

Modeling Dust Generation and Deposition

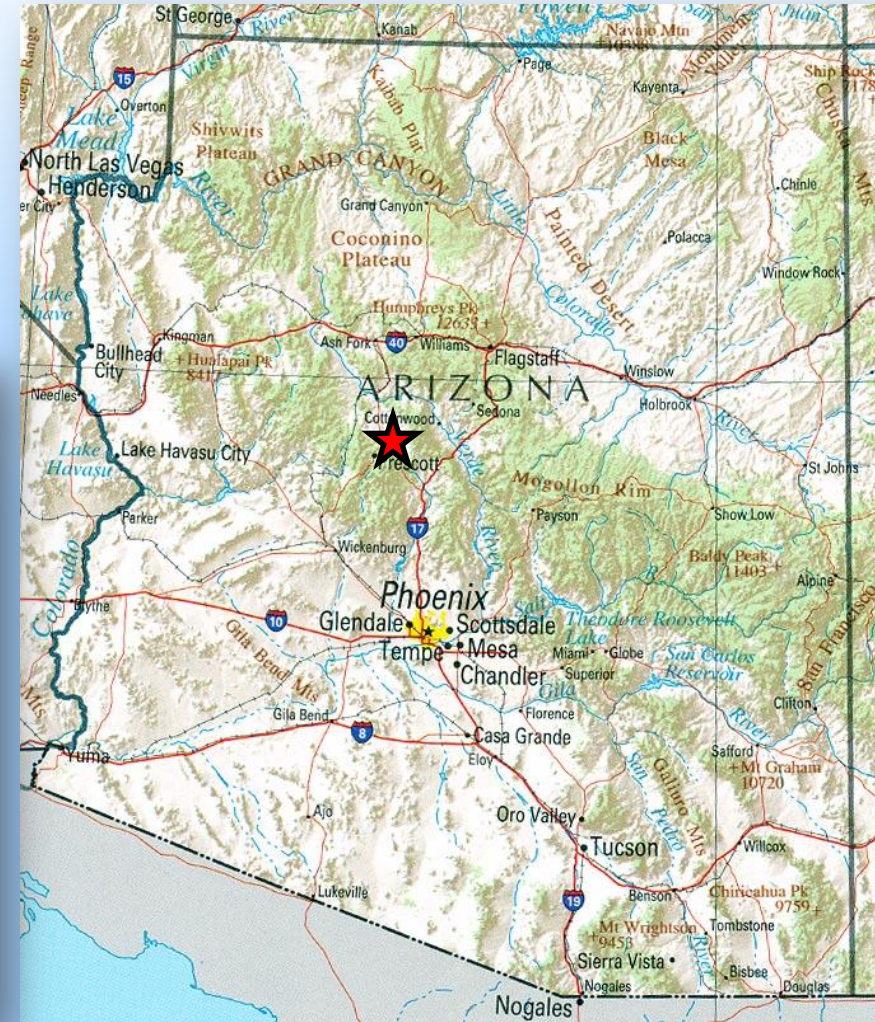
Eduardo Saez, Michael Stovern, Matthew King, Kyle Rine,
Omar Felix, Mary Jones, Victoria Raught, Solianna Herrera,
Eric Betterton

Atmospheric Sciences and Chemical and Environmental
Engineering, University of Arizona, Tucson, AZ

Dust Storm Workshop
Casagrande, Arizona, March 2015

Iron King tailings impoundment

- Superfund site since 2008
- Directly adjacent to the town of Dewey-Humboldt
- Highly contaminated (As, Pb)



