



Fostering Participation in Air Quality Studies Using Small Sensors

Yitong Jiang - University of Toledo

Kevin Czajkowski - University of Toledo

Margaret Pippin - NASA Langley Research Center

Juthi Mitra - University of Toledo



Sources of Air Pollution



Mobile Sources
(vehicles)



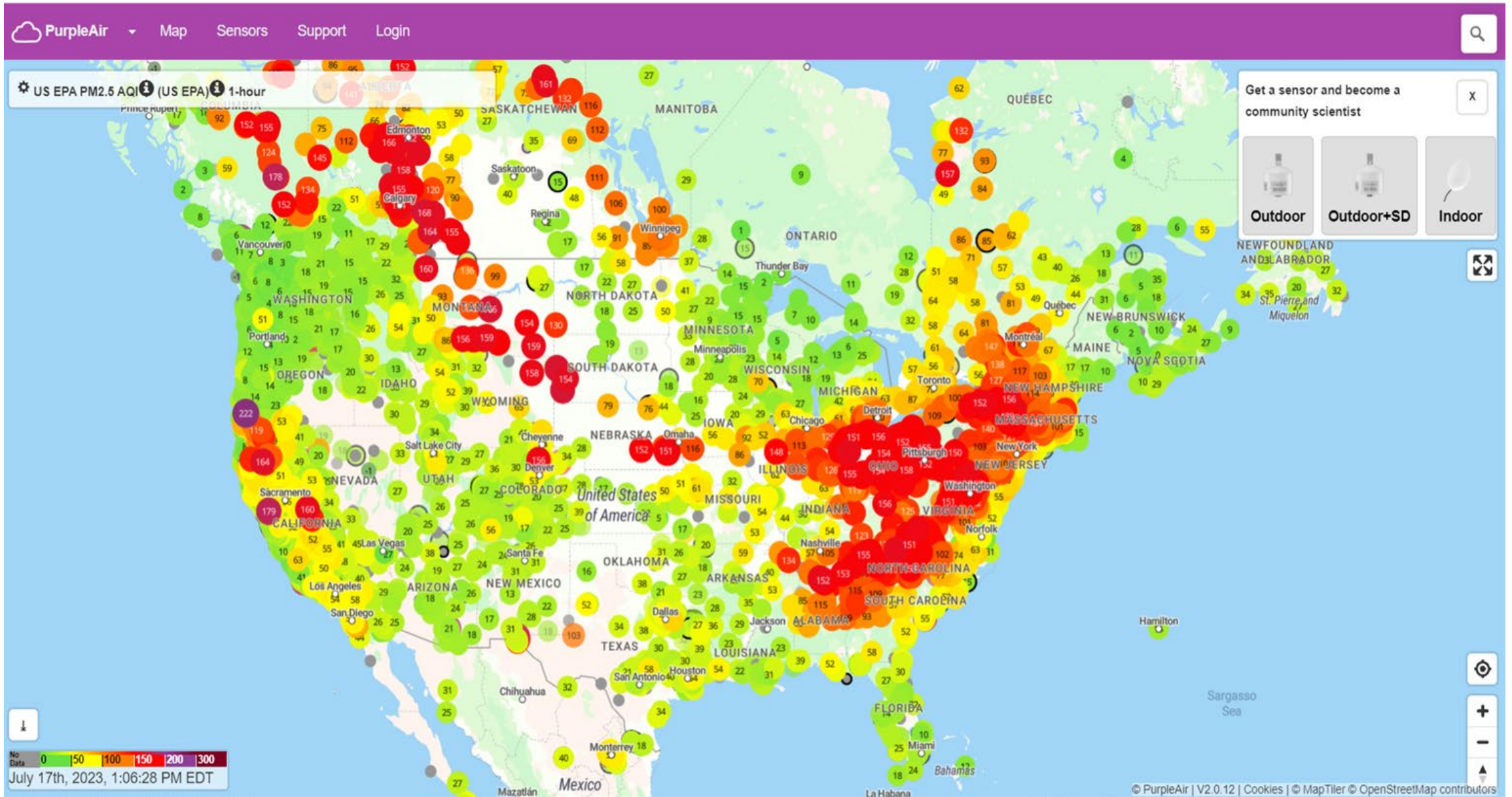
Stationary Sources
(power plants, factories)

Area Sources
(drycleaners, gas stations)



Natural Sources
(forest fires, volcanoes)

