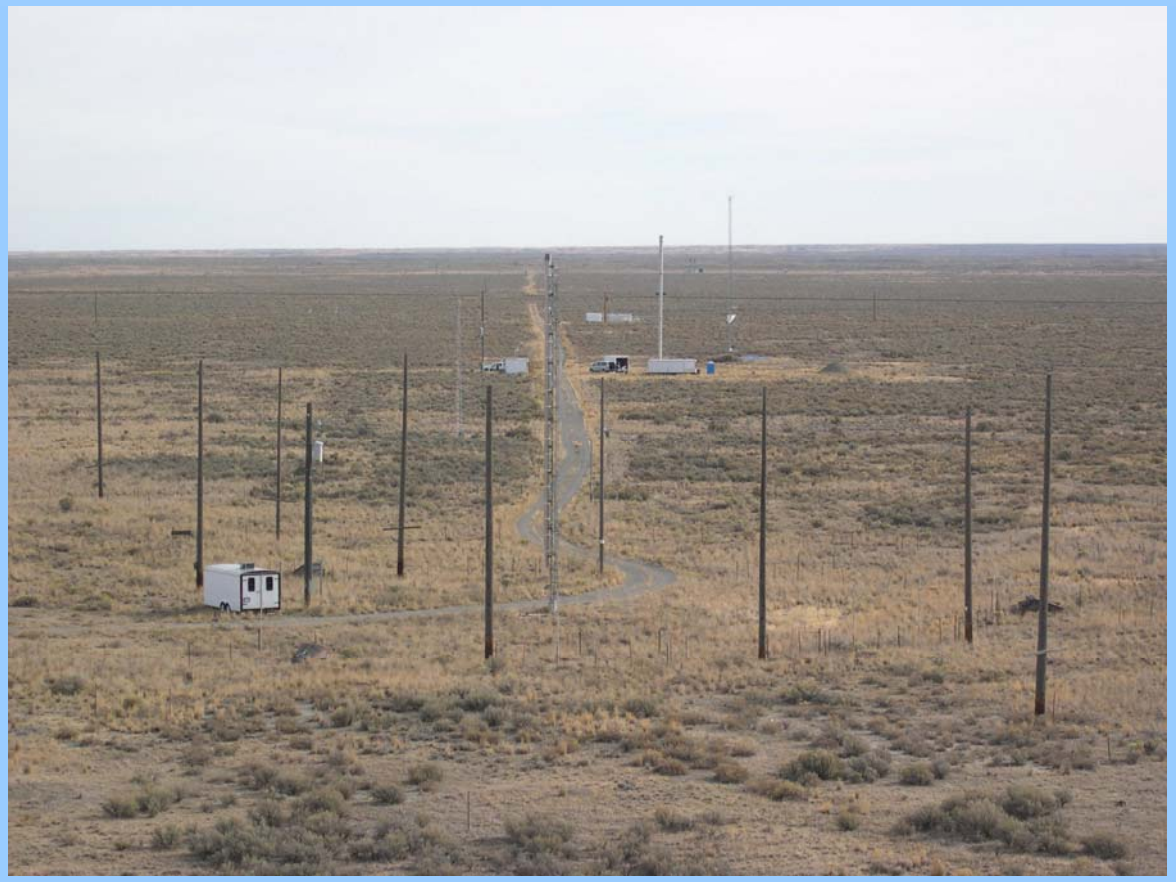
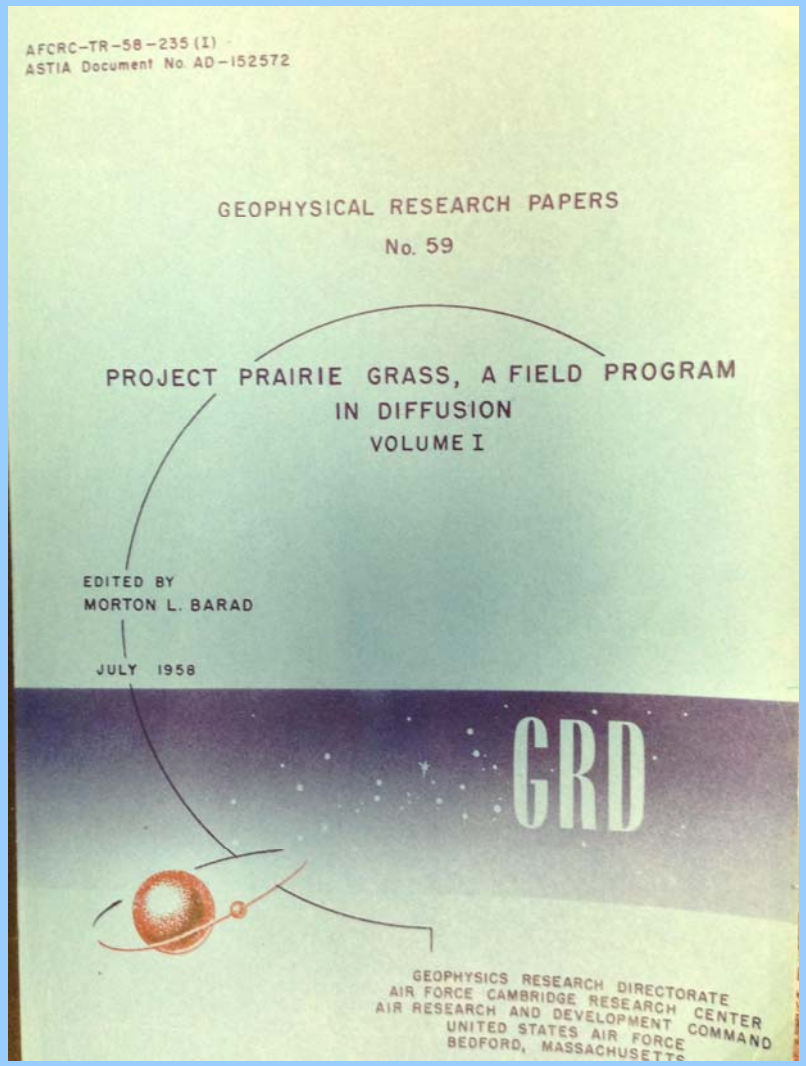
Introduction to Project Sagebrush