Eddy flux towers

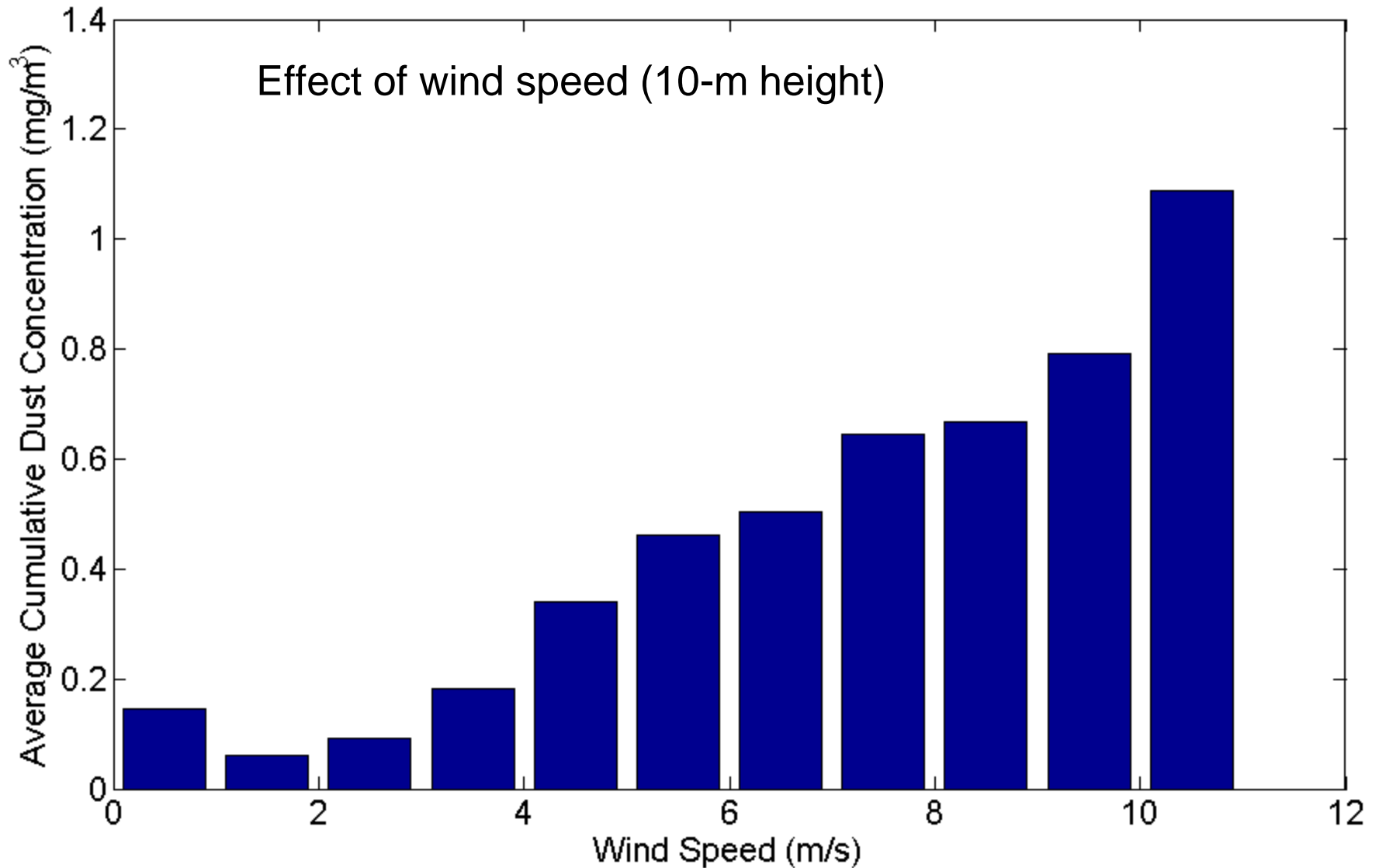
- TSI DUSTTRAKs
- Anemometers
- Wind vanes
- Thermometers
- Hygrometers
- Soil moisture probe
- Soil radiometer

