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Improving Early Warning and Public Awareness of Wildfires and Dust Storms with NASA Data

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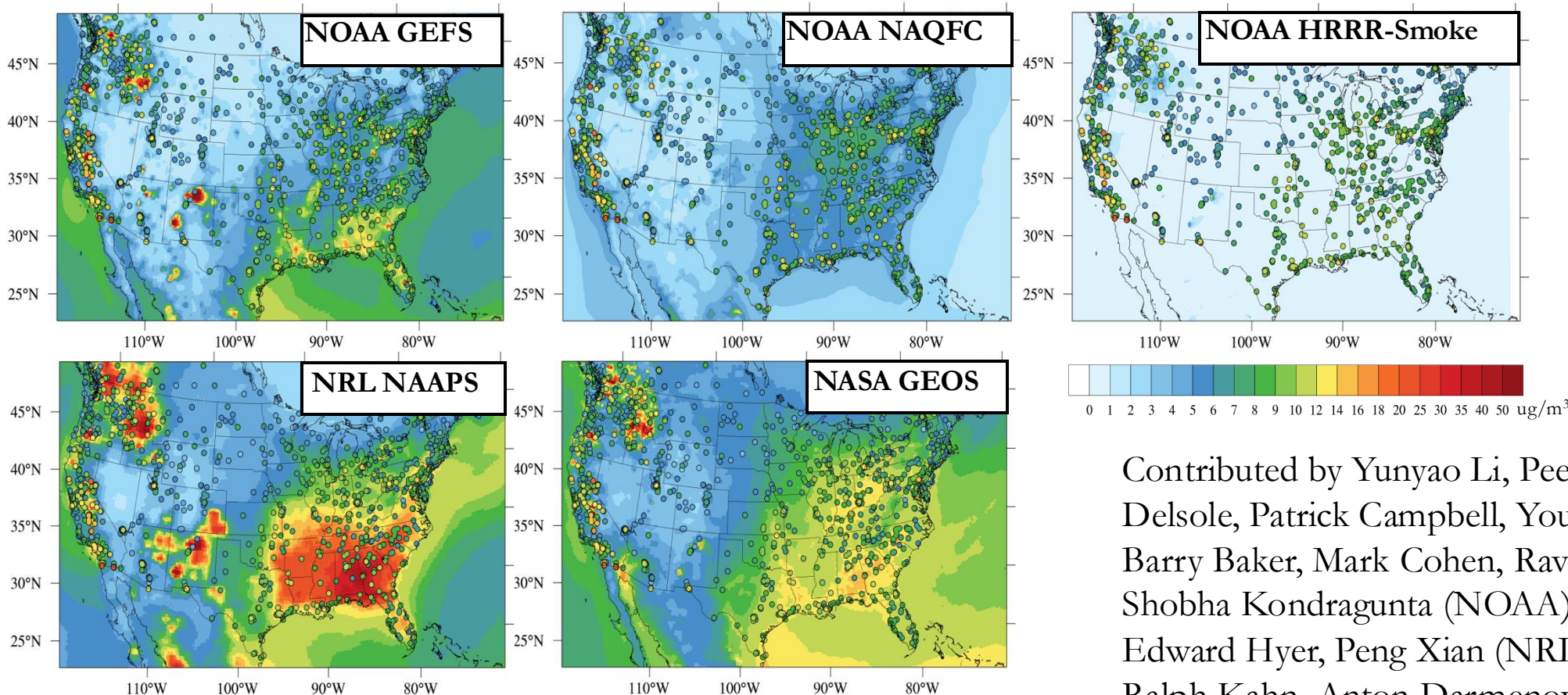
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Health and Air Quality Applied Science Team (HAQAST) Showcase
January 28, 2025, Washington DC

Wildfire Air Quality Forecasts

- Air quality forecasting is a key tool, but with large uncertainties.

