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

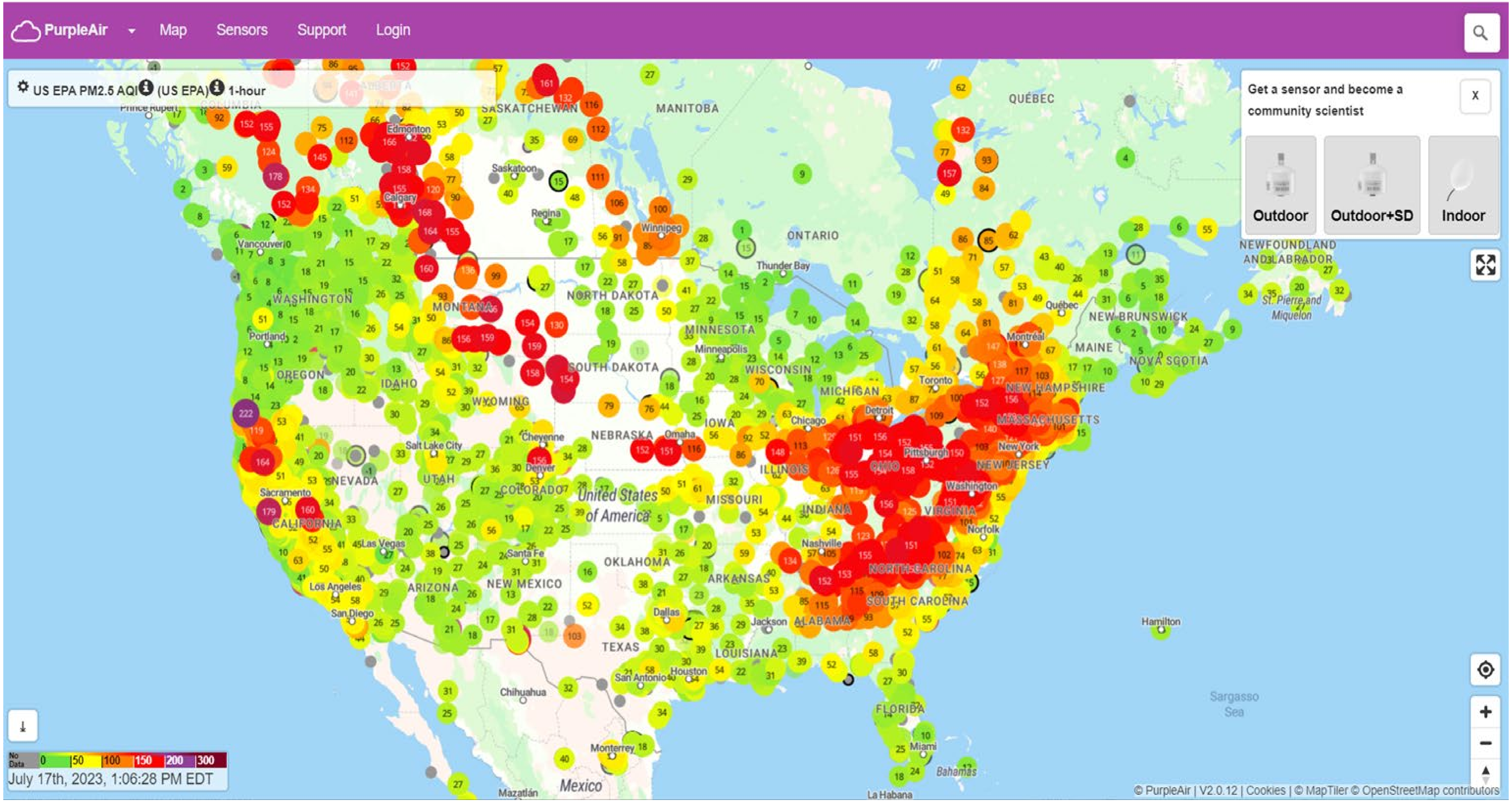
Mobile Sources
(vehicles)

Stationary Sources
(power plants, factories)