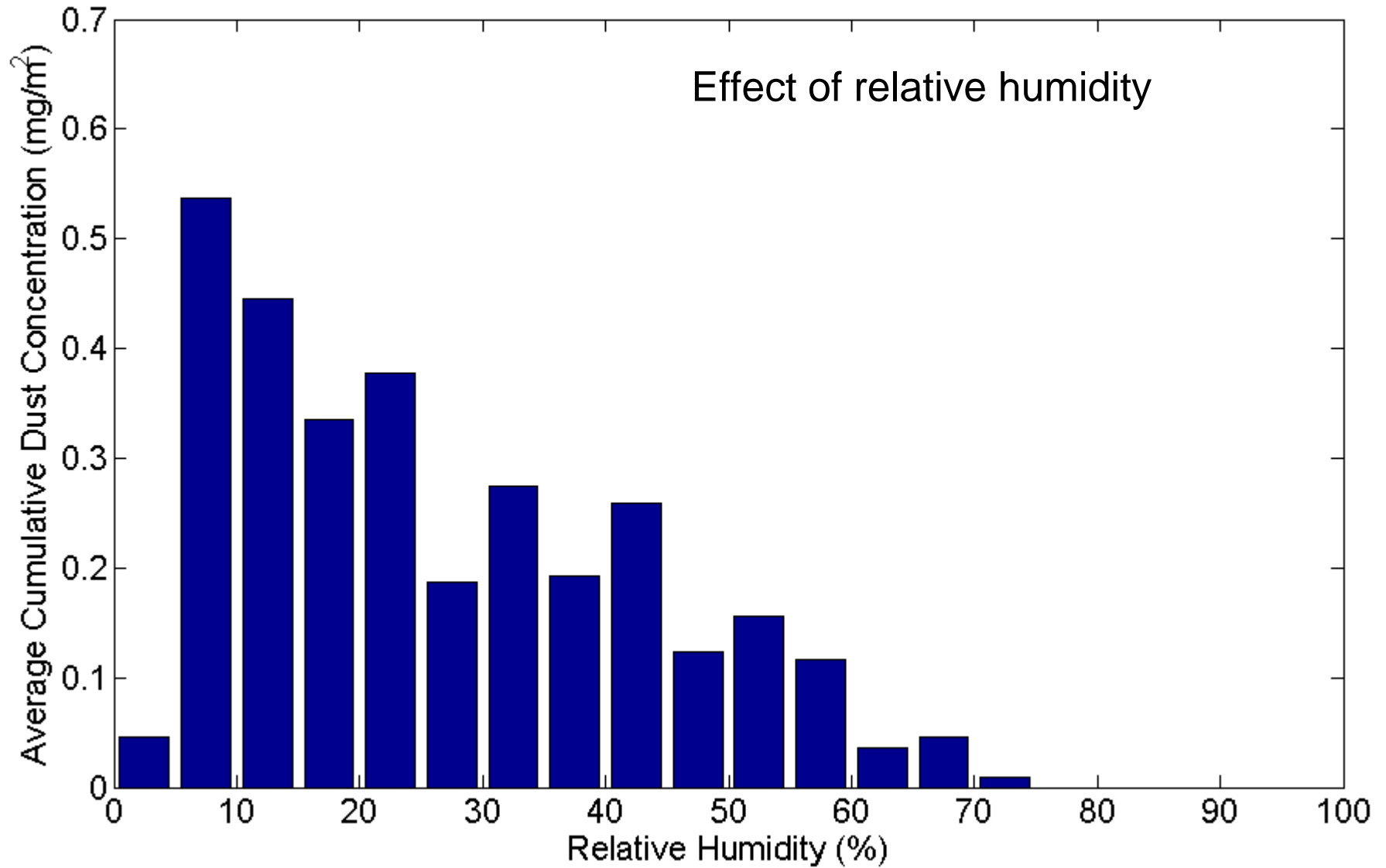


MOUDI

- Micro-Orifice Uniform-Deposit Impactor
- Particle Size Fractionation



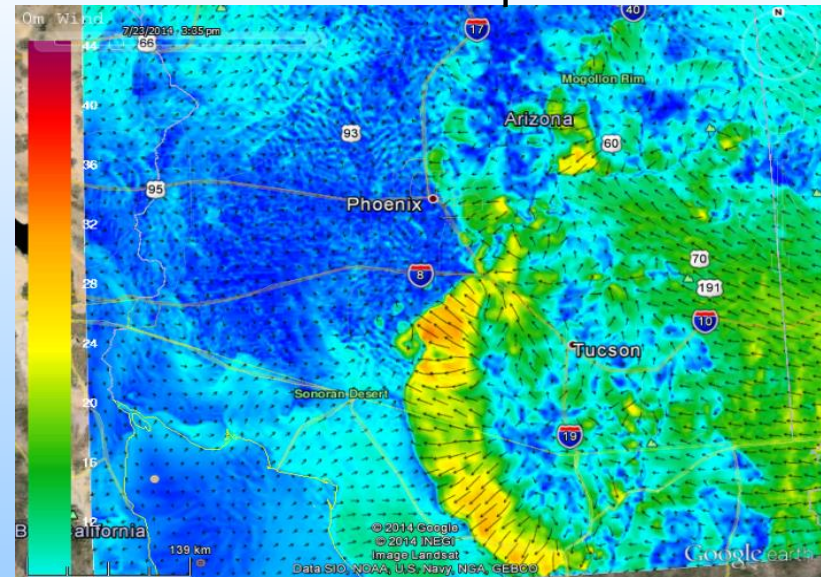




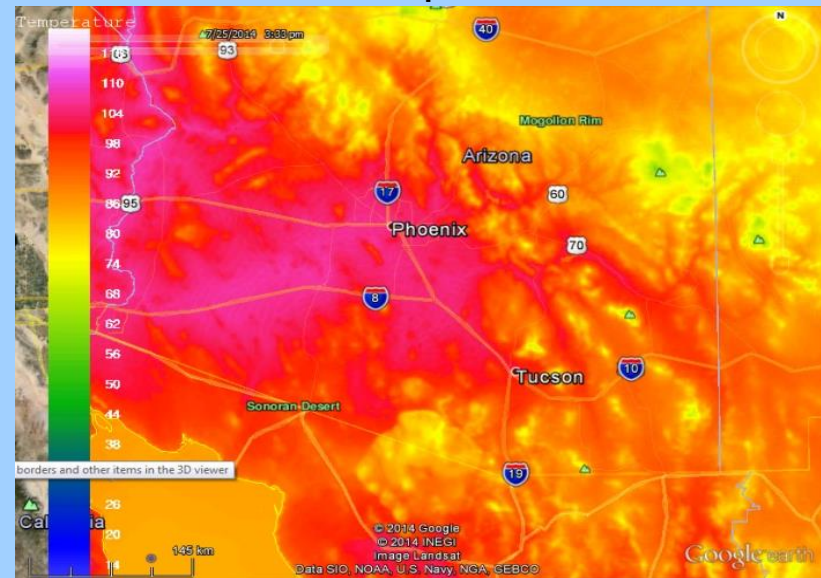
Initialization Weather Forecast

