



ATMOSPHERIC SCIENCES

LIASCIENCE

Measurements of Threshold Friction Velocities on Abandoned Agriculture Fields near Picacho Peak using a Portable Dust Generator

Presenter: Kyle Rine

Acknowledgements: A.E. Sáez, E.A. Betterton,
M. King, M. Jones, P. Saliba

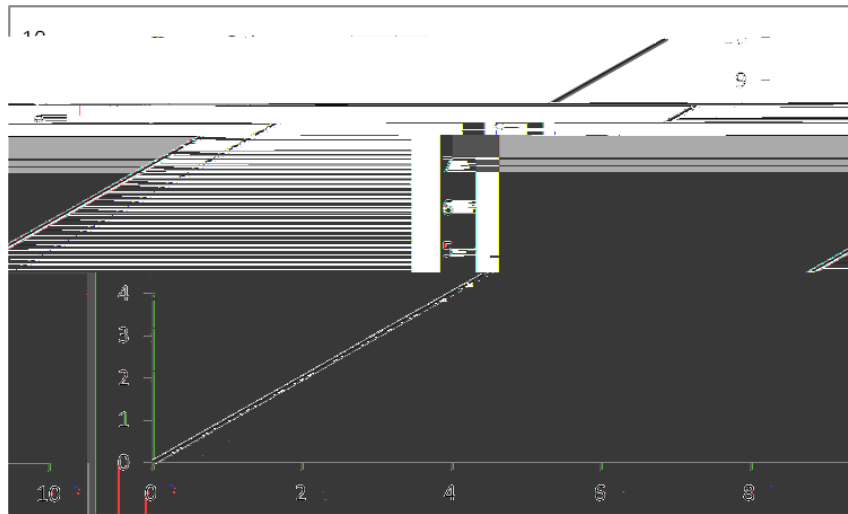
Research Supported by NIEHS Superfund Research
Program

5th annual regional dust workshop, 2016



Would Be Nice...

Nonsense



Wind Speed



Our jobs would be a lot easier if there were a simple linear relation between dust and wind speed. We'd be done!!!

