Project Sagebrush:
A New Look at Plume Dispersion

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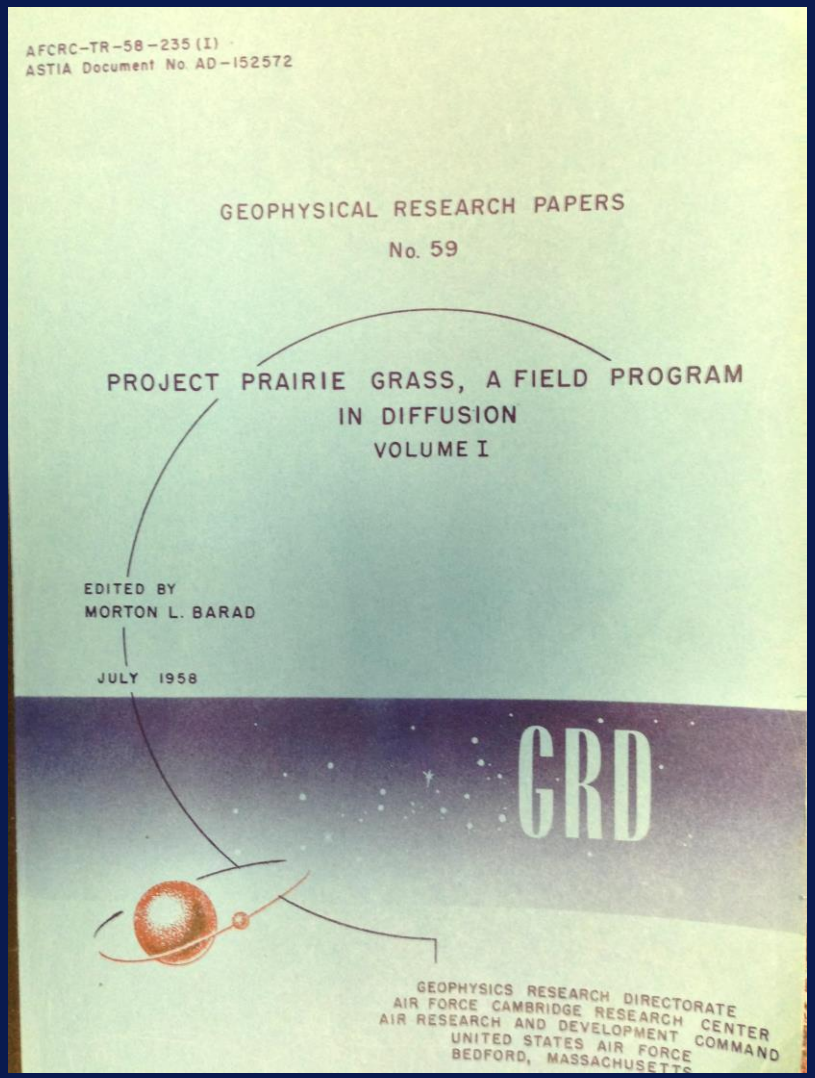
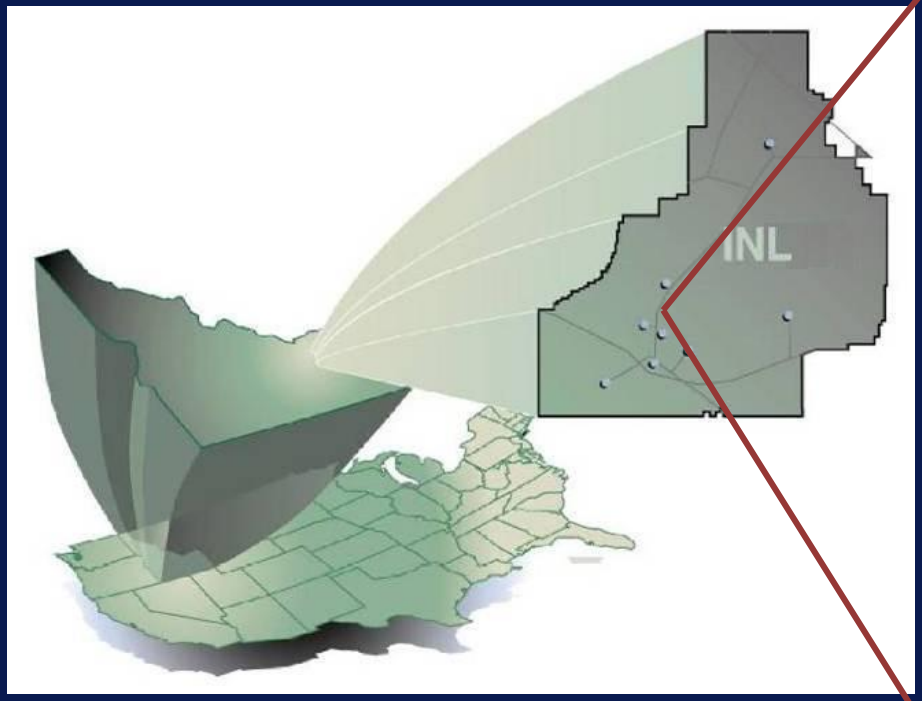
Project Prairie Grass 1956 (PPG)

