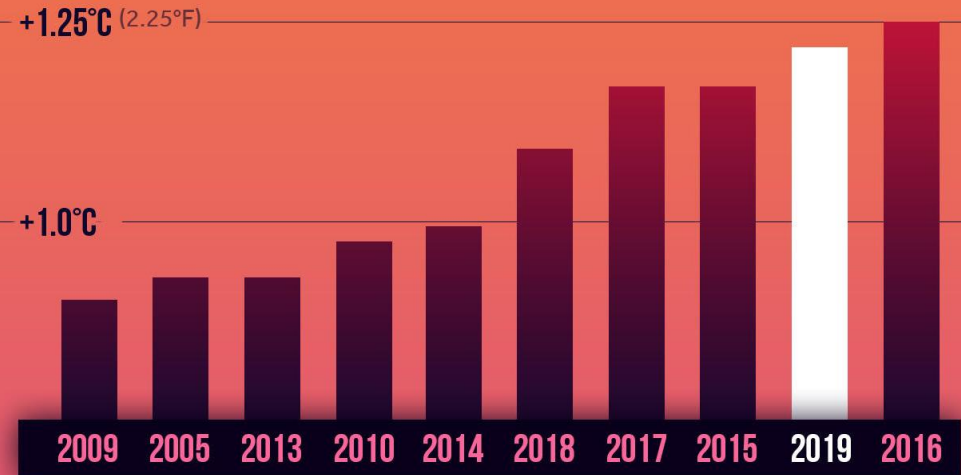


<https://nca2018.globalchange.gov/>



# 10 HOTTEST YEARS ON RECORD GLOBALLY

Last 5 = Hottest 5



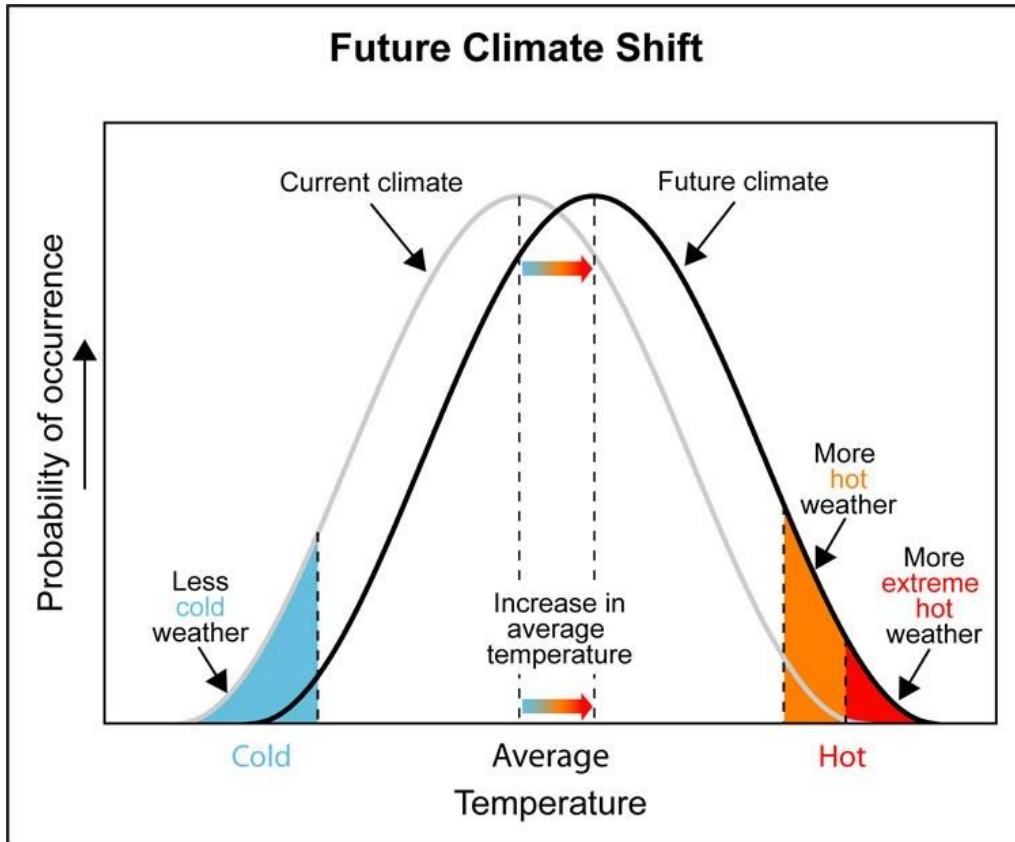
Source: NASA GISS & NOAA NCEI global temperature anomalies (°C) averaged and adjusted to early industrial baseline (1881-1910). Data as of 1/15/2020.

CLIMATE  CENTRAL

- There is a question on how humans, animals and plants that have established themselves in a particular location can adapt to higher average temperatures (Tomlinson et al. 2011).

