



HYDROLOGY & ATMOSPHERIC SCIENCES

LIASCIENCE

Evaluation of threshold friction velocities at potential dust sources in semi-arid regions

2020 Arizona Dust Workshop

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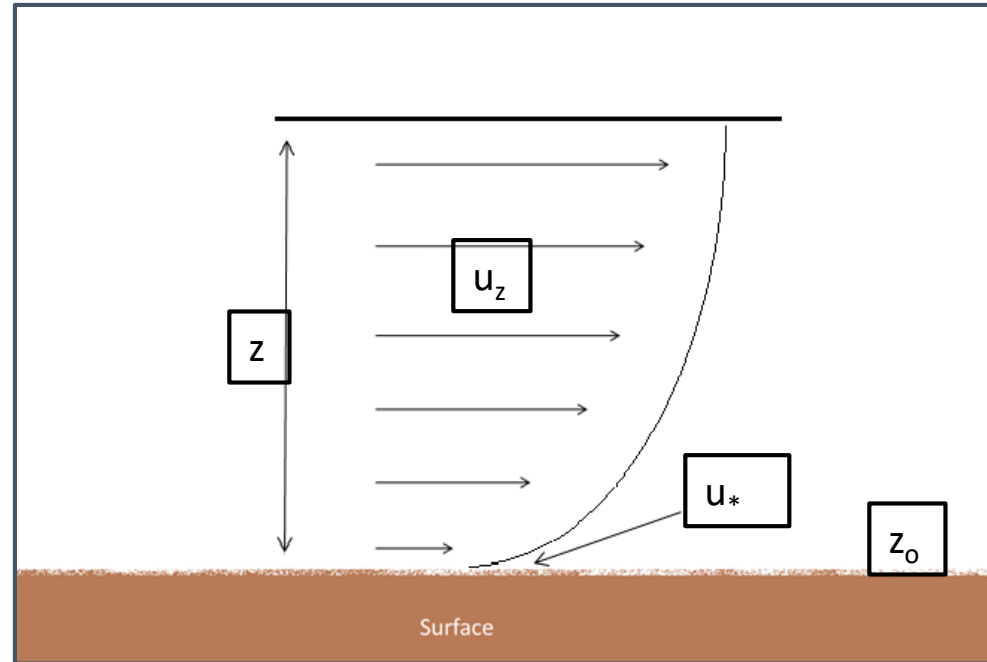
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Theory

- 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_o : Roughness length
 - u_* : Friction velocity



