

Proposal: Impacts of Chihuahuan Desert Dust Storms using GLOBE Data



J. G. Olgin
El Paso Community College



Abstract

Dust storms have impacted the El Paso desert region, peaking the interest of public safety and health professionals. Such storms have transported pathogens from desert soils over long distance, affecting desert inhabitants. These storms have also caused diminished visibility for travelers on US highways and increased desertification. The goal of this project is to determine the frequency and intensity of seasonal dust storms in the region using GLOBE and satellite data and geospatial analysis, and how it can be applied in mitigation efforts in public health and safety arena.

Research Questions

- How can dust storm frequency and intensity vary over seasons?
- What type of weather systems and ground conditions are associated with dust storms in the El Paso region?
- How can the results of this research tie into public health and safety mitigation efforts?

Introduction Content Knowledge

Climate and anthropogenic changes have altered the frequency and magnitude of dust storms in the El Paso, TX region, located in the Chihuahuan desert. These dust storms are responsible for various impacts on the local environment; from decreased or hampered agricultural production (Gholizadeh et al, 2021), increased stress on human health (Arnold, 2020; Aghababaejan et al, 2021; Gill et al, 2023; Papatheodorou & Achilleos, 2025), limiting visibility on roads (Ardon-Dryer et al, 2023), and further erosion of the regional to local environments leading toward increased desertification (Zucca et al, 2022). This is a growing concern to farmers, the general public, and all levels of government.

This research will further develop a framework and insight on the specific conditions that induce dust storms unique to the this desert. Utilizing the GLOBE Observer app, atmospheric and land cover data will be acquired over peak dust storm season during spring and summer of 2026. Combined with satellite data and analysis using GIS techniques, a better understanding of frequency and intensity of dust storms can be determined.

Research Methods

Planning Investigations

- The El Paso region located within the Chihuahuan desert will be the focus of this study (figure 1)
- GLOBE Observer Cloud and Land Cover protocols, Landsat and Langley Research Center (LaRC) data will be utilized
- GIS techniques will be used to study intensity and frequency of dust storms and the relationship between surface and atmospheric condition unique to the Chihuahuan desert.

GLOBE Data to Be Used

- GLOBE Observer Cloud and Land Cover data will be used
- Additional data utilized: Landsat and LaRC data

Carrying Out Investigations

- GLOBE Observer Cloud and Land Cover protocols, Landsat and Langley Research Center (LaRC) data will be utilized
- GLOBE Observer data will be collected daily between 10:00am and 2:00pm
- Corresponding satellite data (i.e. Landsat) will be matched with GLOBE Observer data from the GLOBE database.
- GIS techniques will be used to study intensity and frequency of dust storms and the relationship between surface and atmospheric condition unique to the Chihuahuan desert.



Figure 1: Generalize map of study region, coordinating with data collected at various El Paso Community College campuses.

Results

Analyzing Data

- GIS techniques, such as using band combination, will be used to identify correlations with dust storm intensity and frequency with atmospheric and land cover conditions conducive for such storms.
- Figure 2 is an example of a sample trial during a March 2021 dust storm that occurred over the El Paso region. Visual and infrared data from LaRC, along with photo imagery from the GLOBE Observer app were used for further analysis. Similar approaches will be conducted in this study.

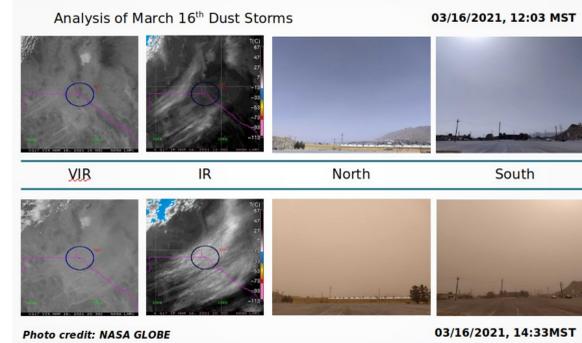


Figure 2: Dust storm analysis taken during the March 2021 dust storm over the El Paso region.

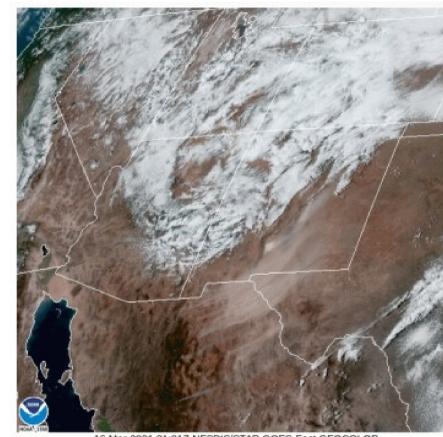


Figure 3: Satellite image of the March 2021 dust storm over the El Paso Region.

Discussion/Broader Impacts

- In arid and semi-arid regions where dust storms are most common, improved understanding can help predict dust events and provide advance warning to mitigate agricultural damages from crop loss and public health from dust carrying pathogens.
- This study can also help improve predictive models, contributing significantly to public health and safety
- This study can also provide a framework for application in high school/college curriculum to better understand the physical sciences.
- Determine the efficacy of GLOBE data in studying dust storm frequency and intensity, and determine where GLOBE data acquisition can be better positioned and utilized to maximize efficacy.

References

- Gholizadeh, H., Zoghiour, M.H., Torshizi, M., Nazari, M. R., Moradkhani, N. (2021). Gone with the wind: Impact of soil-dust storms on farm income. *Ecological Economics*; Volume 188, 107133 <https://doi.org/10.1016/j.ecolecon.2021.107133>.
- Aghababaeian, H., Ostadtaghizadeh, A., Ardalan, A., Asgary, A., Akbary, M., Yekaninejad, M. S., & Stephens, C. (2021). Global Health Impacts of Dust Storms: A Systematic Review. *Environmental health insights*, 15, 11786302211018390. <https://doi.org/10.1177/11786302211018390>
- Ardon-Dryer, K., Gill, T. E., & Tong, D. Q. (2023). When a Dust Storm Is Not a Dust Storm: Reliability of Dust Records From the Storm Events Database and Implications for Geohealth Applications. *GeoHealth*, 7(1), e2022GH000699. <https://doi.org/10.1029/2022GH000699>
- Arnold C. (2020). Dust Storms and Human Health: A Call for More Consistent, Higher-Quality Studies. *Environmental health perspectives*, 128(11), 114001. <https://doi.org/10.1289/EHP7845>
- Gill, T. E., Herrera-Molina, E., Ibarra-Mejia, G., Jeon, S., & Ardon-Dryer, K. (2024). Update-Exposure to dust events and hospitalizations in West Texas cities: The human health consequences of dust. *The Southwest Respiratory and Critical Care Chronicles*, 12(52), 49-51. <https://doi.org/10.12746/swrccc.v12i52.1325>
- Papatheodorou, S. & Achilleos, S. (2025). Epidemiological insights into the health impacts of dust storms. *Environmental Science & Health*; Volume 46,100626. <https://doi.org/10.1016/j.coesh.2025.100626>.
- Zucca, C., Fleiner, R., Bonaiuti, E., Kang, U. (2022). Land degradation drivers of anthropogenic sand and dust storms. *CATENA*, Volume 219, 106575. <https://doi.org/10.1016/j.catena.2022.106575>.