## Cambio Climático en Puerto Rico

# Manifestación de Eventos Climáticos Extremos



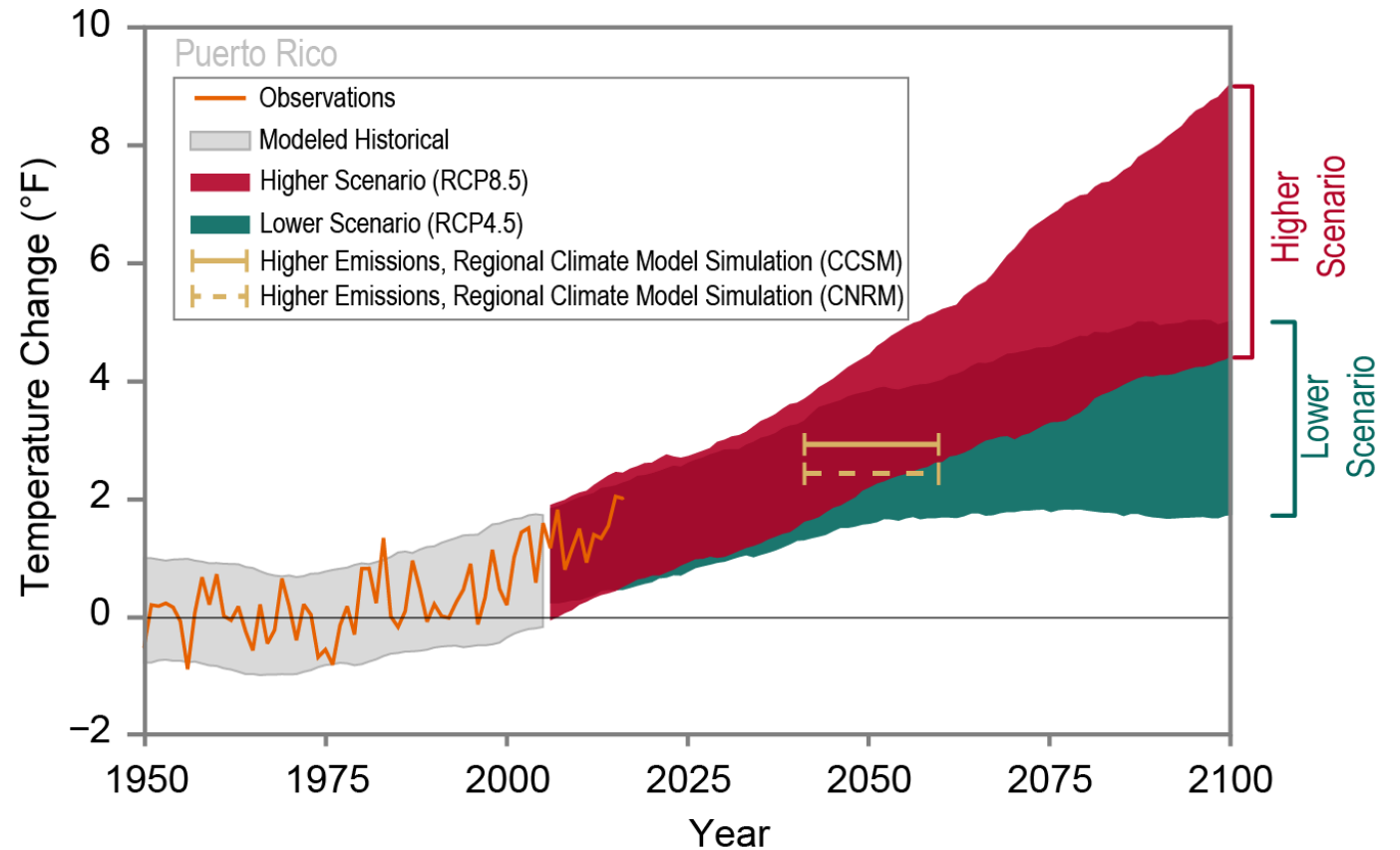
## SCIENCE CONNECTIONS → EXTREME WEATHER & CLIMATE CHANGE

→ Strongest Scientific Evidence Shows Human-Caused Climate Change Is Increasing Heat Waves and Coastal Flooding



# Proyecciones de Temperatura (NCA4)

- Key Message 4: Natural and social systems adapt to the temperatures under which they evolve and operate. Changes to average and extreme temperatures have direct and indirect effects on organisms and strong interactions with hydrological cycles, resulting in a variety of impacts. Continued increases in average temperatures will likely lead to decreases in agricultural productivity, changes in habitats and wildlife distributions, and risks to human health, especially in vulnerable populations. As maximum and minimum temperatures increase, there are likely to be fewer cool nights and more frequent hot days, which will affect the quality of life in the U.S. Caribbean.







*"In these tropical ocean regions, the heat just can't escape. And if nothing escapes, that part of the world just gets hotter and hotter."*

- Graeme Stephens, director of the Center for Climate Sciences at NASA's Jet Propulsion Laboratory (JPL)



NEWS | March 22, 2018

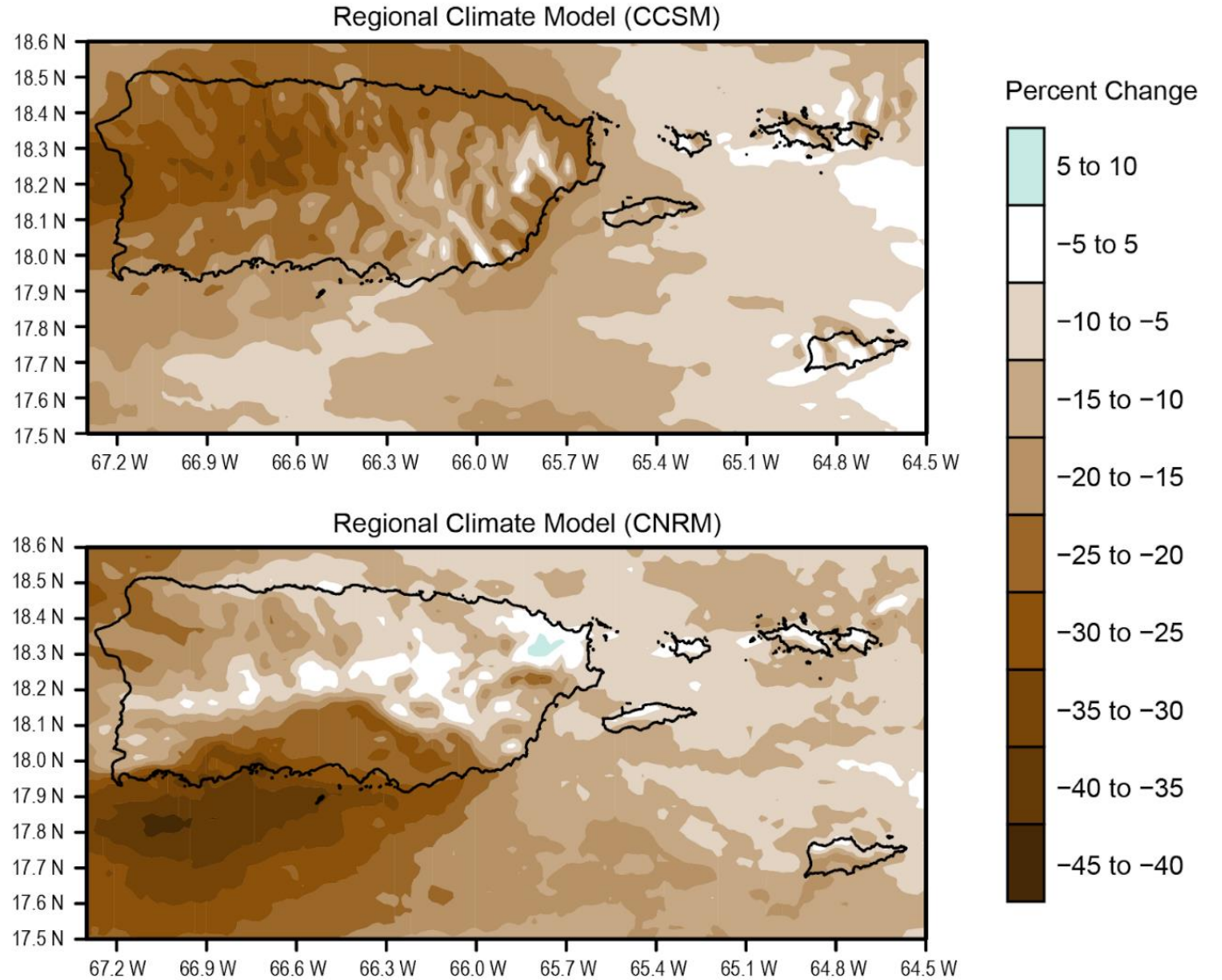
## Scientists assess potential for super greenhouse effect in Earth's tropics



