

# Atmospheric and Stability Effects on Aerially Applied Agricultural Sprays

Bradley K Fritz

USDA-ARS

College Station, TX

# Transport of Aerial Sprays

- Aerially spray droplet transport is a function of:
  - Atmospheric Dispersion
    - Gravitational settling
    - Downwind transport by mean winds
    - Aircraft wake turbulence
    - Turbulent mixing in air

# Objective

- To examine the effects of meteorological conditions, including atmospheric stability, on the fate and transport of aerial sprays

# Methods

- 12 replicated applications
  - AT-402B setup to deliver FINE spray at 3 gpa
    - See paper for more details
  - Meteorological data monitored with tower
  - Airborne and ground deposition samples collected

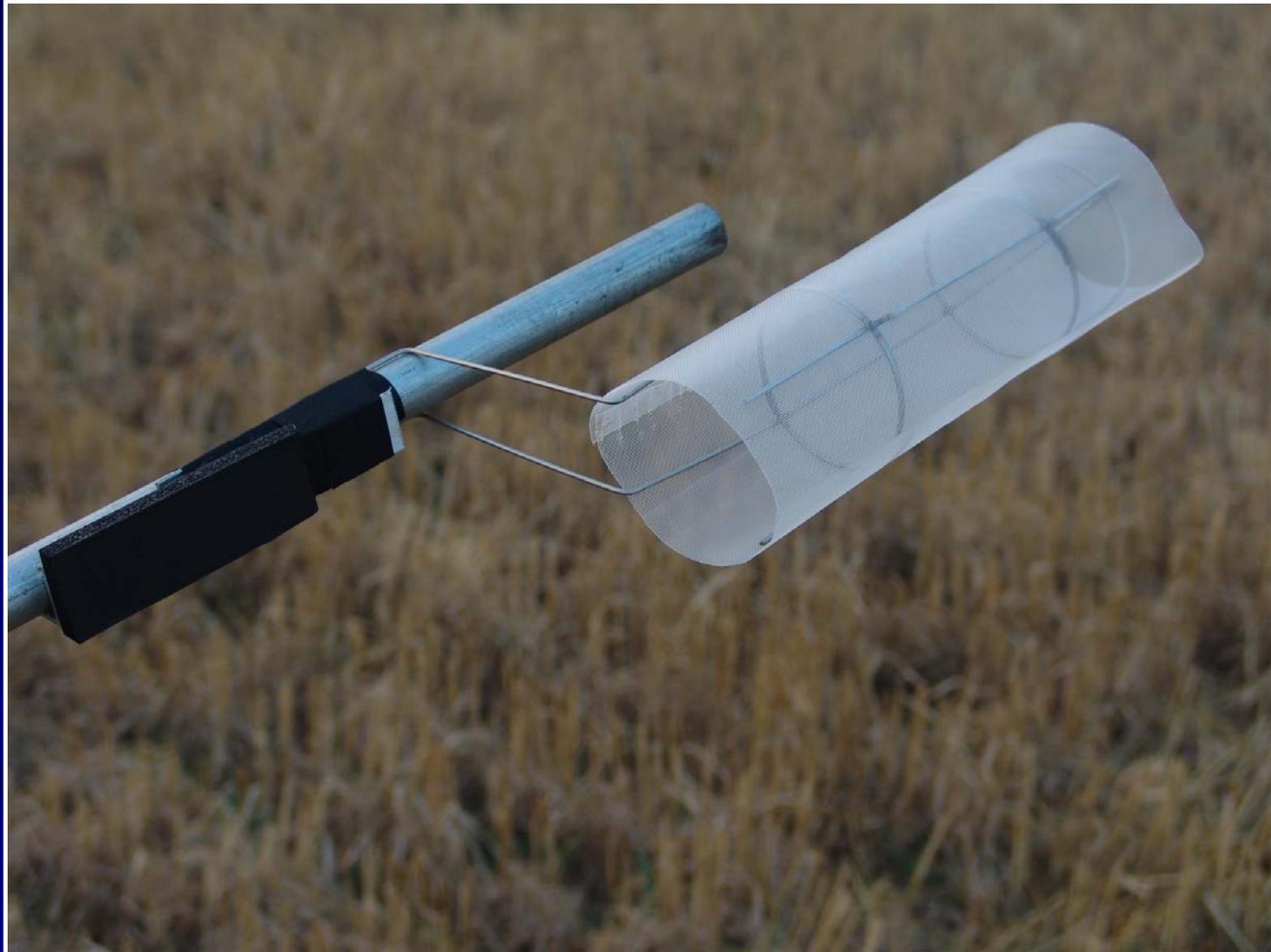
# Meteorological Tower



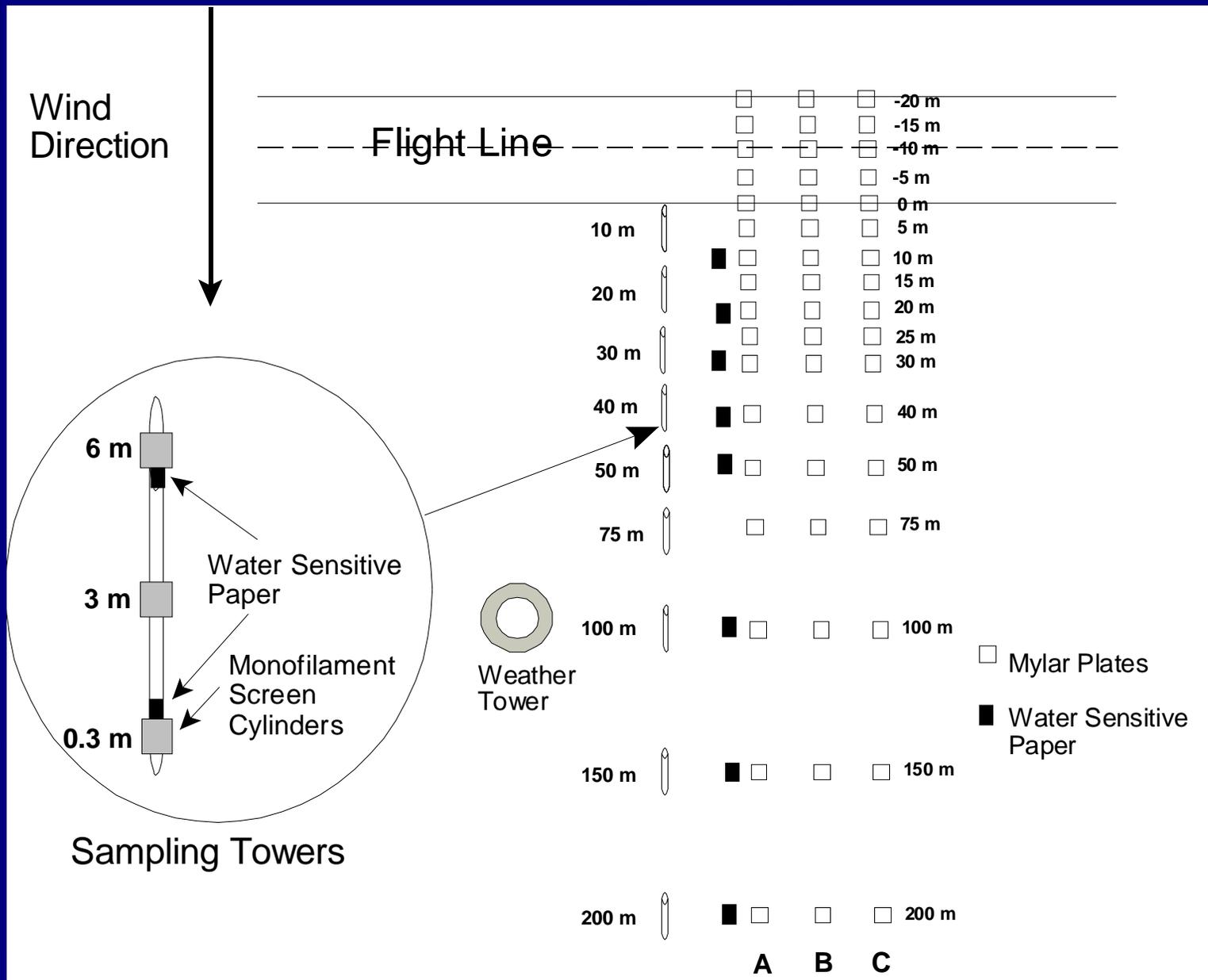