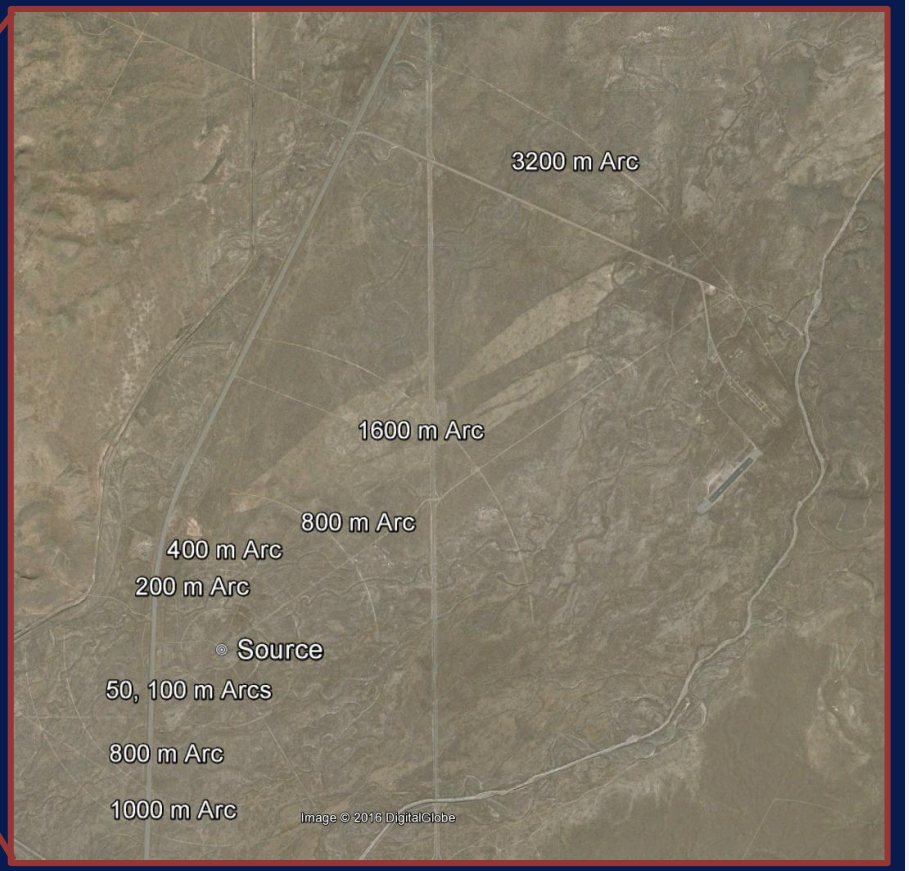


Significant scientific instrument development since PPG:

- Tracer concentration fluctuations with real-time analyzers
- Turbulence measurements with sonic anemometers
- Non-reacting, non-depositing, non-toxic, conserved tracer gases

NOAA Tracer Dispersion Test Bed

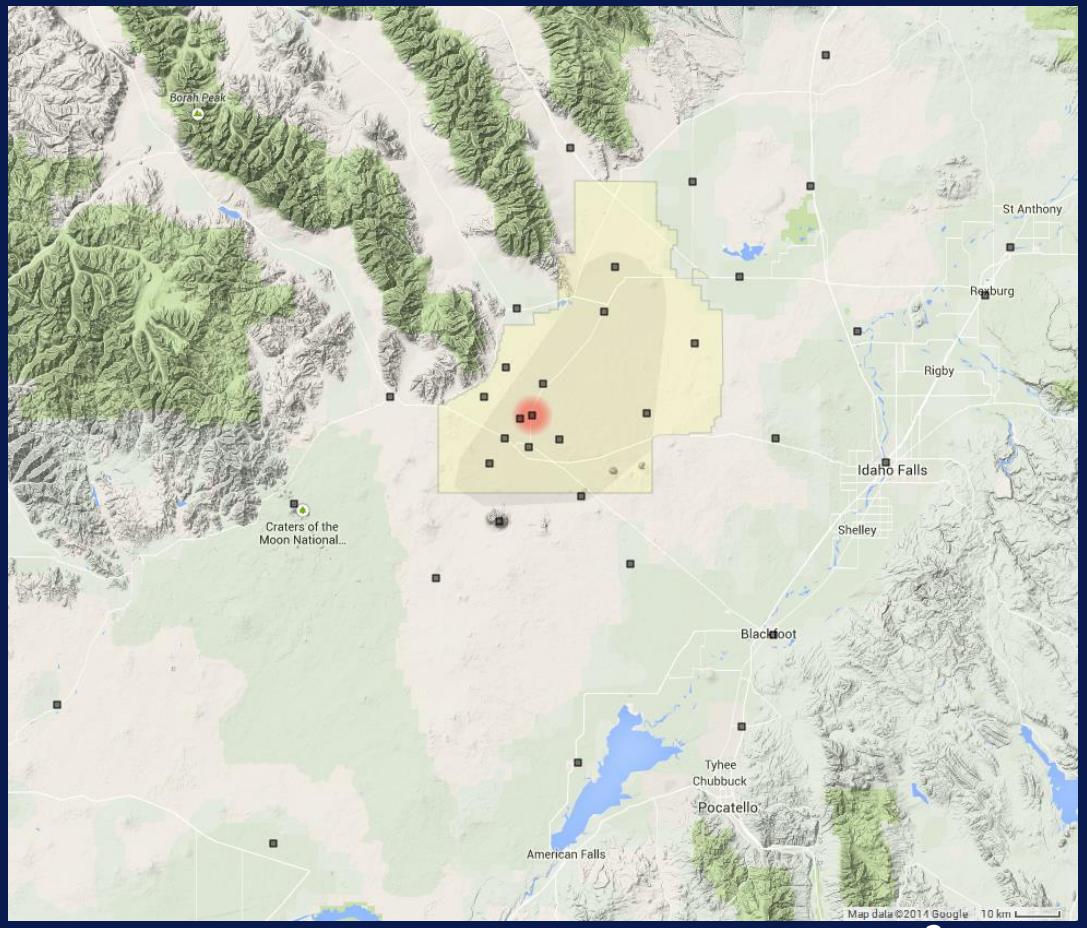




Test bed in the state of Idaho
on the Idaho National Laboratory (INL)

