

Dust Storms, Societal Impacts and Public Awareness

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The “Dust Bowl”

during the Great Depression (1930s)

- ❖ Dust Bowl: A period of severe dust storms during the 1930s;
- ❖ Causes: Extended droughts and poor land management;
 - ✓ Homestead Acts: settlement over the Plains for agriculture ;
 - ✓ New agricultural machinery: Deep plowing, eliminating native grass;
 - ✓ Favorable dust storm conditions during 1930s drought;
- ❖ Farms/houses Buried; Millions forced out; Black sky in DC



(Source:
Library of
Congress)

Another “Dust Bowl”?

Yes!

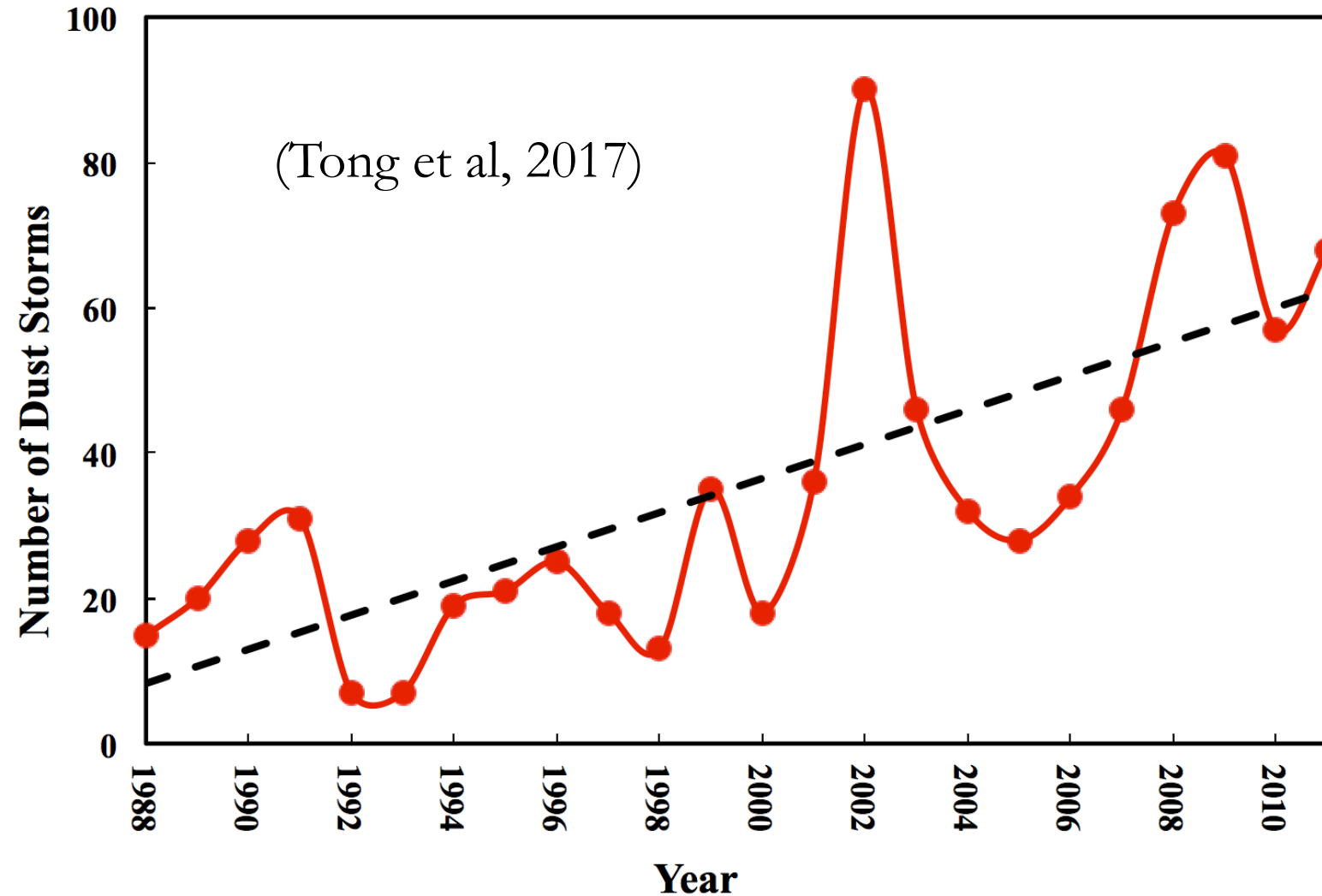
- ❖ Central U.S. plains saw severe droughts about once or twice a century over the past 400 years (Woodhouse & Overpeck, 1998).
- ❖ Global warming → Precipitation shift from subtropics, greater evaporation, less snow/ice, and earlier spring → amplify the effects of natural climatic variations → intensified droughts and “dust-bowlification” (Romm, 2011).