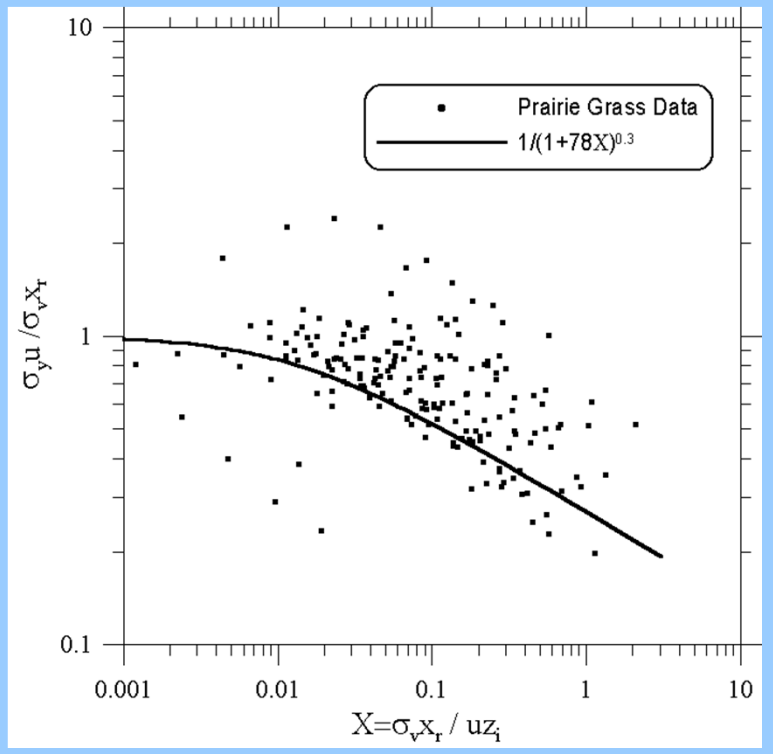


Kirk L. Clawson, Richard M. Eckman, Dennis D. Finn,
Roger G. Carter, Brad R. Reese, Jason D. Rich

NOAA Air Resources Laboratory, Field Research Division, Idaho Falls, Idaho

Project Prairie Grass 1956





Cimorelli et al. (2004) AERMOD: Description of Model Formulation. EPA-454/R-03-004

Limitations of Old Dispersion Data

- Restricted times of year, locations, and averaging times.
- Limited direct turbulence measurements.
- Limited data on vertical plume growth.
- Rarely data on concentration fluctuations.
- Often used reactive or depositing tracers.

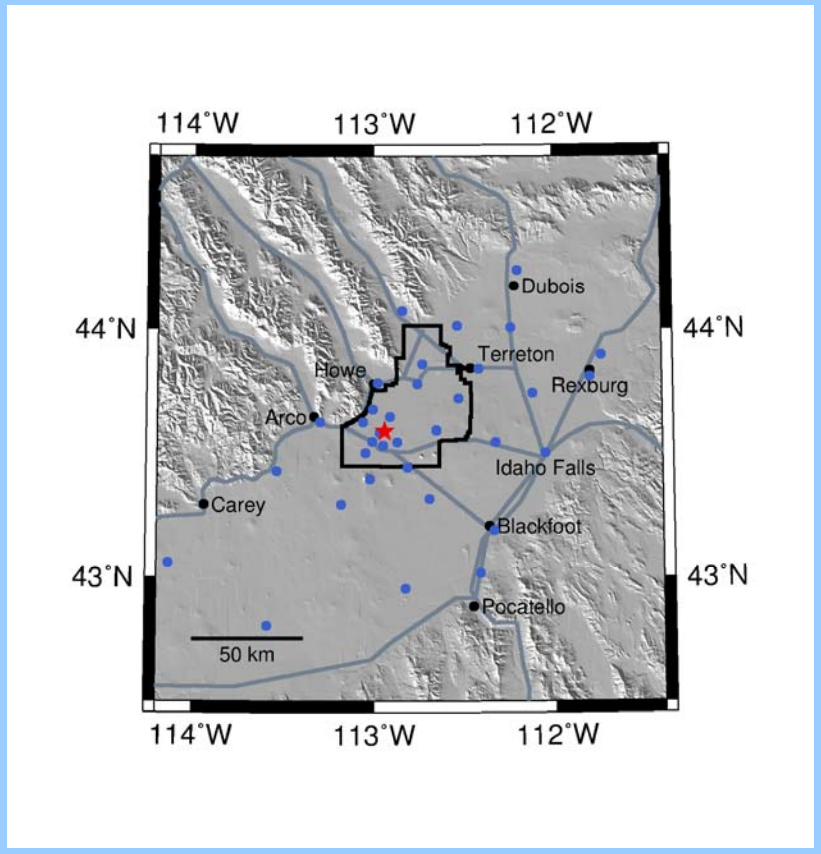
Tracer and turbulence measurement technologies have greatly improved in the >55 years since 1956.