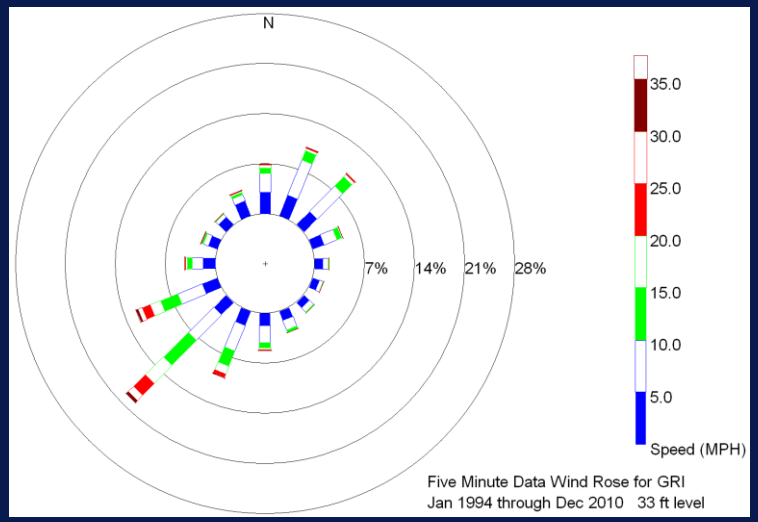
Sampling arcs to 3200 m

NOAA Tracer Dispersion Test Bed



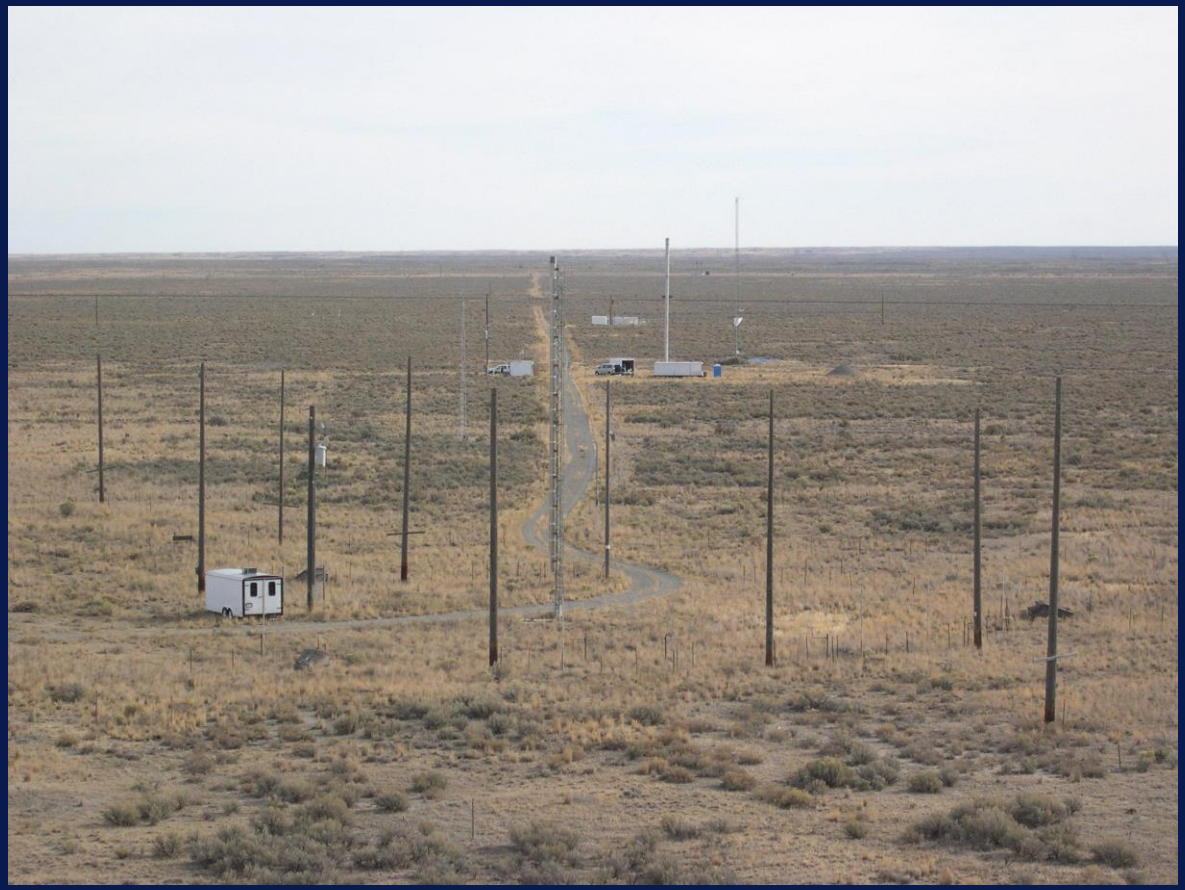
34 station mesonet covers 16k km^2

Mesonet surrounds Test Bed (red dot)