# Samples



# Airborne Samples



# Sampling Layout

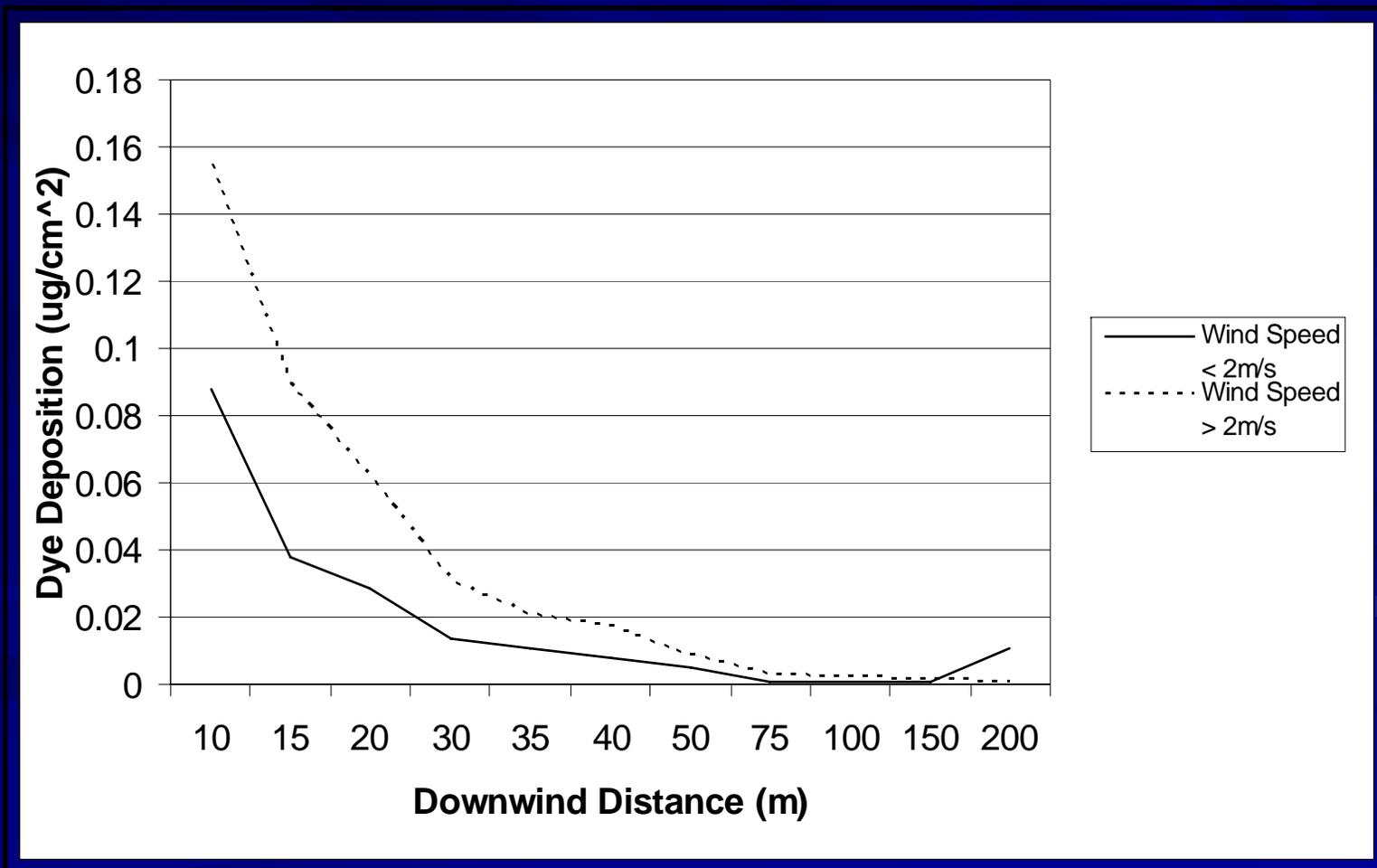


# Results – Met Data

Rep	Time of Acquisition	Wind Speed (m/s)	Stability Ratio	Yates et al. (1976) Stability Class <sup>1</sup>
1	7:16 am	0.5	21.2	VS
2	7:43 am	0.5	-9.1	U
3	8:02 am	1.0	-3.4	U
4	8:18 am	0.8	-3.9	U
5	8:35 am	1.0	-4.0	U
6	8:50 am	0.9	-5.8	U
7	7:04 pm	2.5	-0.2	U
8	7:20 pm	2.5	0.1	S
9	7:36 pm	2.2	0.6	S
10	7:52 pm	2.4	0.7	S
11	8:08 pm	2.4	0.9	S
12	8:24 pm	1.6	3.7	VS