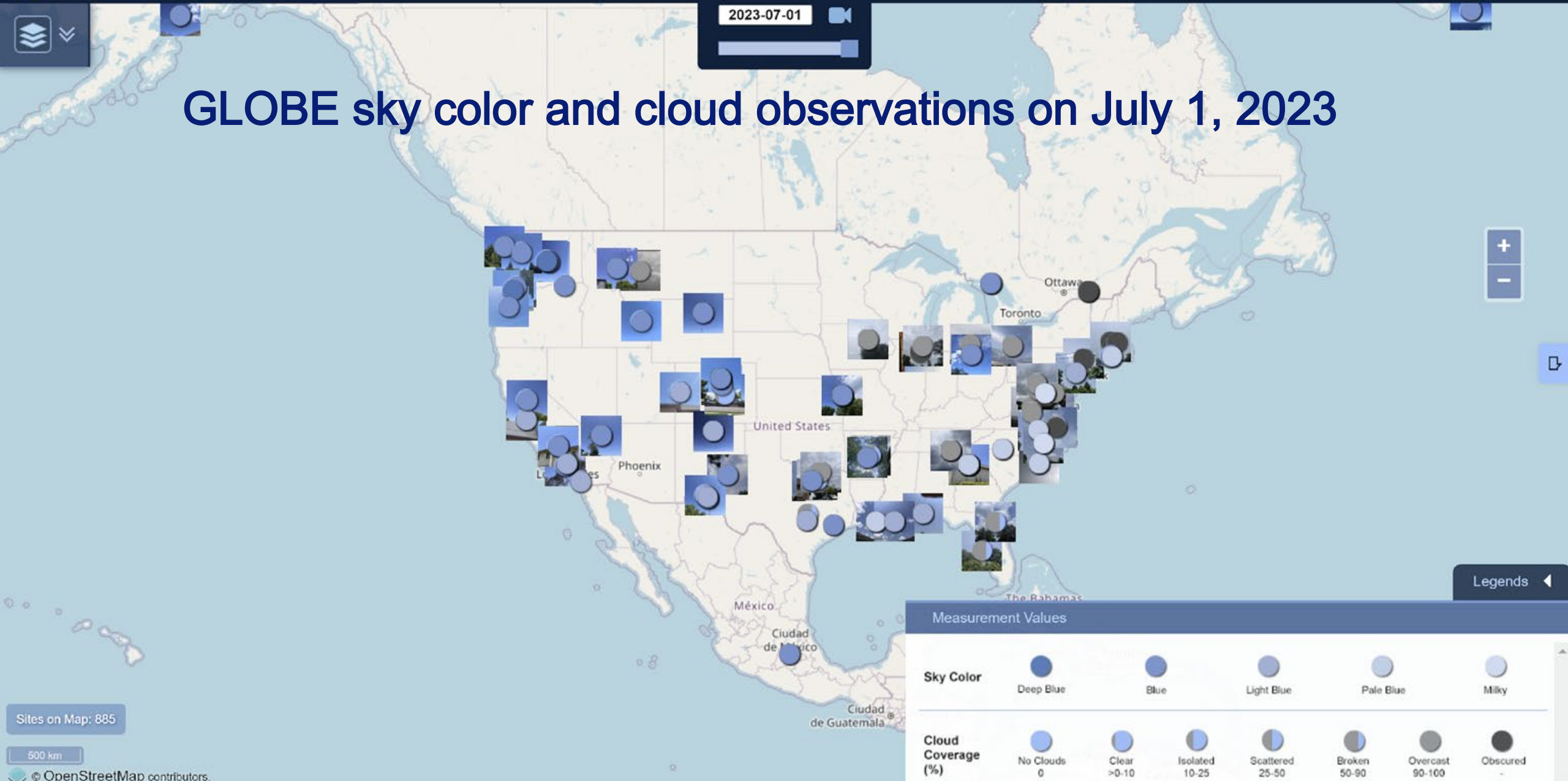
Concentration of PM 2.5 on July 1, 2023





2023-07-01

GLOBE sky color and cloud observations on July 1, 2023



Sites on Map: 885

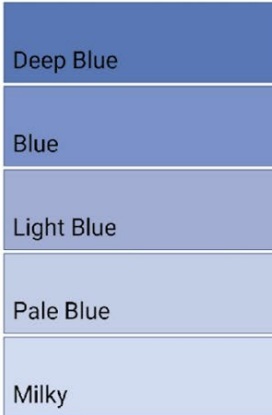
500 km

ACTIVITY: THE COLOR OF YOUR SKY

Sky Color

- Aerosols can impact **sky color**.
- This is seen by looking **up** while facing away from the Sun.

What color is the deepest shade of blue in the sky?



Visibility

- Aerosols can impact **visibility**.
- This is seen by looking **forward** at the horizon away from the Sun.