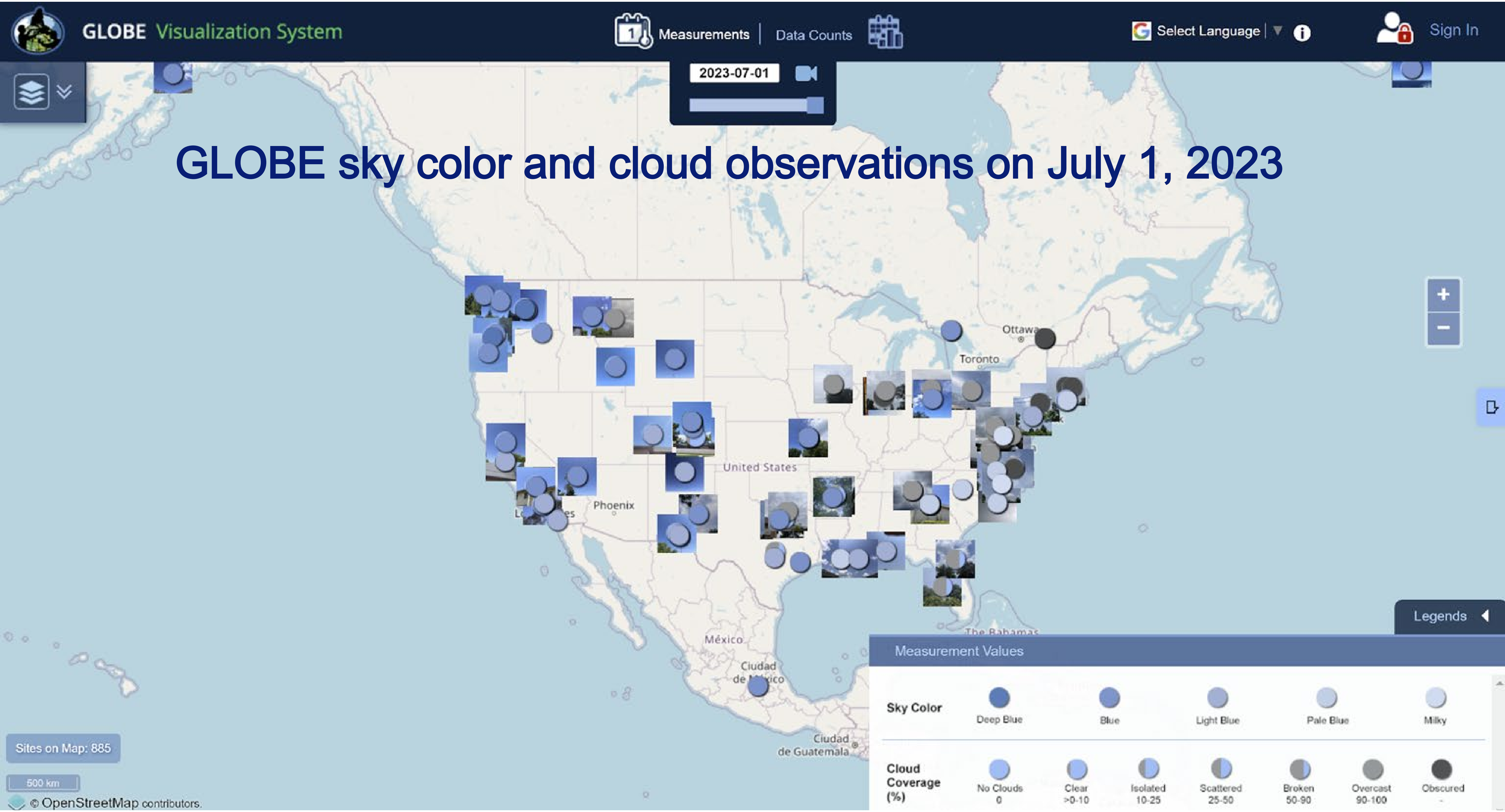
Area Sources
(drycleaners, gas stations)

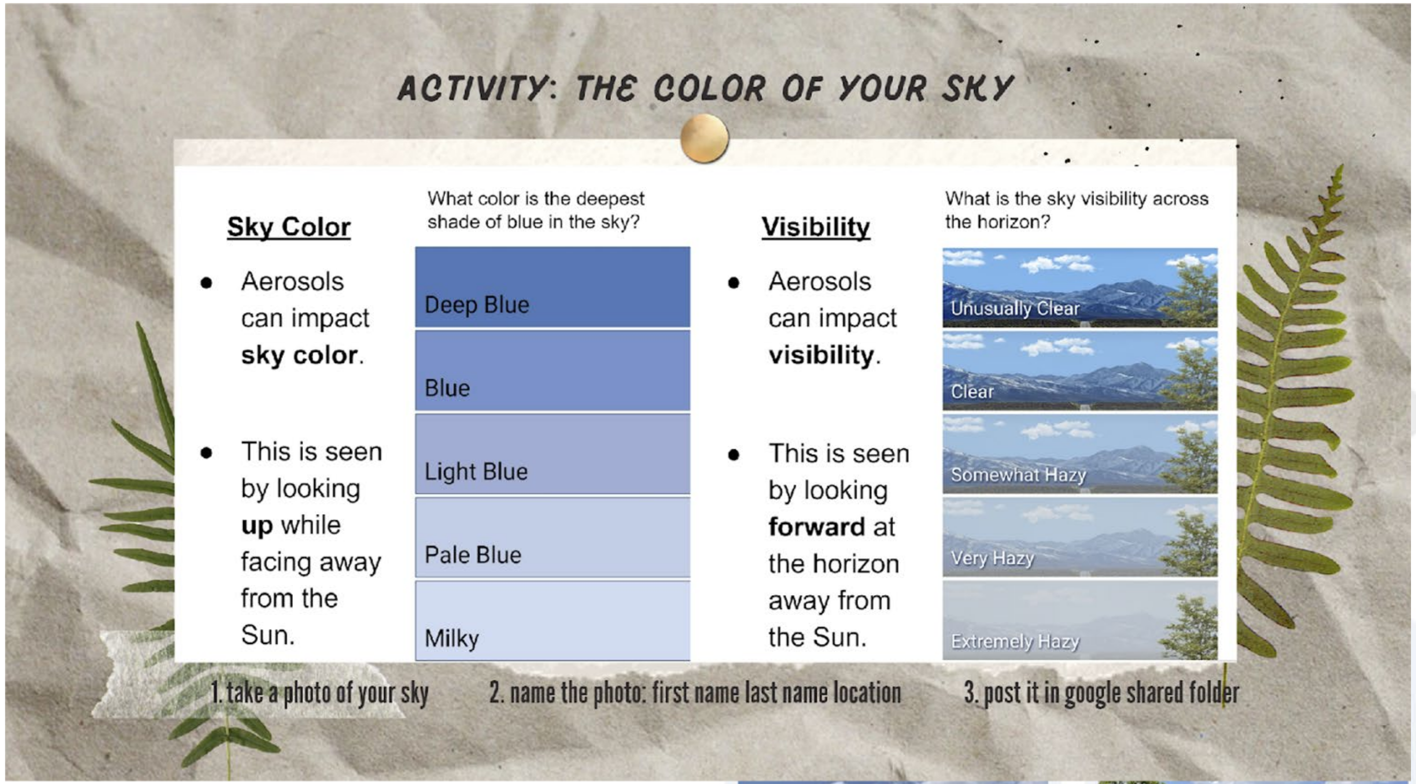
Natural Sources
(forest fires, volcanoes)