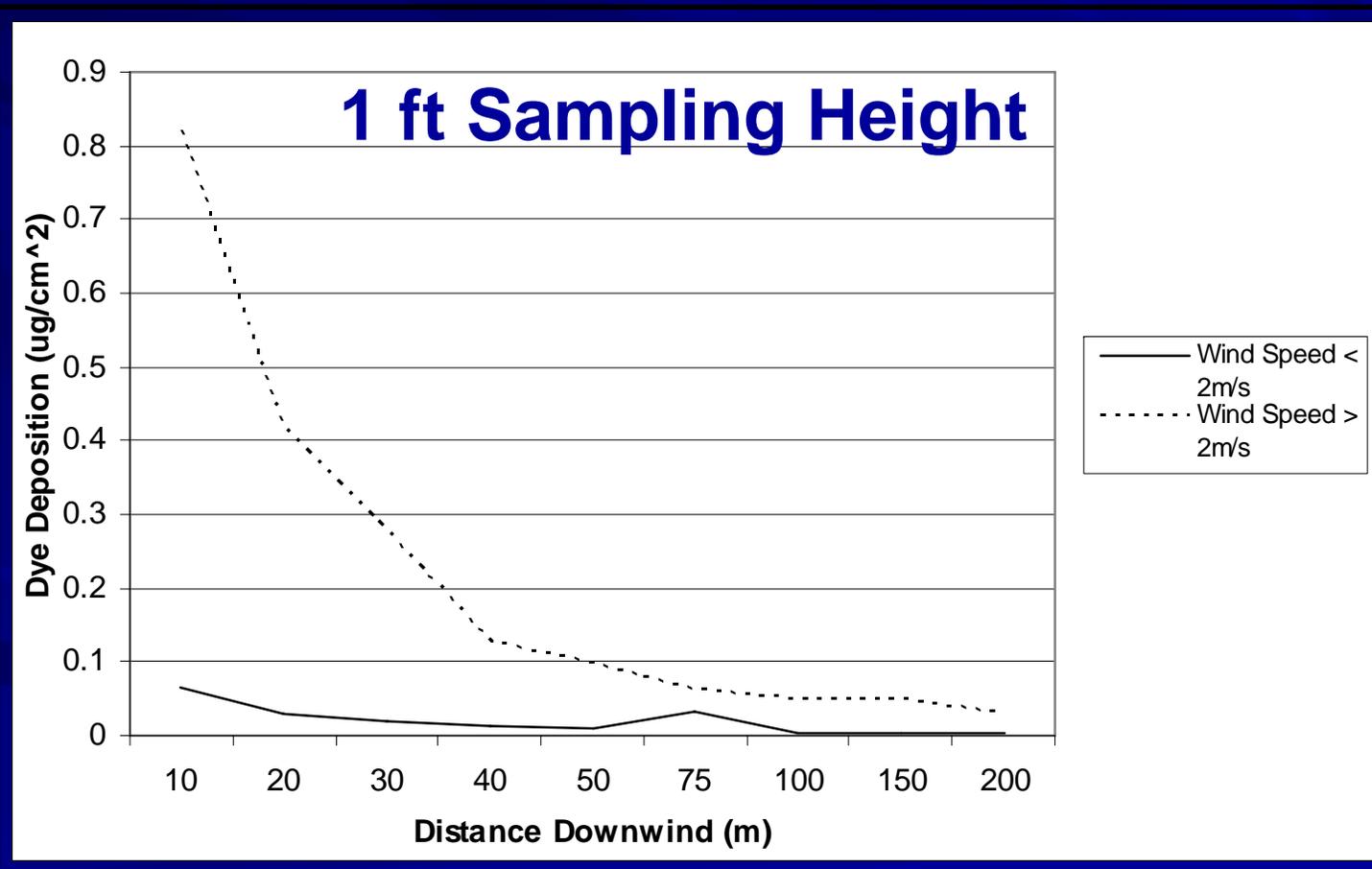
# Ground Deposition - Mylar

- No significant Stability effects
- Higher wind speeds had higher downwind deposition – as would be expected, but wind speed effects wash out past the 50 m mark