Project Sagebrush

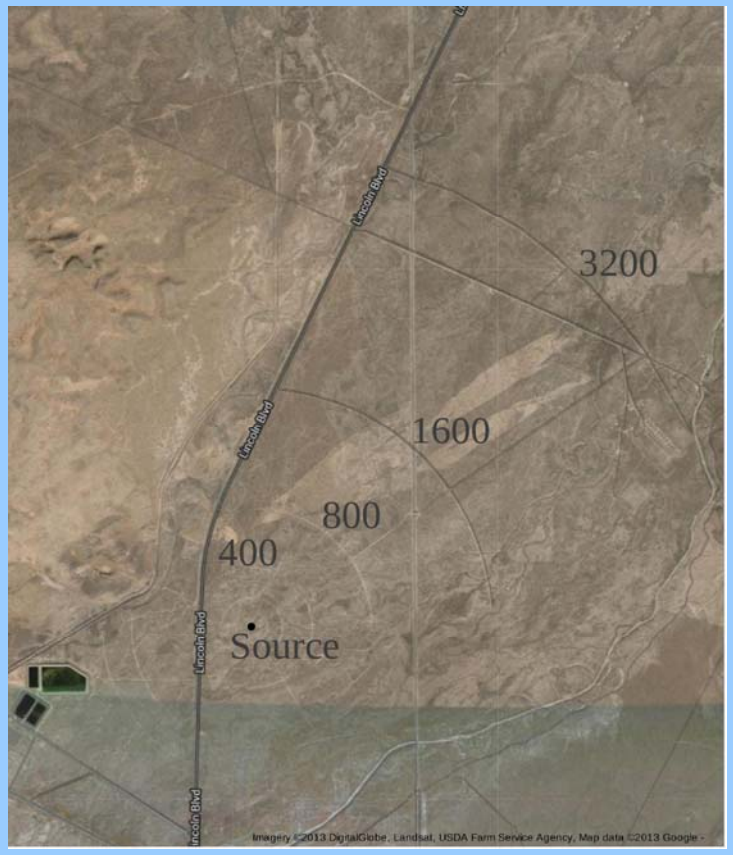
- Revisiting short-range dispersion experiments using modern tracer technology and meteorological instrumentation.
  - Concentration means and fluctuations.
  - Sonic anemometers and fast response IRGAs.
- Conducted at NOAA tracer test facility at DOE's Idaho National Laboratory.
- Multiyear effort started in 2013; limited funding each year.

- Additional capabilities in 2013 from external collaborators:
  - University of Tennessee Space Institute
  - Washington State University
  - Idaho National Laboratory