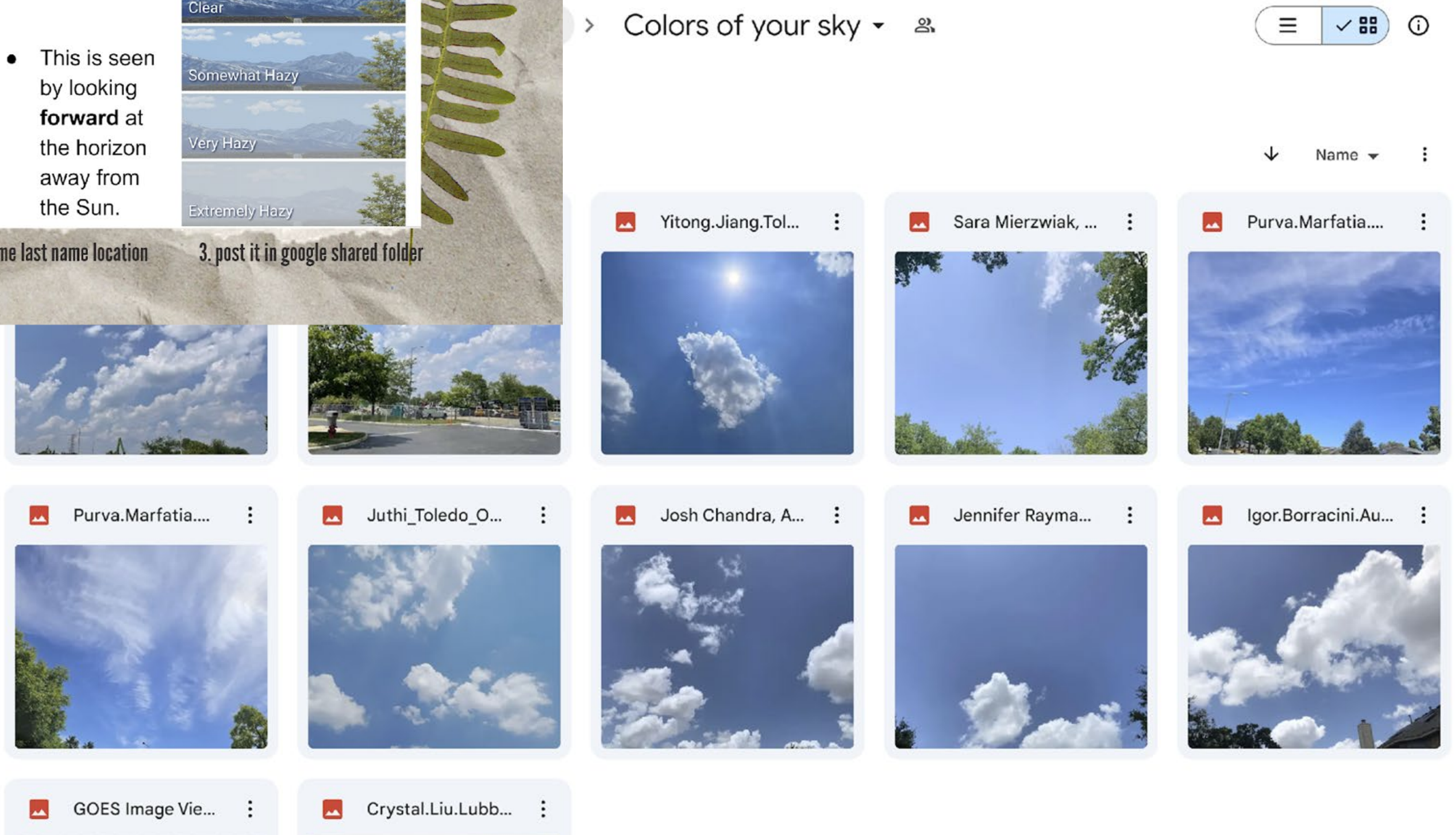
Concentration of PM 2.5 on July 1, 2023



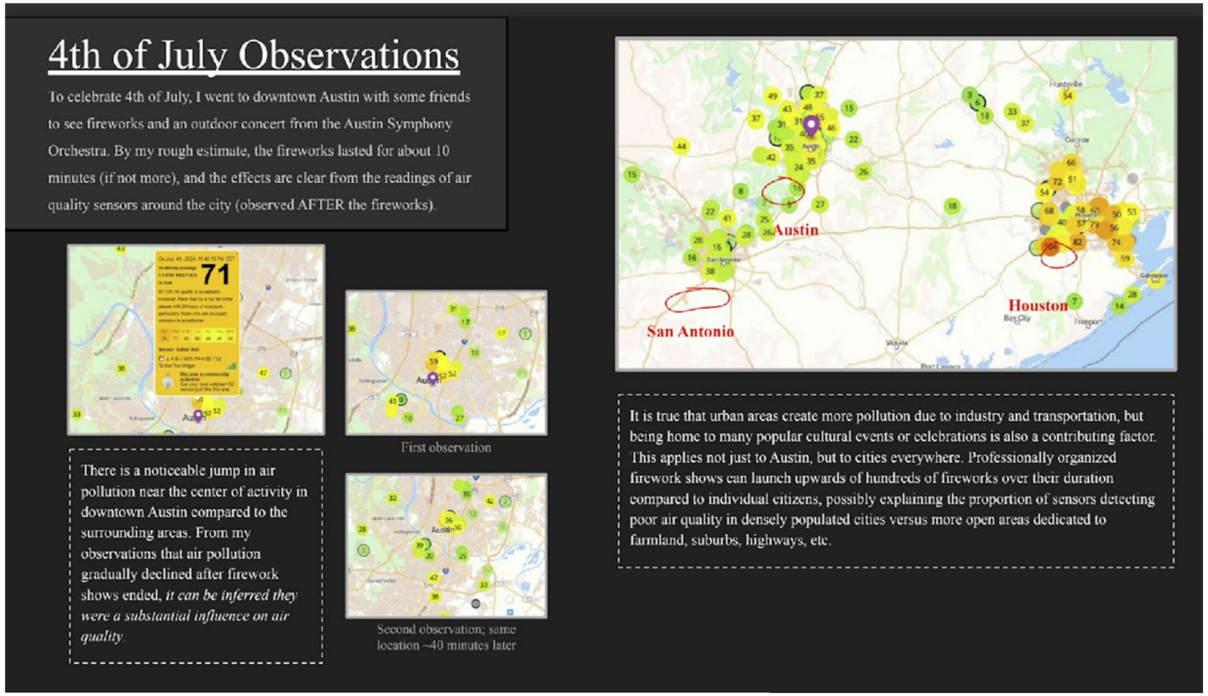
GLOBE sky color and cloud observations on July 1, 2023