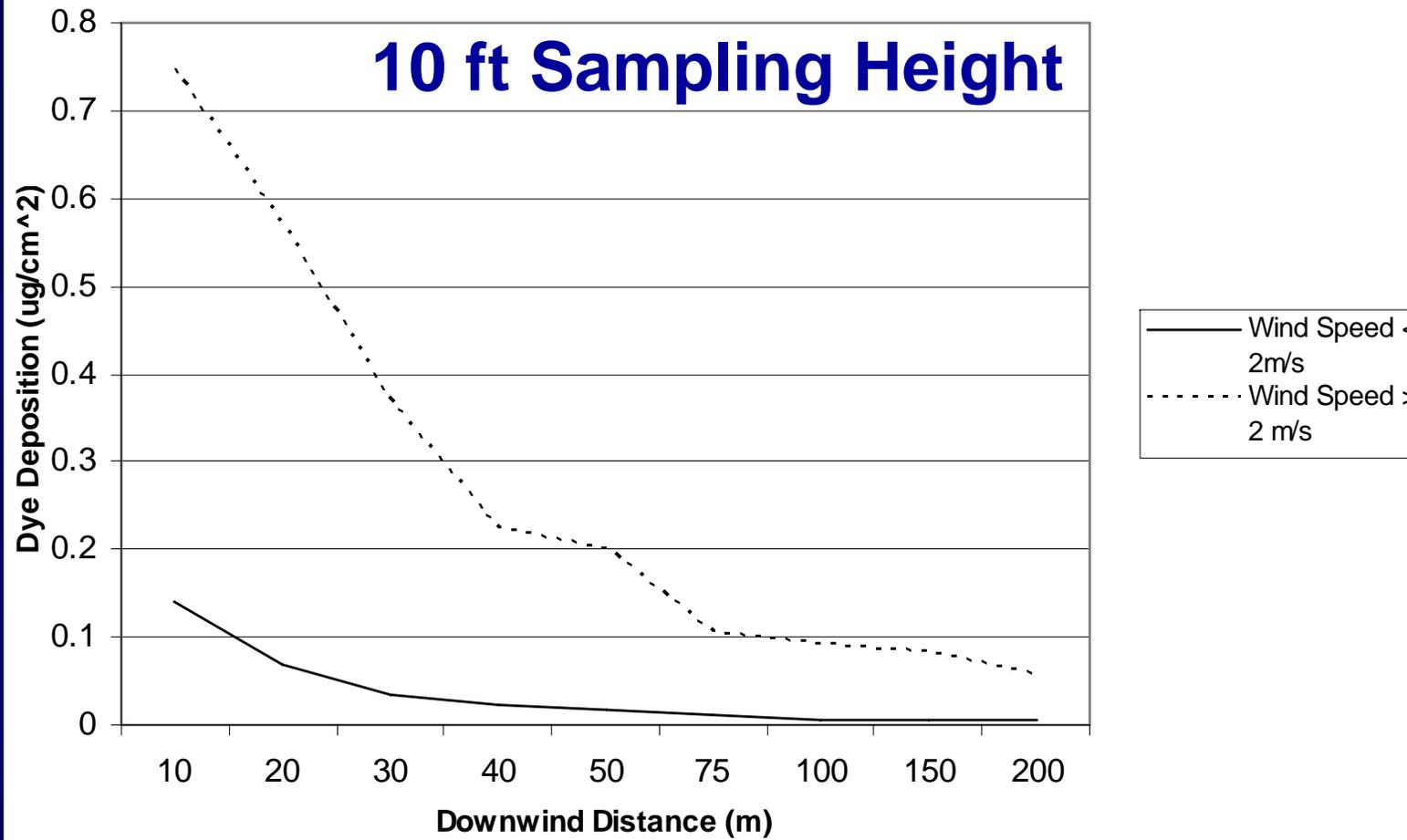


# Airborne Concentration – Nylon Screens

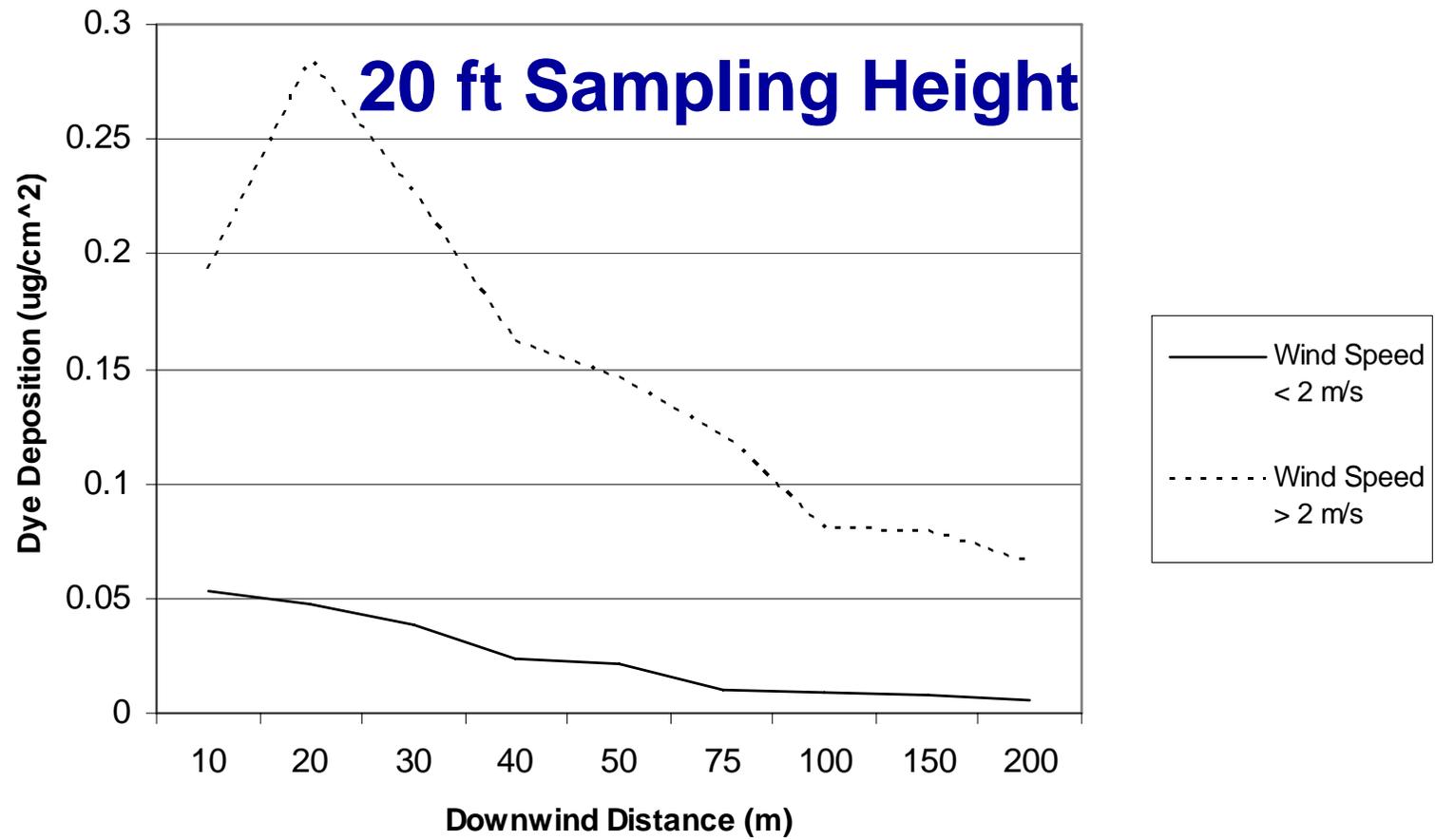
- Again, no stability effects
- Higher Wind speeds had higher downwind concentrations at all sampling heights, but no differences seen past 50 to 75 m.