Wildfire PM_{2.5} Concentration from different forecasts



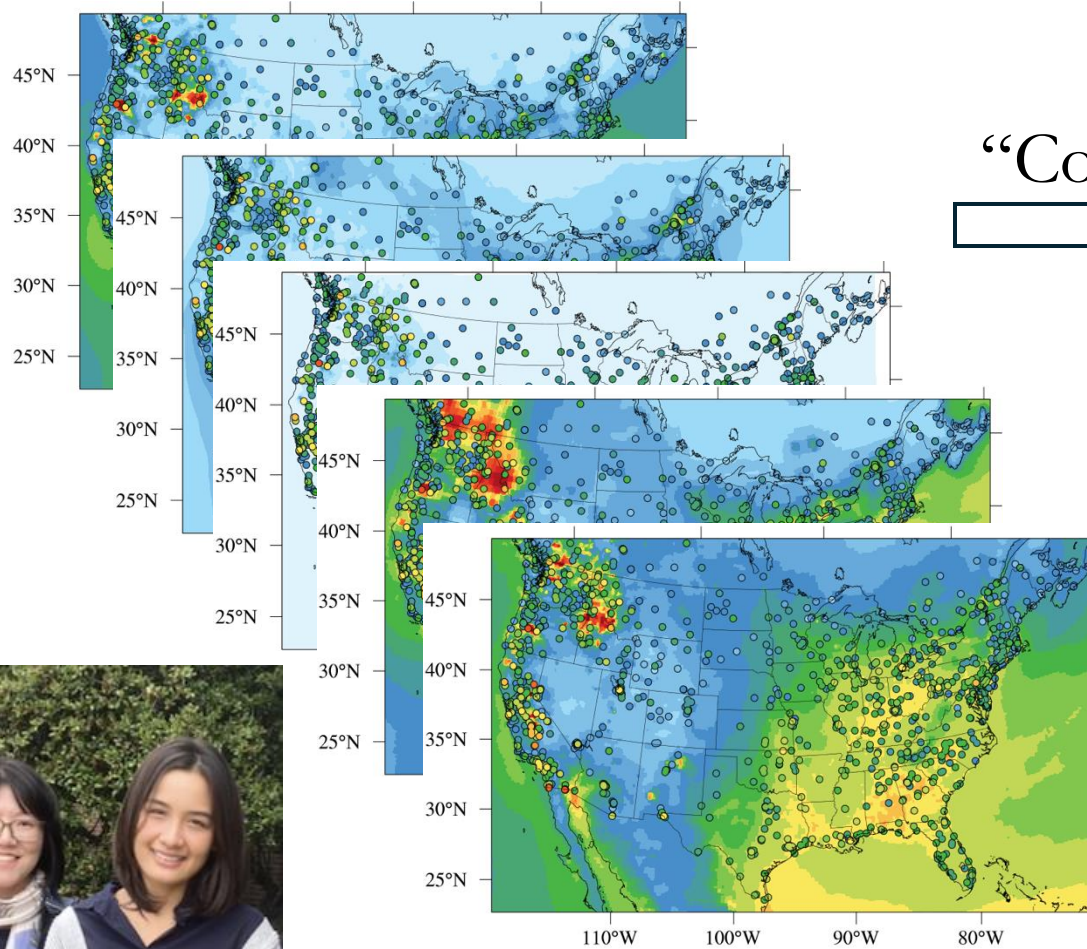
(*Li et al., BAMS, 2024*)

Contributed by Yunyao Li, Peewara Makkaron, Tim Delsole, Patrick Campbell, Youhua Tang (GMU); Barry Baker, Mark Cohen, Ravan Ahmadov, Eric James, Shobha Kondragunta (NOAA); Edward Hyer, Peng Xian (NRL); Ralph Kahn, Anton Darmenov (NASA)

Hmmm, which product should I use???

Multi-Agency Ensemble Forecast

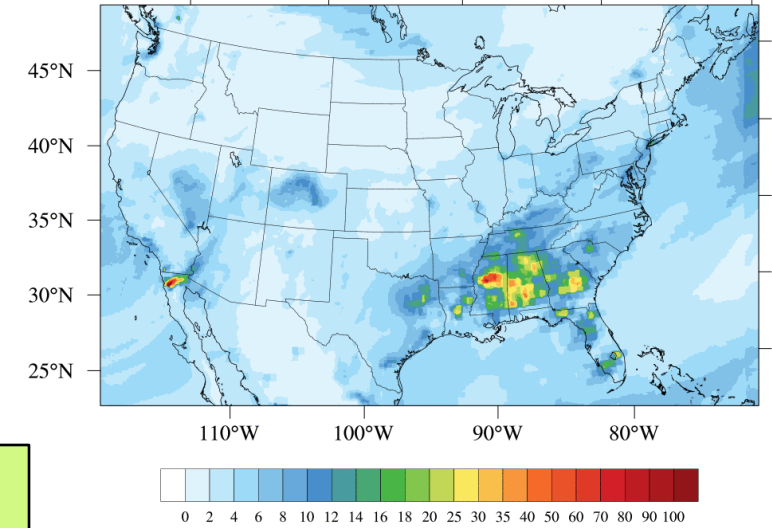
Forecasts from NOAA, NASA & Navy



“Consensus”