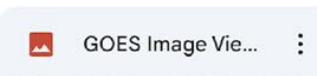
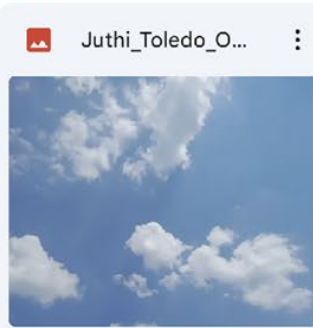
What is the sky visibility across the horizon?



1. take a photo of your sky

2. name the photo: first name last name location

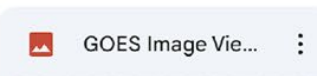
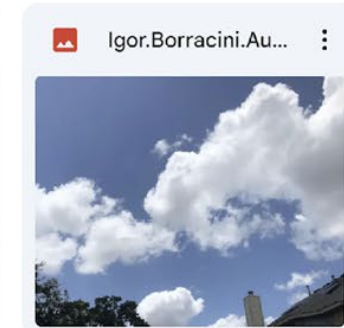
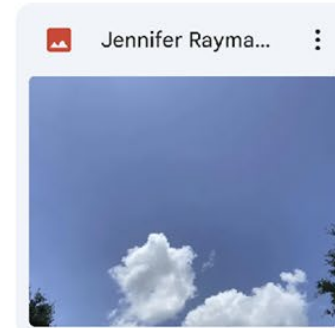
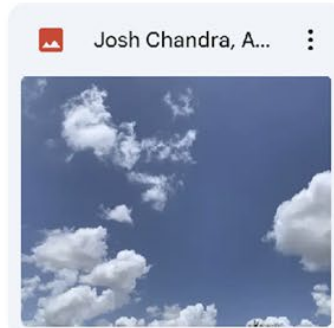
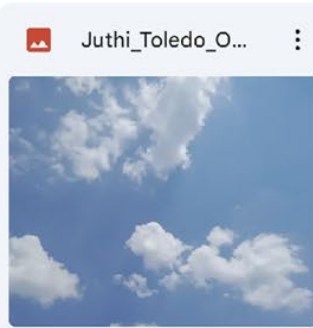
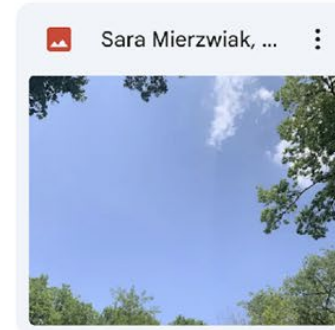
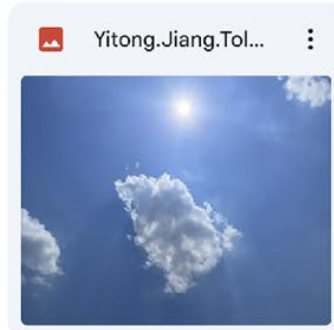
3. post it in google shared folder



> Colors of your sky ▾



↓ Name ▾



Students' observation on July 4, 2024

4th of July Observations

To celebrate 4th of July, I went to downtown Austin with some friends to see fireworks and an outdoor concert from the Austin Symphony Orchestra. By my rough estimate, the fireworks lasted for about 10 minutes (if not more), and the effects are clear from the readings of air quality sensors around the city (observed AFTER the fireworks).