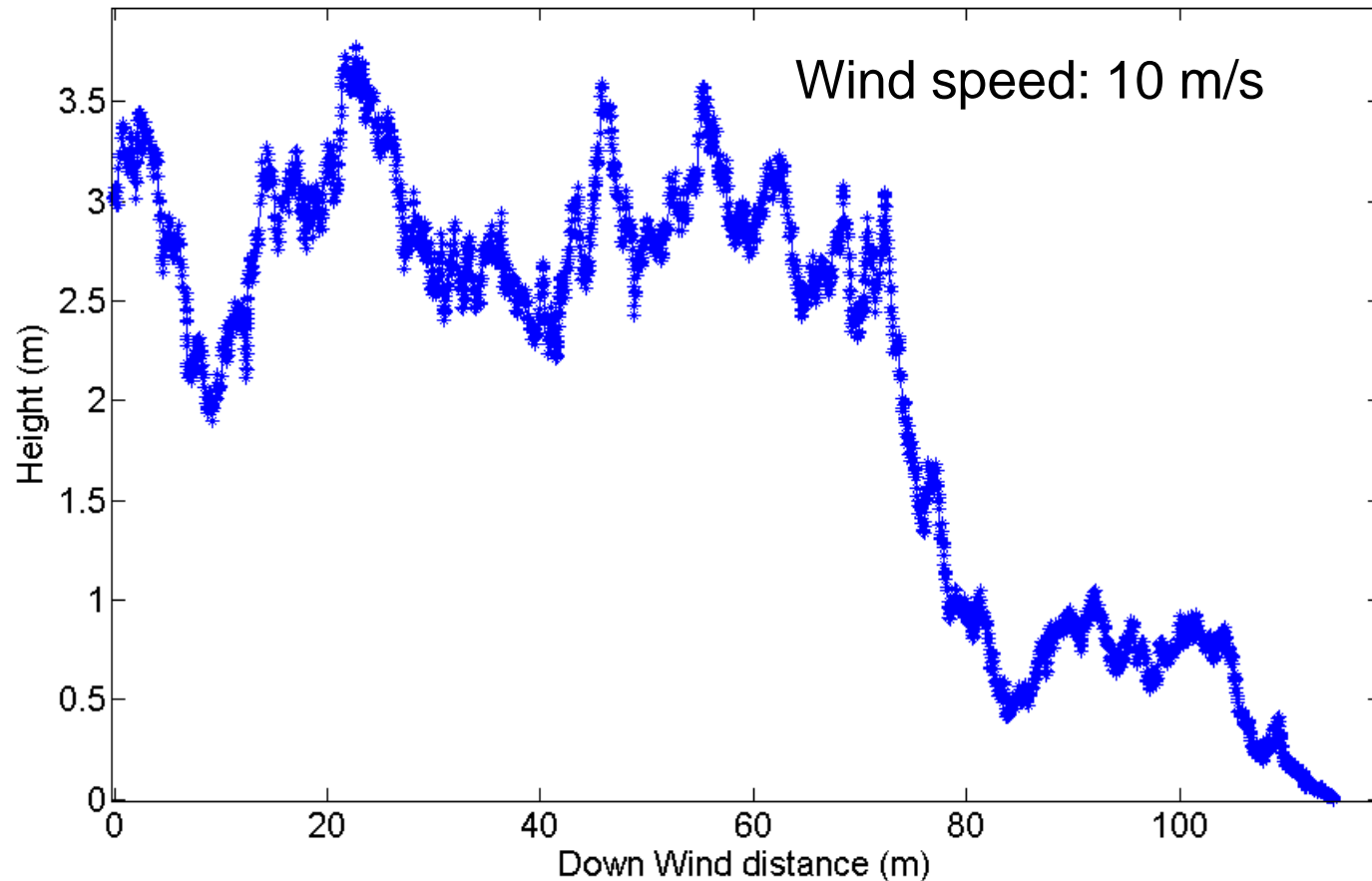
- Operational WRF model
 - 1.8-km spatial resolution (inner domain)
 - Hourly temporal resolution
- Analysis of WRF surface output
 - 10-m Wind Velocity
 - 2-m Temperature
 - 2-m Specific Humidity
 - Surface Pressure