# 10 ft Sampling Height

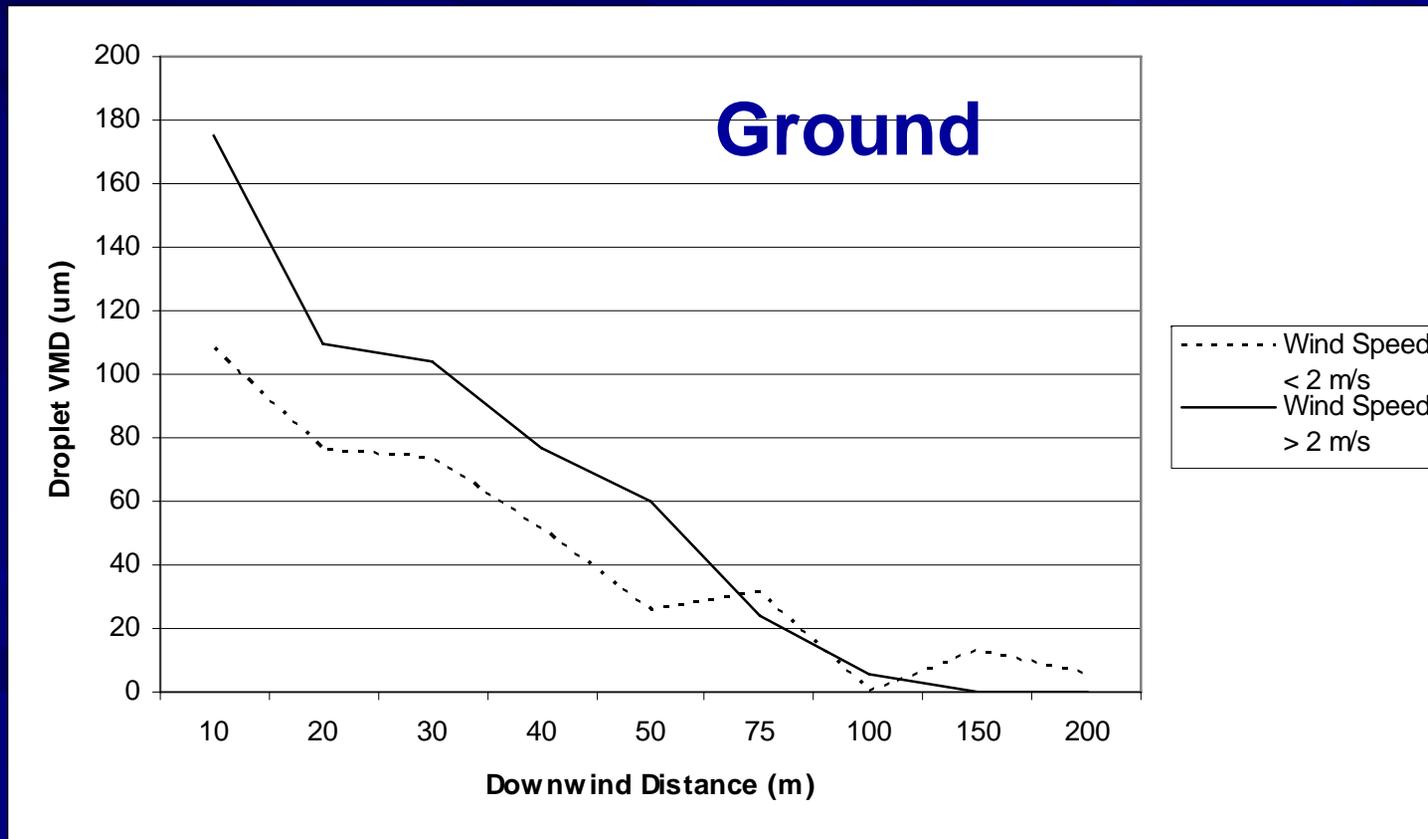


## 20 ft Sampling Height

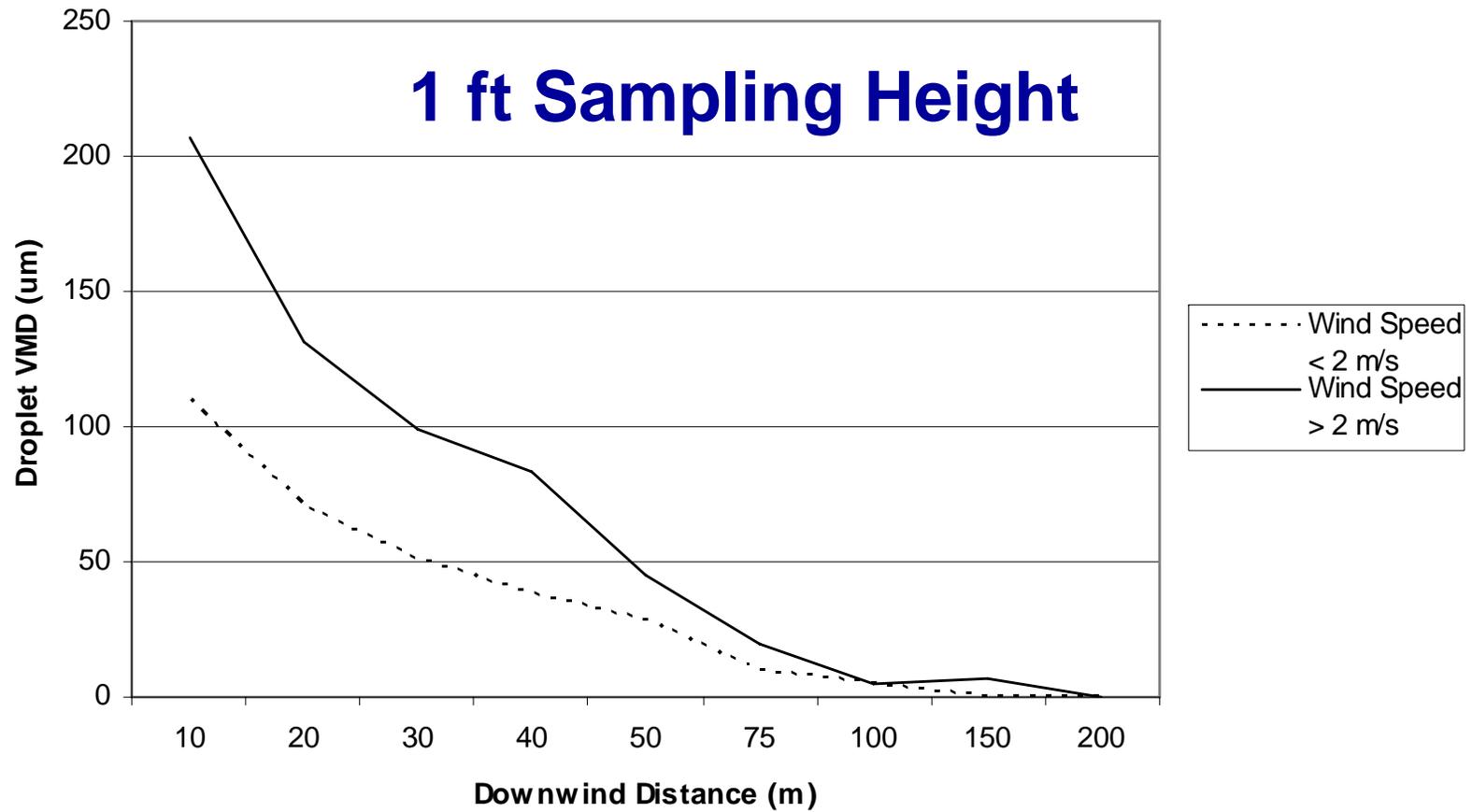


# Droplet Size - WSP

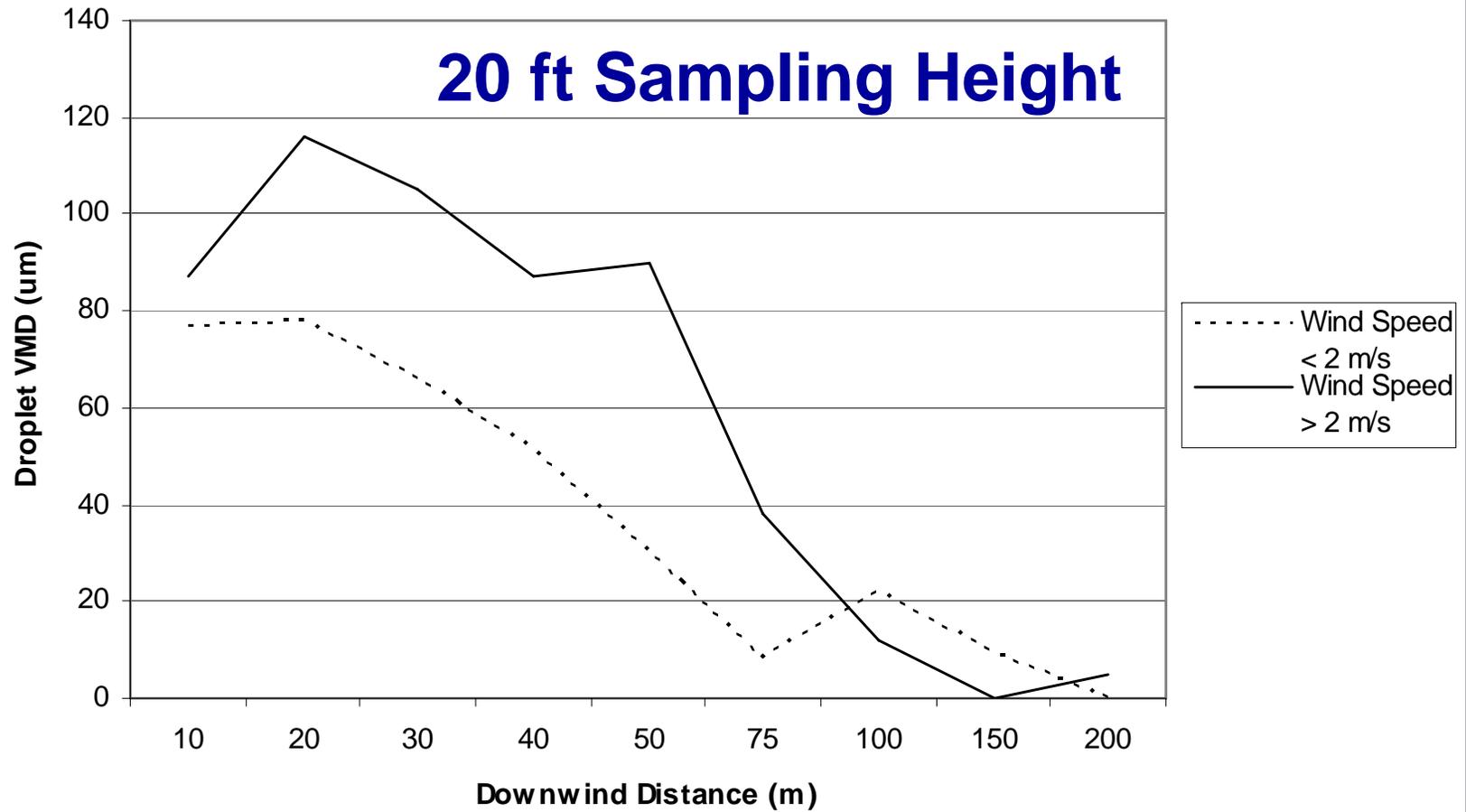
- Again, no stability effects
- Increased wind speeds resulted in increase droplet sizes downwind



# 1 ft Sampling Height



## 20 ft Sampling Height



# Conclusions

- No significant stability effects on ground deposition, airborne concentration, or droplet size
  - Not to imply that stability does not influence spray transport.
- Wind speed was significant as increasing wind speeds increased downwind deposition, airborne concentration and droplet size.
- Higher wind speeds tend to increase travel distance of larger drops while increased stability decreases spray dispersion and increases entrainment time of smaller spray droplets, which in turn can result in increased downwind transport.