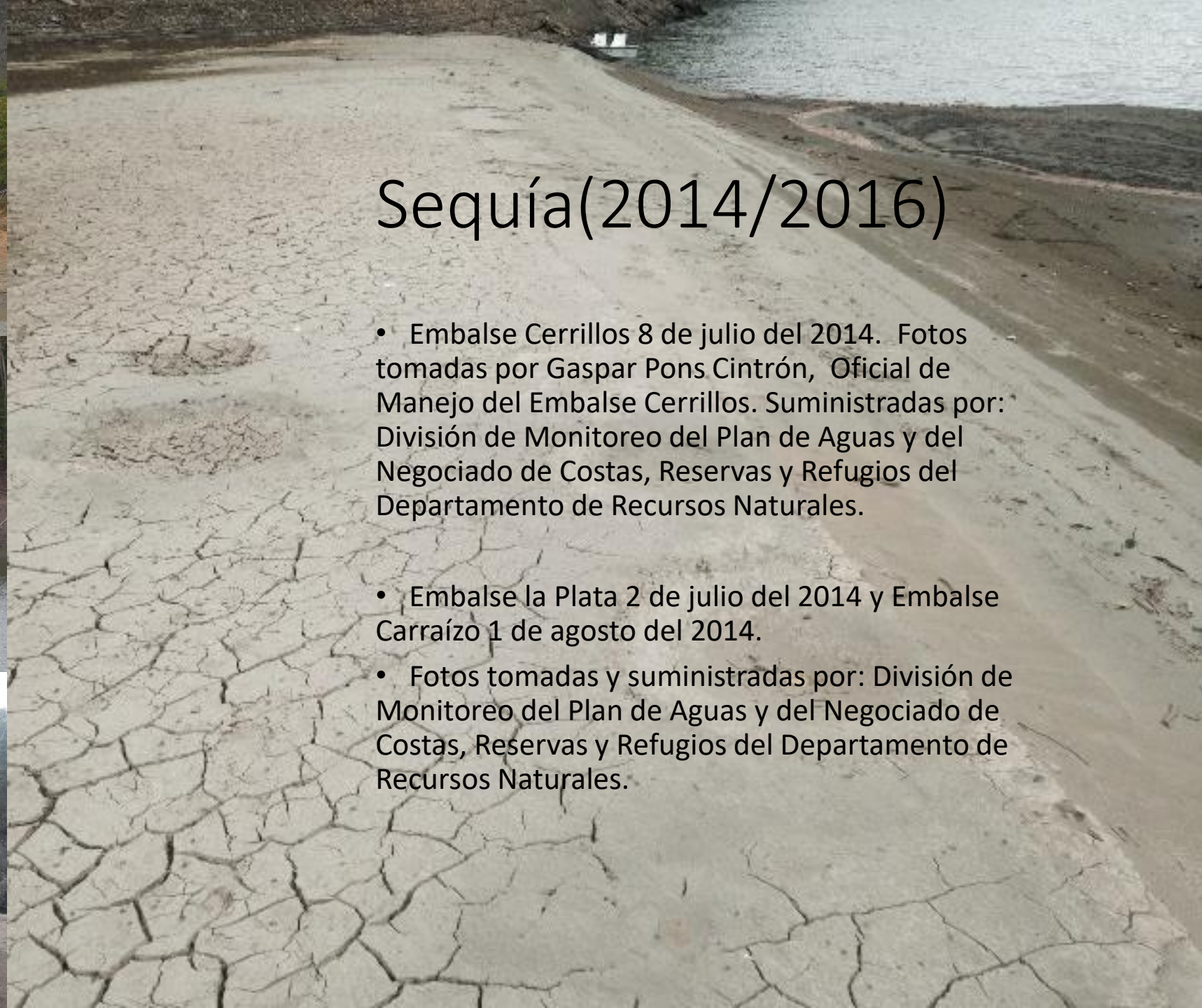


# Proyecciones de Lluvia (Draft NCA4)

- Key Message 1: Freshwater is critical to life throughout the Caribbean. Increasing global carbon emissions are projected to reduce average rainfall in this region by the end of the century, constraining freshwater availability, while extreme rainfall events, which can increase freshwater flooding impacts, are expected to increase in intensity. Saltwater intrusion associated with sea level rise will reduce the quantity and quality of freshwater in coastal aquifers. Increasing variability in rainfall events and increasing temperatures will likely alter the distribution of ecological life zones and exacerbate existing problems in water management, planning, and infrastructure capacity.







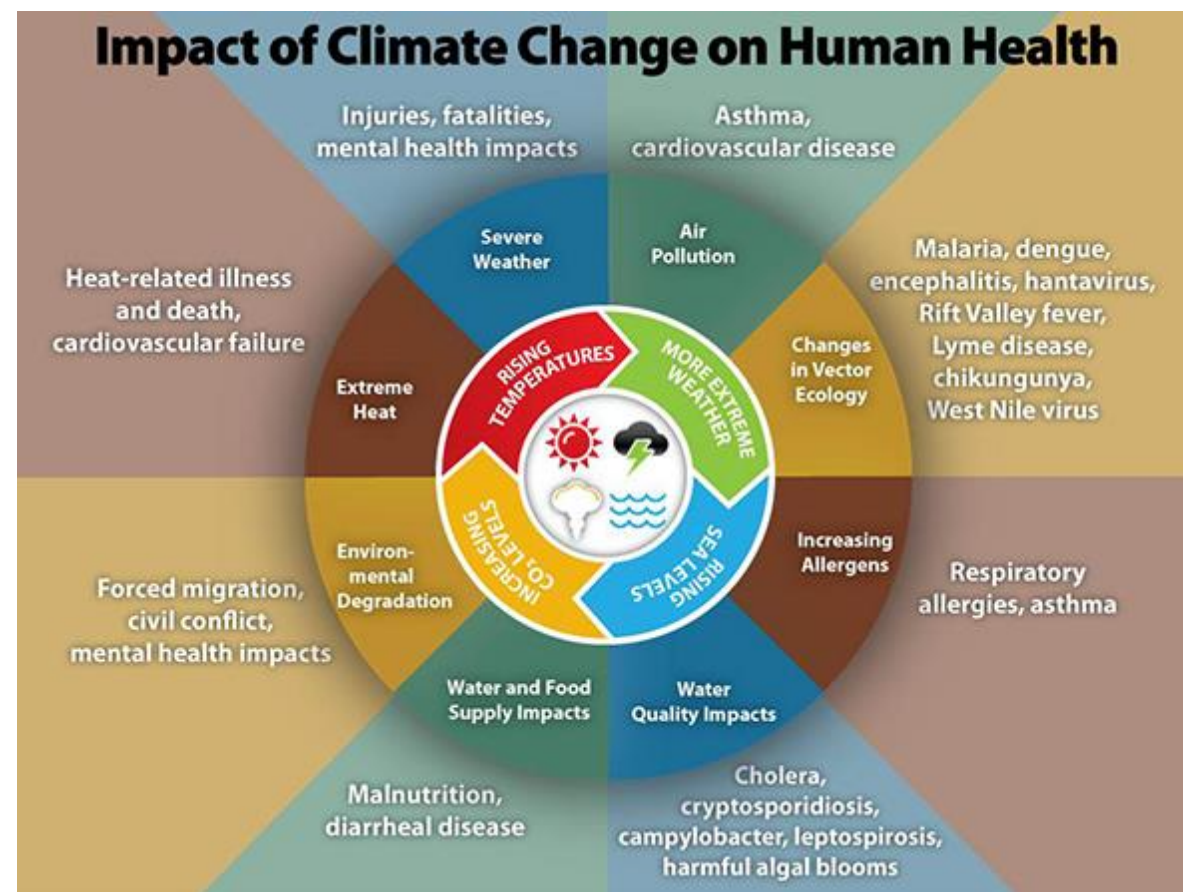
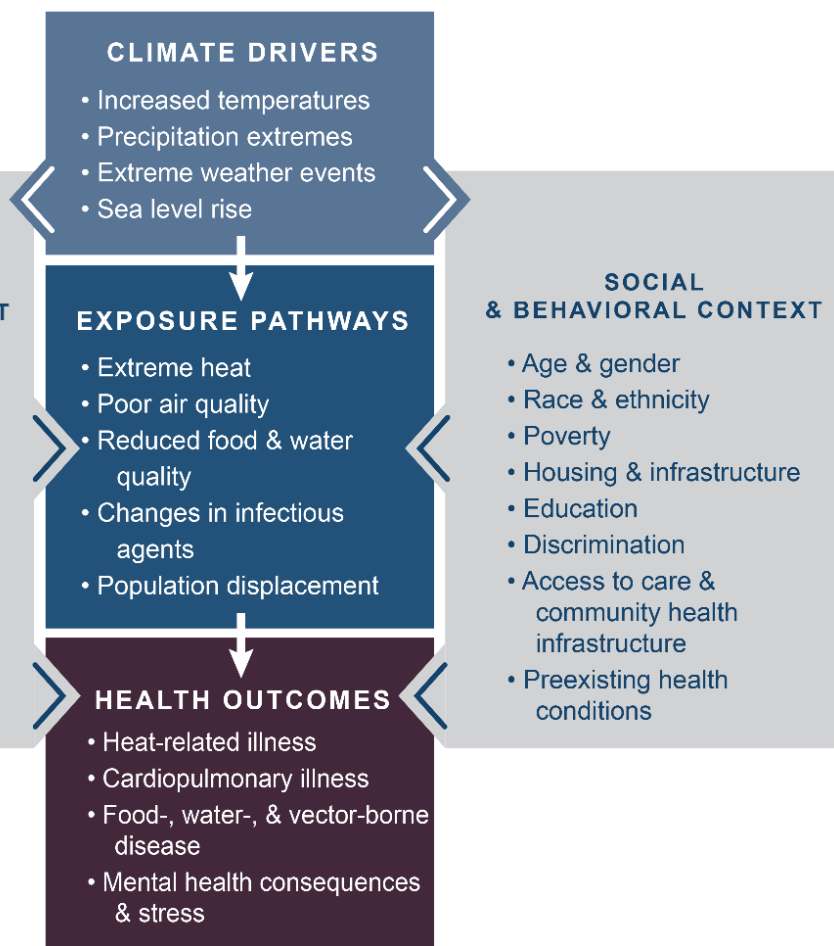
# Sequía(2014/2016)