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

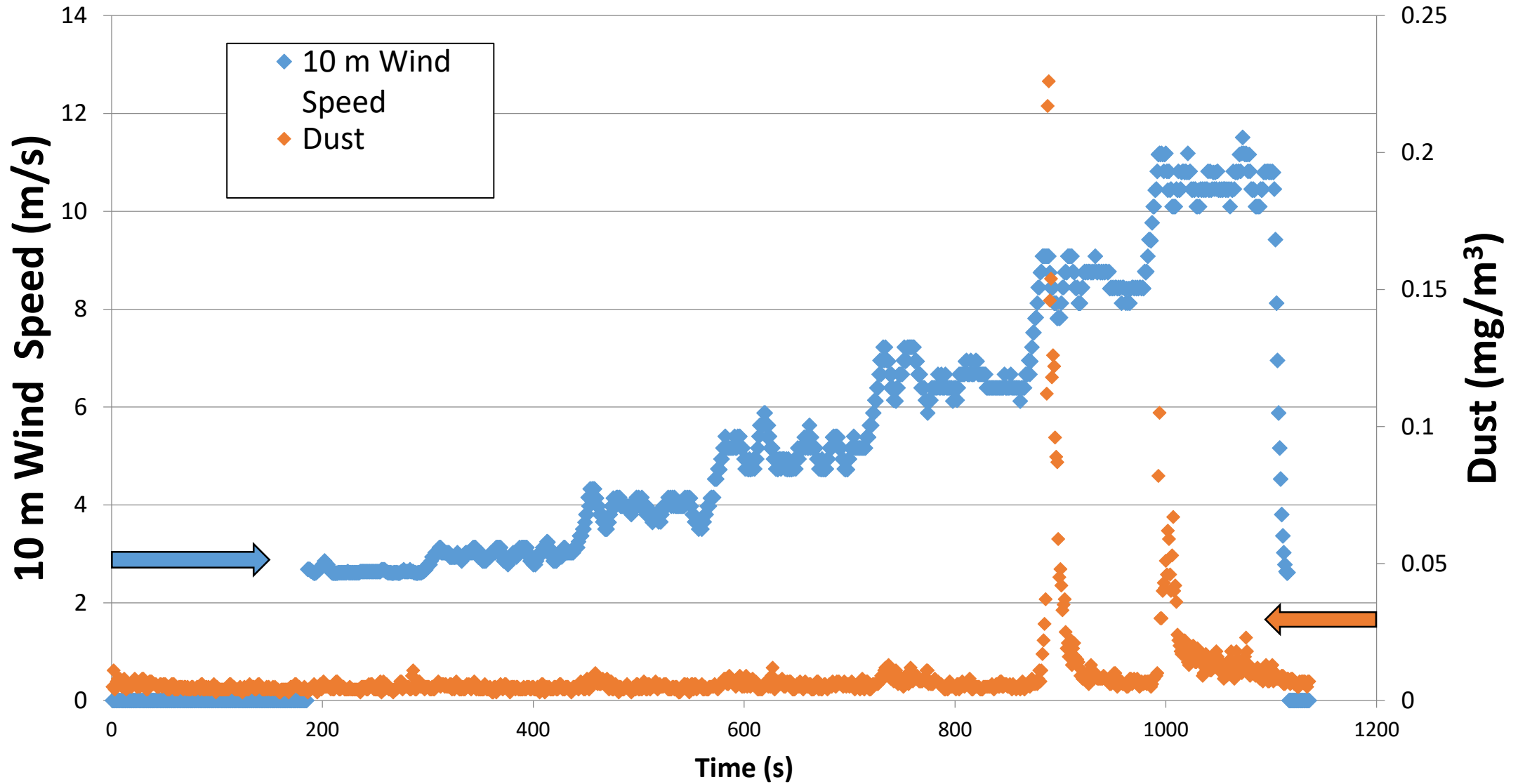
Portable Dust Generator



1. Exhaust Tube 2. Blower 3. Adjustable legs 4. Hall Sensor 5. Annular Ring 6. Isokinetic Sampling Port 7. Motor 8. Adjustable Skirt