Primarily SW and NE winds

Tracer Dispersion Test Bed Features

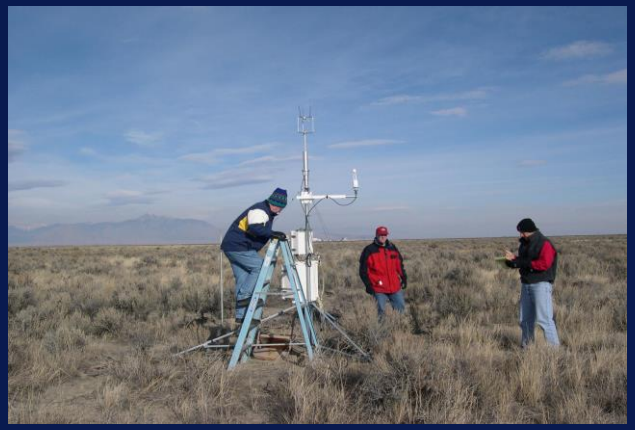


- Command Center and 30 m met tower
- 2 release stacks (15 & 21 m)
- Total energy balance system
  - Eddy covariance flux system
  - Soil heat flux
  - 4-component net radiometer
- 60 m met tower
- MiniSoDAR
- Wind profiling 915 MHz radar
- Radio acoustic sounding system (RASS)
- 8 established sampling arcs
- Z_o = 3-4 cm
- d ≈ 0 cm

Meteorological Equipment

Permanent and Supplemental

Towers (3)



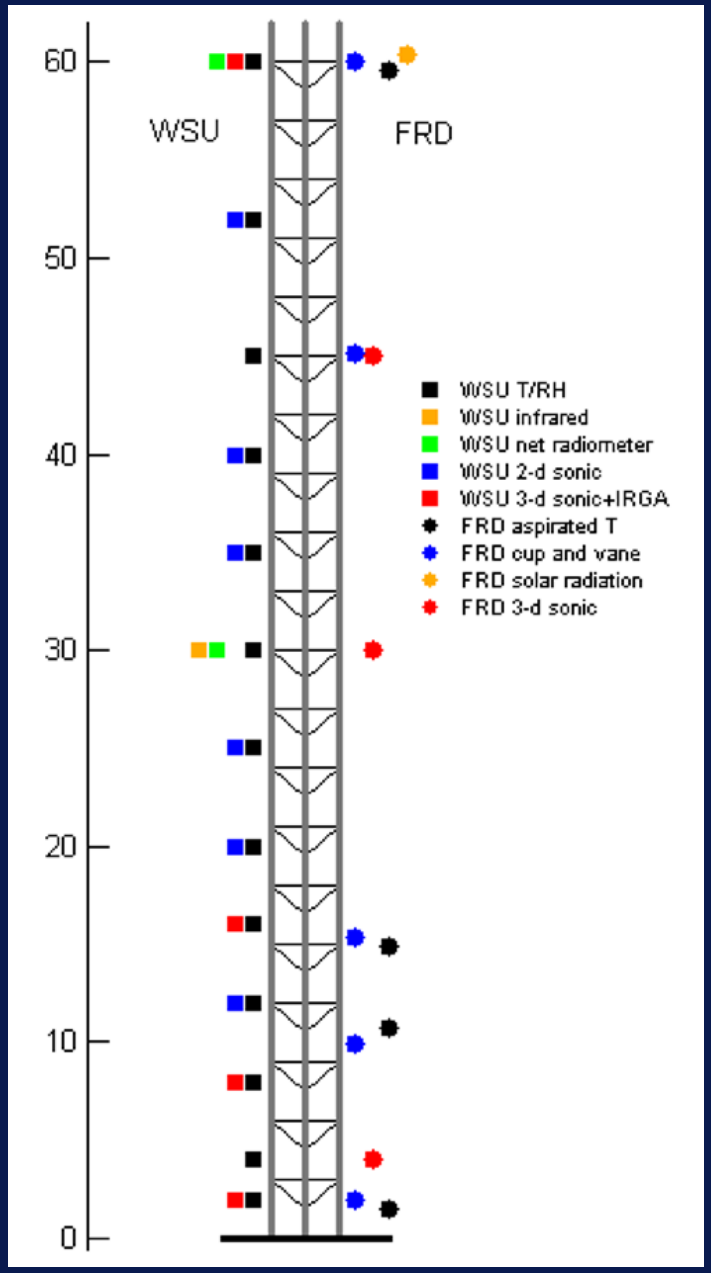
3-d sonics (11) and IRGAs (5)

MiniSoDARs (2)

Radiosondes (2 per test)

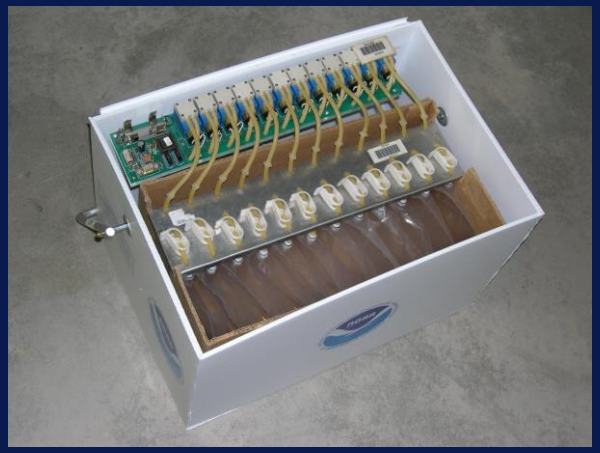
Radar wind profiler and RASS

60 m Tower Layout



Tracer Sampling Equipment

Real-time tracer gas analyzers (6)