- Embalse Cerrillos 8 de julio del 2014. Fotos tomadas por Gaspar Pons Cintrón, Oficial de Manejo del Embalse Cerrillos. Suministradas por: División de Monitoreo del Plan de Aguas y del Negociado de Costas, Reservas y Refugios del Departamento de Recursos Naturales.
- Embalse la Plata 2 de julio del 2014 y Embalse Carraízo 1 de agosto del 2014.
- Fotos tomadas y suministradas por: División de Monitoreo del Plan de Aguas y del Negociado de Costas, Reservas y Refugios del Departamento de Recursos Naturales.



# Estilos de Vida que exacerban nuestra capacidad de respuesta (exposición) (estresores secundarios)

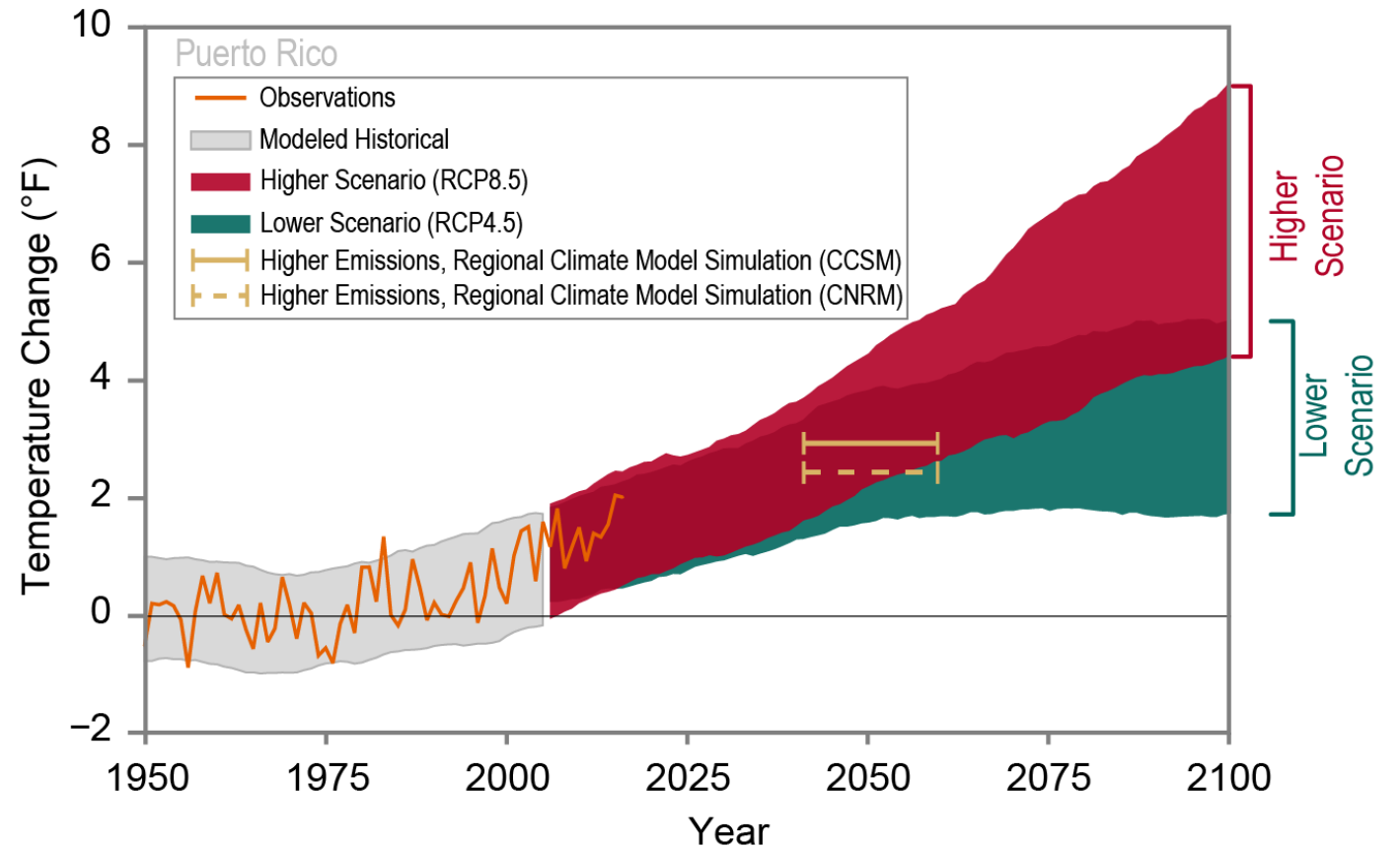
## Climate Change and Health





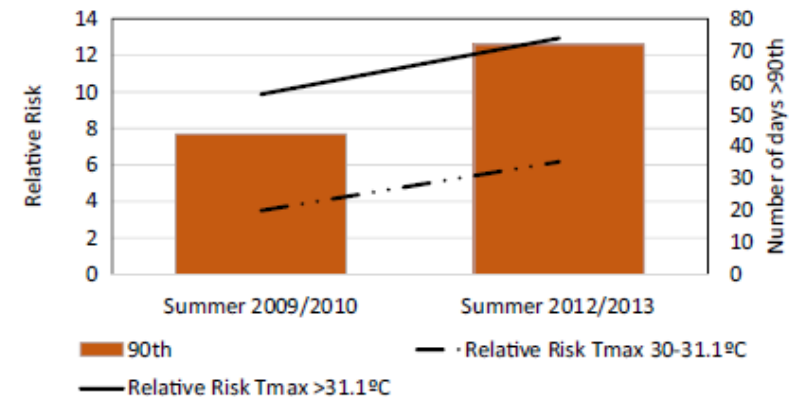
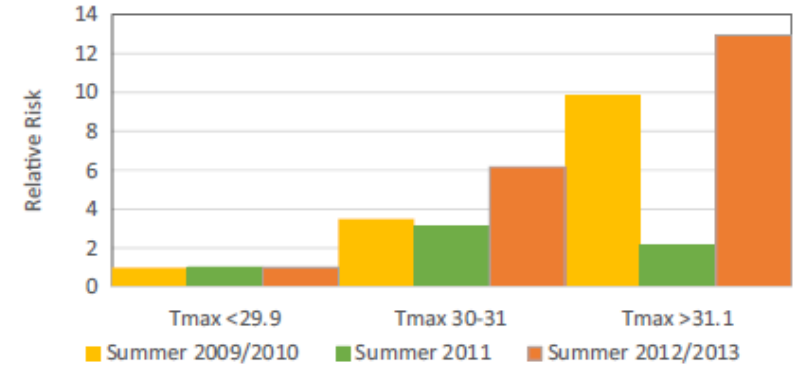
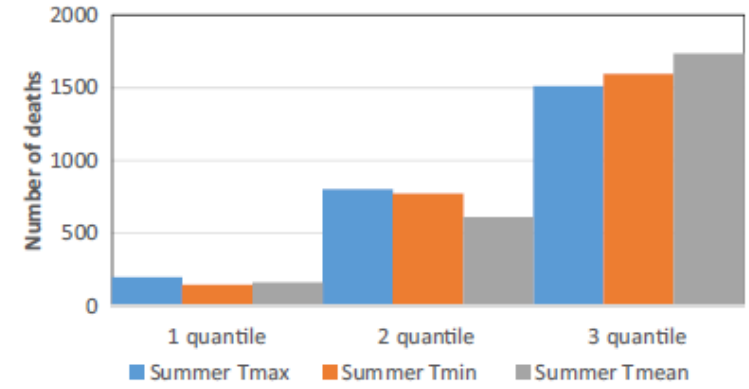
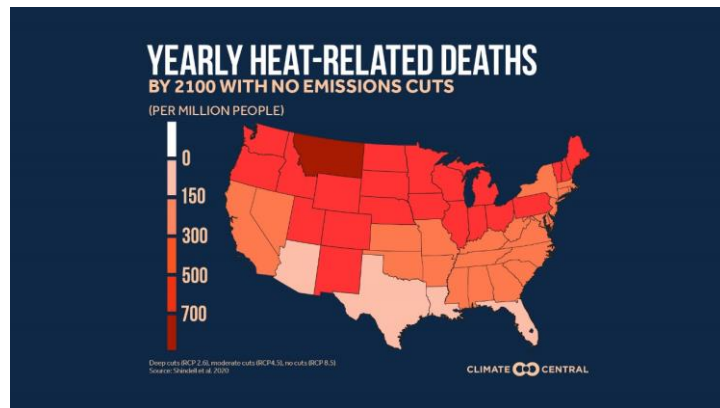
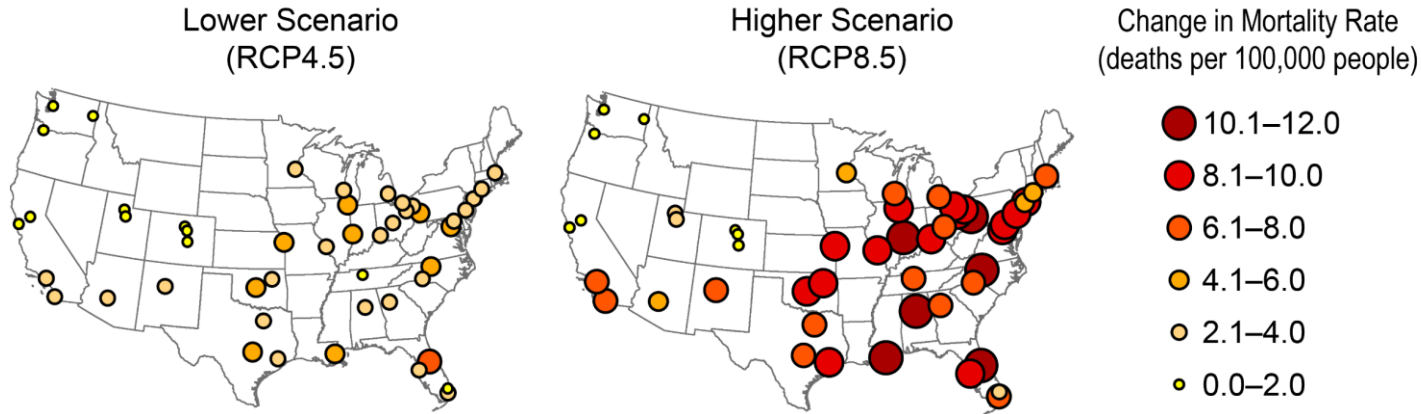
<https://nca2018.globalchange.gov/chapter/20/>