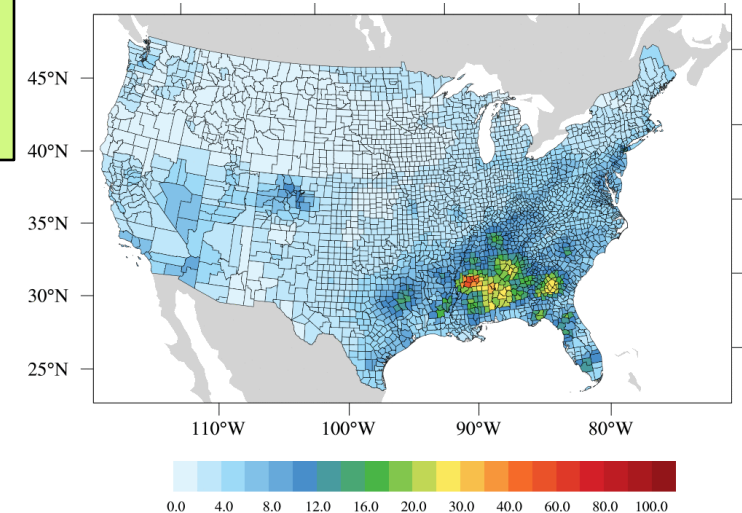


Ensemble Mean 20250127 00 UTC 3 Hourly $PM_{2.5}$ Forecast ($\mu g\ m^{-3}$)



NASA Data Used:
MODIS/VIIRS
AOD; MODIS
FRP; MISR ALH;
GOES-5 AOD,
 $PM_{2.5}$

Customized Products



Data access: NASA GES DISC
Stakeholders: WMO, Kaiser etc.

(Yunyao Li and
Elle Makkaroon)



How Many People Were Killed by Dust Storms?

A Myth of Two Tales

6 killed in 25-vehicle pileup at New Mexico-Arizona line

UPDATED ON: JUNE 20, 2017 / 6:51 AM / AP



LORDSBURG, N.M. -- Authorities in New Mexico say six people are dead after a 25-vehicle pileup on I-10 was caused by sudden blowing dust in New Mexico near the Arizona state line.

“..six people dead after a 25-vehicle pileup”

(Source: CBS News June 2017)



Summary of Natural Hazard Statistics for 2017 in the United States



This National Weather Service (NWS) report summarizes fatalities, injuries and damages caused by severe weather in 2017. The NWS Office of Climate, Water and Weather Services and the National Climatic Data Center compiled this Summary of U.S. Natural Hazard Statistics from Storm Data, a report comprising statistics from NWS forecast offices in the 50 states, Puerto Rico, Guam, and the Virgin Islands.

Summary of 2017 Weather Events, Fatalities, Injuries, and Damage Costs

Weather Event	Fatalities	Injuries	Property Damage (million \$)	Crop Damage (million \$)	Total Damage (million \$)
Other					
Drought	0	0	0.05	0.31	0.36
Dust Storm	0	0	0.35	0.00	0.35
Dust Devil	0	0	0.06	0.00	0.06