Tracer Release Facility

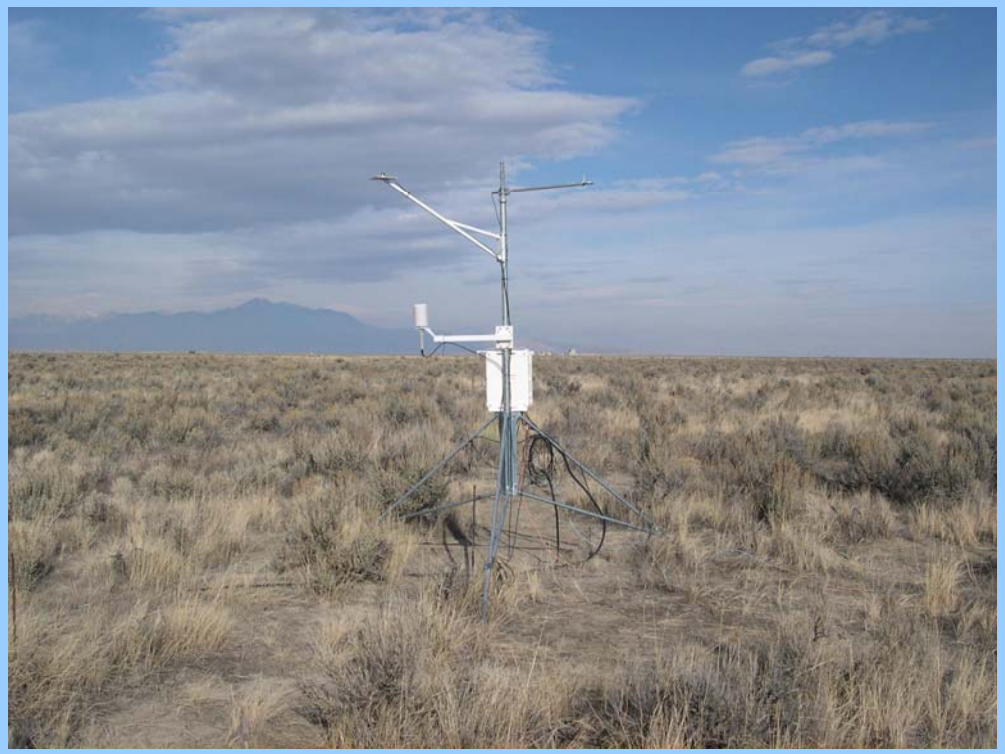


Mesonet towers: blue dots
Tracer source: red star
INL boundary: black outline

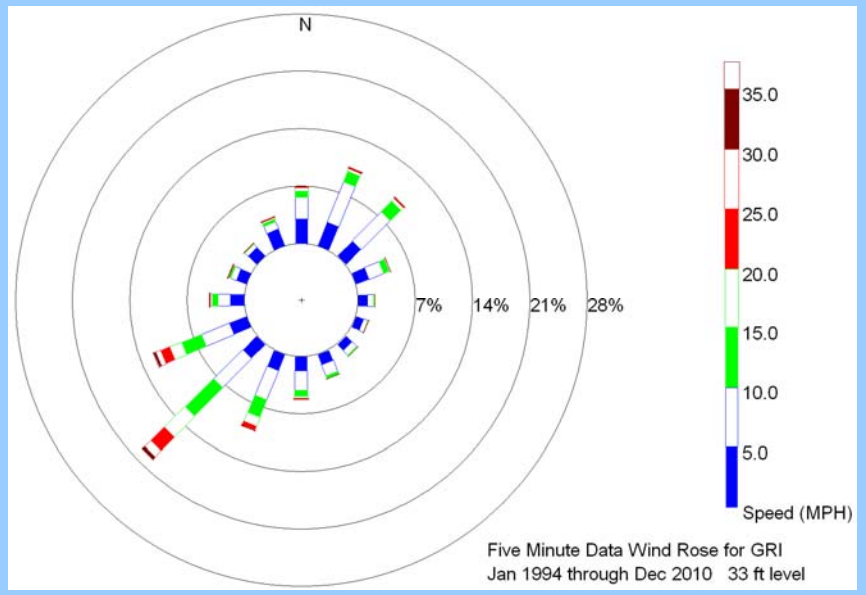


Sampling arcs out to 3200 m

Valley Floor



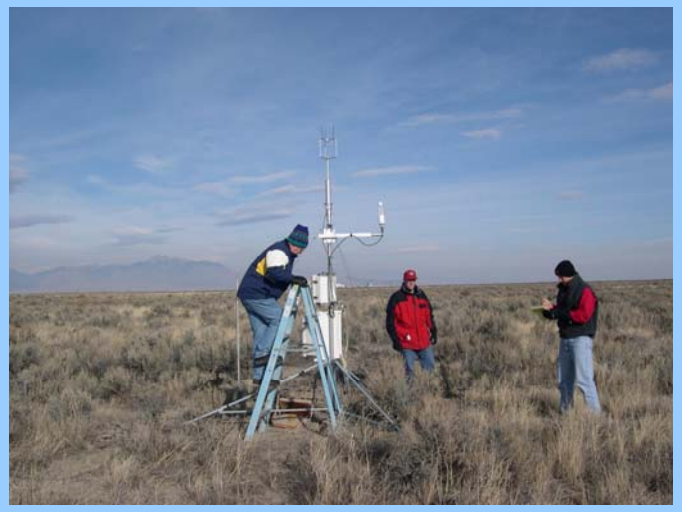
10 m AGL Wind Rose



Meteorological Measurements

Towers

Flux station + sonics

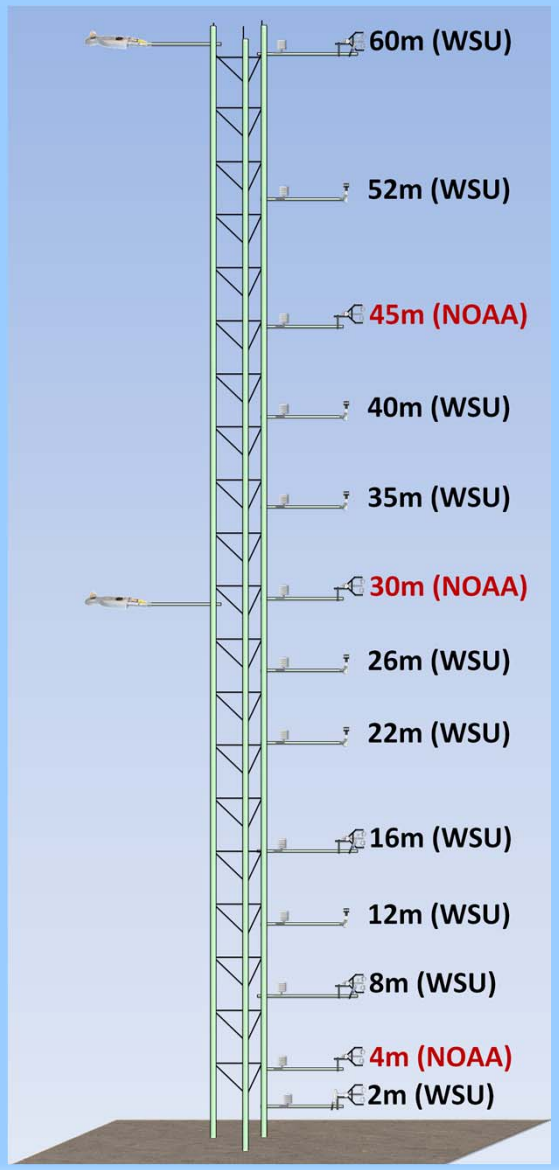


Sodars

Radiosondes

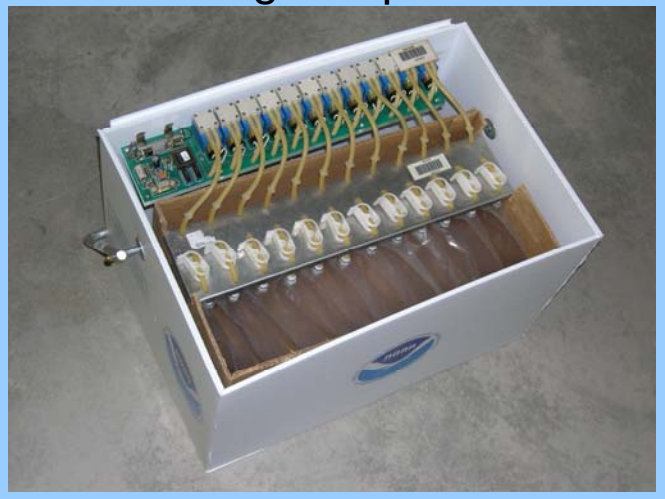
915 MHz radar wind profiler and RASS

Grid 3 Tower Flux Measurements



Tracer Measurements

Bag samplers



Tower samplers

Real-time Tracer Gas Analyzer

UTSI aircraft

Phase 1 Test Conditions

Correct Wind Direction Range

	Test 1	Test 2	Test 3	Test 4	Test 5
Date	2-Oct	5-Oct	7-Oct	11-Oct	18-Oct
Time	1530-1730	1400-1600	1400-1600	1500-1700	1400-1600
Sample Period	Wind direction between 190 and 260 degrees?				
1	NO	YES	YES	YES	YES
2	NO	YES	YES	YES	YES
3	NO	NO	YES	YES	YES
4	NO	YES	YES	YES	YES
5	NO	YES	YES	YES	YES
6	NO	YES	YES	YES	YES
7	NO	YES	YES	YES	YES
8	NO	YES	YES	YES	YES
9	NO	YES	YES	YES	YES
10	NO	YES	YES	YES	YES
11	NO	YES	YES	YES	YES
12	NO	YES	YES	YES	YES