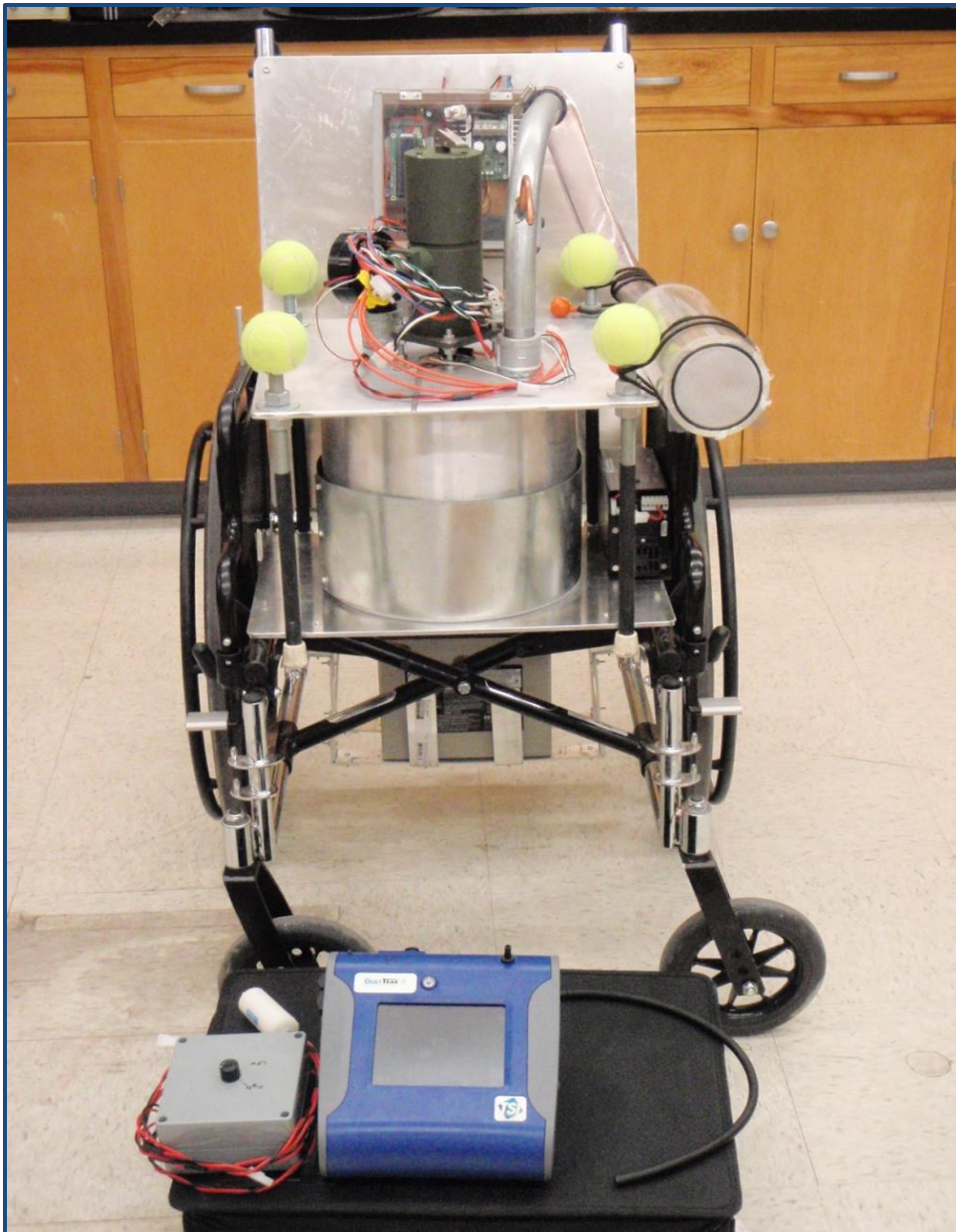
In The Real World

- Wind Speed
- Soil Moisture
- Soil Particle Shape and Size
- Soil Content
- Presence of Crust
- Presence of Vegetation
- Relative Humidity
- Presence of Aerosolizable Particles
- Soil Disturbance Level
- Current Amount of Dust in the Air