Source: <https://www.nws.noaa.gov/om/hazstats/sum17.pdf>

0-5 deaths, on average 1 death per year 4

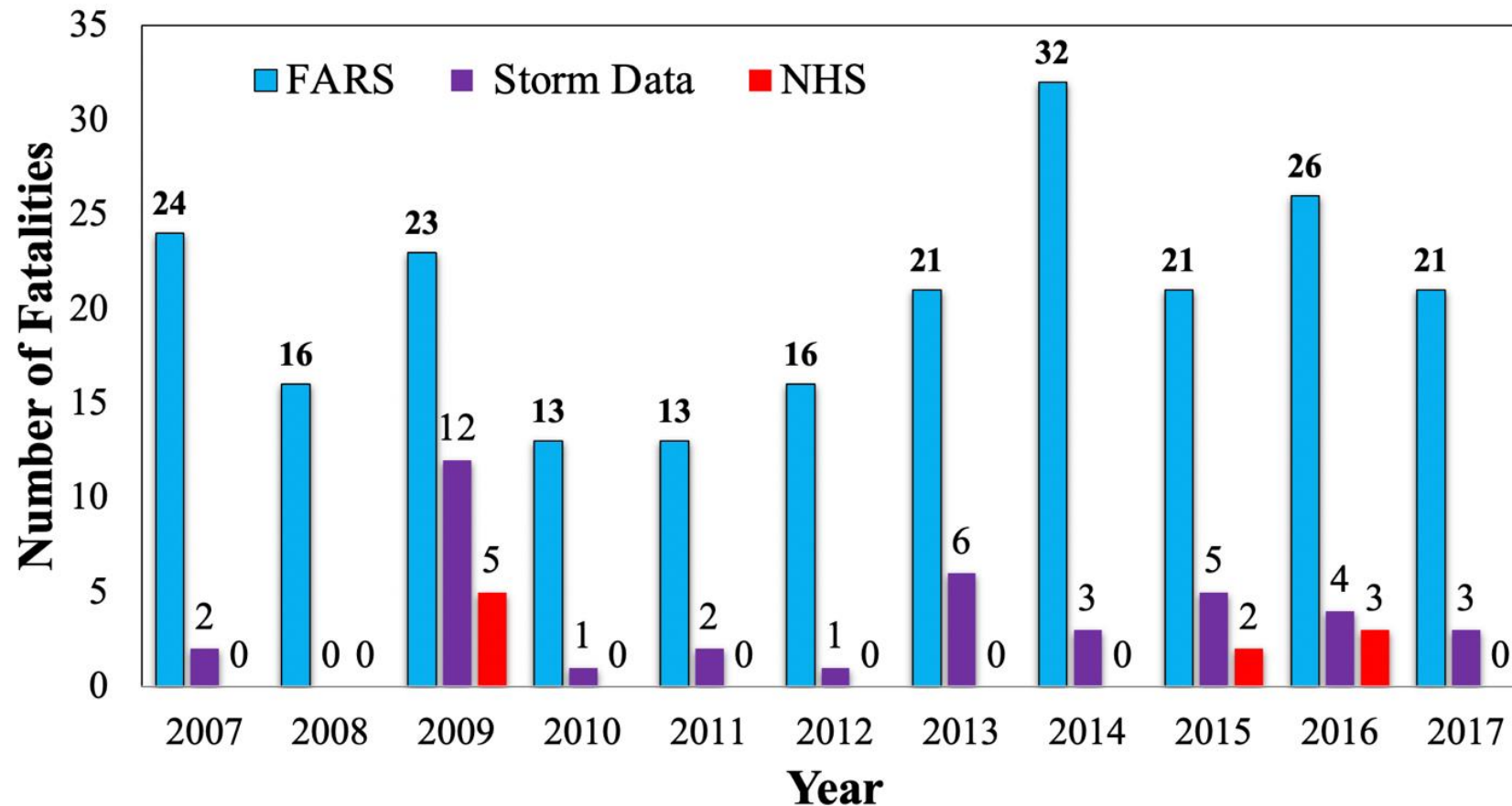
Debunk the Myth using NASA Data and Police Reports

Natural Hazard Statistics (NHS)

(Tong et al., BAMS, 2023)