10 m Wind Speed

	Test 1	Test 2	Test 3	Test 4	Test 5
Date	2-Oct	5-Oct	7-Oct	11-Oct	18-Oct
Time	1530-1730	1400-1600	1400-1600	1500-1700	1400-1600
Sample Period	10 m Wind Speed (m/s)				
1	0.6	3.4	8.4	4.3	4.5
2	1.5	3.4	9.6	5.5	5.1
3	1.2	3.5	9.9	5.4	4.6
4	2.1	4.0	9.5	4.6	4.7
5	1.4	3.0	9.7	5.7	4.9
6		4.6	9.9	6.3	4.9
7	1.4	4.5	9.4	5.4	5.4
8	1.8	4.1	8.9	5.6	5.4
9	2.2	3.9	9.1	4.7	6.5
10	2.0	4.4	9.3	5.8	6.1
11	2.4	3.5	8.6	6.5	5.8
12	2.5	4.0	9.2	6.4	6.4
Average	1.7	3.9	9.3	5.5	5.4

Phase 1 Test Conditions

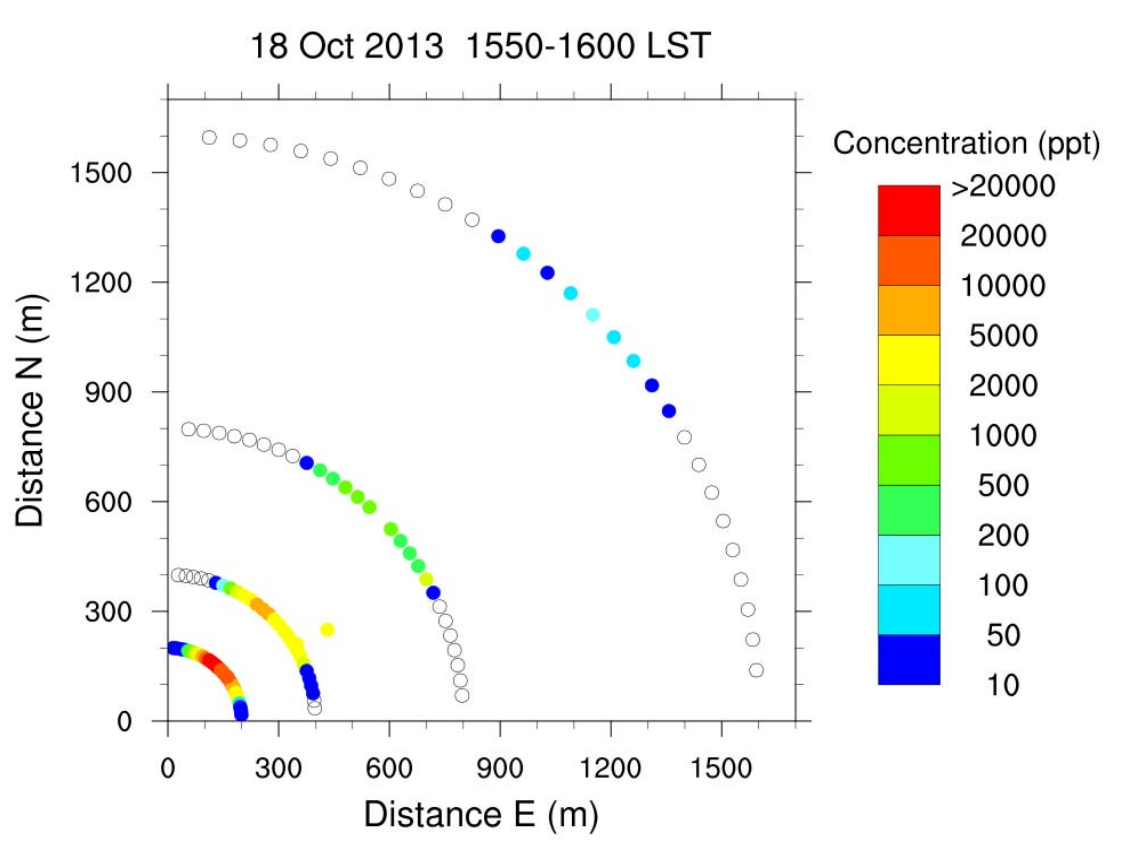
SRDT

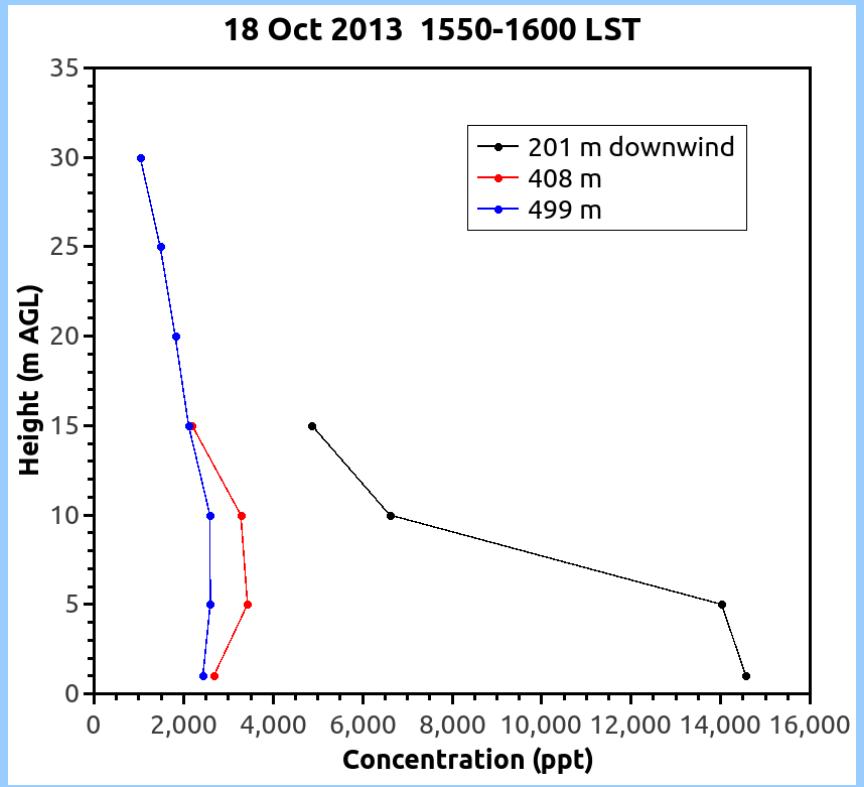
	Test 1	Test 2	Test 3	Test 4	Test 5	Experiment Totals:
Date	2-Oct	5-Oct	7-Oct	11-Oct	18-Oct	
Time	1530-1730	1400-1600	1400-1600	1500-1700	1400-1600	
Sample Period	Letter Category (SRDT)					
1	D	C	D	C	C	
2	D	B	D	D	D	
3	D	C	D	D	C	
4	D	C	D	C	C	
5	D	C	D	D	D	
6	B	C	D	D	D	
7	B	C	D	D	D	
8	C	C	D	D	D	
9	D	C	D	C	D	
10	D	C	D	D	D	
11	D	C	D	D	D	
12	D	C	D	D	D	
Totals:	A=0	A=0	A=0	A=0	A=0	A=0
	B=2	B=1	B=0	B=0	B=0	B=3
	C=1	C=11	C=0	C=3	C=3	C=18
	D=9	D=0	D=12	D=9	D=9	D=39