First observation

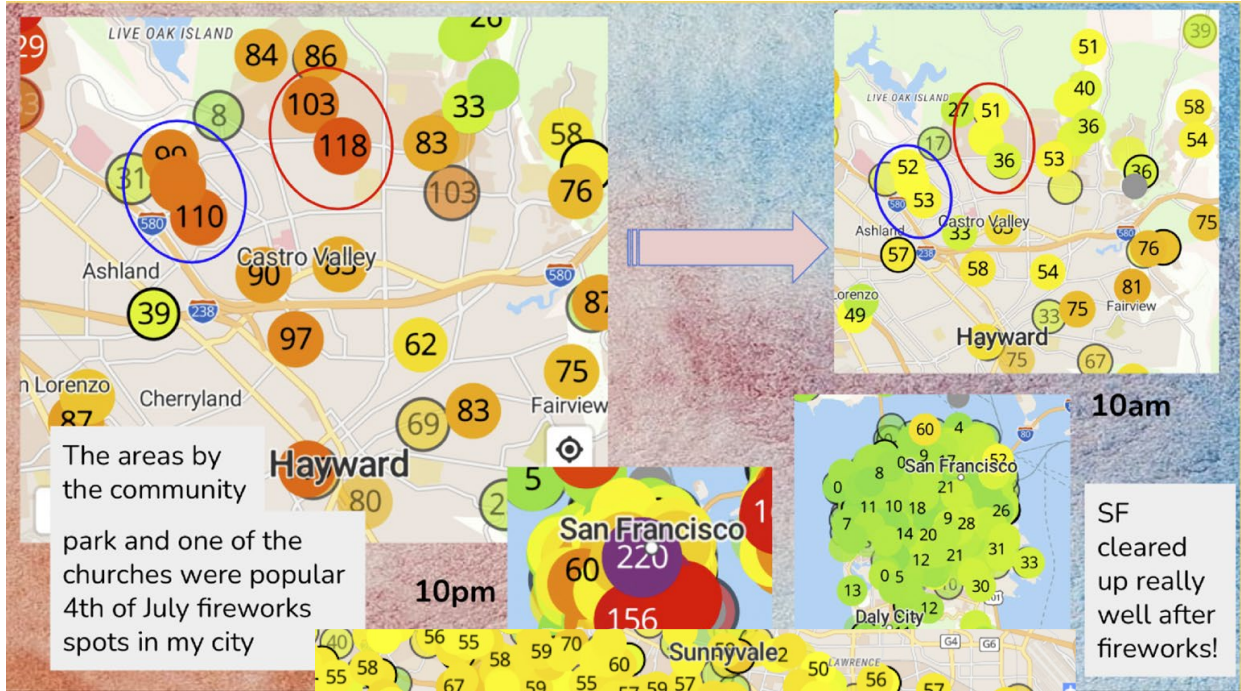
There is a noticeable jump in air pollution near the center of activity in downtown Austin compared to the surrounding areas. From my observations that air pollution gradually declined after fireworks shows ended, it can be inferred they were a substantial influence on air quality.



Second observation, same location ~40 minutes later

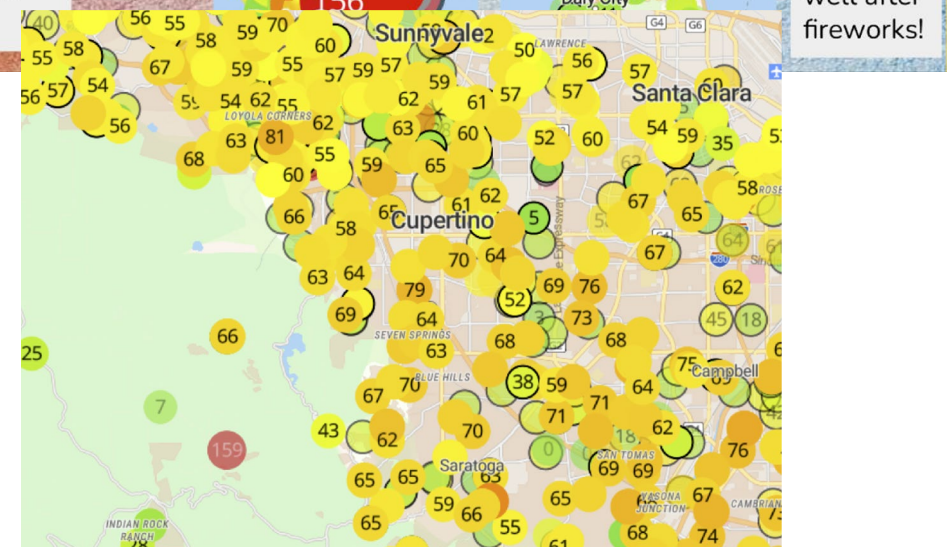
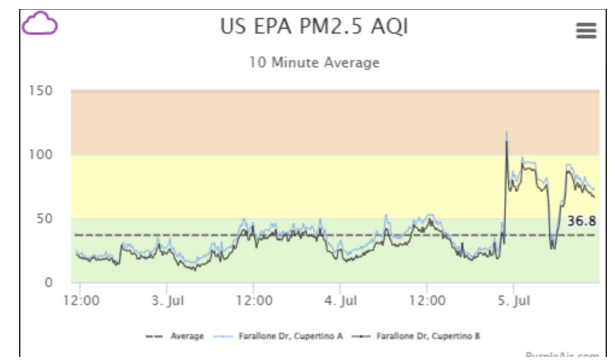


It is true that urban areas create more pollution due to industry and transportation, but being home to many popular cultural events or celebrations is also a contributing factor. This applies not just to Austin, but to cities everywhere. Professionally organized fireworks shows can launch upwards of hundreds of fireworks over their duration compared to individual citizens, possibly explaining the proportion of sensors detecting poor air quality in densely populated cities versus more open areas dedicated to farmland, suburbs, highways, etc.