10-m wind speed



2-m temperature



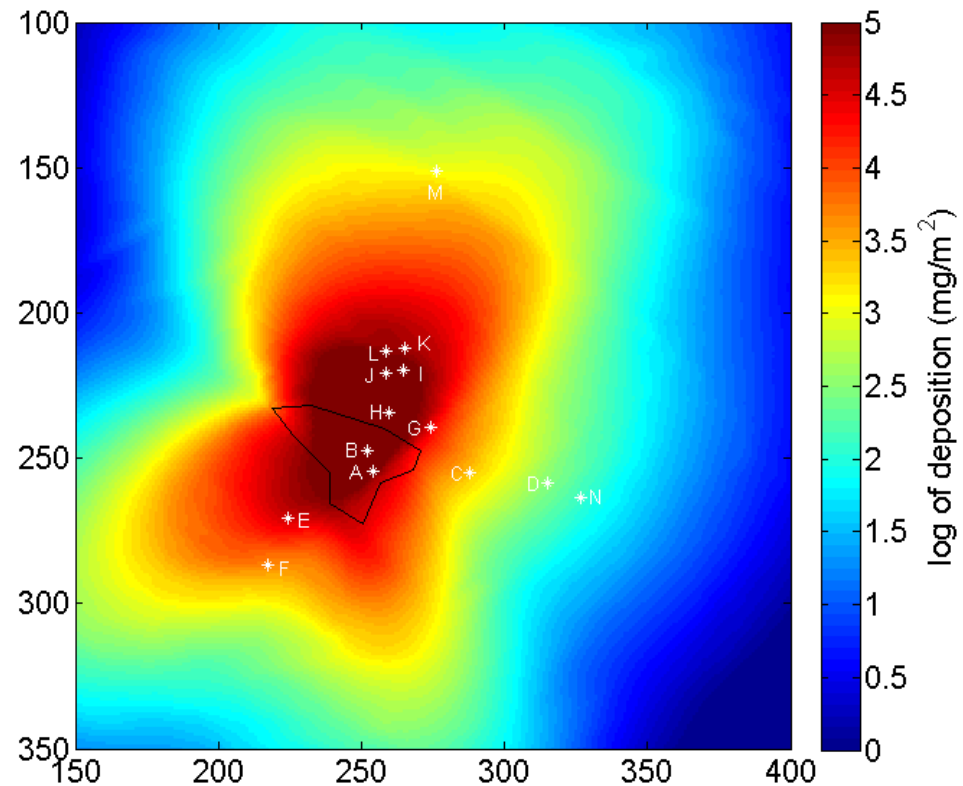


Equations of motion for individual particles coupled to WRF model predictions allow for determination of particle trajectories. Example: 10- μm particle