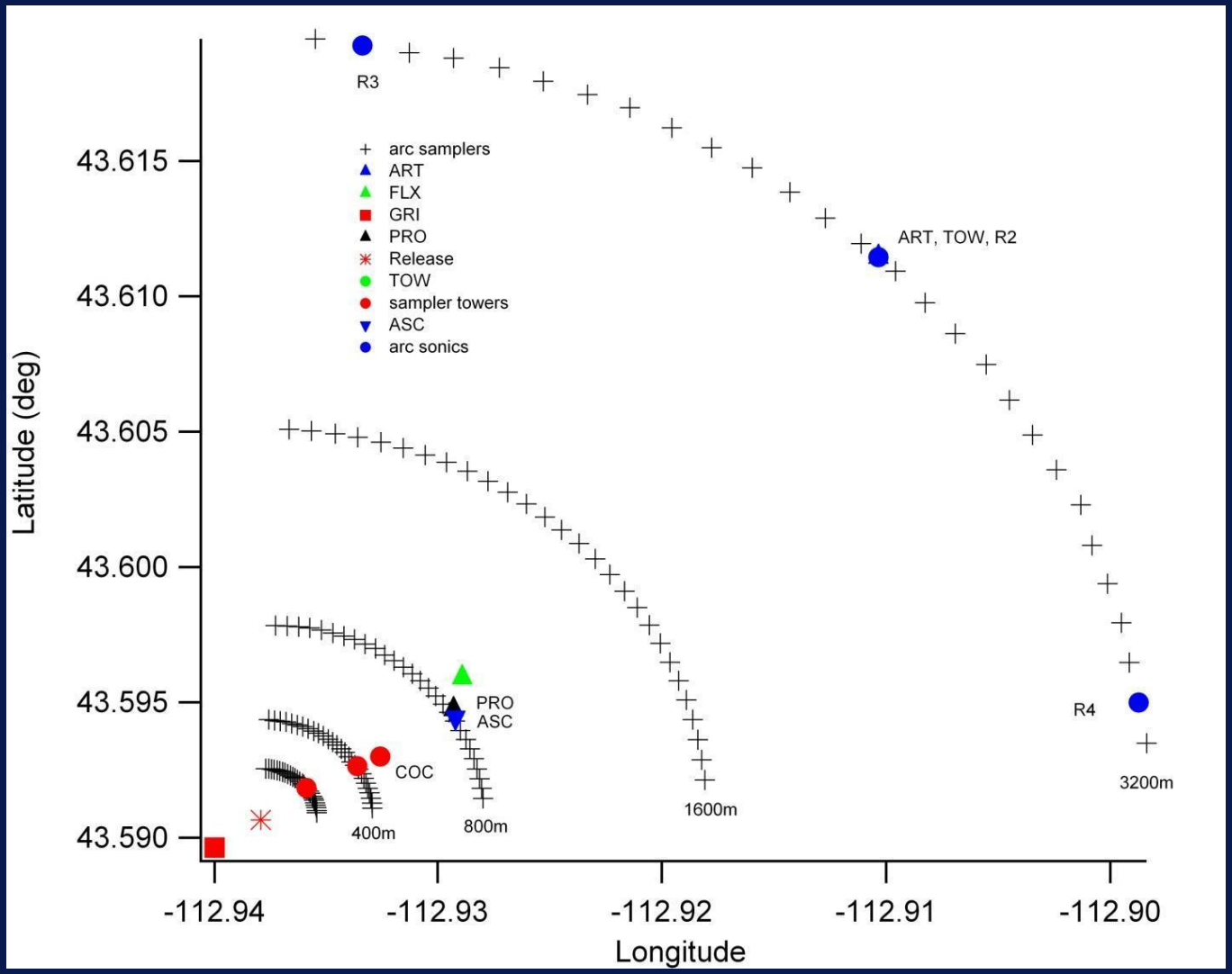


12-sample bag samplers (150)

Sampling towers (3)