Probably Not?

- ❖ Partially man-made → Lessons learned (Lee and Gill, 2015).
- ❖ Under economic stress in 1930s;
- ❖ Many soil conservation measures in places.

Question: *Who is right?*

Long-term Dust Trend



US dust trend: +12%/yr;

Multiple lines of evidence:

- Increase in rainwater calcium (Ca^{2+}) (Brahney et al., 2013);
- Dust deposition on snow (Clow et al. 2016);
- Fine soil air concentration (Hand et al., 2017);
- Dust from agricultural expansion (Lambert et al. 2020)

Call for collaboration: Updating dust trends from multiple sources

New Dust Crash: May 1, 2023 Dust Storm in Illinois

The New York Times

Seven Dead After Dust Storm Causes Crashes on Interstate 55 in Illinois

At least 72 vehicles were involved in pileup crashes after a dust storm swept through central Illinois, forcing the closure a key highway in the region.

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U.S. NEWS

7 dead, 37 hospitalized after blinding dust storm causes pileups on Illinois highway

The death toll in the pileups near Farmersville rose to seven Tuesday.

US Crime + Justice Energy + Environment Extreme Weather Space + Science

Highway reopens after more than 70 vehicles crashed in a dust storm, leaving at least 7 dead



- 8 deaths
- 37 Injuries
- 72 Cars Piled Up
- Deadliest Dust Storm in Eastern United States

Deadliest Dust Storms in Past 30 Years

Deadliest Dust Storms

- 17 deaths, 11/29/1991 CA
- 8 deaths, 5/1/2023 Illinois
- 8 deaths, 7/26/2021 Utah
- 7 deaths, 5/22/2014 NM
- 6 deaths, 6/19/2017 NM

Dust Sources

- Agricultural fields
- Agricultural fields
- Exposed land (unknown land use)
- Playa (dry lake)
- Playa (dry lake)