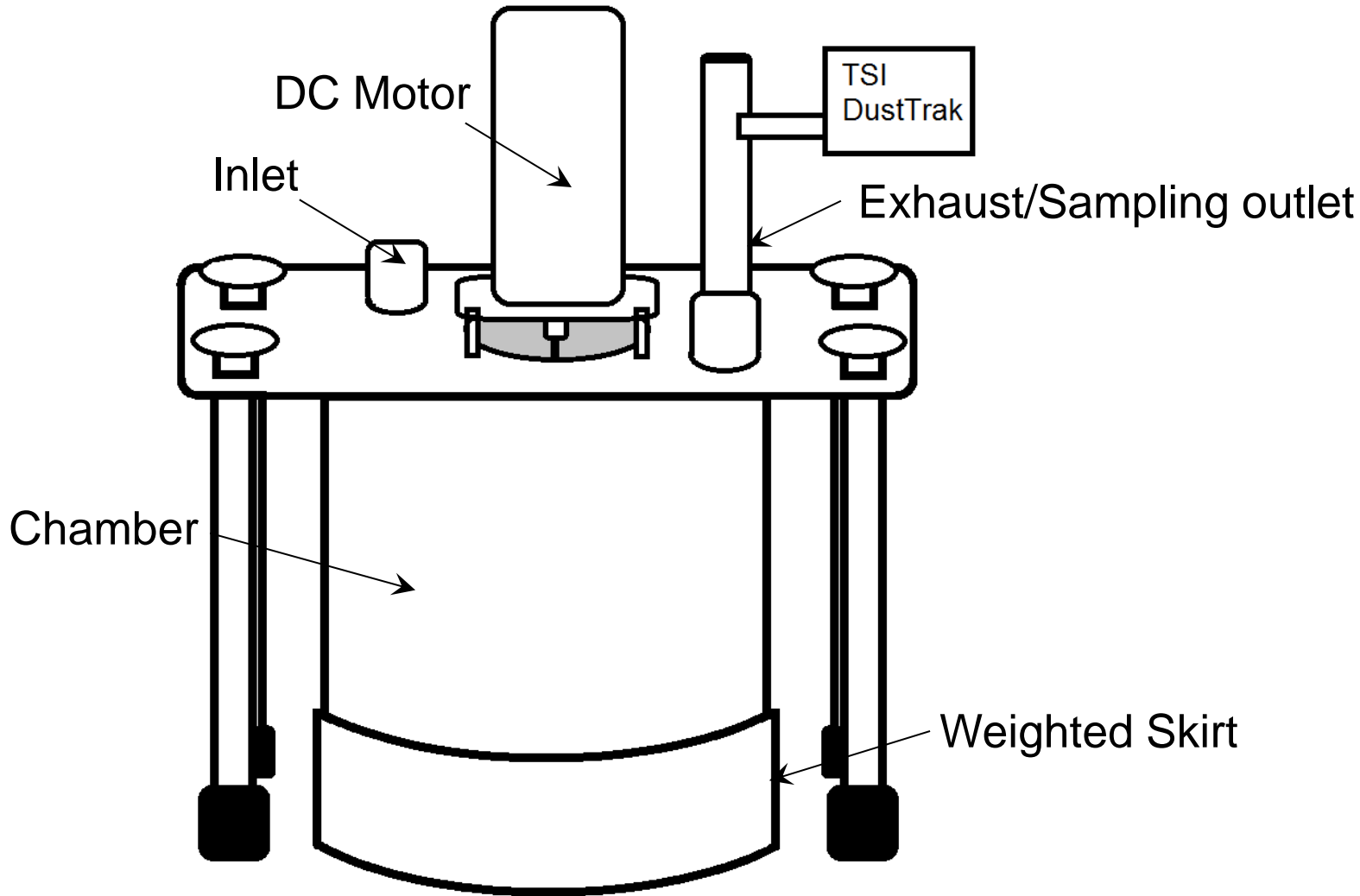


All Factor into Dust Production

Portable Dust Generator



- Based on PI-SWERL by DRI
- Produces a known wind speed
- Measures real time dust production
- Lightweight and Compact



