



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

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### 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!!!

Dust

## 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

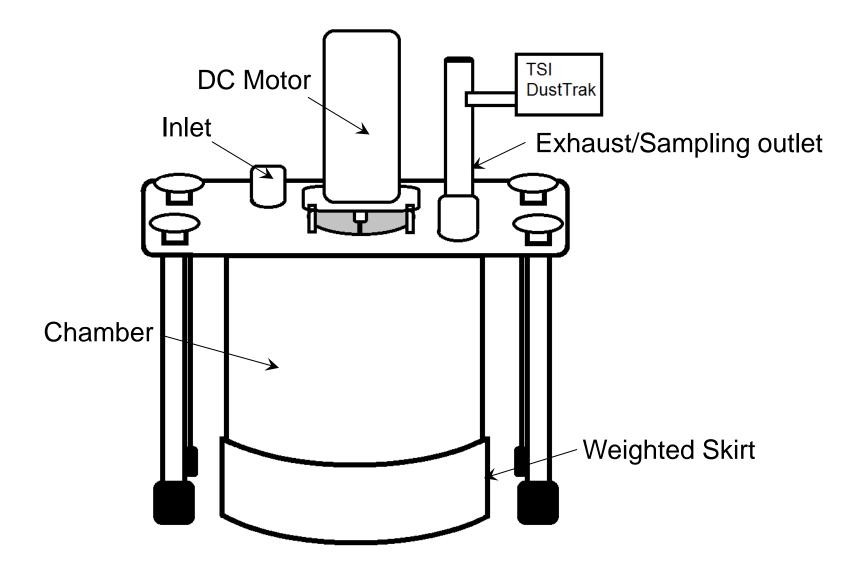


### **All Factor into Dust Production**



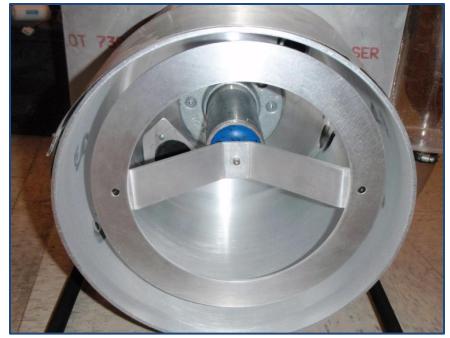
### **Portable Dust Generator**

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





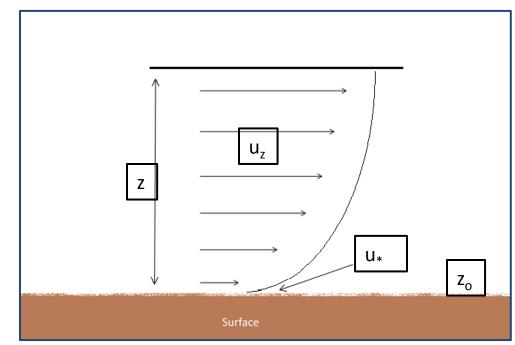






# Theory

- Friction Velocity
  - Shear stress at the surface
  - Mechanical erosion
- Threshold Friction Velocity
  - Friction velocity that is needed for mechanical erosion
  - u<sub>f</sub>
- Log-Wind Profile
  - u<sub>z</sub>: Wind speed at height Z
  - κ: Von Kármán constant (0.4)
  - z<sub>o</sub>: Roughness length
  - u<sub>\*</sub>: Friction velocity



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

#### Advantages over traditional wind tunnel

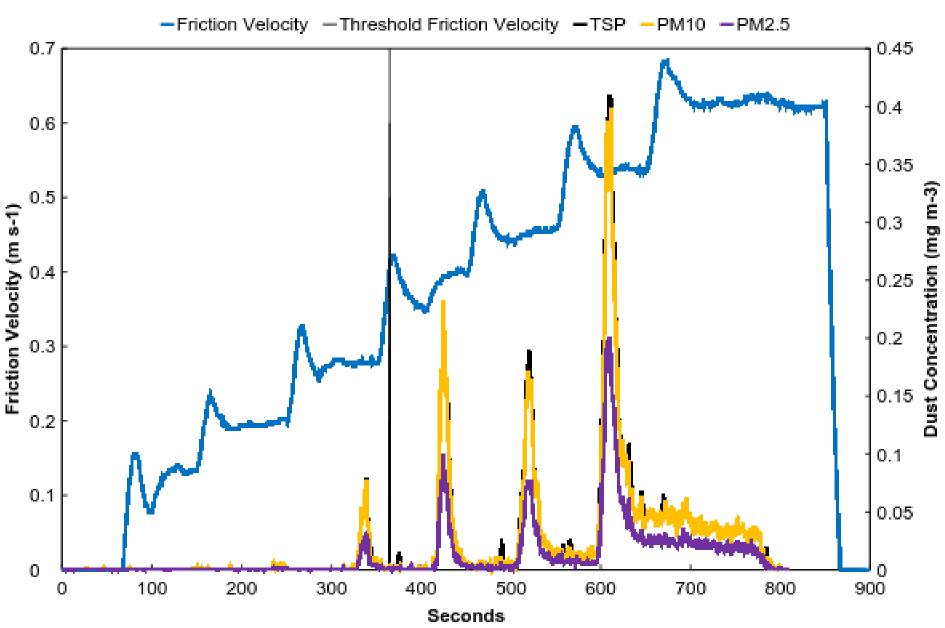
Lower Cost Lower maintenance Less man power required Smaller foot print Ease of use