The areas by the community park and one of the churches were popular 4th of July fireworks spots in my city

10am
SF cleared up really well after fireworks!



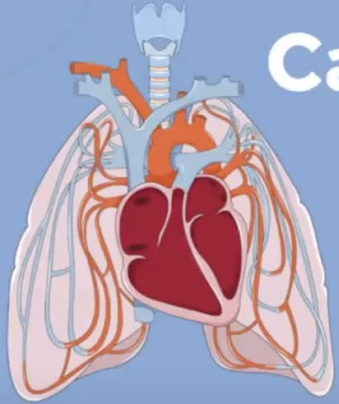


Unraveling the Skies: Analyzing Factors Affecting Flight Cancellation and Delay Rates

Daniel Zhang | Inglemoor High School | Kenmore, WA



NASA SEES Air Quality group research in 2023




California Breath

Analyzing Correlations Between
PM 2.5 Levels and Early
Childhood Asthma via
Examination of Emergency
Department Visits
Hospitalizations from

Nithya Parepally, Centennial High School, Ellicott City, MD
Tanvi Sajja, School for the Talented and Gifted, Columbus, OH

0:01 / 7:17



Determining the Correlation between Economic Factors and Air Quality

ShawnEvan Gutierrez
Advanced Technologies
Academy

A Study of the Las Vegas Valley

Las Vegas Nevada

CSR **NASA** **SEES**

Where the Waves Meet the Sky

Evaluating Disparities in Air Quality Between Coastal and Inland Regions and the Aftermath of Canada's Wildfire Outbreak

By: Kendal Cook (Lake Ridge High School, Mansfield TX) & Shreyaa Sanjay (WWP High School North, Plainsboro NJ)

Image credit: Penn State

0:03 / 6:54

SEES **NASA** **CSR**

Variations in Air Quality within New York City

By Morgan Lin (Saint Vincent Ferrer High School, NY) & Tobi Sakin (Roosevelt High School San Antonio, TX)

A look into the differences in air quality within the urban and suburban areas of the New York Metropolitan Area!

0:01 / 6:10

NASA **SEES** **CSR**

Ember: A Geospatial Approach to Wildfire Risk Modeling using Machine Learning and Remote Sensing Data

Hudson Kim - Westview High School, San Diego, CA
Riya Gupta - Northwood High School, Irvine, CA

Abstract: Since the 1990s, advances in machine learning and remote sensing have dramatically altered humans' understanding of their environment. For the first time in history, it is now possible to make truly global predictions in real time and automate data sifting and analysis with improved accuracy and efficiency. In our research, we developed a machine learning model capable of producing real time wildfire risk assessments from satellite imagery and remote sensing data. We utilized state of the art computer vision architectures and remote sensing data carefully gathered over a 1 year time frame to enable the creation of detailed and accurate wildfire risk maps.

0:04 / 7:13

NASA SEES Air Quality group research in 2023 (cont.)

Continued research for publications

A Geospatial Approach to Wildfire Risk Modeling using Machine Learning and Remote Sensing Data

Riya Gupta, *Northwood High School*, Hudson Kim, *Westview High School*

¹*Abstract*—In recent years, the likelihood of wildfire occurrence has increased in many North American communities as changes in climate have led to longer, more deadly fire seasons. Many Americans, especially those living in Western states, have reported frequent drought and wildfire conditions, leading to an increased need for a modeling program to assess wildfire risk at a low computational cost. The research objective of this paper was to develop a machine learning model capable of producing accurate wildfire risk assessments using five geospatial datasets: Land Fire Mean Return, Annual Precipitation, Sentinel-2 Imagery, Land Cover, and Moisture Deficit & Surplus. To create the model, three separate machine learning architectures were implemented (U-Net, DeepLabV3, and the Pyramid Scene Parsing Network) and then applied to the study area of San Bernardino County, CA for the year of 2020. This study demonstrated a proof of concept for further inquiry into combining artificial intelligence and geospatial datasets to create useful insights.

²*Index Terms*— Optical data, Geophysical data, Deep learning, Natural disasters and hazard

I. INTRODUCTION

SINCE California's first recorded wildfire in 1889, there has been a significant increase in the frequency of wildfires throughout the state. The increasing risk of wildfires has contributed to higher levels of inhalable particulate matter, placing an economic and health strain on local communities [1]. As wildfires continue to threaten California residents, accurate wildfire prediction models are crucial for managing fire response assets and addressing wildfire trends. Moreover,

accurate, and easily available to communities with frequent fire occurrence [3].