Illinois Dust Storm



Utah Dust Storms



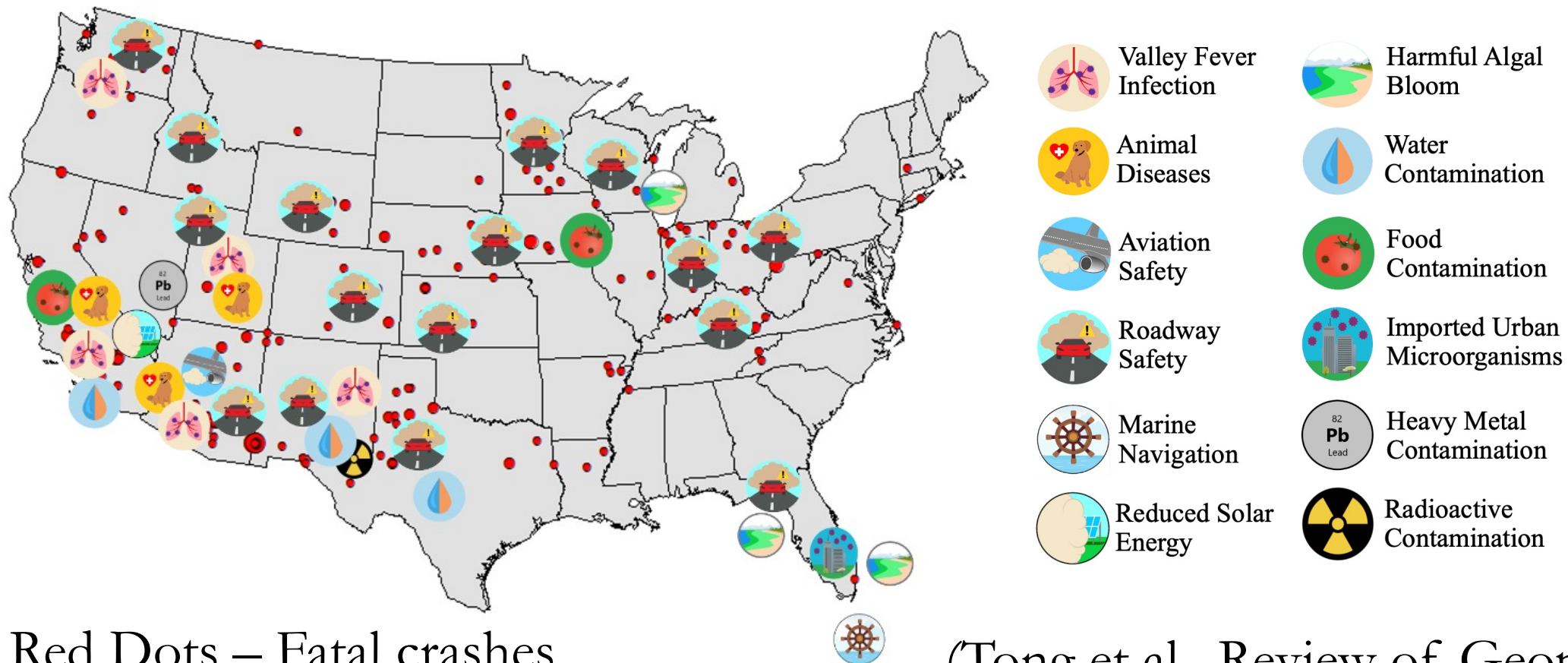
NM Lordsburg Playa



- Deadliest dust storms are from 1) cropland and 2) dry lakes (Playas);
- Satellite observations of real-time land changes needed for dust forecasting.