In situ verification

- Inverted-disc (Frisbee) samplers
 - Weight
 - Chemical composition
 - Lead isotopes
- Month long sampling campaigns
 - May and June, 2014

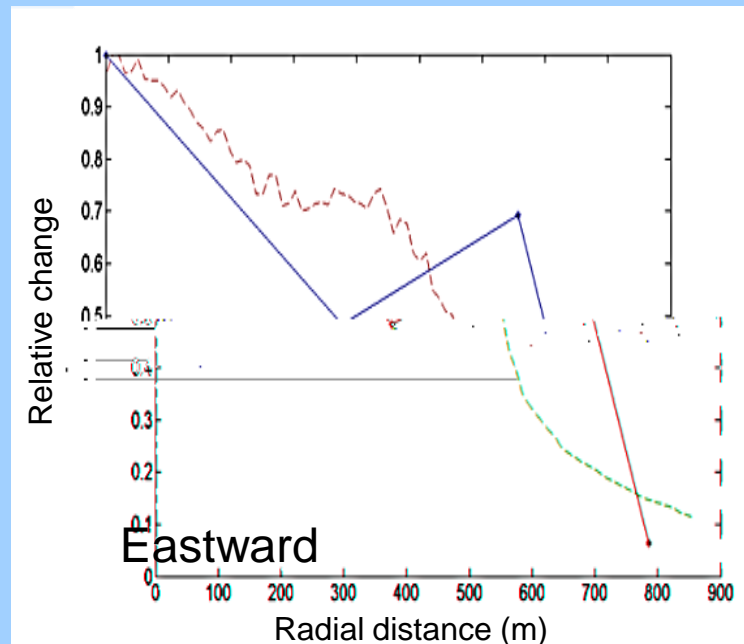
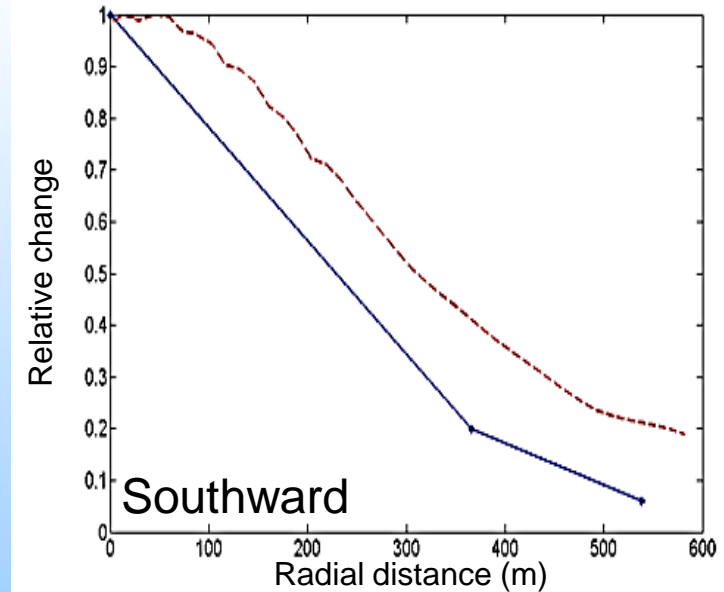
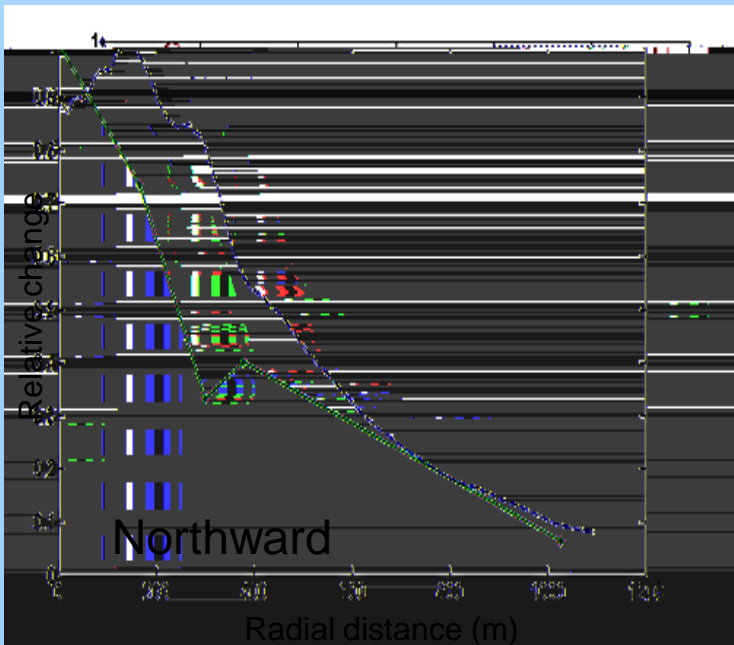
DFM results for May 2014