Univ. Tennessee Space Institute aircraft

Conceptual Test Layout



Phase 1 Test Summary

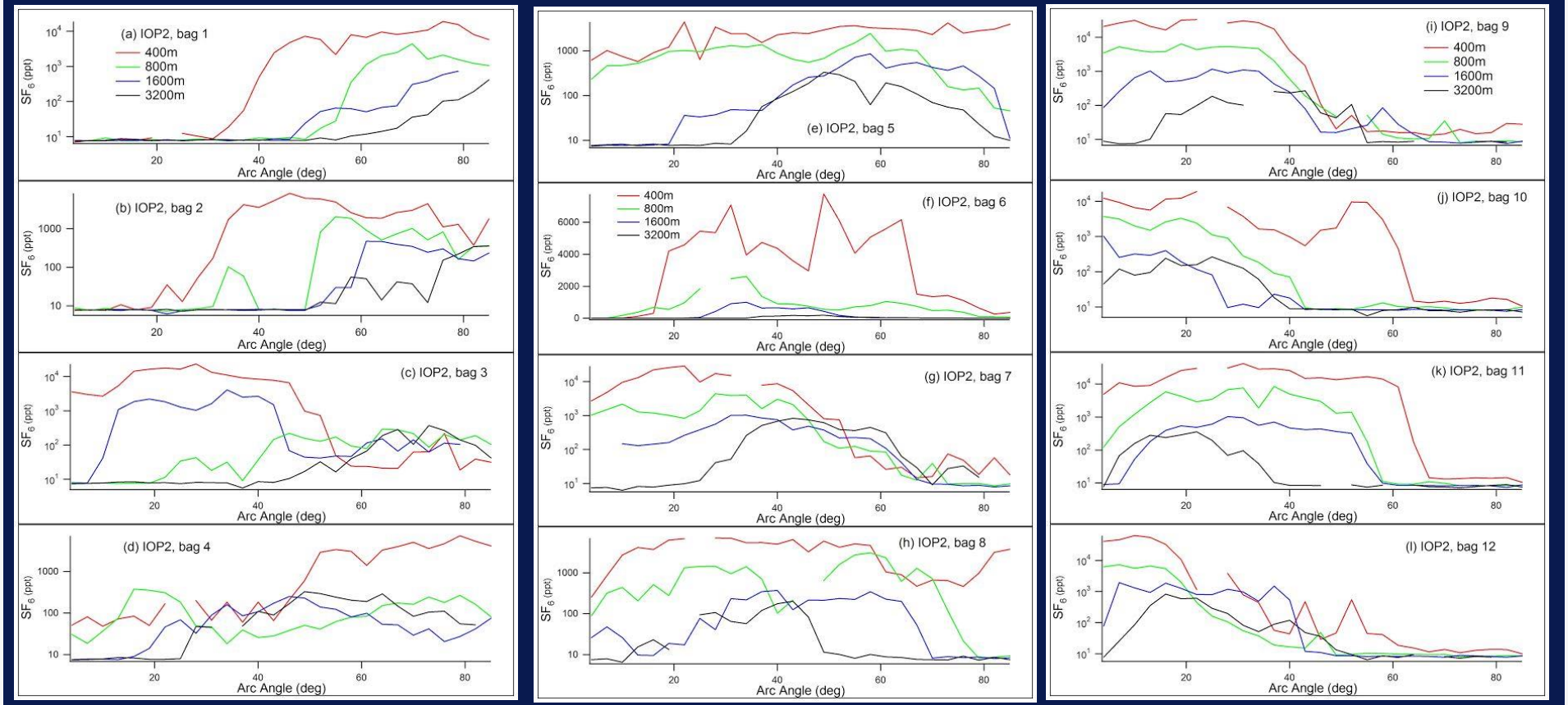
- October 2013
- Afternoon only
- 5 tests
  - 2½ hour duration
    - First ½ hour for steady-state conditions
  - 10 minute averaging period
  - 60 separate realizations
- 4 sampling arcs
  - 200, 400, 800, 1600 m
  - 400, 800, 1600, 3200 m
- Tracer: sulfur hexafuoride

Phase 1 Test Conditions

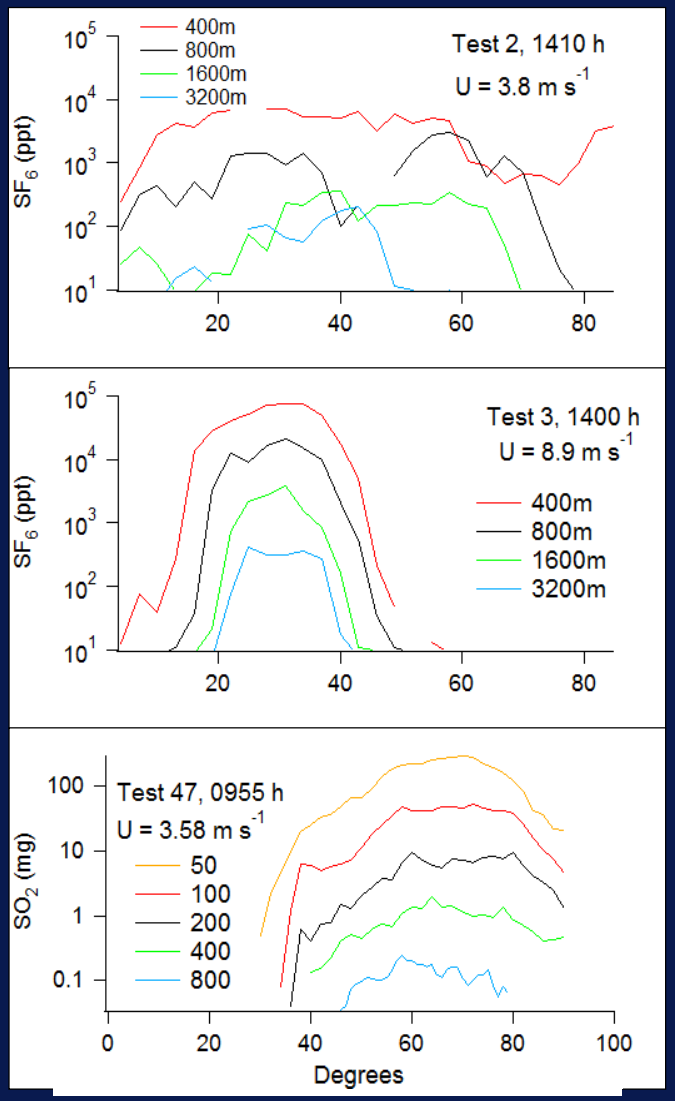
Test (#)	Wind Speed (m/s)	u* (m s^{-1})	σ_θ (deg)	z/L	Turbulence Intensity	Mixing Height (m)	EPA Stability Category
1	1.3	0.12	34.2	-1.75	0.477	1115	Strongly Unstable
2	3.2	0.23	28.5	-0.79	0.466	1105	Unstable
3	8.6	0.56	9.4	-0.05	0.194	950	Neutral
4	5.0	0.34	14.7	-0.23	0.264	2130	Slightly Unstable
5	4.3	0.34	15.4	-0.20	0.310	1130	Unstable