Dust Effects on Health and Safety

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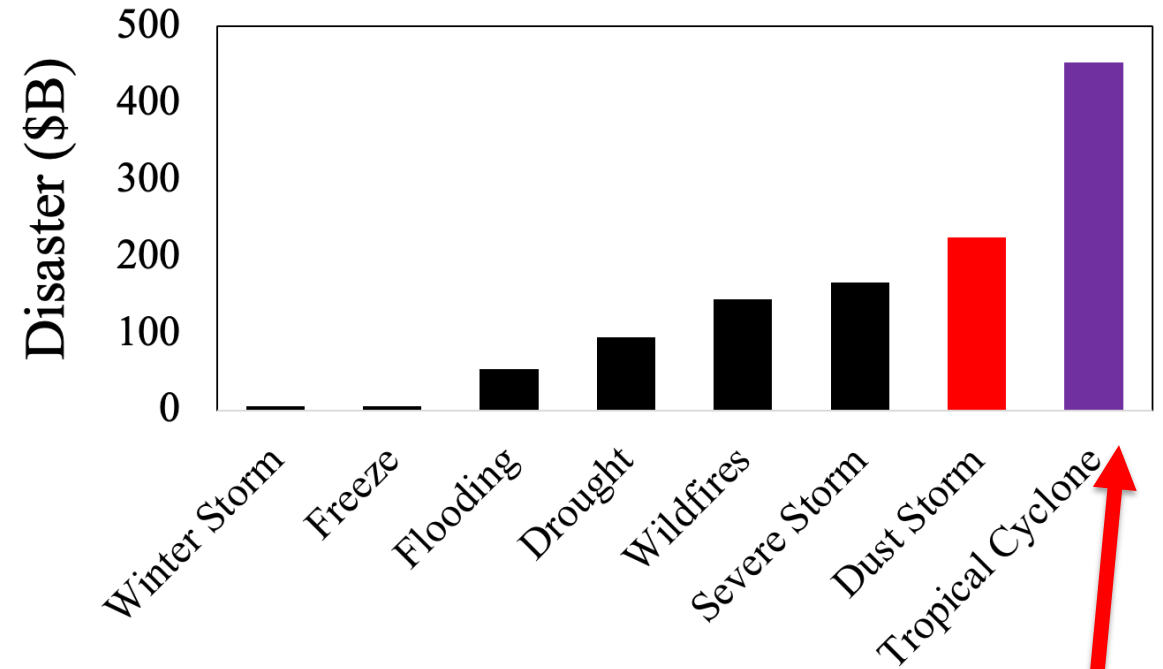
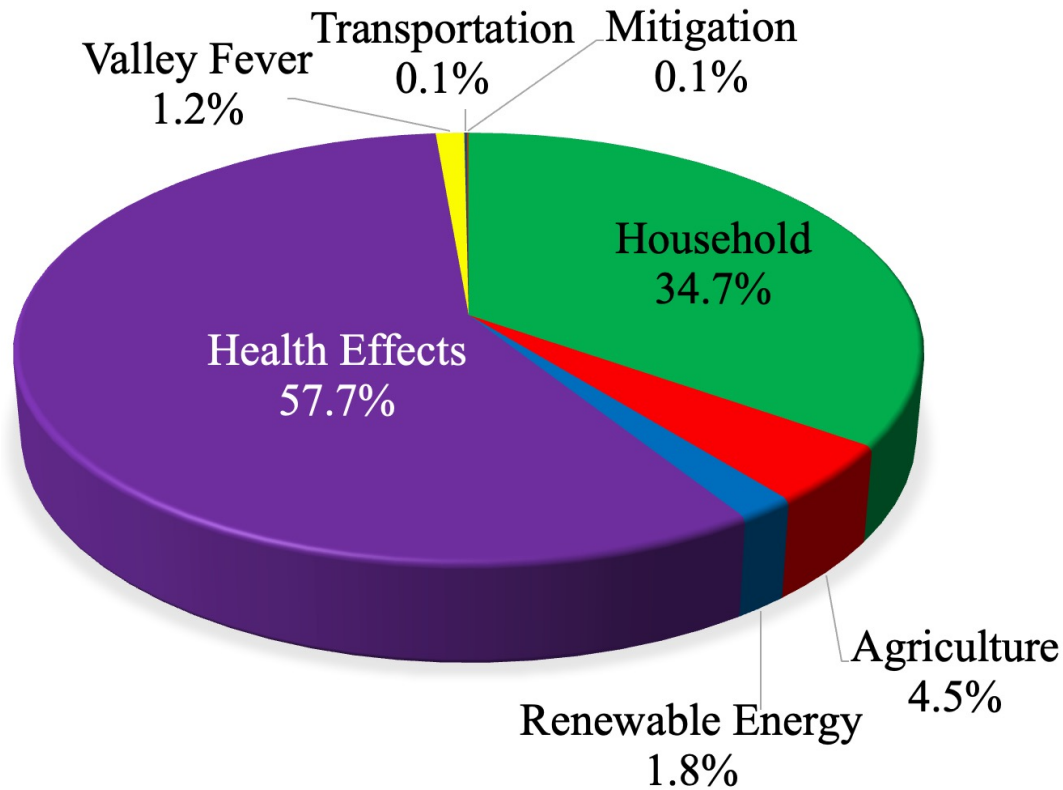
(Tong et al., Review of Geophysics, 2023)

Economic Cost of Dust Impacts in US (2017)

(Feng et al., in preparation)