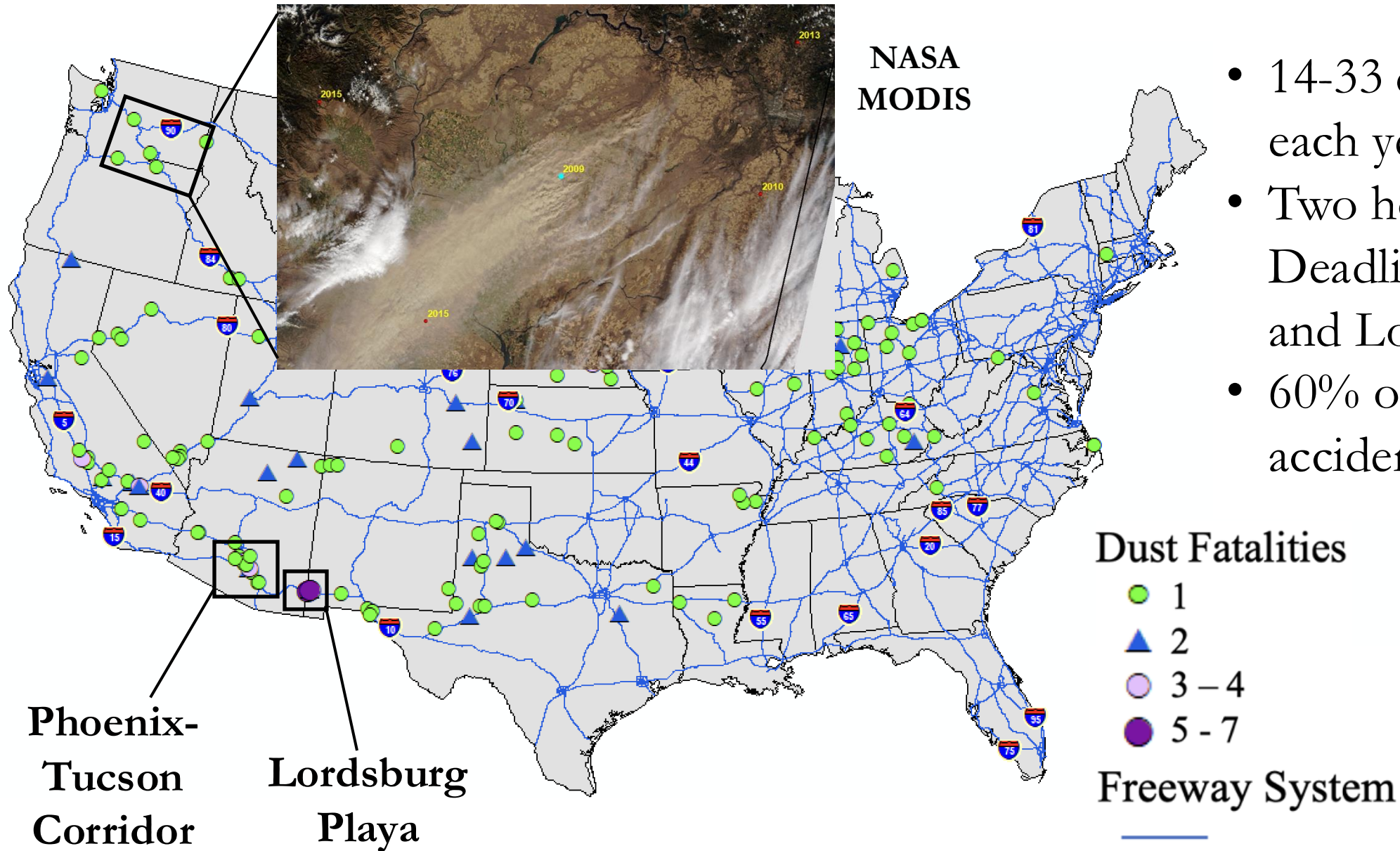
Storm Data: Crowd-sourced weather reports

Police Reports: DOT Fatality Analysis Report System (FARS)



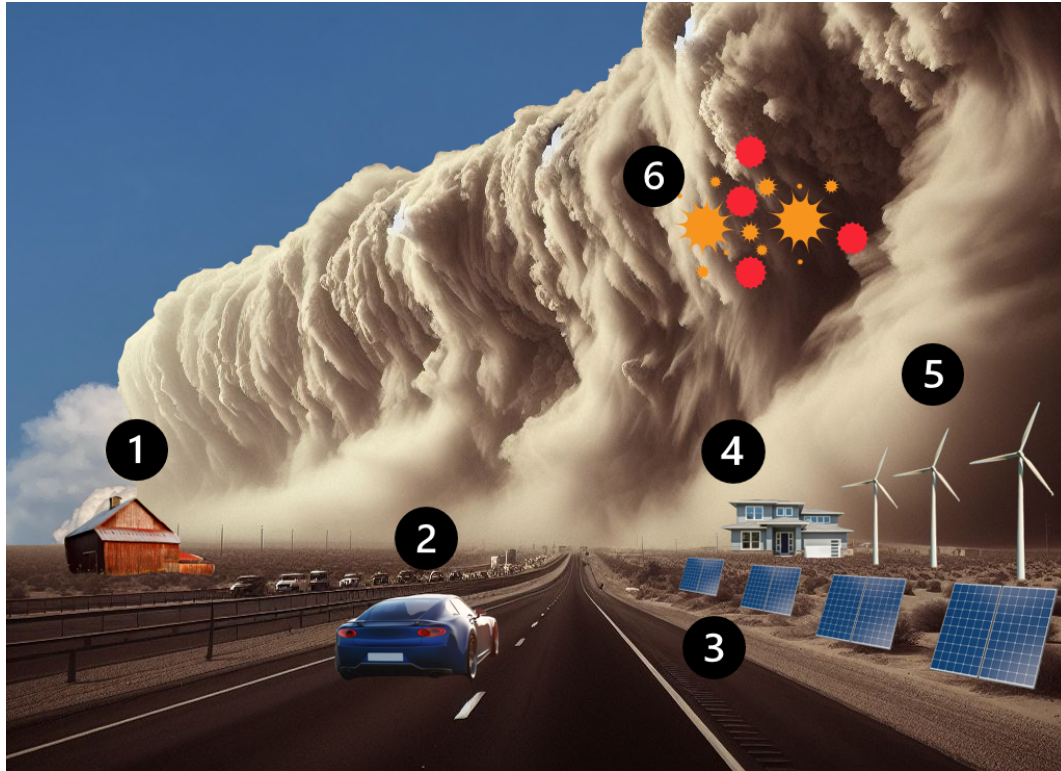
20-times More People Killed by Dust Storms!