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

Dust and Wind Speed in Picacho Peak

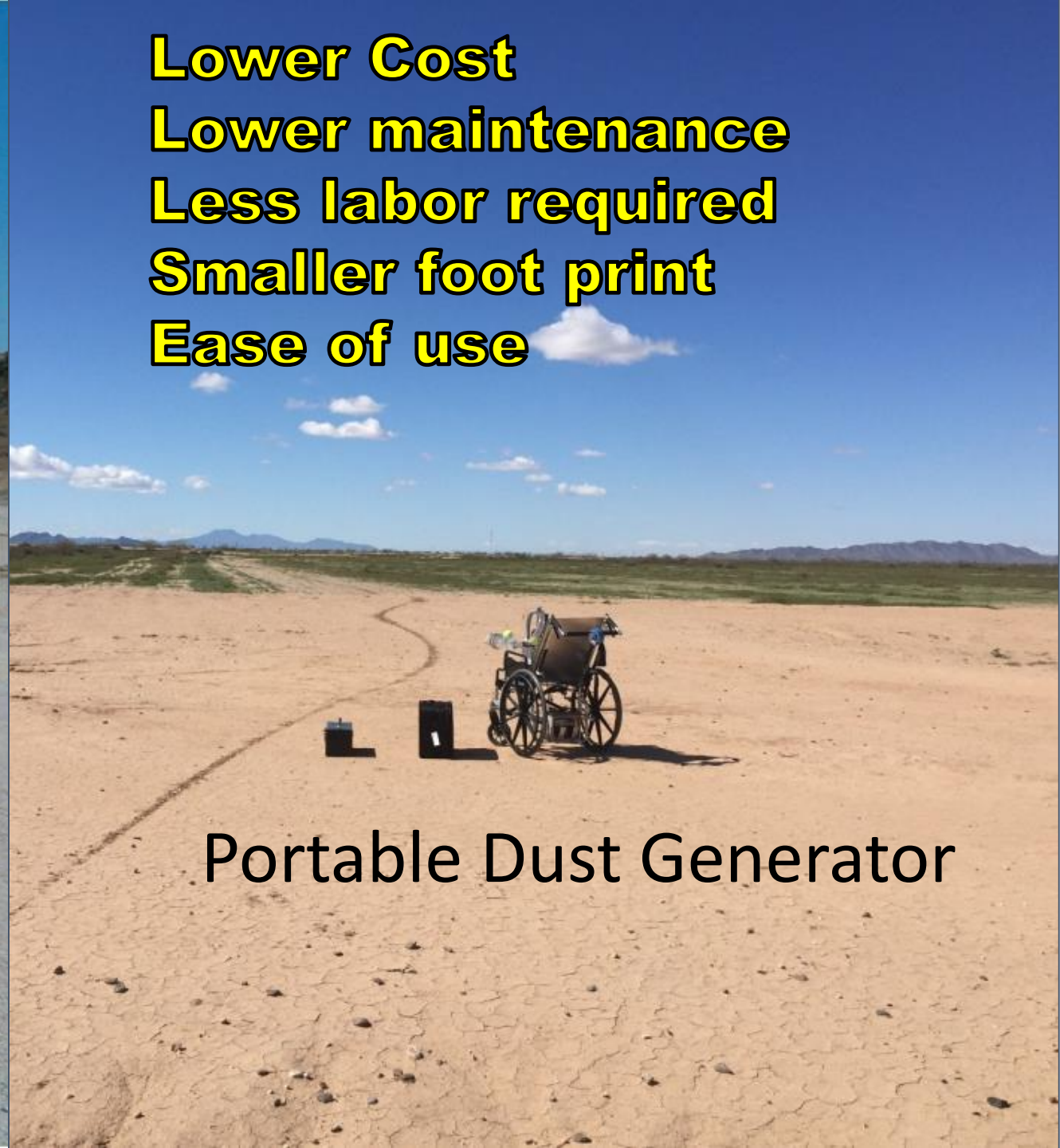




Traditional Wind Tunnel

Photo Credit: Desert Research Institute

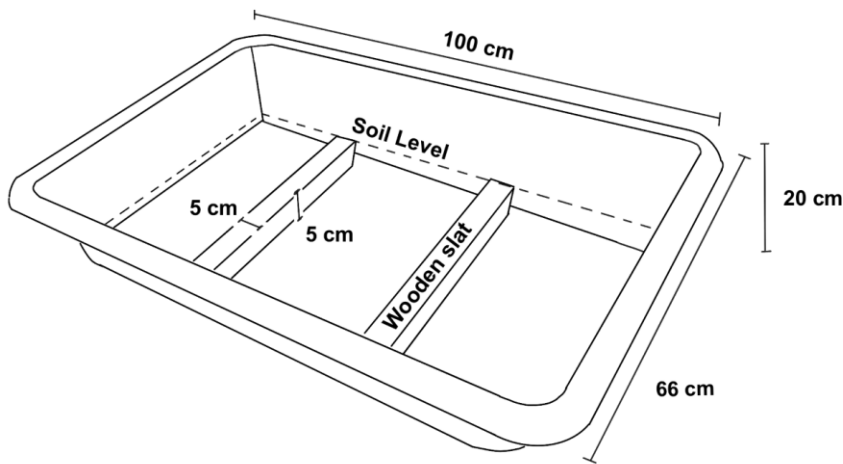
Lower Cost
Lower maintenance
Less labor required
Smaller foot print
Ease of use