Total Annual Cost: \$225B

Comparison with \$B Disasters



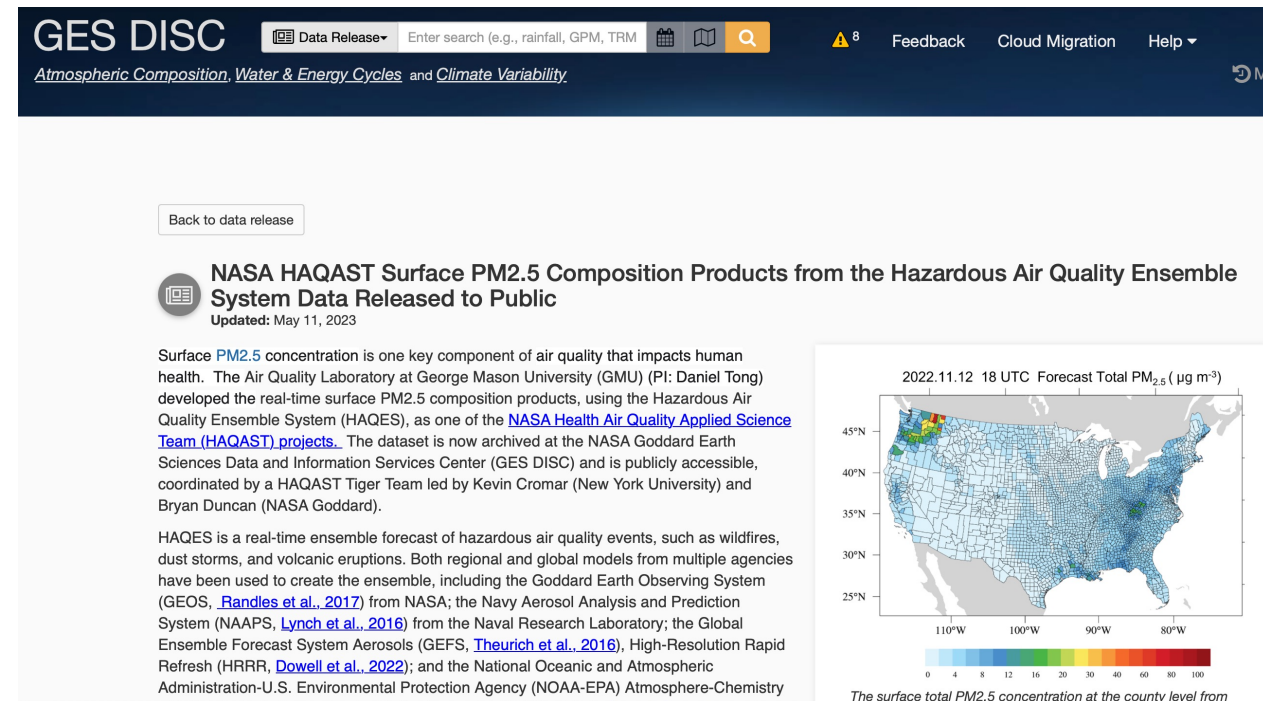
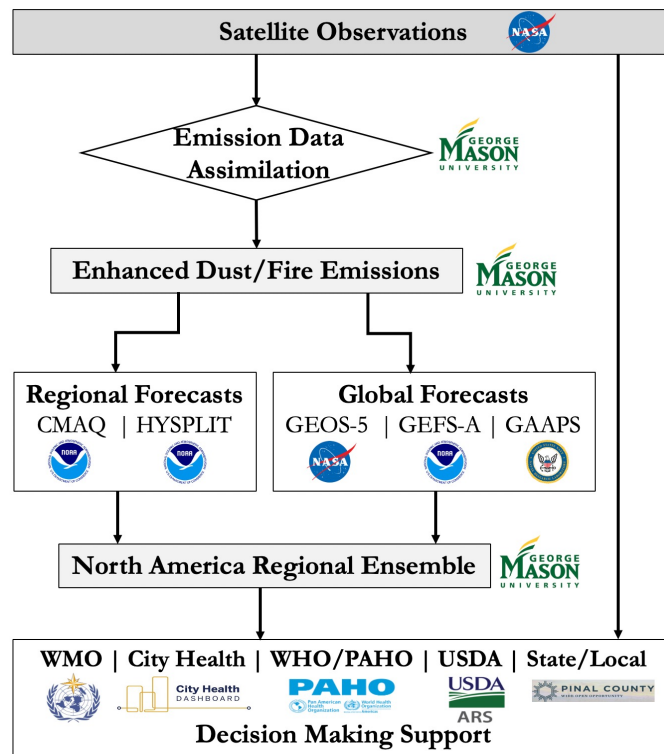
There were 17 tropical storms, including hurricanes Harvey, Irma, and Maria, in 2017.

- Socioeconomic cost of dust amounts to \$225B
- Major sectors include human health, household and agriculture

(Unpublished data – Do not cite or post) ⁸

Satellite-Aid Dust Forecasts

- Satellite-aided dust forecasting (MODIS/VIIRS albedo) → NOAA operational forecasts (Research-to-Operation led by Barry Baker, NOAA); <https://airquality.weather.gov>.
- HAQAST Core Project: Hazardous Air Quality Ensemble System (HAQES): Consensus forecast using 5 products from 3 federal agencies (NOAA, NASA, NRL)



Real-time Forecast Data (netCDF or ASCII) archived at NASA GES DISC₉ as part of HQAST Tiger Team Project led by Kevin Cromar and Bryan Duncan.