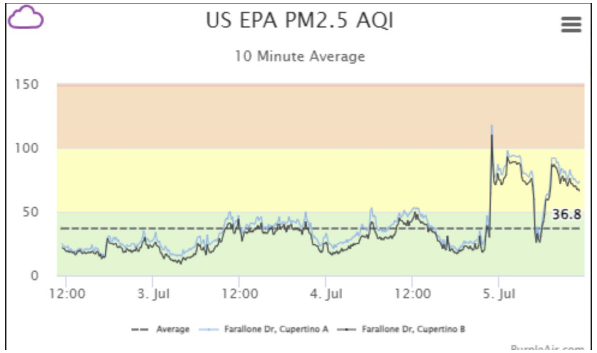


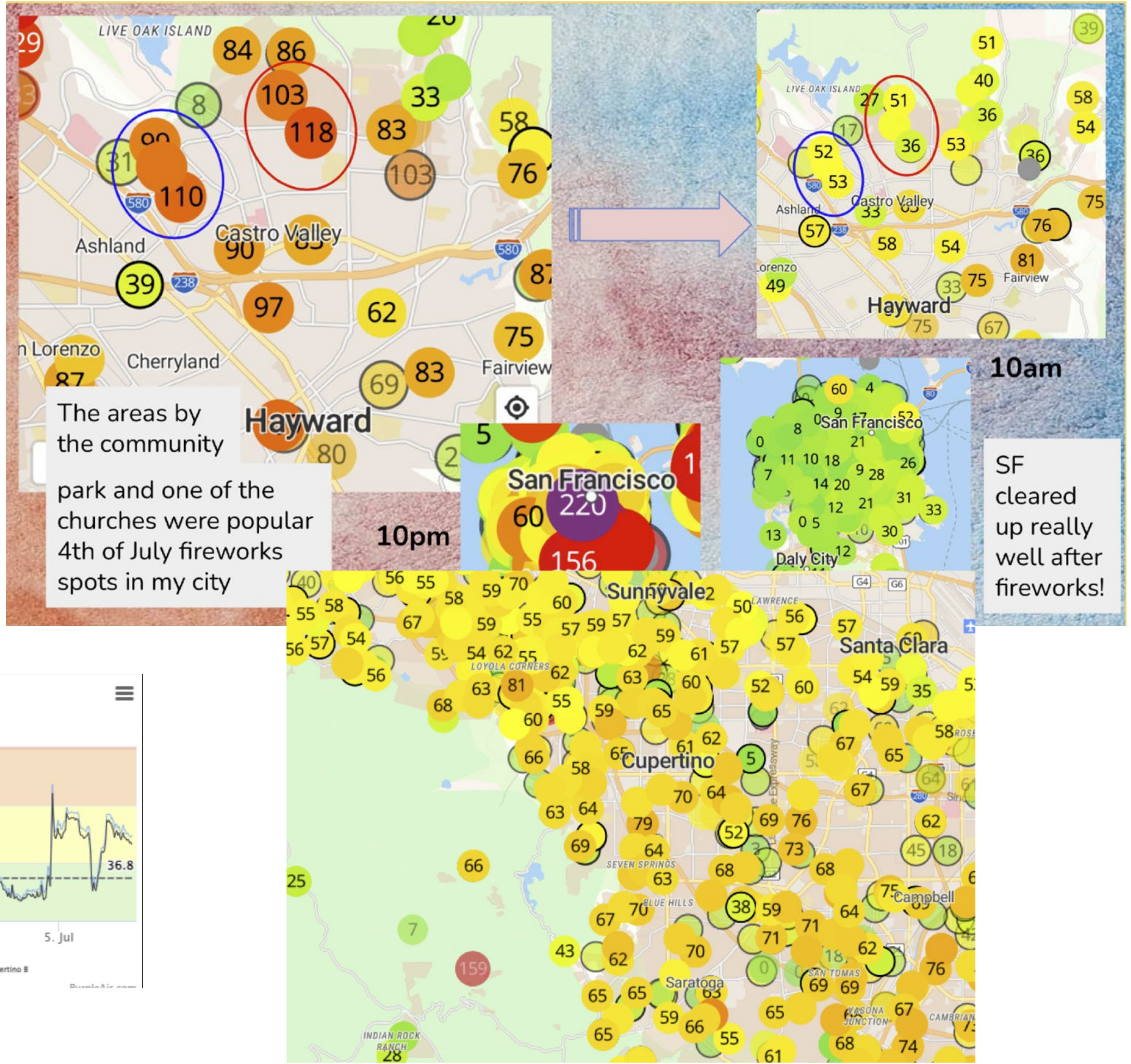

ACTIVITY: THE COLOR OF YOUR SKY
Sky Color
Aerosols can impact sky color.
This is seen by looking up while facing away from the Sun.
What color is the deepest shade of blue in the sky?
Deep Blue
Blue
Light Blue
Pale Blue
Milky
Visibility
Aerosols can impact visibility.
This is seen by looking forward at the horizon away from the Sun.
What is the sky visibility across the horizon?
Unusually Clear
Clear
Somewhat Hazy
Very Hazy
Extremely Hazy
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
Yitong.Jiang.Tol...
Sara Mierzwiak, ...
Purva.Marfatia....
Purva.Marfatia....
Juthi_Toledo_O...
Josh Chandra, A...
Jennifer Rayma...
Igor.Borracini.Au...
GOES Image Vie...
Crystal.Liu.Lubb...