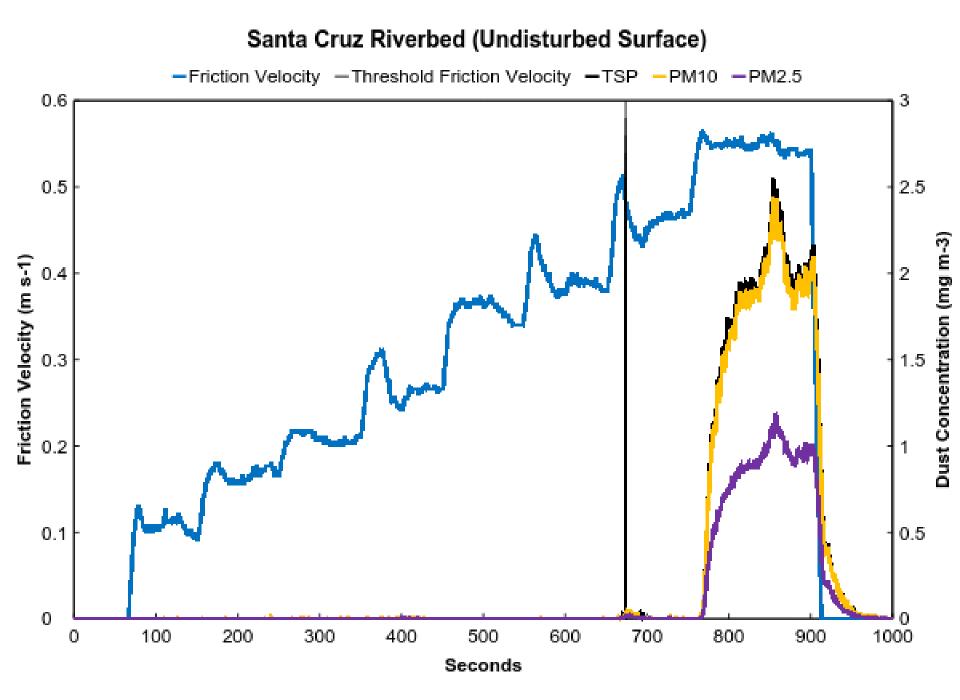
#### **Traditional Wind Tunnel**

#### Portable "Wind Tunnel"



#### Iron King Tailings (Disturbed Surface)





### Threshold Friction Velocity data

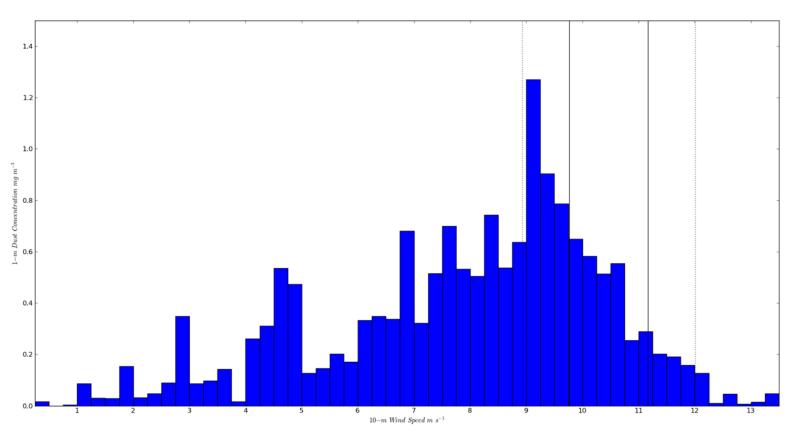
Location	U∗ (m s⁻¹)	U <sub>10</sub> (m s⁻¹)	n
Santa Cruz	(0.48-0.56) ± 0.03	(12.96-15.12) ± 0.81	4
Antelope Ravine U.	(0.58-0.61) ± 0.03	(15.98-16.81) ± 0.83	5
I.K. Lower Tailings	(0.39) ± 0.03	(10.89) ± 0.84	1
I.K. Upper Tailings	(0.35-0.40) ± 0.03	(9.77-11.17) ± 0.84	5
Antelope Ravine D.	$(0.40) \pm 0.04$	(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