Where Did Fatal Crashes Occur?



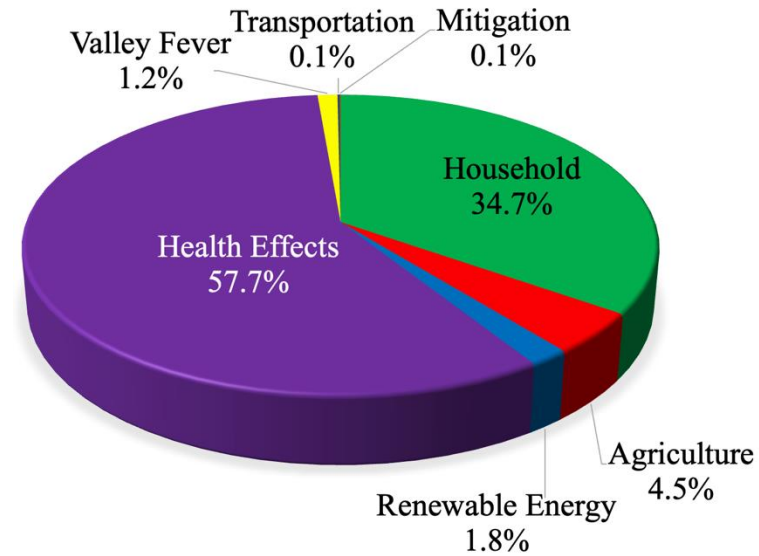
Economic Cost of Dust Impacts in US (2017)

Dust Impacts on Society

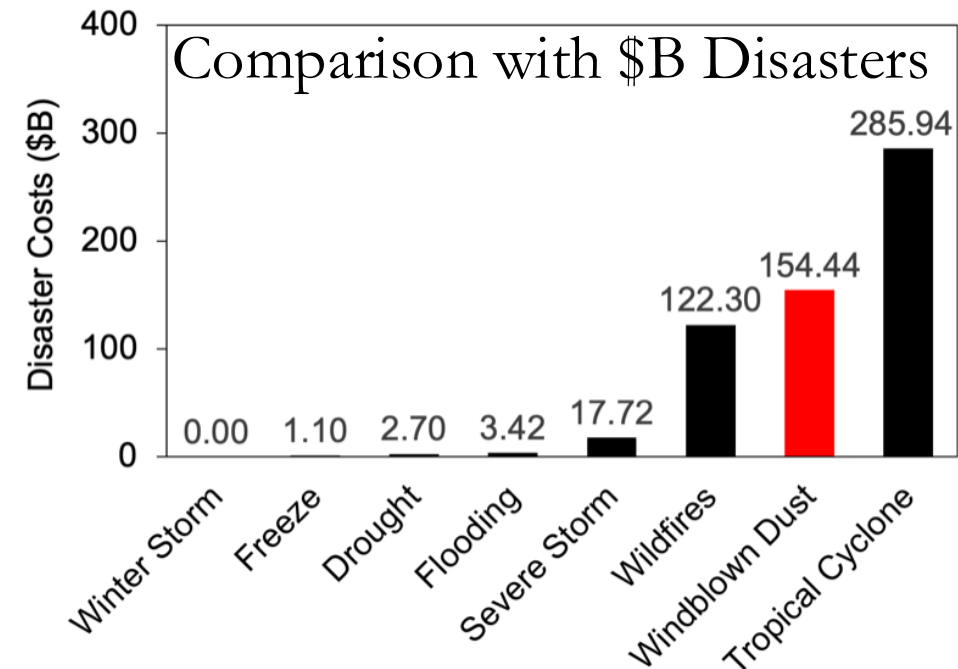


Total Annual Economic Cost:
\$154B (2017 Dollar)