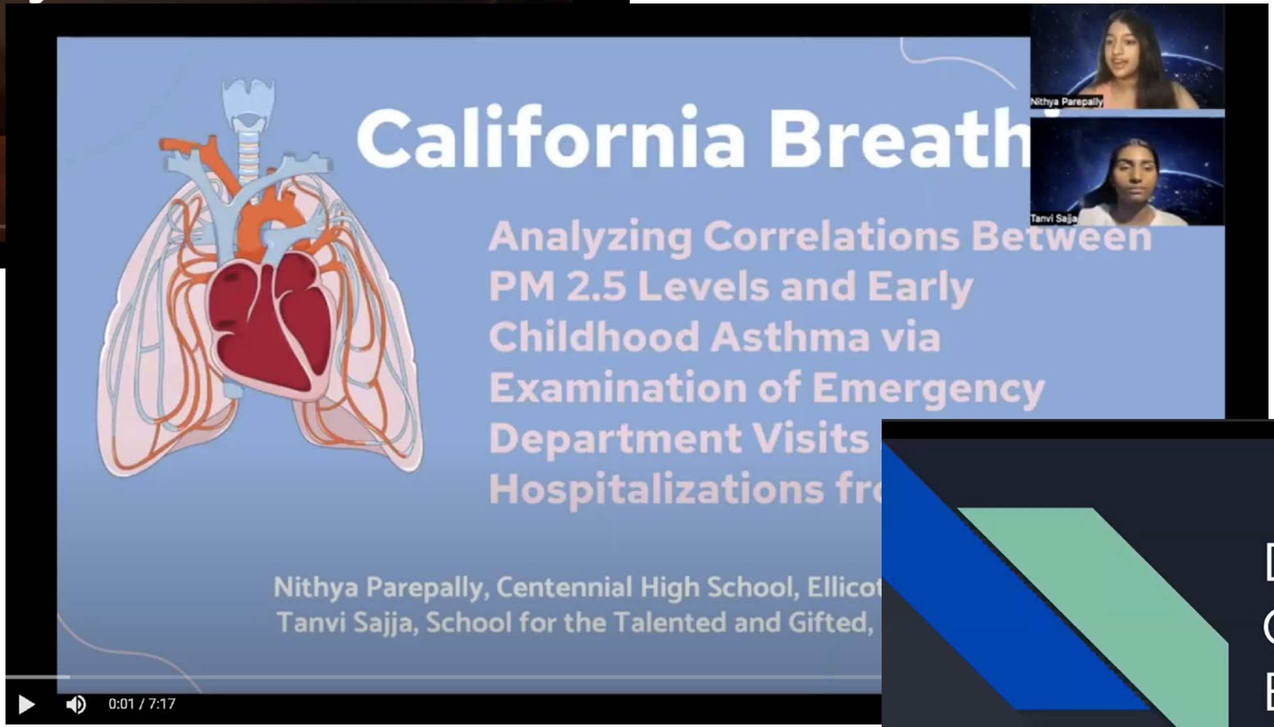
Students' observation on July 4, 2024

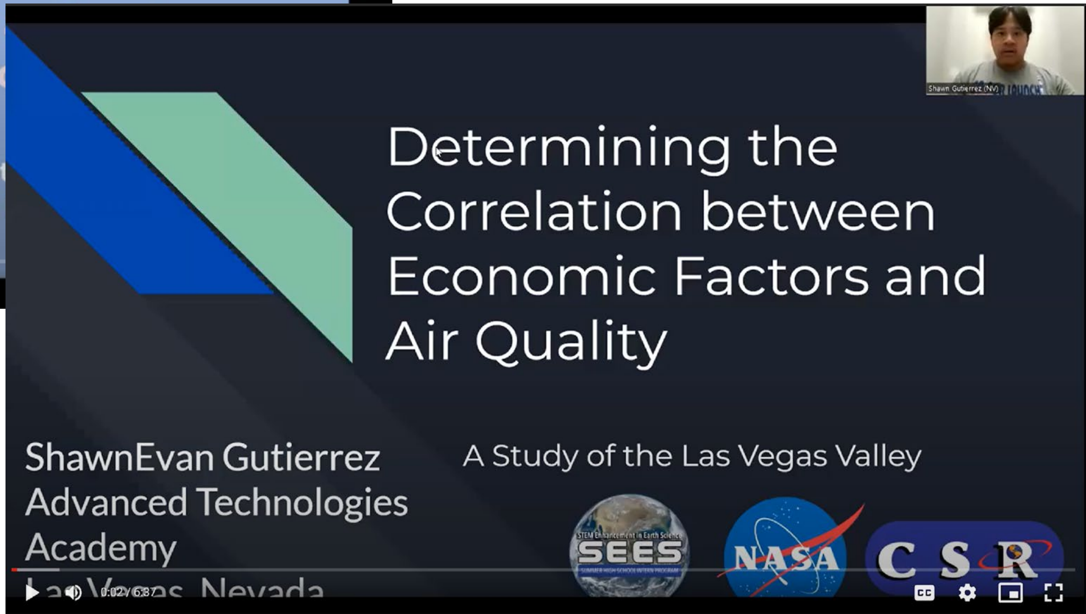


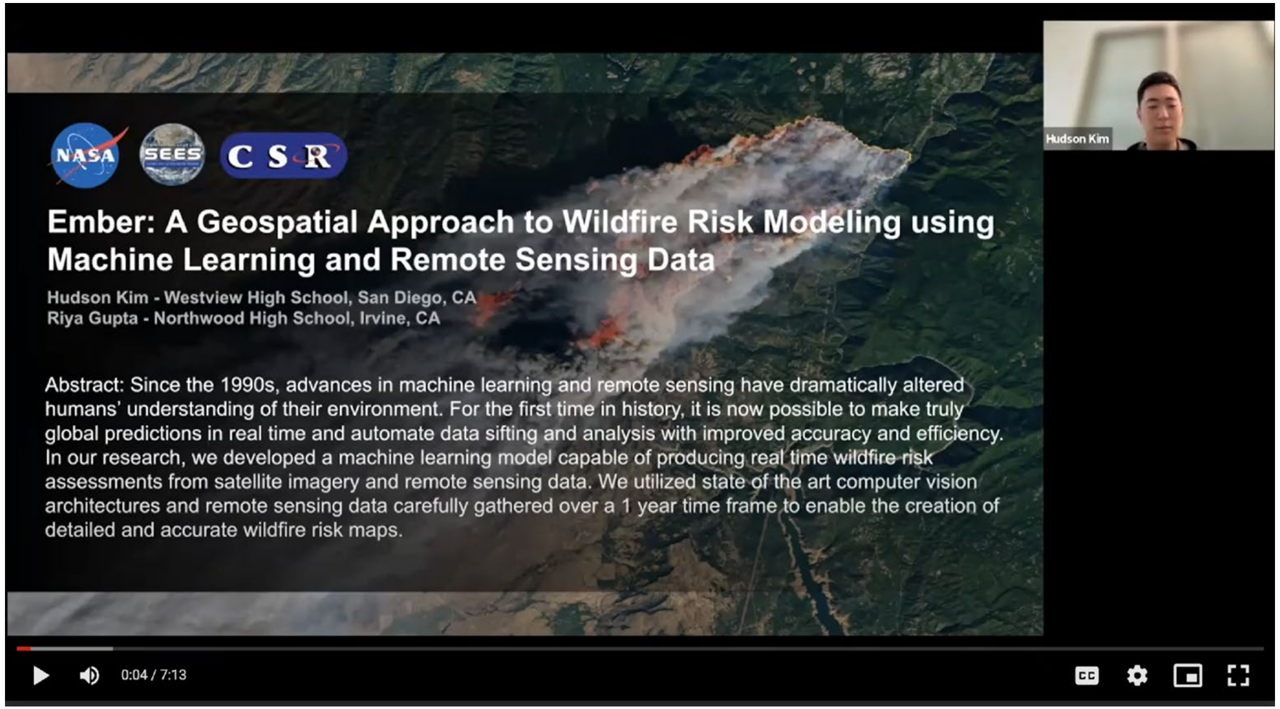




NASA SEES Air Quality group research in 2023







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.**

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

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

JOURNAL OF EMERGING INVESTIGATORS

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

Rebekah Repp[1] Yitong Jiang[2] Kevin Czajkowski[2]