Totals: A: 12, B: 8, C: 20, D: 20

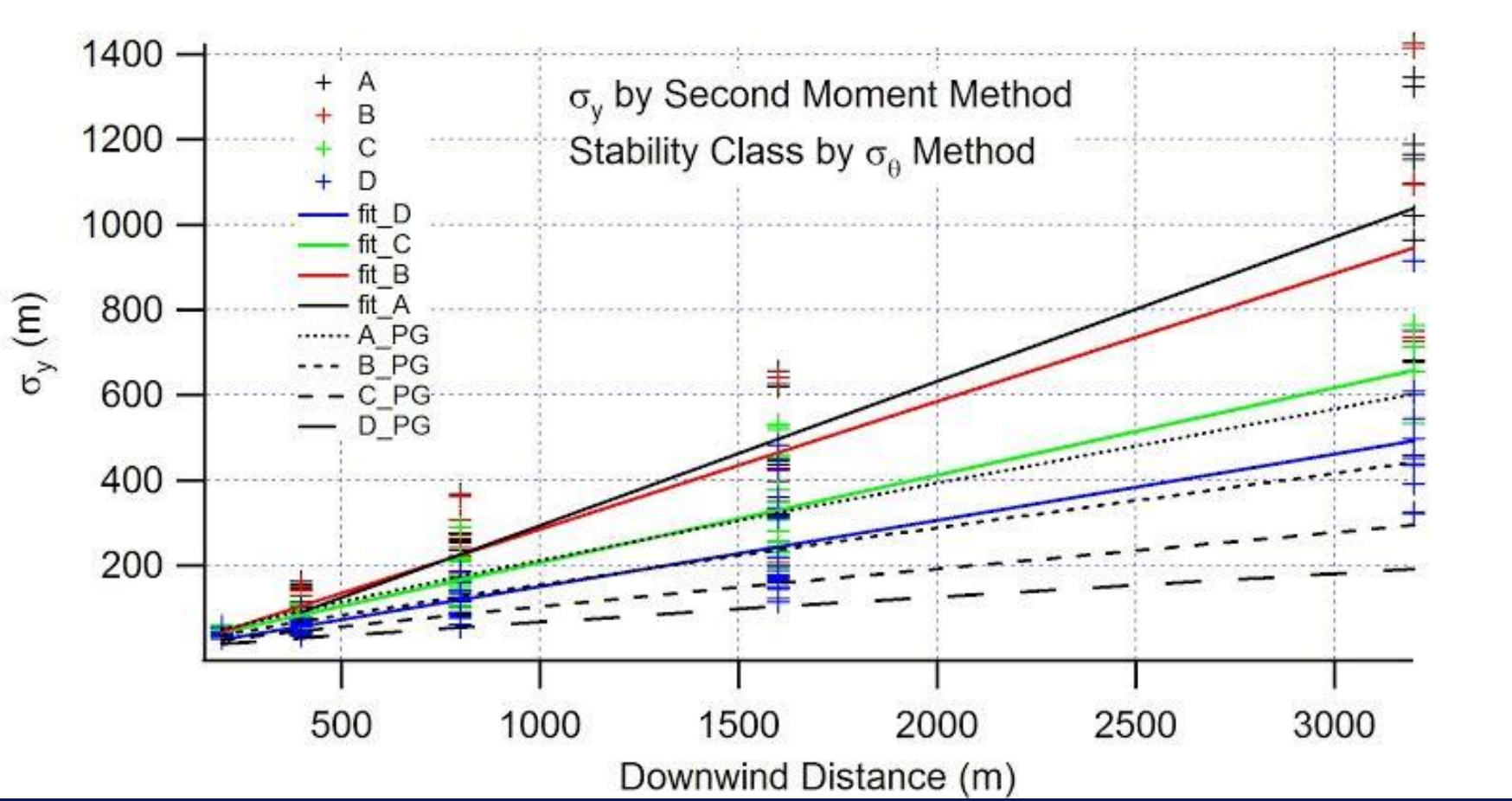
Concentration Cross-sections



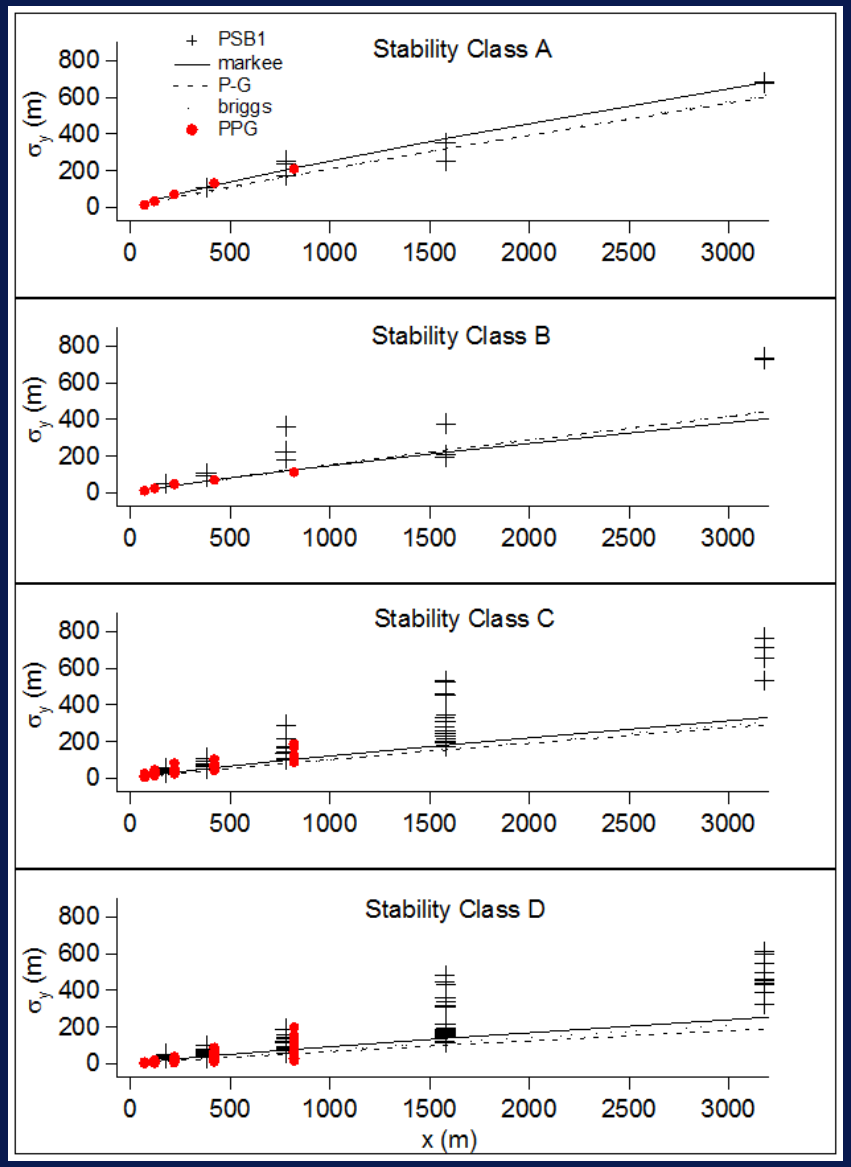
PPG Cross-section Comparison



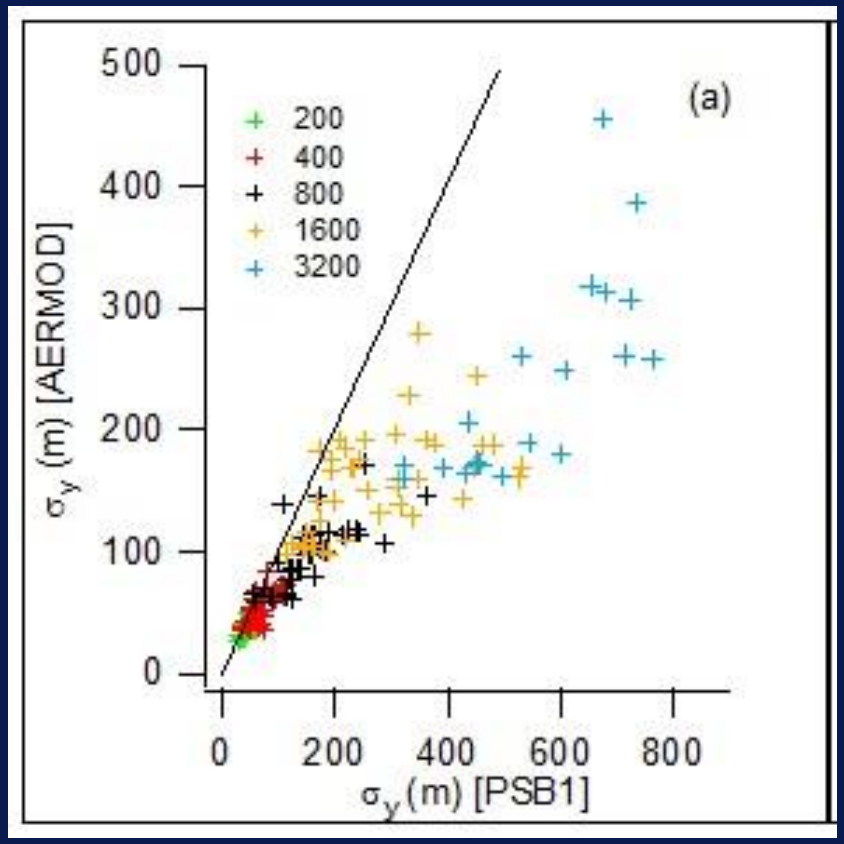
σ_y vs. Downwind Distance and Stability Class



Comparison with Prairie Grass



Comparison with AERMOD



Future Plans

- Share data as widely as possible
  www.noaa.inel.gov/projects/sagebrush/sagebrush.htm

- Establish collaborative partnerships to continue analysis
  - Concentration fluctuations
  - Vertical dispersion

- Additional experiment this year in light winds (<3 m s^{-1})
  - Both stable and unstable atmospheric conditions
  - July-August (daytime) and October (nocturnal)