(Feng et al., Nature Sustainability, 2025)

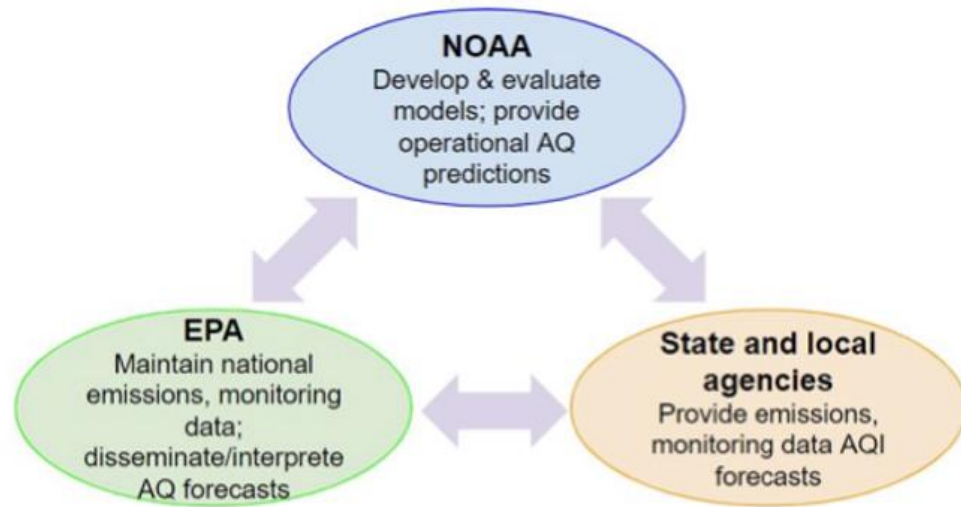


(Irene Feng, GMU)