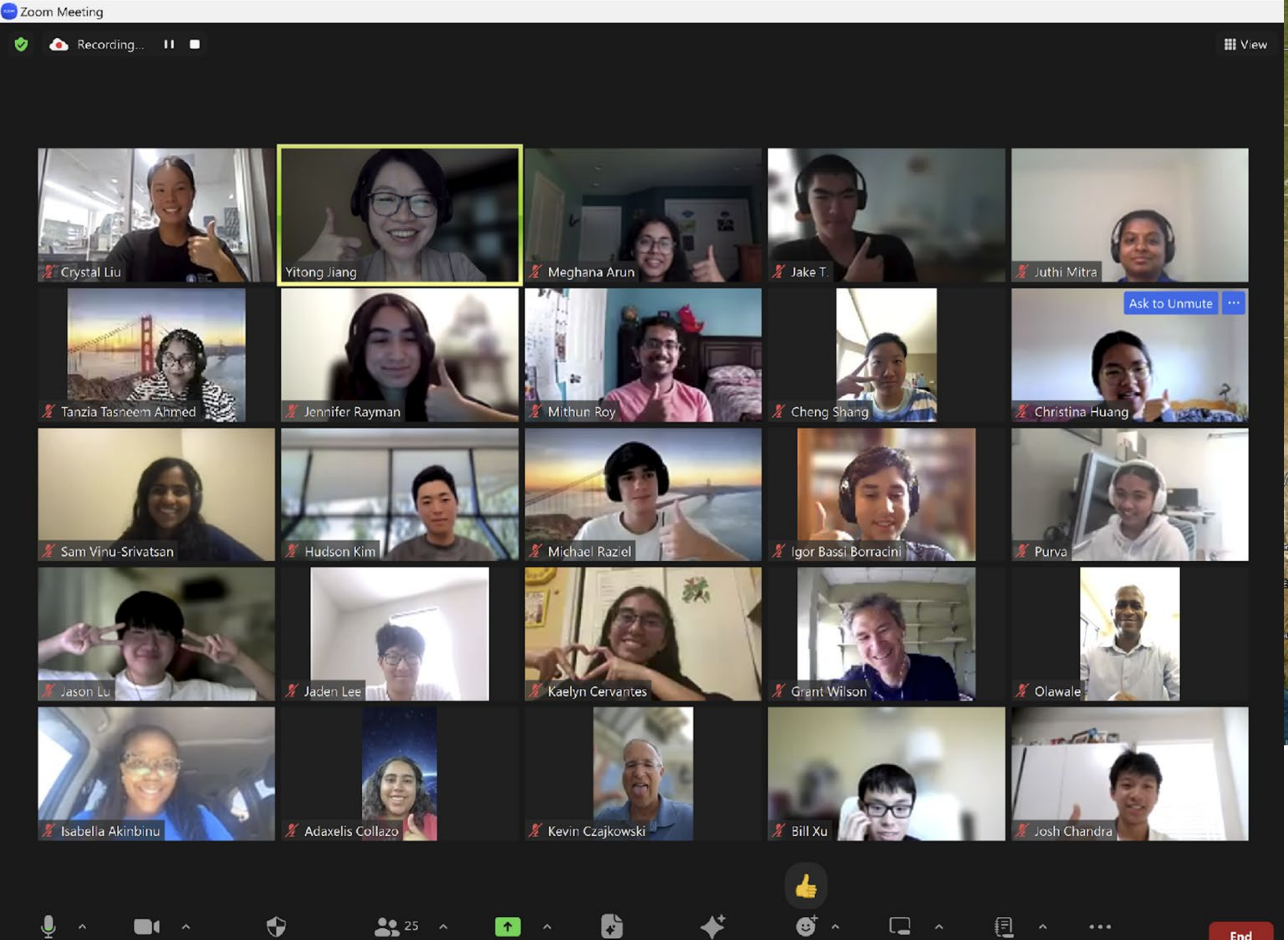
[1] Northview High School, Sylvania, Ohio
[2] Department of Geography and Planning, University of Toledo, Toledo, Ohio

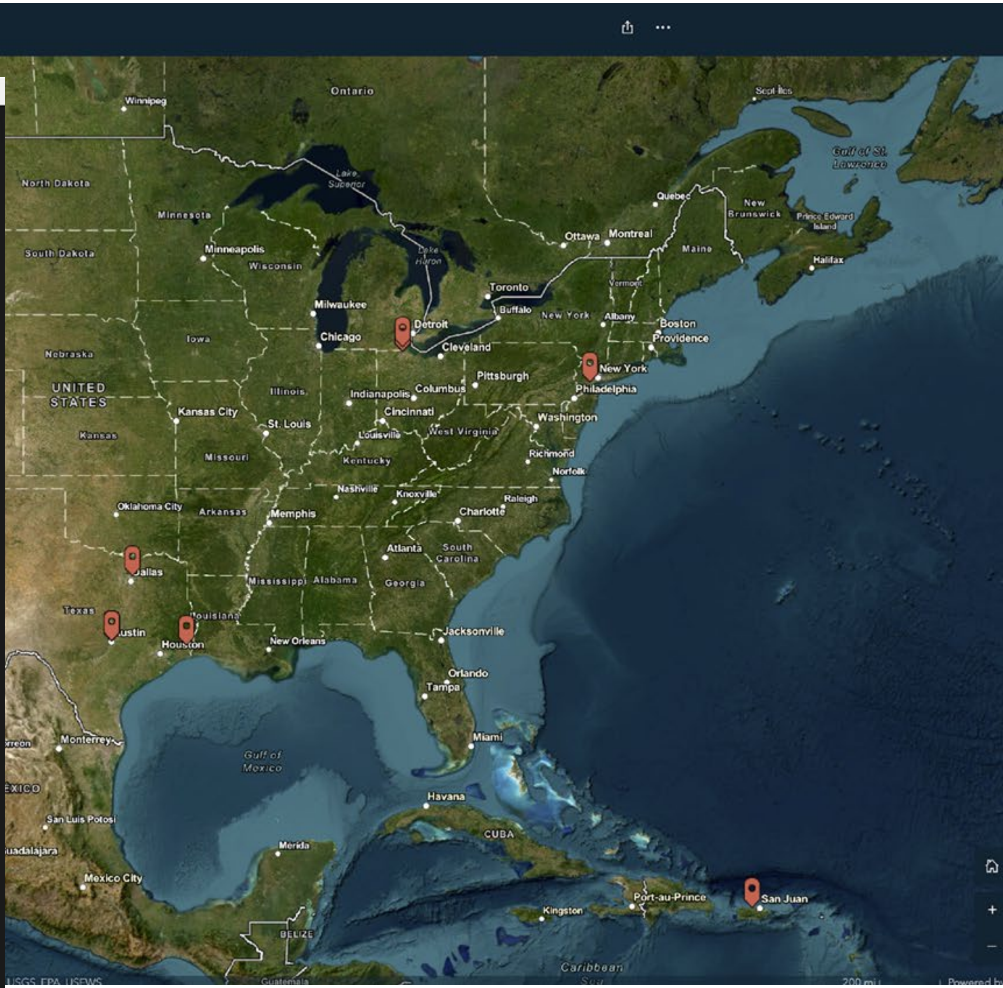
Student Authors
Please list all student author names here and indicate whether in middle or high school
Rebekah Repp – High School