Dust Alliance for North America (DANA)

Public Outreach and Community Building

What is DANA? Partnership of scientists and practitioners with a purpose to accelerate transition of research into service.



SOUTHERN NM & WESTERN U.S. DUST SYMPOSIUM
October 25 – 27, 2021
Las Cruces, NM

The purpose of this symposium is to ultimately answer one question: "Are opportunities to apply dust research being missed?" Federal, state, and local agencies create policies for clean and healthy air, which benefit from both national and international research. However, difficulties arise in translating research results into policy. This symposium will attempt to bridge the gap between research and applications into policy-making that results in tangible public benefits. Topics on the agenda include dust and PM₁₀ mitigation issues in Southern New Mexico and beyond; dust impacts on environmental quality, transportation safety, and public health; and the state-of-the-science in airborne dust research. This symposium focuses on windblown dust in the southwestern U.S. and North America, but with a global context.

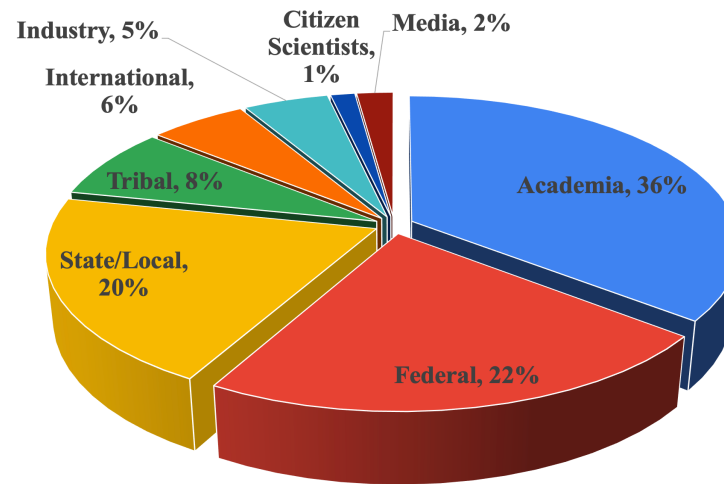
THEMES

- Dust Research
- Mitigation
- Transportation
- Health

REGISTER TO ATTEND OR SUBMIT AN ABSTRACT HERE:
<https://dustworkshop.com/>

DEADLINE TO SUBMIT AN ABSTRACT: OCT 8, 2021

CONTACT INFO:
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William Sprigg
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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  Natasha Sadoff NASA

Contact Us: dustalliance.na@gmail.com



Dust Stakeholder Workshop (October 2021)

Status of DANA

- Steering Committee (30 members, Chair: Bill Sprigg)
- Executive Committee (President: Scott Van Pelt, HAQAST Co-I)
- 450+ members; Monthly webinars/ Workshops/ Collaborative Projects

[Join DANA at dustalliance.org](https://dustalliance.org)

DANA Webinars (Karin Ardon-Dryer, Ling Ren and Jenny Hand)



United Nations

International Day of Combating Sand and Dust Storms, 12 July

The UN General Assembly proclaimed 12 July as the International Day of Combating Sand and Dust Storms (SDS) ([A/RES/77/294](#)).



*Addressing International Conference on Aeolian Research
as Chair of WMO SDS Research Programme*



*Hiking at White Sand NP to
Celebrate Dust Day*

International Dust Day is a big milestone to raise public awareness of negative dust impacts.

Closing Thoughts

- a. Paucity of observations in dusty areas → losing sites due to funding
- b. Need better satellite sensors/algorithms to detect dust storms
- c. Environmental justice: Not well studied, but likely to be serious
- d. Needs for real-time monitoring of soil disturbance
- e. Modeling: Good at capturing large dust storms, but not so for smaller “killer” storms, such as the Utah and Illinois ones.

Acknowledgement

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- Data from DOT, NOAA, NASA, EPA, NPS and their partners.