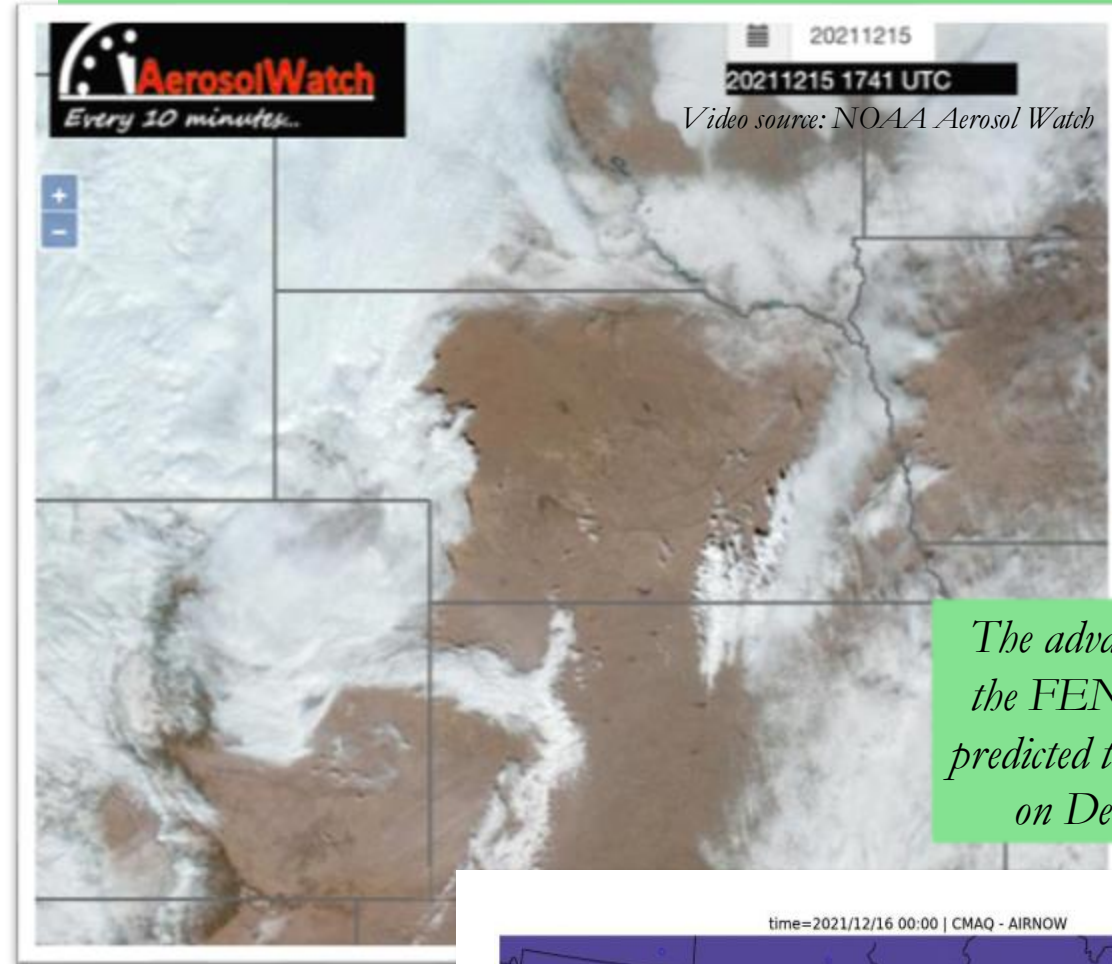


Improving Dust Storm Forecasts with NOAA

National Air Quality Forecast Capability (NAQFC)



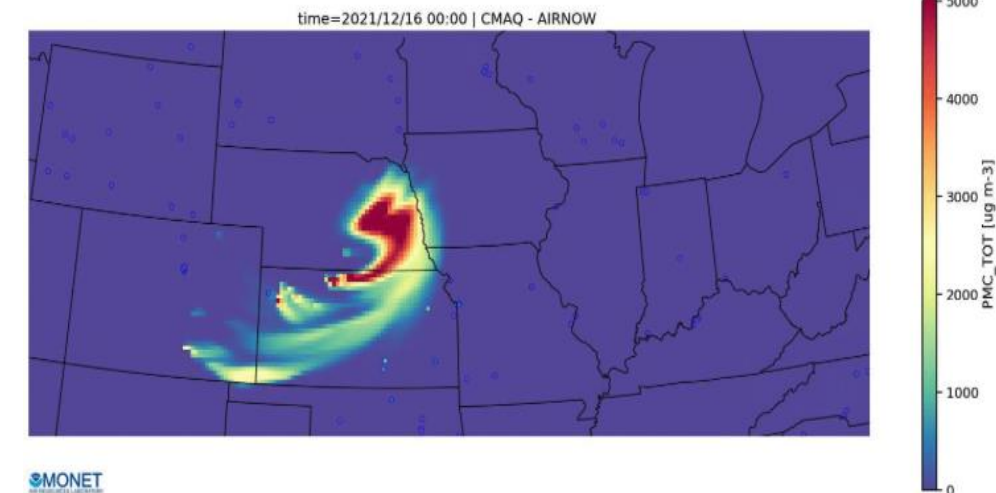
New methods for assimilating MODIS/VIIRS satellite data into NOAA's National Air Quality Forecast Capability (NAQFC) are operational. 72-hour dust forecasts now available across CONUS.



(Barry Baker, NOAA)

The advanced NAQFC with the FENGSHA dust model predicted the extreme wind event on December 15, 2021.

Satellite data used:
MODIS/VIIRS
Albedo, AOD &
NDVI, and GOES-
16 dust mask



(Courtesy of John Haynes)



(Scott Van Pelt, USDA)

Public Outreach and Community Building



(Sara Basart,
World Meteorological
Organization, WMO)



Dust Alliance for North
America (DANA)

600+ scientists and practitioners



**United
Nations**

**International Day of Combating Sand and
Dust Storms, 12 July**

Register for the webinar



**Dust Alliance for North America (DANA)
Spring 2022 Webinar Series**

DANA is an informal partnership of scientists and practitioners with the purpose to accelerate the transition of dust-related research into service.

WHEN: Every 2nd Friday @ 1 pm ET (12 pm CT, 11 am MT, 10 am PT)

The DANA webinar series will highlight different dust-related topics, promote communications and collaborations among members, engage community interests, and enhance public awareness on dust-related challenges under climate change.

February 11	March 11	April 8	May 13
			 
DANA Executive Committee	Richard Reynolds USGS, Institute for Rock Magnetism, University of Minnesota	Cassandra Gaston Department of Atmospheric Sciences, RSMAS, University of Miami	John Haynes NASA

Contact Us: dustalliance.na@gmail.com

(See flash talk by Scott Van Pelt)



HAQAST member Daniel Tong addressing
audience as Chair of WMO Dust Programme