Model (DFM PM27)

VS

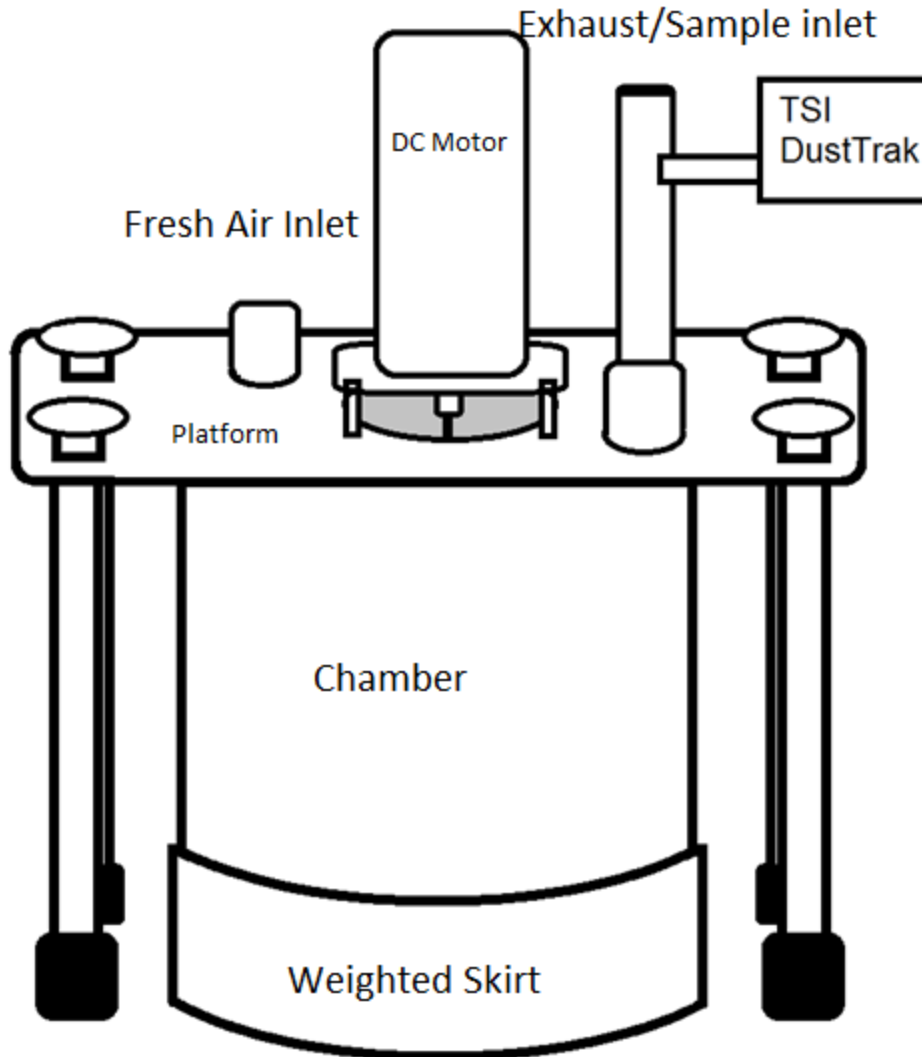
Observed (lead concentration)



1. The deposition forecasting model can be used to predict transport and deposition of $PM_{2.7}$ tailings dust
2. Arsenic and lead contaminants can be used as tailings dust tracers
3. DFM captured the spatial variations of the deposition patterns up to 1 km distance from the tailings

Next: Develop a realistic model for dust generation.

First step: Measurement of threshold friction velocities



- Based on PI-SWERL (Etyemezian et al., 2007)
- A rotating annular ring provides shear to generate dust
- Wind speeds measured by a calibrated Irwin sensor
- Objective: to measure threshold friction velocities for dust generation

Picacho Peak

- Measured RPM
- +— TSP Concentration
- PM10 Concentration
- x— PM2.5 Concentration