DC Motor

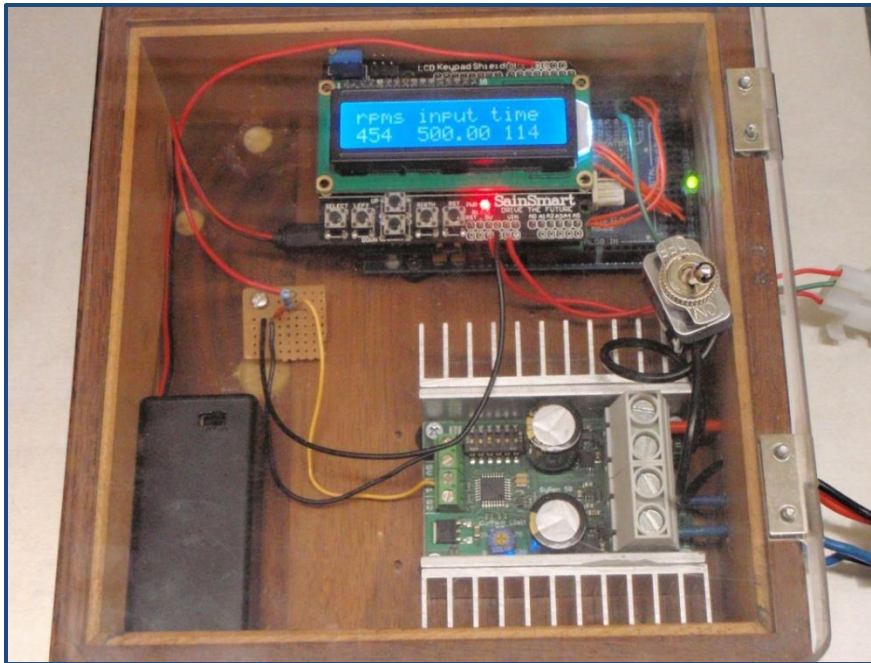
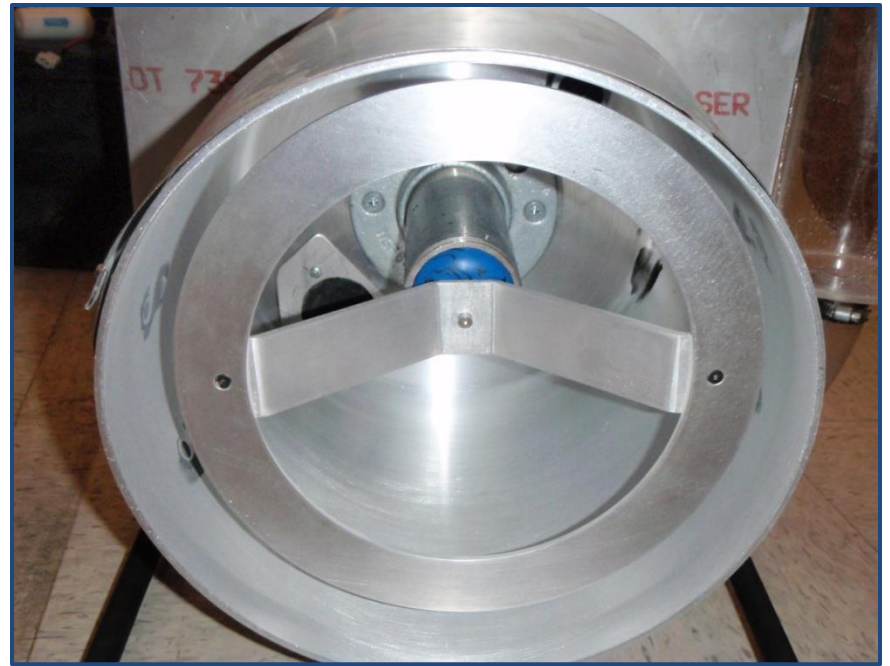
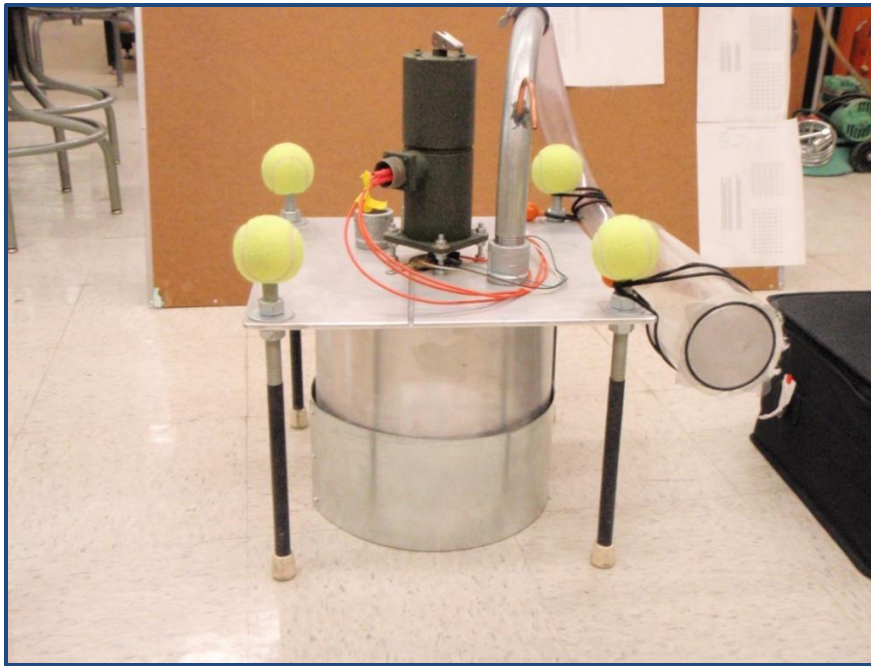
Inlet