- Key Message 4: Natural and social systems adapt to the temperatures under which they evolve and operate. Changes to average and extreme temperatures have direct and indirect effects on organisms and strong interactions with hydrological cycles, resulting in a variety of impacts. Continued increases in average temperatures will likely lead to decreases in agricultural productivity, changes in habitats and wildlife distributions, and risks to human health, especially in vulnerable populations. As maximum and minimum temperatures increase, there are likely to be fewer cool nights and more frequent hot days, which will affect the quality of life in the U.S. Caribbean.



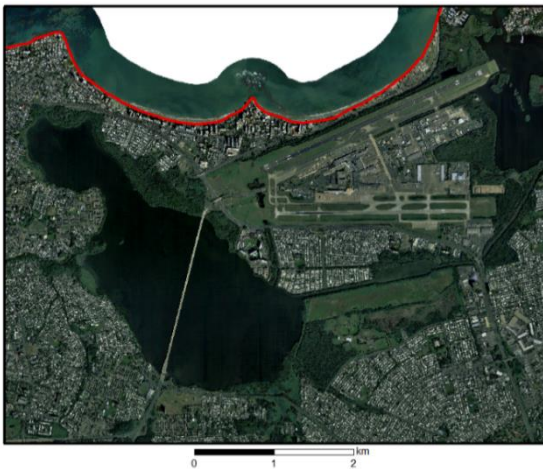
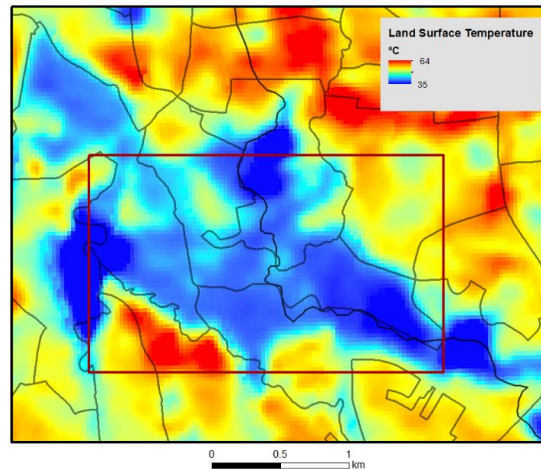
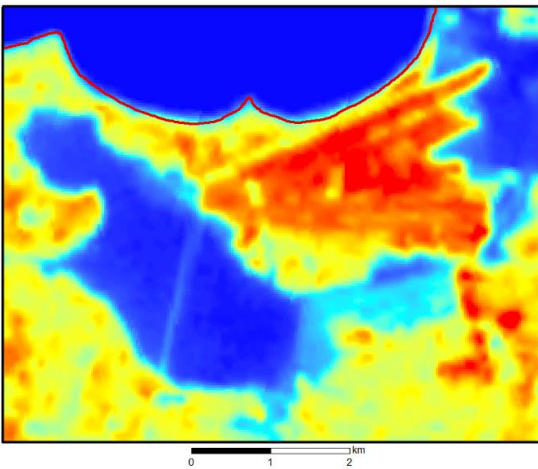
# Climate change, heat, and mortality in the tropical urban area of San Juan, Puerto Rico

Pablo A. Méndez-Lázaro<sup>1</sup> · Cynthia M. Pérez-Cardona<sup>2</sup> · Ernesto Rodríguez<sup>3</sup> · Odalys Martínez<sup>3</sup> · Mariela Taboas<sup>1</sup> · Arelis Bocanegra<sup>1</sup> · Rafael Méndez-Tejeda<sup>4</sup>