σ_θ

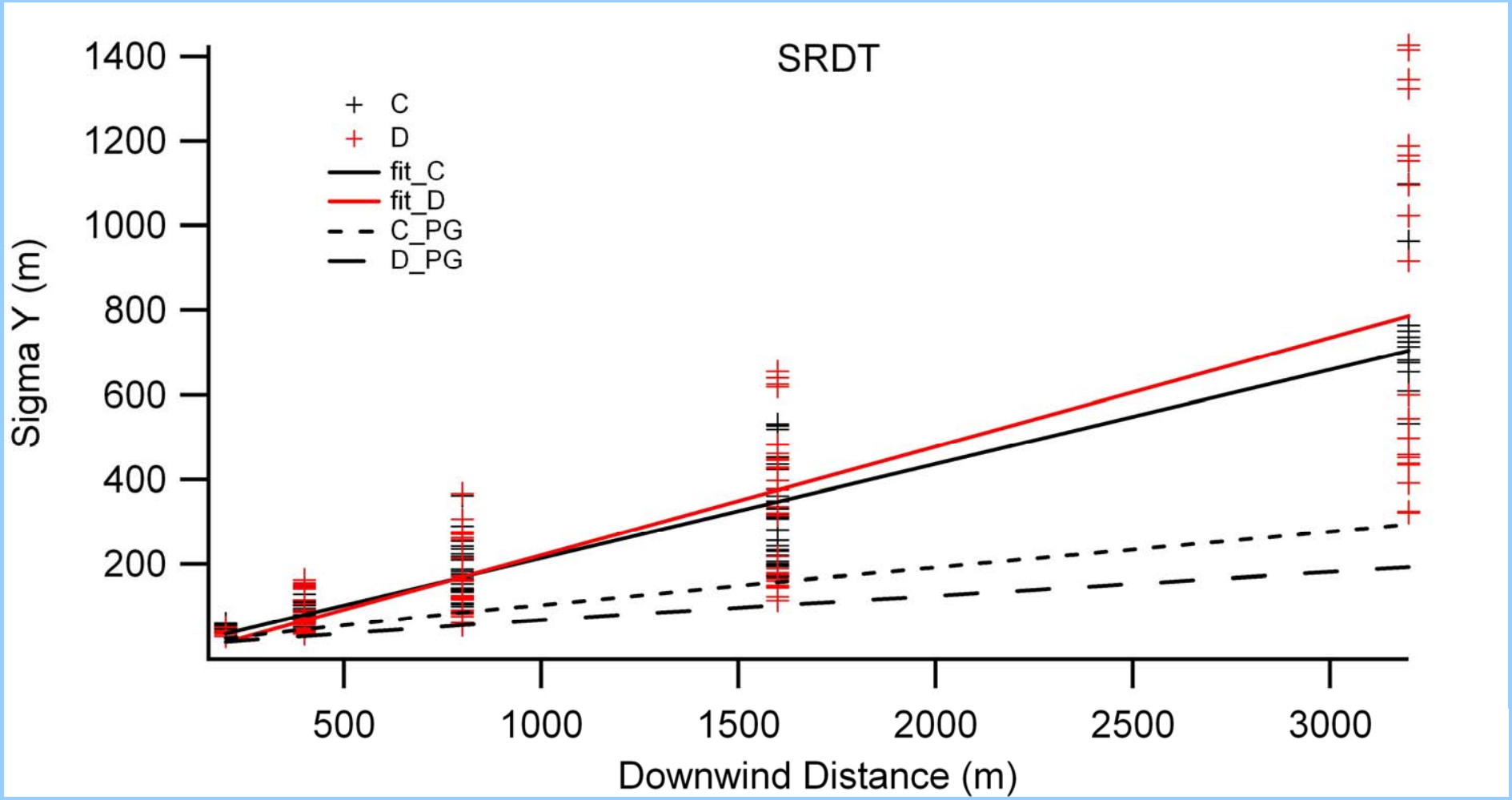
	Test 1	Test 2	Test 3	Test 4	Test 5	Experiment Totals:
Date	2-Oct	5-Oct	7-Oct	11-Oct	18-Oct	
Time	1530-1730	1400-1600	1400-1600	1500-1700	1400-1600	
Sample Period	Letter Category (σ_θ adjusted for wind speed)					
1	B	B	D	C	C	
2	B	B	D	C	C	
3	C	B	D	C	C	
4	A	C	D	C	C	
5	A	B	D	D	C	
6	A	C	D	D	C	
7	A	C	D	C	C	
8	A	C	D	C	C	
9	A	B	D	C	D	
10	A	C	D	C	D	
11	B	C	D	D	C	
12	A	D	D	D	D	
Totals:	A=8	A=0	A=0	A=0	A=0	A=8
	B=3	B=5	B=0	B=0	B=0	B=8
	C=1	C=6	C=0	C=8	C=9	C=24
	D=0	D=1	D=12	D=4	D=3	D=20