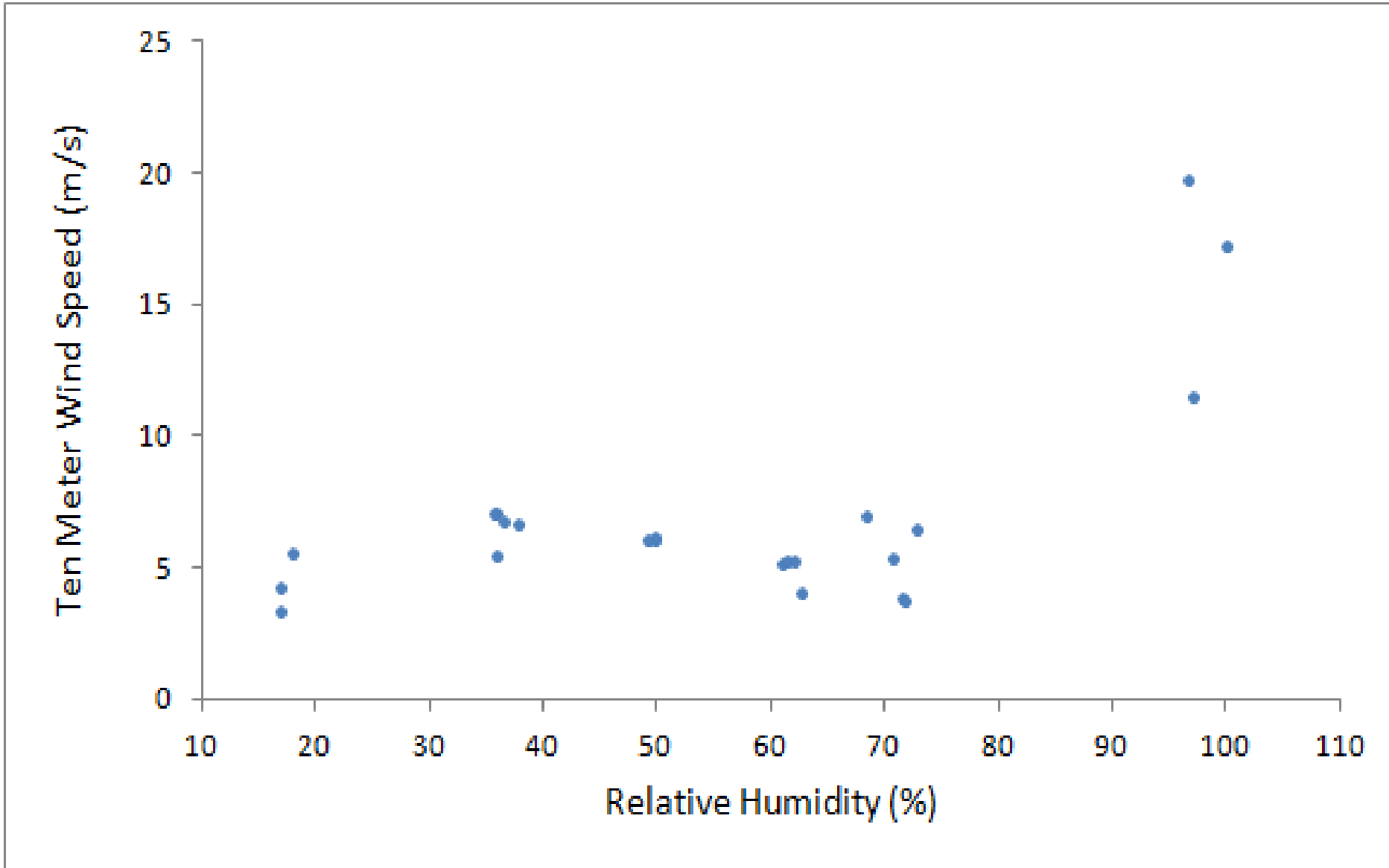
Portable Dust Generator

Effect of Atmospheric Relative Humidity

- Soil moisture and relative humidity.
- The Biosphere 2, humidity controlled environments.
- Reproducible test surface.



Effect of Atmospheric Relative Humidity



Erodible Potential of Surfaces

The potential for a dust storm can depend on presence of aerosolizable particles.

- Recent wind activity.
- Crusting/disturbance of the surface.

On Crusted surfaces

After the initial run, Threshold Friction Velocity values increased past the detection limit of our instrument.

On Disturbed surfaces

Threshold Friction Velocity values remained constant through successive runs.

Thank You