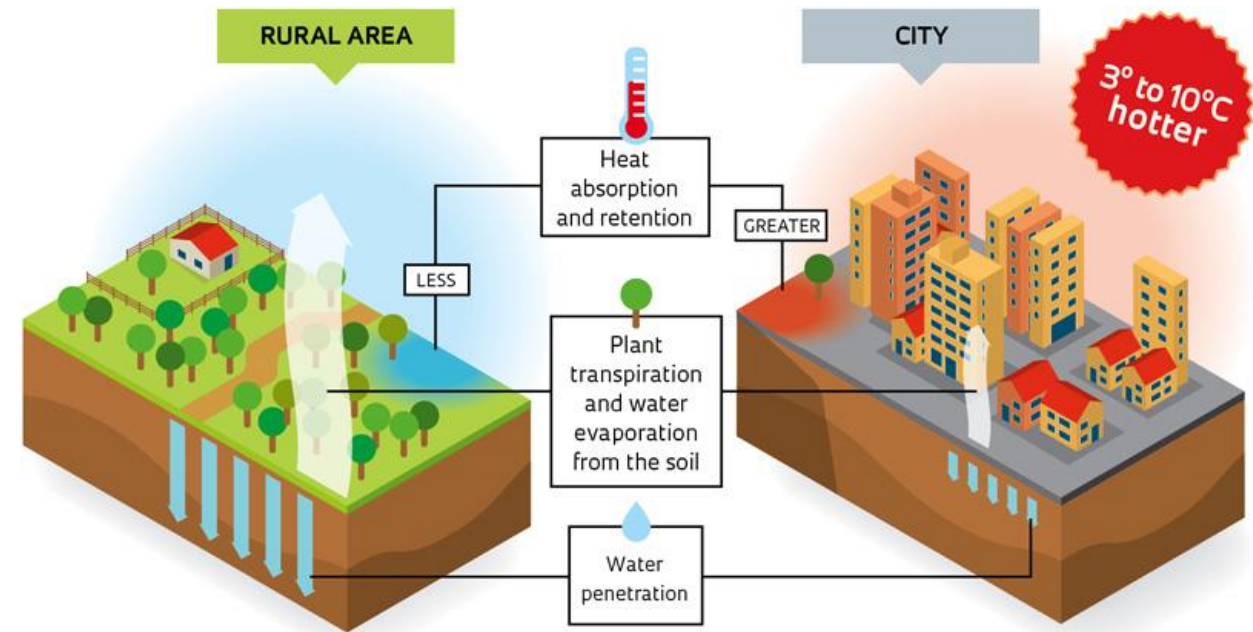


## A heat vulnerability index to improve urban public health management in San Juan, Puerto Rico

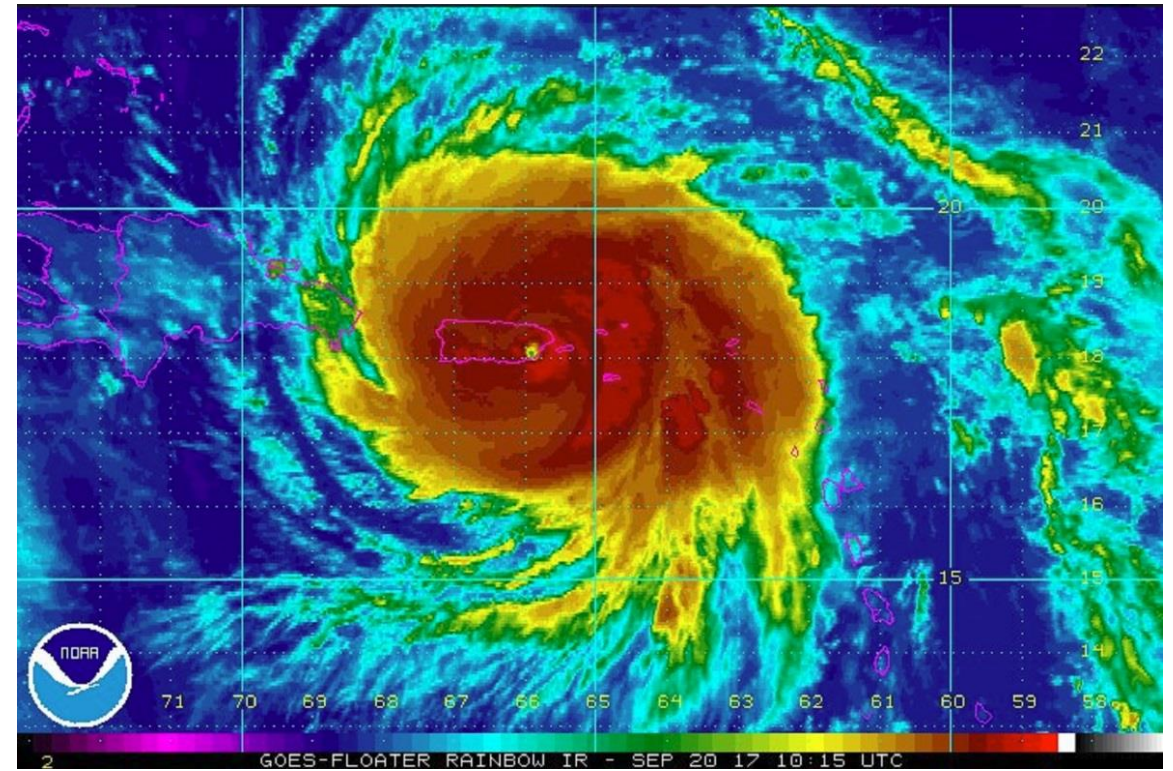
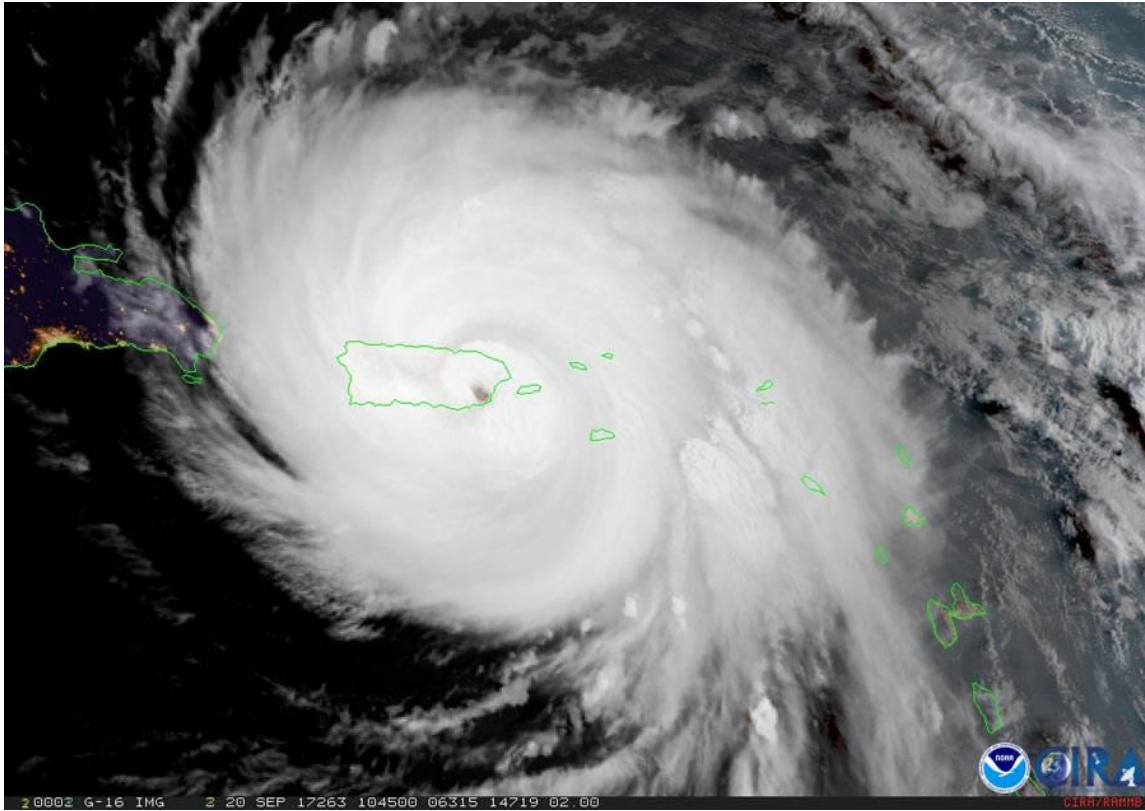
Pablo Méndez-Lázaro<sup>1</sup> · Frank E. Muller-Karger<sup>2</sup> · Daniel Otis<sup>2</sup> ·  
Matthew J. McCarthy<sup>2</sup> · Ernesto Rodríguez<sup>3</sup>