TSI
DustTrak

Exhaust/Sampling outlet

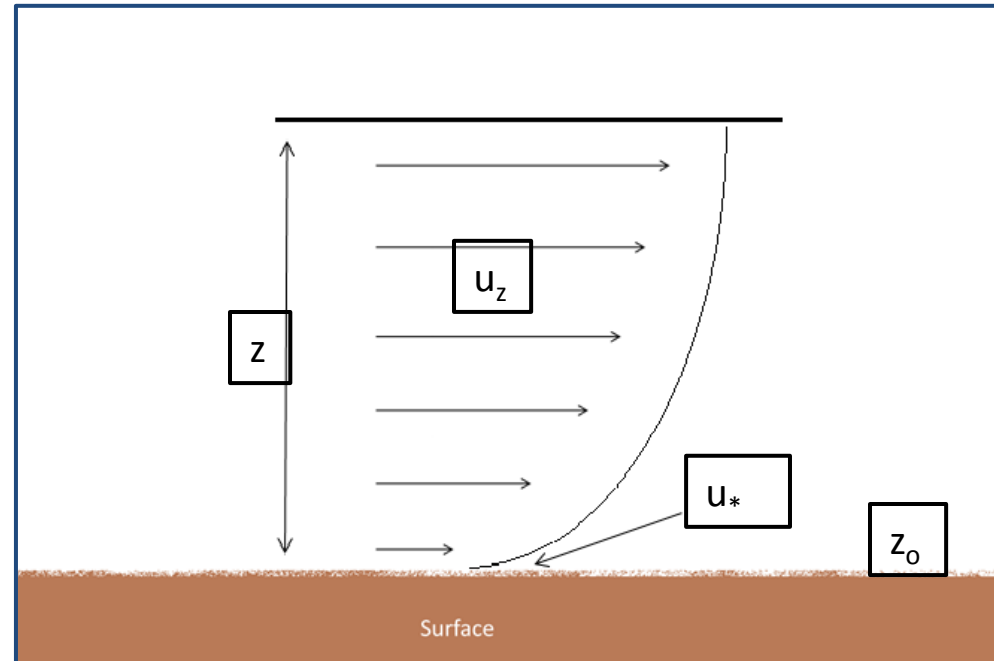
Chamber

Weighted Skirt



Theory

- Friction Velocity
 - Shear stress at the surface
 - Mechanical erosion
- Threshold Friction Velocity
 - Friction velocity that is needed for mechanical erosion
 - u_f
- Log-Wind Profile
 - u_z : Wind speed at height Z
 - κ : Von Kármán constant (0.4)
 - z_0 : Roughness length
 - u_* : Friction velocity



$$\frac{u_z}{u_*} = \frac{1}{\kappa} \ln \left(\frac{z}{z_0} \right)$$

Advantages over traditional wind tunnel

- Lower Cost
- Lower maintenance
- Less man power required
- Smaller foot print
- Ease of use