II. LITERATURE REVIEW

In recent years, the development of high-resolution satellite imagery from sources such as the Aqua and Terra satellites, has opened the possibility of developing an efficient and accurate wildfire risk modeling framework [4], [5]. Such frameworks support wildfire preparedness, one of the four components of wildfire management, through greater satellite data accessibility to support the development of a predictive model [6]. When taking data from a satellite source and applying it to a geospatial machine learning model, the accuracy of the results depends on the quality of the datasets used to train the model. Scott *et al.* presented an open-source Wildfire Hazard Potential map which provides further research into wildfire risk forecasting based on population density, building coverage, housing unit density, building exposure type, housing unit exposure, housing unit impact, and housing unit risk updated yearly [7]. With its results, this dataset provided promise in being used as a ground truth data layer to help train a model with similar input factors.

Several studies have been conducted using various physics-based parameters and environmental factors to model the growth and spread of fire during a wildfire event. In June 2022, a study conducted in London used inverse modeling based on Latent Assimilation techniques to estimate the parameters of a wildfire, finding that machine learning driven prediction models created a precise reconstruction of test datasets [8]. Additionally, a number of studies have applied deep learning to assess datasets that combine environmental



1 Assessing the impact of wildfire smoke on PM2.5 levels: comparing outdoor and indoor air quality

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5 Rebekah Repp¹ Yitong Jiang² Kevin Czajkowski²

6
7 ¹Northview High School, Sylvania, Ohio

8 ²Department of Geography and Planning, University of Toledo, Toledo, Ohio

9 10 11 Student Authors

12 *Please list all student author names here and indicate whether in middle or high school*