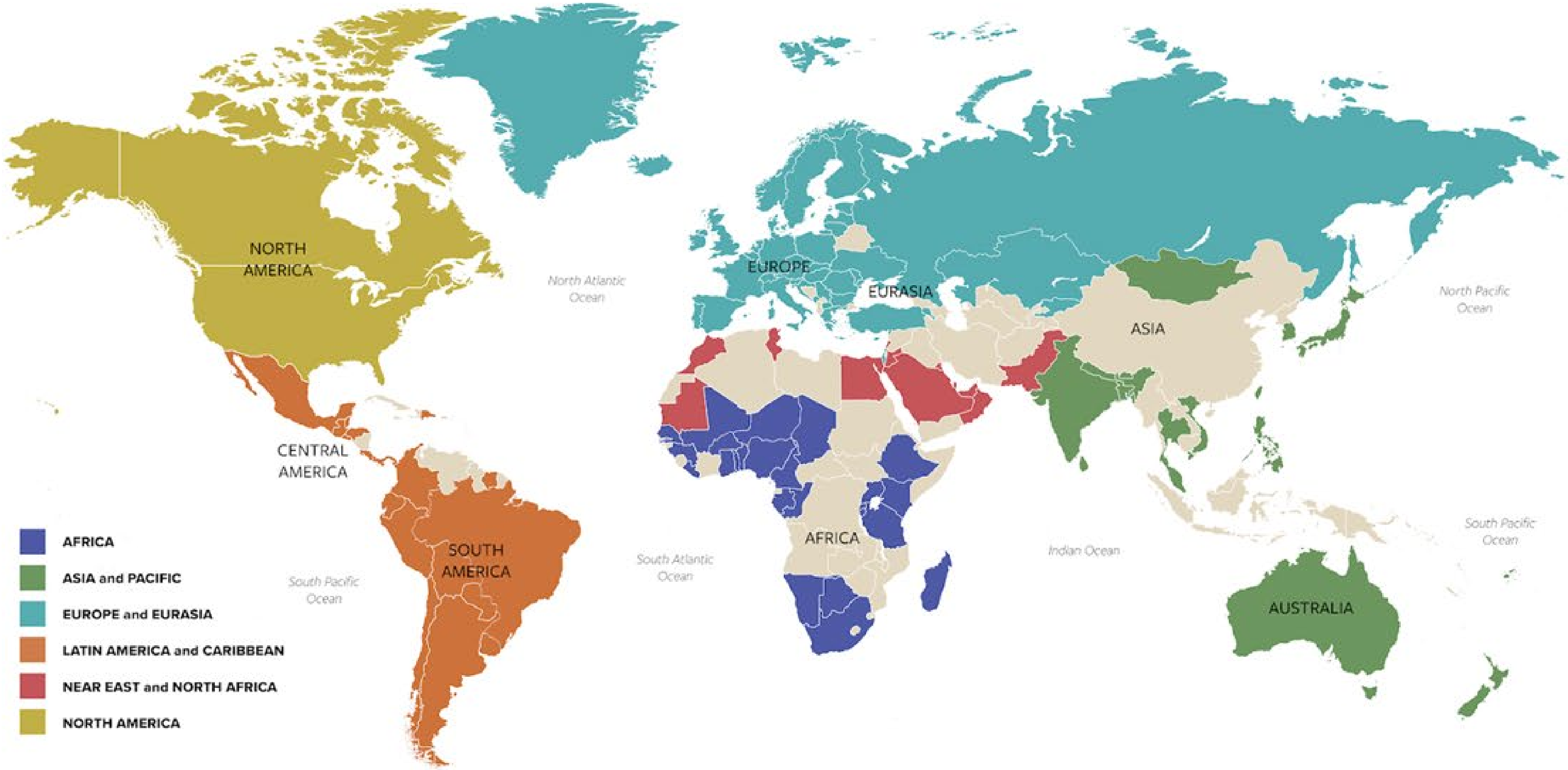
SUMMARY

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

Air Quality Interns 2024






NORTH
AMERICA
CENTRAL
AMERICA
SOUTH
AMERICA
EUROPE
EURASIA
ASIA
AFRICA
AUSTRALIA
North Atlantic
Ocean
North Pacific
Ocean
South Pacific
Ocean
South Atlantic
Ocean
Indian Ocean
South Pacific
Ocean
AFRICA
ASIA and PACIFIC
EUROPE and EURASIA
LATIN AMERICA and CARIBBEAN
NEAR EAST and NORTH AFRICA
NORTH AMERICA

Thank you!

Yitong.Jiang@utoledo.edu

Kevin.Czajkowski@utoledo.edu

For more information visit www.globe.gov