Traditional Wind Tunnel

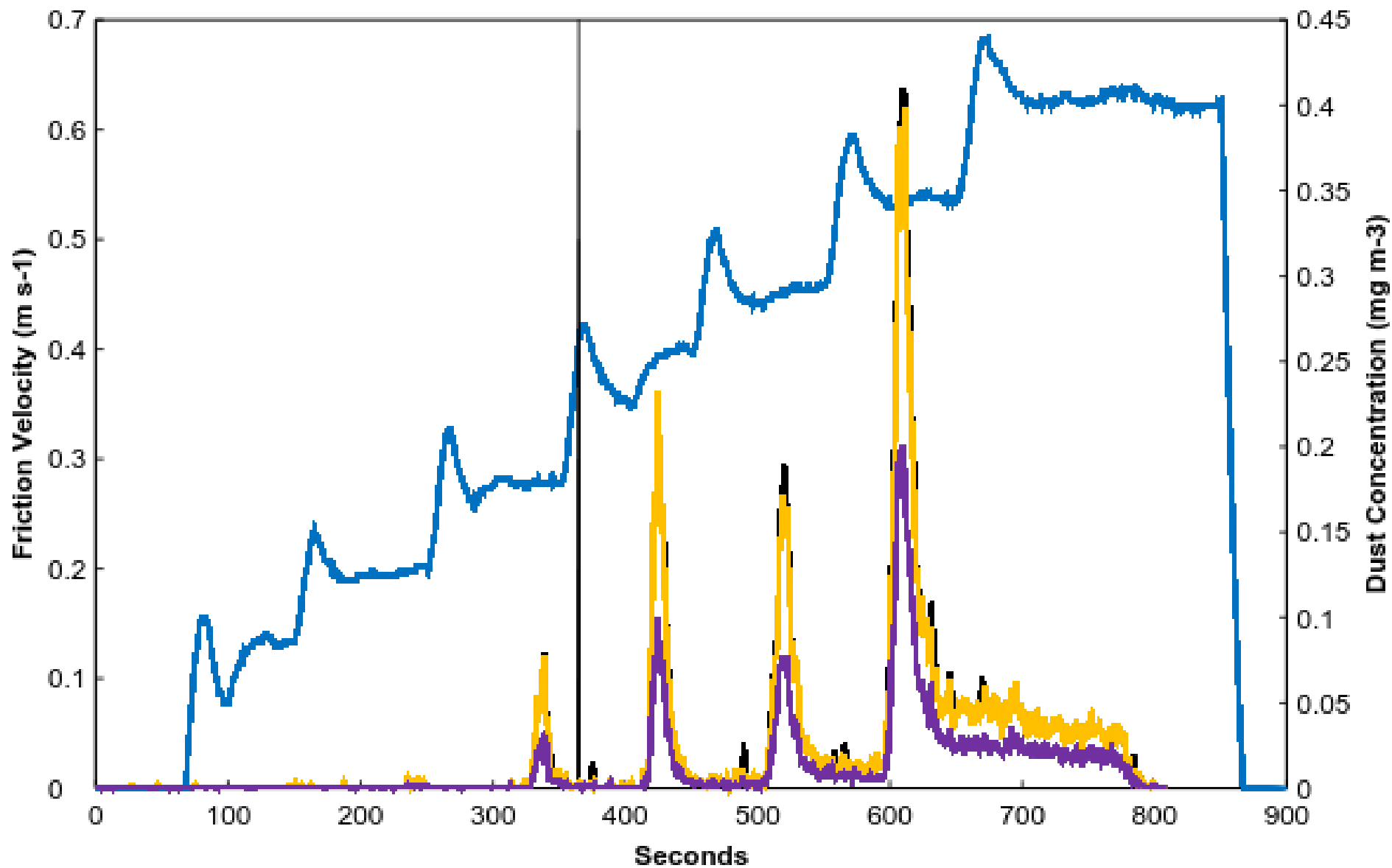


Portable “Wind Tunnel”