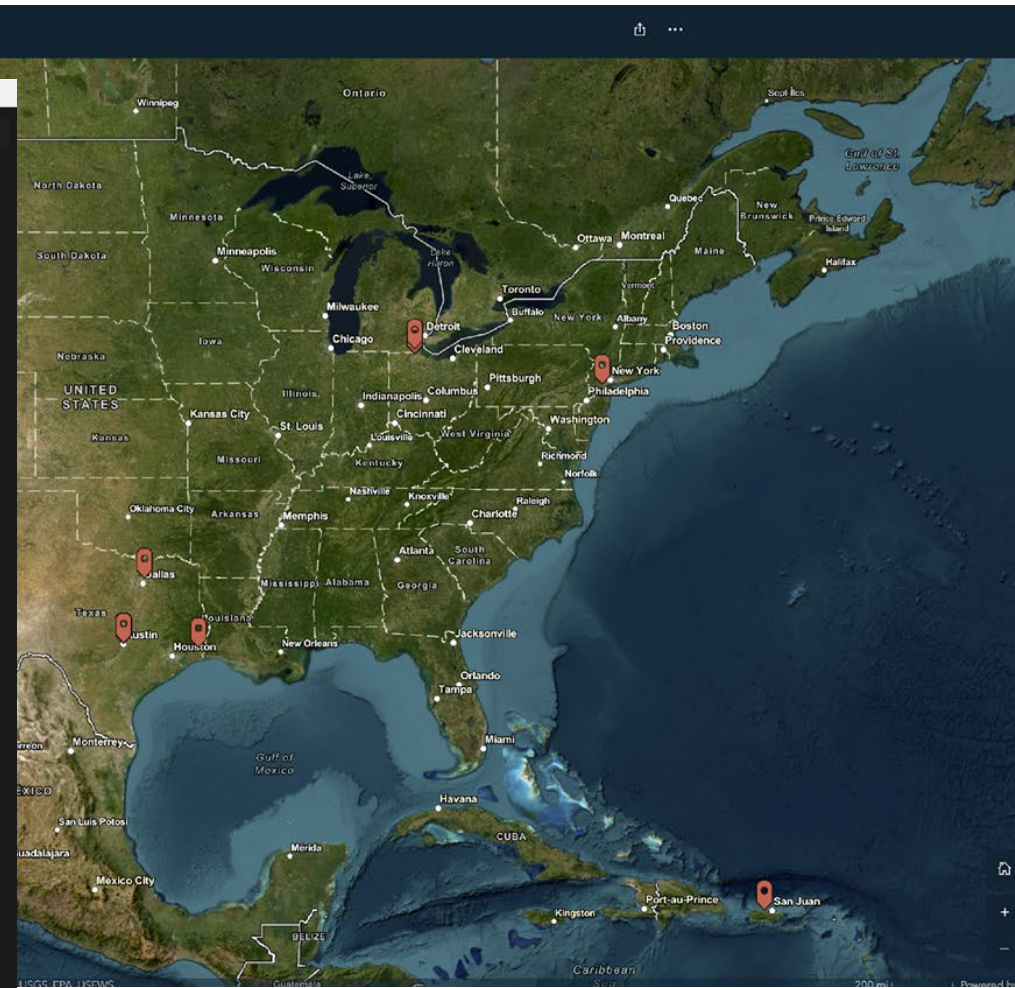
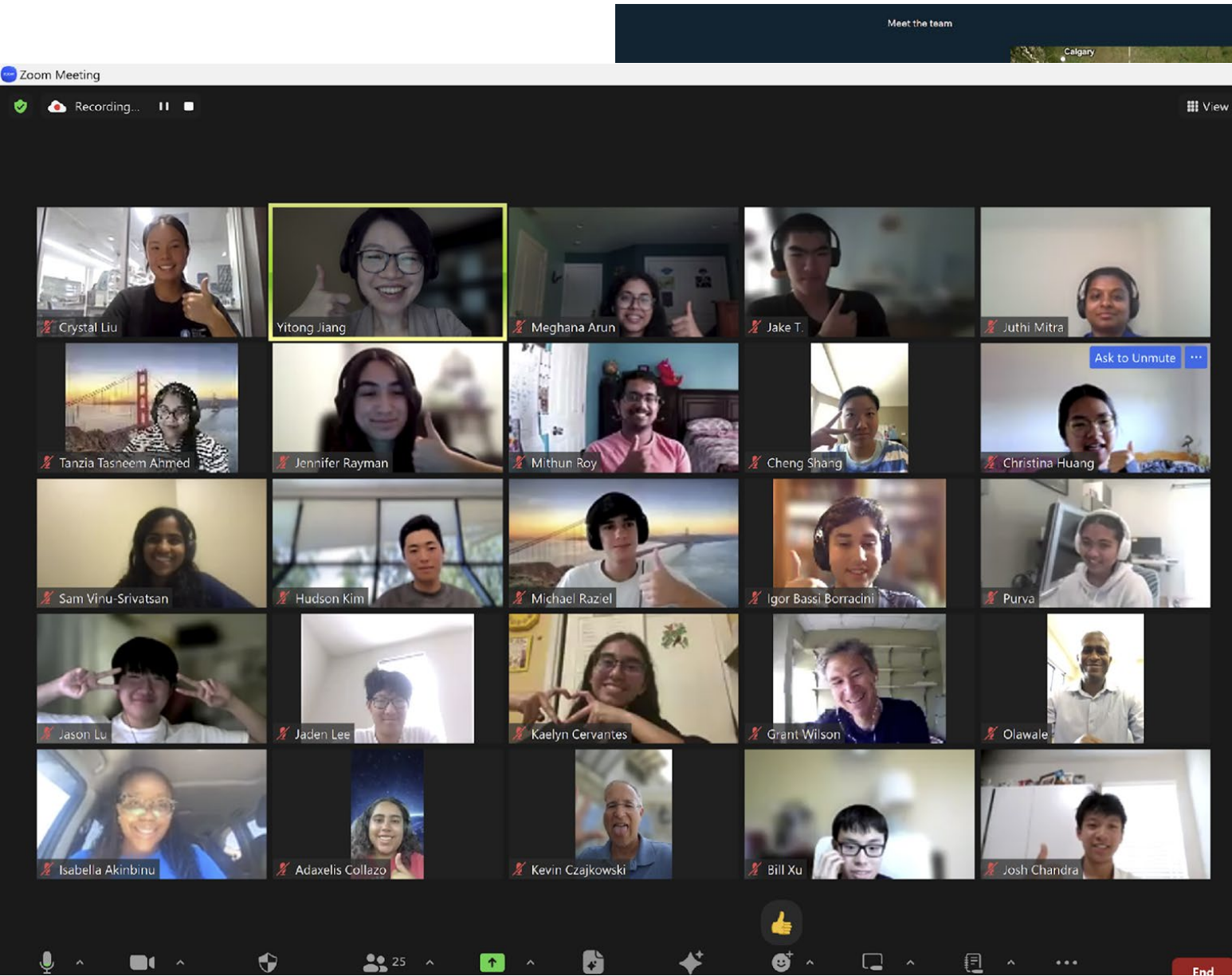
13 Rebekah Repp – High School

14 15 16 SUMMARY

17 The 2023 wildfires in Canada have led to increases in PM2.5 levels throughout the U.S.
18 since early May 2023. The purpose of this study is to evaluate the impact of outdoor
19 wildfire smoke on indoor PM2.5 levels. Outdoor and indoor air quality was monitored
20 through changes in PM2.5 particles from PurpleAir sensors from July 1 to July 14. Data
21 was collected from five sensors in four different locations in Sylvania, Ohio; San
22 Bernardino, California; New York City, New York; and Chicago, Illinois; with two sets of
23 sensors located in Chicago, each with an indoor and outdoor sensor within 50 feet of
24 each other. The I/O ratios (the indoor PM2.5 amount divided by the outdoor PM2.5
25 amount) of the mean indoor and outdoor PM2.5 levels and R-values of July 1-July 14