## Why the urban heat island effect occurs







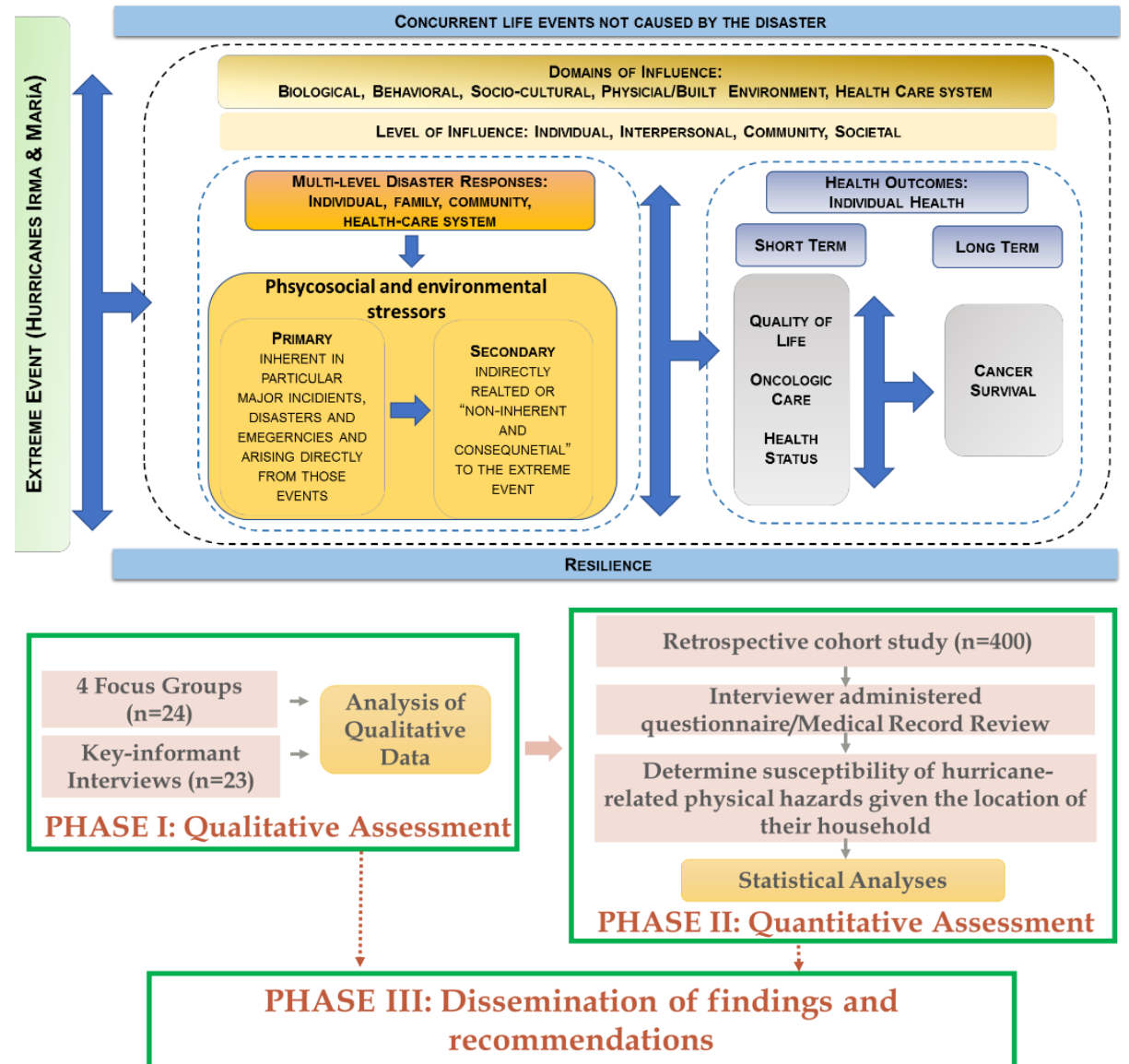
# Huracán María 2017

- Wind – Rainfall – Storm Surge – Flooding – Landslides –

# Impact of Hurricane-Related Stressors and Responses on Oncology Care and Health Outcomes of Women with Gynecologic Cancers from Puerto Rico and US Virgin Islands

NCI Grant #R21CA239457

FIGURE 1. CONCEPTUAL FRAMEWORK: IMPACT OF STRESSORS AND MULTI-LEVEL RESPONSES ON HEALTH OUTCOMES GYN CANCER PATIENTS



<https://www.cdc.gov/features/diabetesheattravel/index.html>

## CDC Features

CDC > CDC Features > Diseases & Conditions



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## Managing Diabetes in the Heat

How to keep your cool during the hottest time of year.

Did you know that people who have diabetes—both type 1 and type 2—feel the heat more than people who don't have diabetes? Some reasons why:

- Certain diabetes [complications](#), such as damage to blood vessels and nerves, can affect your sweat glands so your **body can't cool as effectively**. That can lead to [heat exhaustion and heat stroke](#), which is a medical emergency.
- People with diabetes **get dehydrated** (lose too much water from their bodies) more quickly. Not drinking enough liquids can raise blood sugar, and high blood sugar can make you urinate more, causing dehydration. Some commonly used medicines like diuretics ("water pills" to treat high blood pressure) can dehydrate you, too.
- [High temperatures](#) can change **how your body uses insulin**. You may need to test your blood sugar more often and adjust your insulin dose and what you eat and drink.



### It's the Heat *and* the Humidity

Even when it doesn't seem very hot outside, the combination of heat and humidity can be dangerous for people with diabetes.

#### Your Summer Checklist

- Drink plenty of water.

## Bronchoconstriction Triggered by Breathing Hot Humid Air in Patients with Asthma Role of Cholinergic Reflex

Don Hayes, Jr.<sup>1,2,3\*</sup>, Paul B. Collins<sup>4</sup>, Mehdi Khosravi<sup>2</sup>, Rwei-Lung Lin<sup>5</sup>, and Lu-Yuan Lee<sup>5</sup>

<sup>1</sup>Department of Pediatrics, <sup>2</sup>Department of Internal Medicine, <sup>3</sup>Department of Surgery, <sup>4</sup>Pulmonary Function Laboratory, and <sup>5</sup>Department of Physiology, University of Kentucky Medical Center, Lexington, Kentucky

**Rationale:** Hyperventilation of hot humid air induces transient bronchoconstriction in patients with asthma; the underlying mechanism is not known. Recent studies showed that an increase in temperature activates vagal bronchopulmonary C-fiber sensory nerves, which upon activation can elicit reflex bronchoconstriction.

**Objectives:** This study was designed to test the hypothesis that the bronchoconstriction induced by increasing airway temperature in patients with asthma is mediated through cholinergic reflex resulting from activation of these airway sensory nerves.