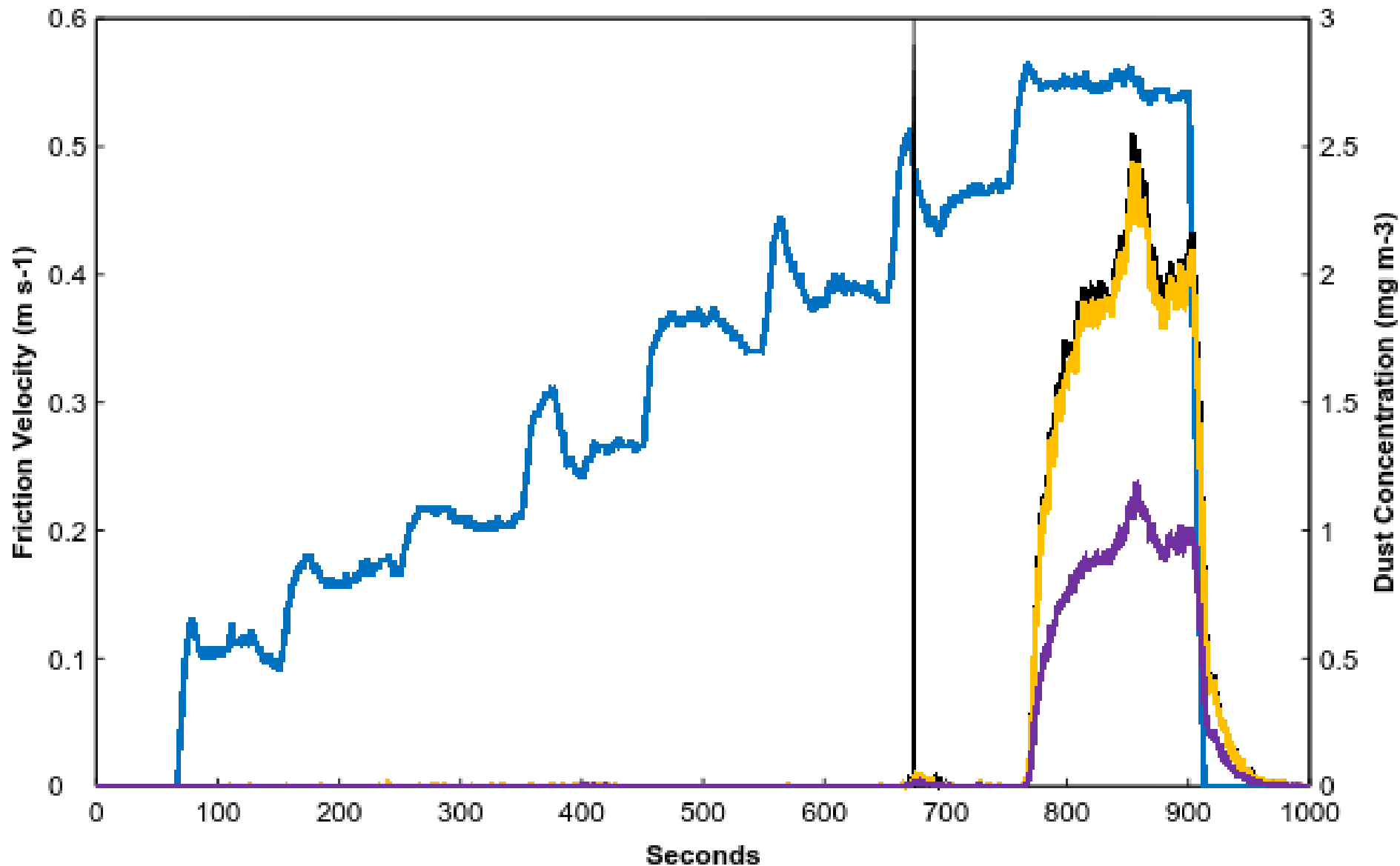
Iron King Tailings (Disturbed Surface)

— Friction Velocity — Threshold Friction Velocity — TSP — PM10 — PM2.5



Santa Cruz Riverbed (Undisturbed Surface)