Accepted by IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing

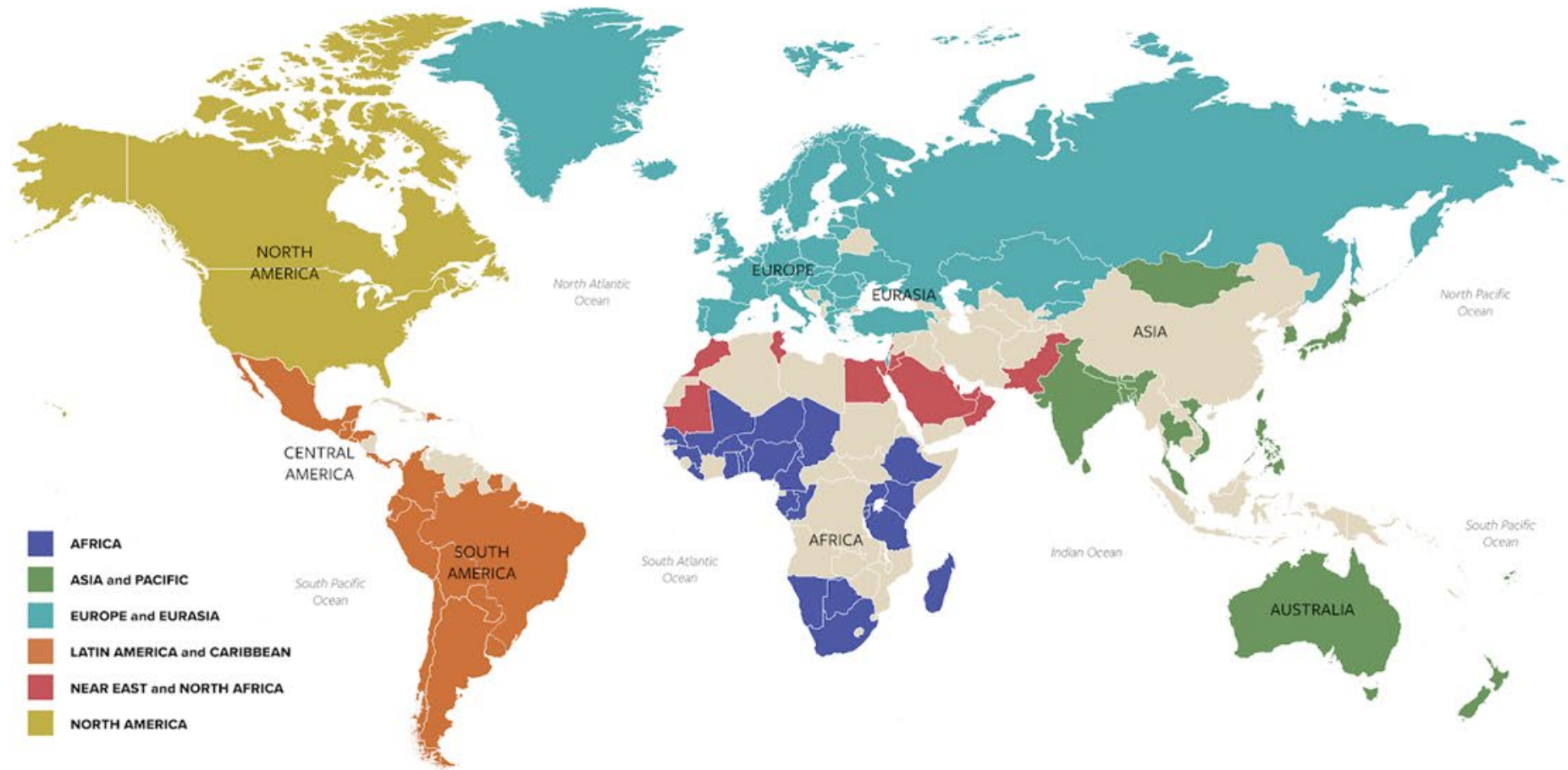
Air Quality Interns 2024





The GLOBE Program

#GLOBEMeeting2024





Thank you!

Yitong.Jiang@utoledo.edu

Kevin.Czajkowski@utoledo.edu

For more information visit www.globe.gov