Phase 1, Test 5, October 2013

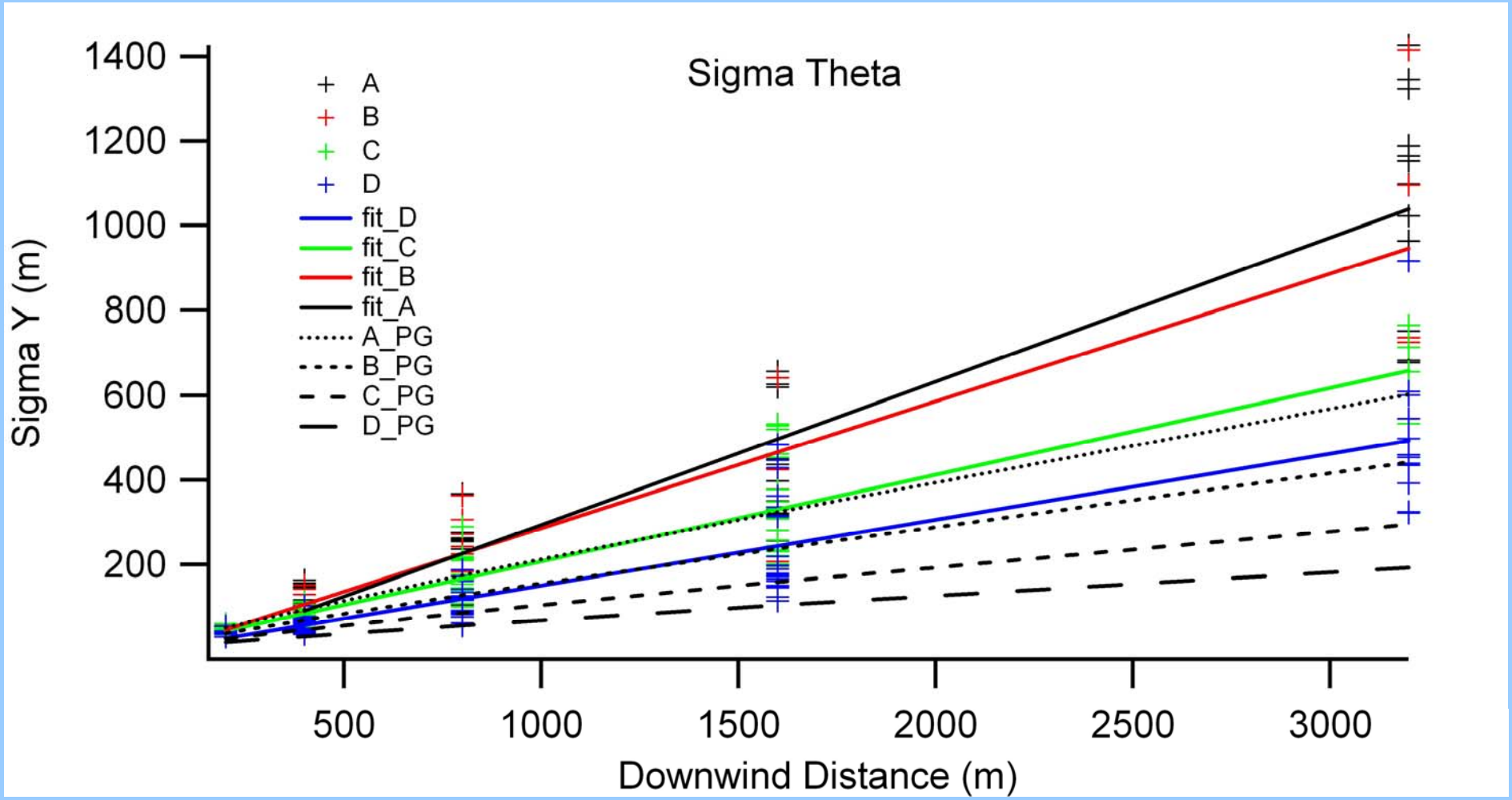




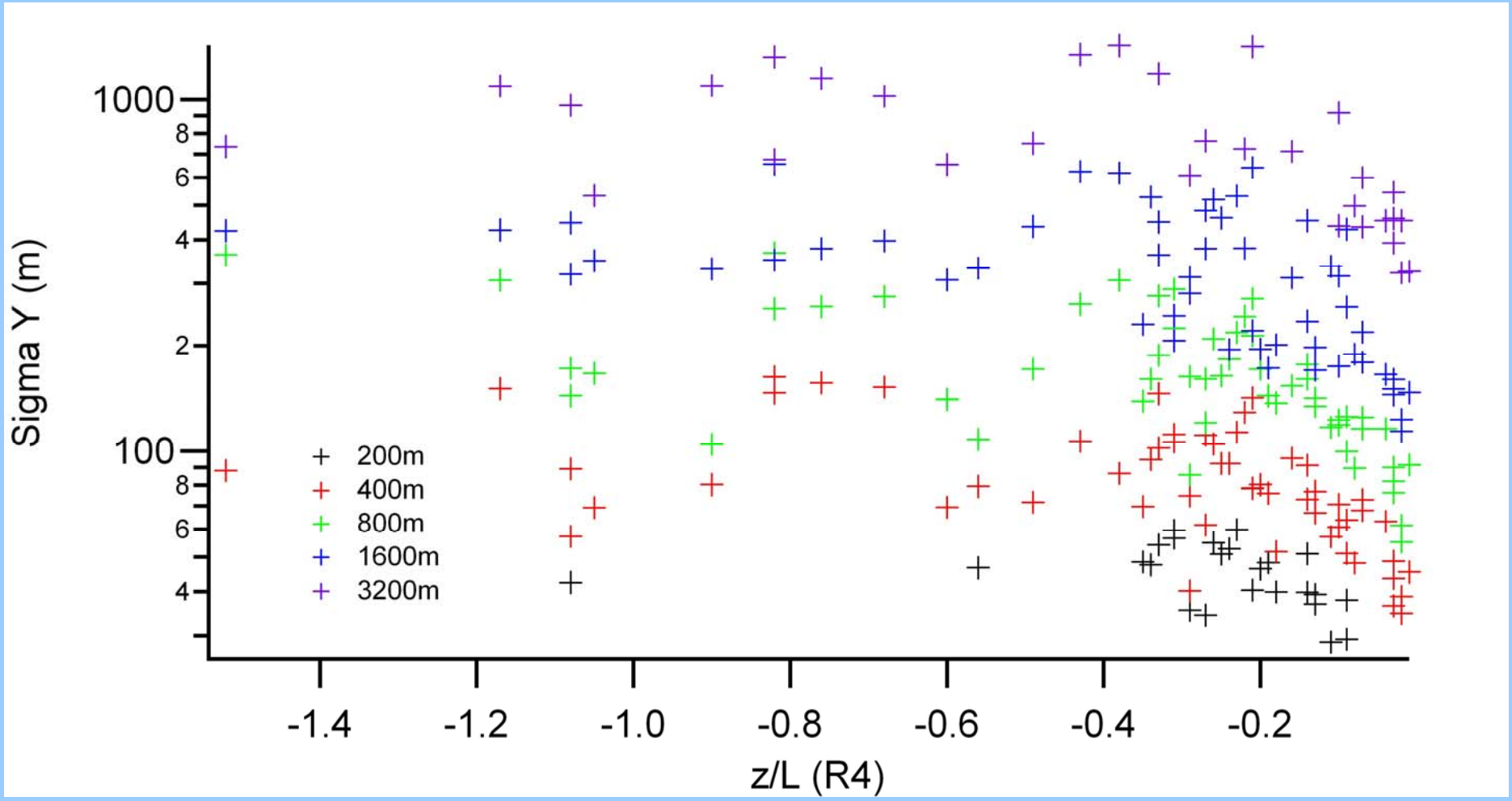
SRDT Stability Categories



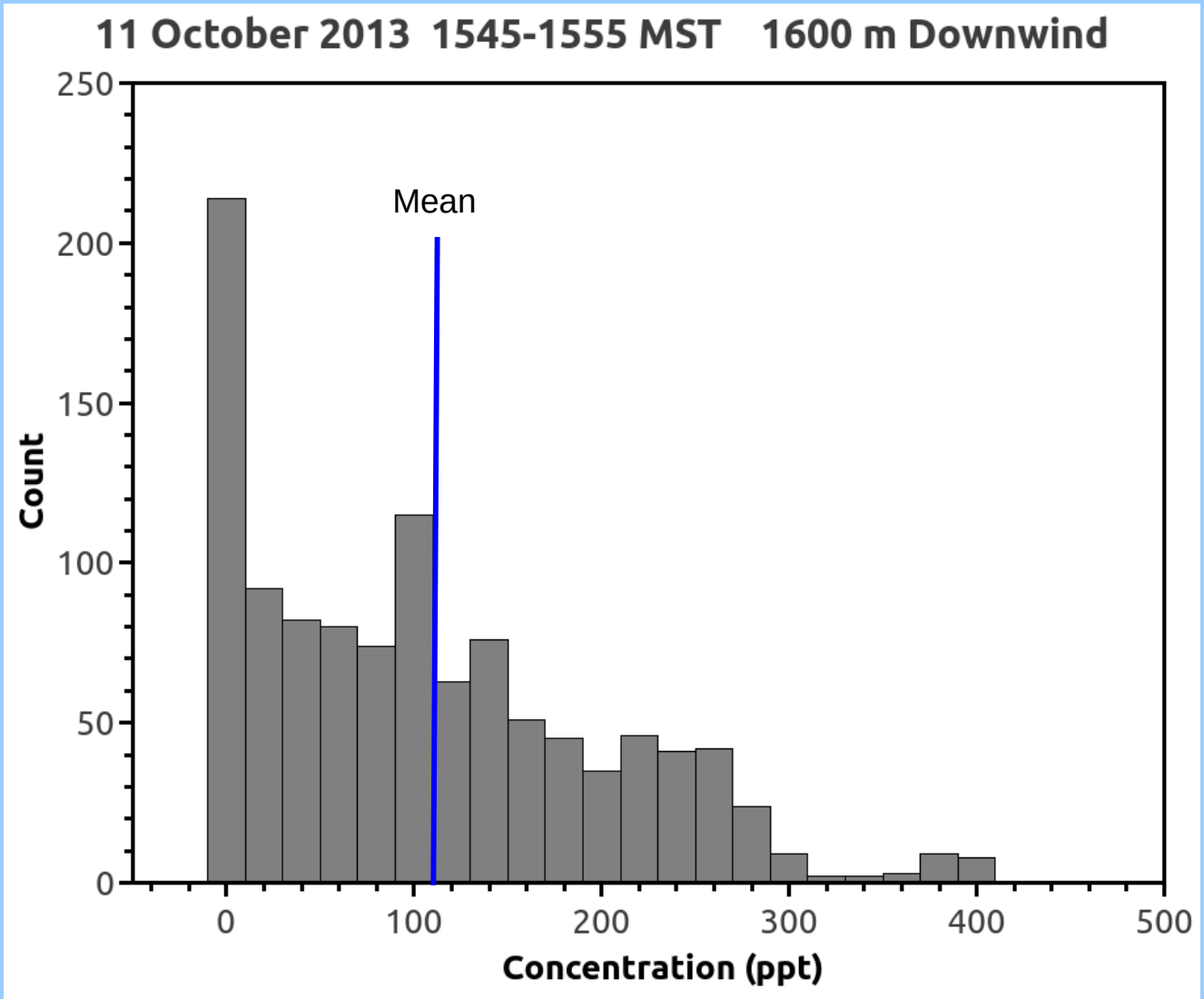
Wind Direction Standard Deviation



z/L


Sigma Y (m)
1000
8
6
4
2
100
8
6
4
200m
400m
800m
1600m
3200m
-1.4
-1.2
-1.0
-0.8
-0.6
-0.4
-0.2
z/L (R4)

Concentration Histogram



Partnership Opportunity

- Additional phases in future years
  - Stable atmosphere
  - Vertical dispersion
- Accelerated effort with funding partners