— Friction Velocity — Threshold Friction Velocity — TSP — PM10 — PM2.5



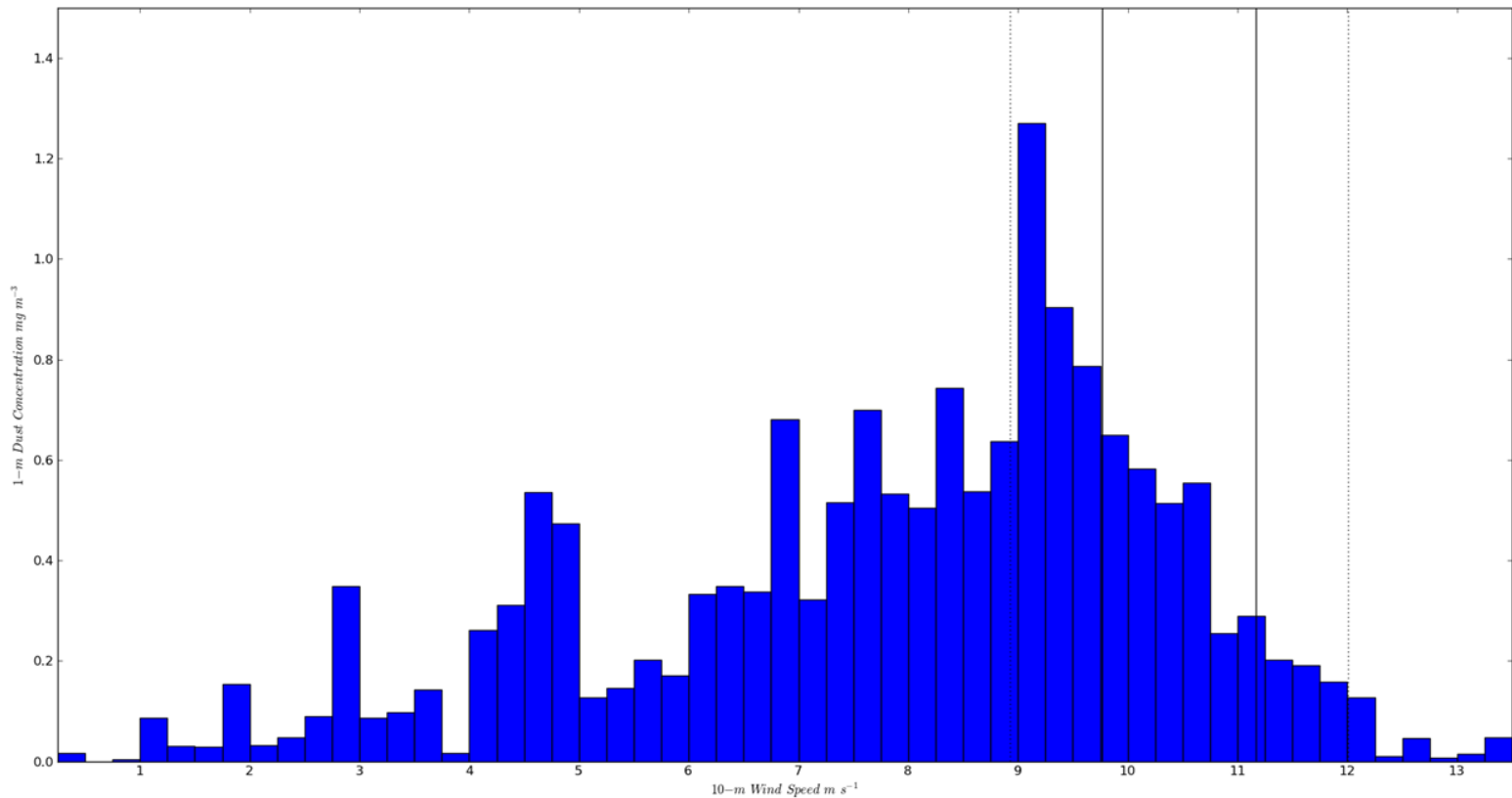
Threshold Friction Velocity data

Location	U_* (m s ⁻¹)	U_{10} (m s ⁻¹)	n
Santa Cruz	(0.48-0.56) ± 0.03	(12.96-15.12) ± 0.81	4
Antelope Ravine U.	(0.58-0.61) ± 0.03	(15.98-16.81) ± 0.83	5
I.K. Lower Tailings	(0.39) ± 0.03	(10.89) ± 0.84	1
I.K. Upper Tailings	(0.35-0.40) ± 0.03	(9.77-11.17) ± 0.84	5
Antelope Ravine D.	(0.40) ± 0.04	(9.47) ± 0.95	1
Picacho Peak	(0.32-0.37) ± 0.02	(9.53-11.02) ± 0.89	3



Dust Observations in Iron King

June 2012 to May 2013 (8 AM to 8 PM)



1-m dust [10 minute average]
10-m winds [10 minute average]

What's next?

- Picacho Peak Area
- Dewey- Humboldt
- Wilcox Playa

Thank You