**Methods:** Specific airway resistance ( $SR_{aw}$ ) and pulmonary function were measured to determine the airway responses to isocapnic hyperventilation of humidified air at hot ( $49^{\circ}\text{C}$ ; HA) and room temperature ( $20\text{--}22^{\circ}\text{C}$ ; RA) for 4 minutes in six patients with mild asthma and six healthy subjects. A double-blind design was used to compare the effects between pretreatments with ipratropium bromide and placebo aerosols on the airway responses to HA challenge in these patients.

**Measurements and Main Results:**  $SR_{aw}$  increased by 112% immedi-

### AT A GLANCE COMMENTARY

#### Scientific Knowledge on the Subject

Recent studies suggest that increasing temperature within the physiological range can sensitize and stimulate C-fiber sensory nerves in the lung that express the thermosensitive transient receptor potential vanilloid type 1 channels (TRPV1). Activation of these sensory nerves is known to trigger various symptoms associated with airway inflammatory diseases, such as cough and bronchoconstriction.

#### What This Study Adds to the Field

This study suggests that hyperventilation of hot humid air evoked coughs and bronchoconstriction in patients with mild asthma but not in healthy subjects. The airway con-



<https://phys.org/news/2018-11-storm-lower-cost-air-quality-pollutants.html#jCp>

Home / Earth / Environment



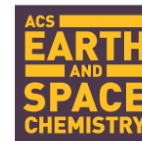
NOVEMBER 16, 2018

## After the storm: Lower-cost air quality monitors measured pollutants in Puerto Rico after Hurricane Maria

by Carnegie Mellon University Mechanical Engineering



Hurricane Maria, September 20, 2017. Credit: NASA Earth Observatory



Article

Cite This: *ACS Earth Space Chem.* 2018, 2, 1179–1186

<http://pubs.acs.org/journal/aescsq>

### Air Quality in Puerto Rico in the Aftermath of Hurricane Maria: A Case Study on the Use of Lower Cost Air Quality Monitors

R. Subramanian,<sup>\*,†,Ⓞ</sup> Aja Ellis,<sup>†,∞</sup> Elvis Torres-Delgado,<sup>‡</sup> Rebecca Tanzer,<sup>†</sup> Carl Malings,<sup>†</sup> Felipe Rivera,<sup>§</sup> Maité Morales,<sup>‡</sup> Darrel Baumgardner,<sup>||</sup> Albert Presto,<sup>†,Ⓞ</sup> and Olga L. Mayol-Bracero<sup>‡</sup>

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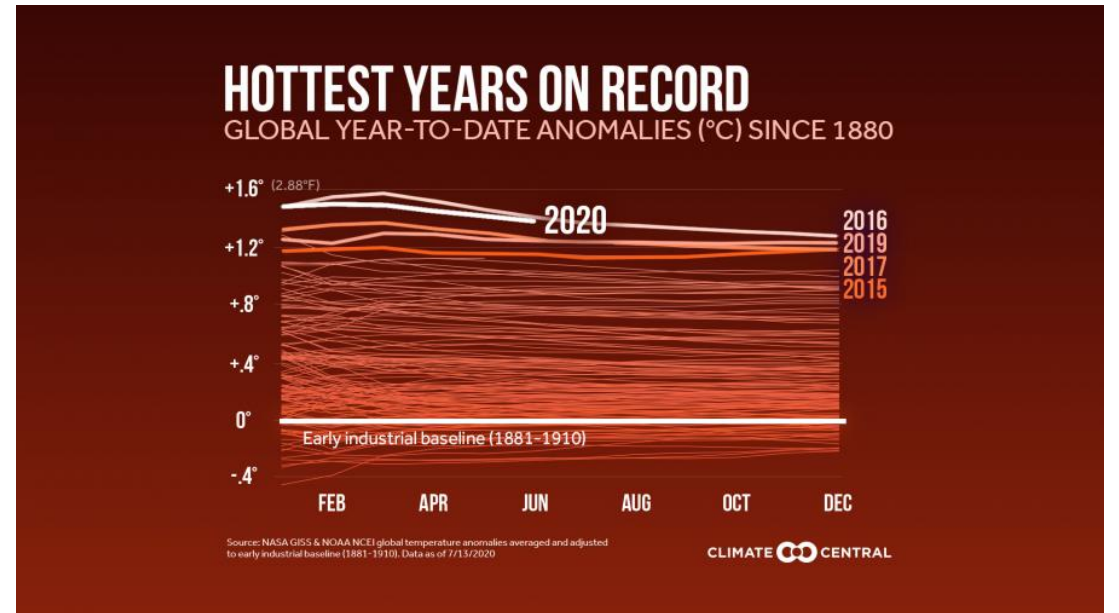
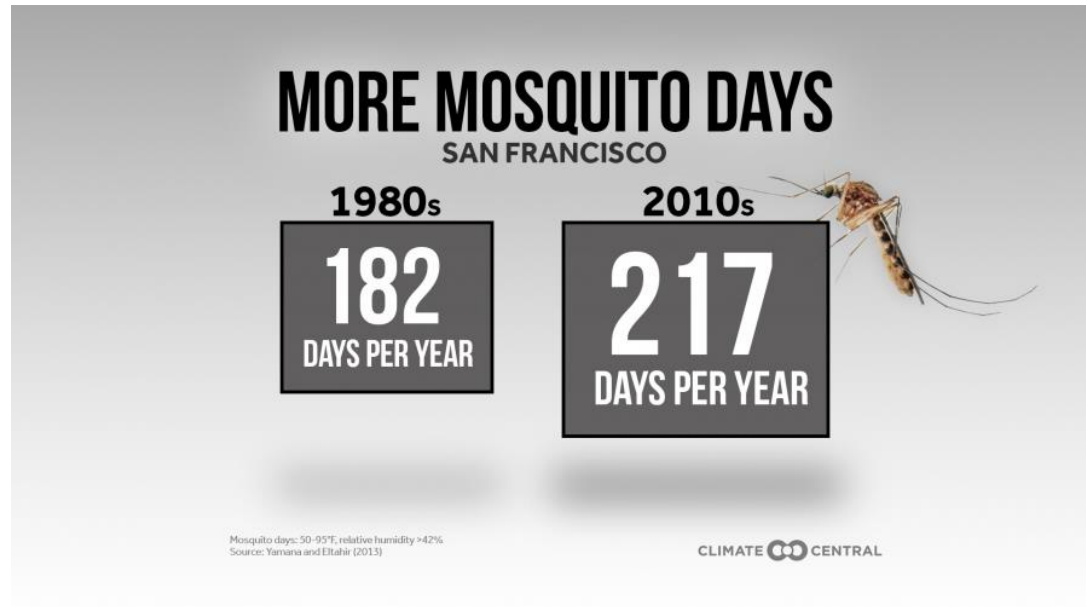
<sup>||</sup>Droplet Measurement Technologies, Longmont, Colorado 80503, United States

Supporting Information

In the first month of collection, SO<sub>2</sub> concentrations exceeded the EPA's threshold approximately 80 percent of the time.

SO<sub>2</sub> concentrations exceeded 200 ppb, well over the EPA's threshold of 75 ppb

# US Climate Central





## Pablo A. Méndez Lázaro, Ph.D.

**Principal Investigator:** NASA--Early Warning of Synoptic Air Quality Events to Improve Health and Well Being in the Greater Caribbean Region (80NSSC19K0194)

**Co-Principal Investigator:** NIH--Impact of Hurricane-Related Stressors and Responses on Oncology Care and Health Outcomes of Women with Gynecologic Cancers from Puerto Rico and US Virgin Islands

**City Co-lead:** NSF--Urban Resilience to Extreme Weather Events-SRN, [www.urexsrn.net](http://www.urexsrn.net)

Environmental Health Department  
Graduate School of Public Health